

Erythropoietin Management in Tambon, or Sub-district, Health Promoting Hospitals in Phetchaburi Province

นิพนธ์ต้นฉบับ

Original Article

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาสถานการณ์การจัดการยาอีริโทรโพอิตินของเจ้าหน้าที่ในโรงพยาบาลส่งเสริมสุขภาพตำบล (รพ.สต.) ในเขตจังหวัดเพชรบุรี **วิธีการศึกษา:** การศึกษาเชิงสำรวจแบบภาคตัดขวางนี้เก็บข้อมูลตั้งแต่มกราคมถึงมีนาคม 2560 โดยส่งแบบสอบถามทางไปรษณีย์ให้แก่ รพ.สต. 117 แห่ง ในจังหวัดเพชรบุรี สอบถามผู้อำนวยการ รพ.สต. และบุคลากรที่รับผิดชอบจัดการยาแต่ละ 1 คน ตามด้านความรู้และการปฏิบัติในการจัดการยาอีริโทรโพอิติน ได้แบบสอบถามที่นำมาวิเคราะห์ได้ 150 ฉบับ จากรพ.สต. 75 แห่ง (ร้อยละ 64.10) **ผลการศึกษา:** ผู้ตอบกลับส่วนใหญ่เป็นเพศหญิง (ร้อยละ 89.33) อายุเฉลี่ย 42.80 ปี มีประสบการณ์จัดการยาอีริโทรโพอิตินร้อยละ 58.67 โดยมีประสบการณ์ด้านการให้ยามากที่สุด บุคลากรส่วนใหญ่ไม่เคยรับการอบรมเกี่ยวกับกระบวนการจัดการยา (ร้อยละ 97.33) มีรพ.สต. ที่ให้บริการฉีดยาร้อยละ 49.34 มีค่านิยมผู้ป่วยมาฉีดยาแต่ละ 1 คน บุคลากรมีความรู้ในภาพรวมระดับปานกลาง แต่มีความรู้ระดับสูงในด้านการขนส่งและเก็บรักษา ยา มีการปฏิบัติโดยรวมทุกด้านระดับสูง ปฏิบัติเรื่องฉีดยาเข้าทางใต้ผิวหนังได้ถูกต้องทุกครั้งมากที่สุด ผู้อำนวยการรพ.สต. มีความคิดเห็นต่อการจัดการยาในภาพรวมทุกด้านระดับต่ำ และเห็นว่าด้านงบประมาณเป็นปัญหามากที่สุด ส่วนบุคลากรติดตามผลการรักษาจากยานี้ได้ระดับปานกลางเท่านั้น เนื่องจากขาดความเชื่อมโยงของระบบข้อมูลด้านผลการรักษาของผู้ป่วยระหว่าง รพ.สต. และโรงพยาบาลแม่ข่ายประสบการณ์ของบุคลากรมีความสัมพันธ์กับระดับการปฏิบัติในการจัดการยาอีริโทรโพอิติน (P -value = 0.048) ผู้อำนวยการรพ.สต. และบุคลากรส่วนใหญ่ต้องการให้จัดอบรมความรู้การดูแลผู้ป่วยไตและการใช้ยา สรุป: พบว่าประมาณครึ่งหนึ่งของ รพ.สต. ในจังหวัดเพชรบุรีให้บริการฉีดยาอีริโทรโพอิติน แต่ความรู้และการปฏิบัติบางประเด็นของบุคลากรควรได้รับการพัฒนา ปัจจุบันยังไม่มีแนวทางปฏิบัติในการจัดการยาอีริโทรโพอิตินใน รพ.สต. โรงพยาบาลแม่ข่ายควรจัดอบรมให้ความรู้เรื่องยาอีริโทรโพอิตินแบบสร้างประสบการณ์และพัฒนาาระบบเชื่อมโยงข้อมูลผู้ป่วยร่วมกันระหว่างโรงพยาบาลแม่ข่ายกับรพ.สต. เพื่อพัฒนาระบบการจัดการยาอีริโทรโพอิตินในรพ.สต. ให้ดูแลผู้ป่วยโรคไตเรื้อรังได้มีประสิทธิภาพยิ่งขึ้น

คำสำคัญ: ยาอีริโทรโพอิติน, โรคไตเรื้อรัง, โรงพยาบาลส่งเสริมสุขภาพตำบล, การจัดการ

Abstract

Objective: To determine the situations of erythropoietin management of personnel at tambon, or sub-district, health promoting hospitals (SDHPHs) in Petchaburi province, Thailand. **Methods:** This cross-sectional survey was conducted from January to March 2017. Questionnaires were mailed to 117 SDHPHs. A director and a staff member of each SDHPH were assigned to be informants. The informants were asked about knowledge and practice on erythropoietin management. The response rate was 64.10%. **Results:** Most of the respondents were female (89.33%), with the average age of 42.80 years. Most of them had experience in erythropoietin management (58.67%), mostly involving in the drug management (88.00%). Most of the staff members had never been trained on erythropoietin management (97.33%). It was found that 49.34% of SDHPHs provided erythropoietin injection service with a mode of 1 patient per SDHPH receiving the service. Staff members had a moderate level of overall knowledge; while specific knowledge in drug transportation and storage was found at a high level. Overall practice was in the high level. The drug subcutaneous injection was found the most correct practice. Directors of SDHPHs had a low level of agreement in all aspects of erythropoietin management. Specifically, budget management was rated as problematic. Therapeutic monitoring by staff members could be done at a moderate level since there was a lack of data sharing between the network node hospital and SDHPHs. Staff experience and erythropoietin management practice level was related (P -value = 0.048). Most of the directors and staff members needed training for chronic kidney disease care and erythropoietin use. **Conclusion:** Almost half of personnel at SDHPHs provided erythropoietin injection. They needed more training in erythropoietin management. At present, no specific guideline on the management for SDHPHs is provided. The network node hospital should provide training for these SDHPHs as well as patient data sharing to improve the care patients with chronic kidney disease.

Keywords: erythropoietin, chronic kidney disease, sub-district health promoting hospital, management

Introduction

Chronic kidney disease (CKD) has been a highly burdensome public health problem worldwide. The CKD incidence was 7.2% among people aged 30 years or older and increased to 23.4 – 35.8% among those 64 years or older.¹ In Thailand, the incidence of CKD stage 1 – 5 was 17.5%.² The incidence CKD has been rapidly increasing and

hence the increase in treatment cost. The progression prevention to the last stage of CKD and its complications is the main goal of the early treatment. One of the most critical complications of CKD is anemia, which has been found in 15% of CKD patients and 95% of CKD patients undergoing dialysis.³ With the chronic kidney damage, erythropoietin could

not be produced. Physiologically erythropoietin is responsible for stimulating the production of red blood cells. In addition to the kidney damage, anemia in CKD patients was also contributed by iron depletion from blood loss during hemodialysis, short-lived red blood cells, and accumulated wastes. These metabolic wastes could stimulate systemic inflammation which could further damage the production of red blood cells.⁴ Anemia could reduce quality of life of CKD patients immensely. Anemia could also increase cardiovascular diseases, and rates of hospitalization and mortality among CKD patients.⁵ These enormous burdens prompt the urgent need to correct anemia among CKD patients with various treatment modalities including erythropoiesis-stimulating agent (ESA), iron supplements and blood transfusion for severe cases.

Erythropoiesis- stimulating agent (ESA) such as erythropoietin, a biological substance, has been recommended for anemia treatment in CKD patients by the well-known US National Kidney Foundation (NKF) clinical practice guidelines known as the NKF Kidney Disease Outcomes Quality Initiative or NKF KDOQI. In Thailand, erythropoietin is recommended to start for patients with hemoglobin (Hb) level of less than 10 g/dL and no other causes of anemia. Target Hb is set at 10 - 11.5 g/dL. Hb level should not be higher than 13 g/dL to avoid the risk of cerebrovascular event since erythropoietin could increase blood pressure and the occlusion in the blood vessel used for hemodialysis.^{6,7}

At present, erythropoietin has been increasingly used for CKD patients. In Thailand, 81% of CKD patients on hemodialysis have been using erythropoietin, with the dose of 5,000 to 15,000 units per week or higher⁸; while in the US, an average erythropoietin dose of 18,206 units per week has been used for CKD patients on hemodialysis.⁹ This relatively prevalent use of erythropoietin has inevitably raised some safety concerns. Erythropoietin use could cause a serious side effect of the loss of bone marrow production of red blood cells known as pure red cell aplasia (PRCA). In Thailand, reports showed that the incidence of PRCA was 1:2,608 which was about 50 times of that worldwide.¹⁰ Even though the specific cause could not be verified, the most possible speculated one was the inappropriate administration of the drug.¹⁰ With such concern, the Nephrology Society of Thailand has issued a treatment guideline to prevent PRCA which suggests the use of erythropoietin only for approved indications and proper

administration as directed. Once in doubt, one should always administer erythropoietin through intravenous rather than subcutaneous injection. Another crucial aspect of PRCA in Thailand was that it was surprisingly a product-specific mishap. Therefore, it has been recommended that the products should be acquired from reliable providers with approved standards of storage and transportation. The procured products should be, transferred, distributed and stored appropriately throughout the cold-chain supply to prevent erythropoietin molecular transformation which could damage the drug stability.⁷ All of these recommendations are based on the Good Distribution Practice (GDP) and the Good Storage Practice (GSP).¹¹

Healthcare service system for CKD patients has been changing since 2007 as the National Health Security Office (NHSO) of Thailand announced the 'PD First' policy to offer the continuous ambulatory peritoneal dialysis (CAPD) for CKD patients. Since then, the number of CKD patients undergoing CAPD had been continuously increasing and reached 20.8% in 2012.¹² Based on the criteria of the PD First policy, CKD patients had the right to access erythropoietin use. In addition, CKD patients undergoing hemodialysis were also allowed for the access to erythropoietin. For hemodialysis patients, they were given erythropoietin only in the hospital by medical team where hemodialysis was provided. CKD patients undergoing CAPD on the other hand could have a home supply of erythropoietin and have a staff member at a healthcare setting in their community to properly administer the drug for them.¹³ The distribution of erythropoietin injection to CKD patients with CAPD in their community has been directed by cold-chain distribution with the referral system approved by the CAPD patient care network.¹³

To provide the community based erythropoietin use for CAPD patients, a network for effective distribution and administration of the drug is needed. Phrachomklao Hospital (or King Mongkut Memorial Hospital) has been acting as the center of the provincial network of healthcare service for CAPD patients in the province of Petchaburi, Thailand. In 2016, 95.58% of CKD patients undergoing CAPD were given erythropoietin with an average dose of 8,000 units per week. In Petchaburi province, there were 117 tambon, or sub-district, health promoting hospitals (SDHPHs) locating in communities throughout the province. Of these 117 SDHPHs, 59 of them had patients who were given regular erythropoietin injection.

To achieve an effective and safe use of erythropoietin, Phrachomklao Hospital hold annual academic conferences to provide the staff members of the SDHPHs the knowledge about CKD and erythropoietin use. Among CKD patients undergoing dialysis provided by the Dialysis Center of Phrachomklao Hospital, all hemodialysis patients received erythropoietin injection at the center, while CAPD patients were given the drug at the SDHPHs in their community. Erythropoietin supply was given to CAPD patients in cold container and brought to the SDHPH in their community for storage and regular injection by the staff member. Referral document and medication administration record form were also given to the SDHPH. Since the start of the erythropoietin injection service at the SDHPH, certain problems have been found. Some staff members at the SDHPHs did not know how to manage the patients with uncontrolled blood pressure before injection. Certain issues regarding transportation, distribution, storage, indication, preparation, administration, and monitoring of erythropoietin were not well understood by these staff members.

Based on the new policy known as kidney disease service plan of the Ministry of Public Health, healthcare settings at all levels have been required to provide primary care to slow kidney disease progression. Since 2017, SDHPHs have been mandated to screen people with a risk of kidney disease and provide people the knowledge about kidney disease in order to prevent and slow the disease progression. SDHPHs have been also needed to coordinate with provincial hospital for care continuity and erythropoietin injection.

To take a full responsibility to provide erythropoietin injection service, staff members of the HDHPHs needed to be equipped with better knowledge and understanding about the service system. However, their knowledge and understanding about transportation, distribution, storage, indication, preparation, administration, and monitoring of erythropoietin should be clarified so that they could be supported properly. This study aimed to determine the situation of management of erythropoietin at the sub-district health promoting hospitals (SDHPHs) in Petchaburi province. Specifically, we aimed to determine 1) the situation regarding personnel, budget, materials and devices, and overall management, 2) the knowledge about erythropoietin management, and 3) the practice of erythropoietin management among staff members at the SDHPHs in Petchaburi province. Findings could be

useful in improving all aspects of management system of erythropoietin in SDHPHs.

Methods

In this cross-sectional research, study population was all 117 tambon, or sub-district, health promoting hospitals (SDHPHs) in Petchaburi province. Since all SDHPHs were subject to the survey, study sample was thus equivalent to study population. Of each of these 117 SDHPHs, we asked the director and a staff member responsible for erythropoietin who had been working at the SDHPH for at least one year to be the informant, resulting in a total of 234 informants. In this study, erythropoietin management situation was defined as opinion regarding personnel, budget, materials and devices, and overall management. Additionally, it also included knowledge and practice in managing erythropoietin including transportation/ distribution, storage, indication, preparation, administration, and monitoring on safety and effectiveness of erythropoietin.

Study instruments included a set of self-administered questionnaires. The first part of the questionnaire asked about demographic information of the staff members and directors of the SDHPHs; while the second part asked about the experience of erythropoietin management in both groups of informants. The third part asked the directors of SDHPHs about their opinion on erythropoietin management while asked the staff members about their practice of erythropoietin management. For the directors, there were four groups of questions including personnel, budget, materials and devices, and overall management with a total of 105 questions. The response was a 5-point rating scale from 1-least agreed to 5-most agreed. Based on Levin and Rubin, the total score was categorized into three levels, i.e., low, medium and high with 21 – 49, 49.01 – 77, and 77.01 – 105 points, respectively. For staff members, there two parts. Part one consisted of fifteen questions about knowledge with a score of 1 for correct answer and 0 for incorrect one. Based on Bloom' concept, knowledge was categorized as low, medium and high levels with 0 – 60%, 61 - 79%, and 80 - 100% of the total score, respectively. Part two had 33 questions asking the staff members about their practice in erythropoietin management. With a 4-point rating scale ranging from 1-never to 4-always, the total score was 132 points. Based on Levin and Rubin's concept, practice was categorized into low, medium and high

levels with 33.00 – 66.00, 66.01 – 99.00, and 99.01 – 132.00 points, respectively. The fourth part was an open question asking for suggestions to improve the service network for patients with chronic kidney disease.

For quality assurance, the questionnaires were verified for validity by experts and revision was made according to the comments. Reliability was tested in 40 individuals comparable to the target sample including directors of SDHPHs and staff members responsible for erythropoietin management. Reliability of knowledge questions was in a low level with a K-R coefficient of 0.44; while those of practice and management sections were high with Cronbach's alpha coefficients of 0.837 and 0.923, respectively.

For data collection process, 234 copies of questionnaire were mailed to all 117 SDHPHs between January 1 and March 15, 2017. For each SDHPH, two copies of the questionnaire were for two informants, i.e., the director and the practicing staff member. To remind those not responding, the questionnaire was mailed again on February 15, 2017.

Data analysis

Results were presented as descriptive statistics including frequency with percentage, mean with standard deviation, and median, as applicable. Chi-square test or Fisher's exact test as appropriate.

Results

Of 234 informants mailed, questionnaires of 150 responding informants from 75 tambon, or sub-district, health promoting hospitals (SDHPHs) were returned and analyzable (response rate of 64.10%). Among 75 directors of the SDHPHs responding the questionnaire, almost two-thirds were women (61.33%) with the age of 50 years or older (68.00%) and an average age of 50.85 ± 5.70 years. The majority had a Bachelor's degree (80.00%). It was found that 86.67% of them were actual directors, while the rest were acting directors. Their main responsibility was management (50.00%). Among 75 staff members responsible for administration of erythropoietin, most of them were women (89.33%) with the age of 40 – 49 years (57.33%) and an average age of 42.80 ± 5.87 years. Almost all of them had a Bachelor's degree (93.33%). Since 86.67% of them were nurse, their main responsibility was nursing service (69.33%).

In terms of experiences in handling erythropoietin among the staff members, more than half reported they had an experience in erythropoietin management (58.67%). They had been handling erythropoietin for an average of 1.45 ± 0.79 years. In terms of tasks, of 50 SDHPHs responding the questionnaire, 44 of them (88.00%) reported that they involved the most in the step of administration (injection) of erythropoietin to the patients. Almost all of the directors and staff members of the SDHPHs reported that they never had been provided with about erythropoietin (94.67% and 97.33%, respectively). It was found that 37 SDHPHs (49.34%) provided erythropoietin injection service for the patient while the rest (38 SDHPHs or 50.67%) did not, with a median of 1 patient receiving the service in each SDHPH (Table 1).

Table 1 Experiences in handling erythropoietin among the staff members (N = 75) and directors (N = 75) of sub-district health promoting hospitals (SDHPHs).

| Experiences in handling erythropoietin | Directors of SDHPHs (N = 75) | | Staff members (N = 75) | |
|--|------------------------------|-------|------------------------|-------|
| | No. | % | No. | % |
| Having experience in erythropoietin management (n = 75) | | | | |
| No | 50 | 66.67 | 31 | 41.33 |
| Yes | 25 | 33.33 | 44 | 58.67 |
| Experience with erythropoietin management (yrs) | | | | |
| n | 25 | | 44 | |
| mean \pm SD | 1.36 \pm 0.70 | | 1.45 \pm 0.79 | |
| min – max | 1 - 15 | | 1 - 15 | |
| Categorized duration | | | | |
| 1 – 2 yrs | 19 | 76.00 | 32 | 72.73 |
| 3 – 4 yrs | 3 | 12.00 | 4 | 9.09 |
| 5 yr or older | 3 | 12.00 | 8 | 18.18 |
| Having training on erythropoietin management | | | | |
| No | 71 | 94.67 | 73 | 97.33 |
| Yes | 4 | 5.33 | 2 | 2.67 |
| Number of training | | | | |
| n | 4 | | 2 | |
| min – max | 1 - 3 | | 1 - 4 | |
| Categorized number of training | | | | |
| 1 | 3 | 75.00 | 1 | 50.00 |
| 3 | 1 | 25.00 | 0 | 0 |
| 4 | 0 | 0 | 1 | 50.00 |
| Tasks in erythropoietin management (n = 50) (more than one task could be reported by a person) | | | | |
| Erythropoietin injection | - | - | 44 | 88.00 |
| Chronic kidney disease care | - | - | 33 | 66.00 |
| Erythropoietin preparation | - | - | 32 | 64.00 |
| Erythropoietin storage | - | - | 26 | 52.00 |
| Erythropoietin management control | - | - | 9 | 18.00 |
| Number of patients with chronic kidney diseases receiving erythropoietin injection at each SDHPH Median = 1 patient, min – max = 1 – 4 patients | | | | |
| Categorized number of patients | | | | |
| 0 | - | - | 38 | 50.67 |
| 1 | - | - | 14 | 18.67 |
| 2 | - | - | 11 | 14.67 |
| 3 | - | - | 11 | 14.67 |
| 4 | - | - | 1 | 1.33 |

Regarding **knowledge about erythropoietin management**, these 75 staff members revealed an average score of 10.23 ± 2.43 points. In consistent with the average score, most staff members achieved a moderate level of knowledge (68.18%). The topics with high score levels were in storage of erythropoietin including transportation of erythropoietin to SDHPHs (94.67%) and temperature proper for storage (88.00%). However, topics with low level of knowledge were indications of erythropoietin for kidney disease (48.00%), and measurement of blood pressure before injecting erythropoietin (52.00%) (Table 2).

Table 2 Knowledge on erythropoietin management among staff members (N = 75).

| Knowledge aspects | No. of staff members with correct answer | % | Level of knowledge |
|---|--|-------|--------------------|
| 1. Cause leading to the indication of erythropoietin | | | |
| Anemia caused by chronic kidney disease | 63 | 84.00 | High |
| 2. Indications | | | |
| Chronic anemia requiring erythropoietin | 47 | 62.67 | Medium |
| Erythropoietin for chronic kidney disease | 36 | 48.00 | Low |
| 3. Dosage | | | |
| Initial dose prescribed by physician for the SDHPH referral | 56 | 74.67 | Medium |
| 4. Erythropoietin preparation | | | |
| Preparation for injection | 43 | 57.33 | Low |
| 5. Erythropoietin administration | | | |
| Erythropoietin injection | 46 | 61.33 | Medium |
| 6. Erythropoietin storage | | | |
| Transportation of erythropoietin from hospital to SDHPH | 71 | 94.67 | High |
| Erythropoietin storage at SDHPH | 66 | 88.00 | High |
| 7. Adverse effects | | | |
| Persistent anemia despite erythropoietin injection | 57 | 76.00 | Medium |
| Frequent adverse effects of erythropoietin | 53 | 70.67 | Medium |
| Management of high blood pressure caused by erythropoietin | 47 | 62.67 | Medium |
| Contra-indication of erythropoietin | 41 | 54.67 | Low |
| Blood pressure measurement in patients receiving erythropoietin | 39 | 52.00 | Low |
| 8. Therapeutic follow-up | | | |
| Laboratory measures for erythropoietin therapeutic outcomes | 62 | 82.67 | High |
| Duration and frequency of erythropoietin therapy monitoring | 40 | 53.33 | Low |
| Average knowledge score* (mean \pm SD) | 10.23 \pm 2.43 | 68.18 | Medium |

* A possible total score of 16 points.

In terms of the **practice of erythropoietin management**, of the 75 staff members, 60 of them reported the practice and their answers were analyzable. Of these 60 staff members, 83.33% reported their overall practice at a high level. High level of reported practice was found in drug preparation both

in vial and cartridge containers (90.00% and 86.67%, respectively), administration (90.00%), and storage (90.00%). Unfortunately, practice level of therapeutic monitoring of erythropoietin was less impressive with frequencies of staff members evenly distributed at the low, moderate and high levels (30.00, 36.67, and 33.33%, respectively) (Table 3).

Table 3 Practice level on erythropoietin management among staff members (N = 60).

| Practice aspects (mean score \pm SD) | Number (%) of staff members by level of practice | | |
|---|--|------------|------------|
| | Low | Medium | High |
| Overall practice (117.93 \pm 16.21) | 1 (1.67) | 6 (10.00) | 53 (88.33) |
| Individual aspects | | | |
| Erythropoietin preparation | | | |
| - solution in vial (43.72 \pm 6.78) | 2 (3.33) | 4 (6.67) | 54 (90.00) |
| - solution in pre-filled syringe (18.47 \pm 2.80) | 2 (3.33) | 6 (10.00) | 52 (86.67) |
| Erythropoietin administration (33.70 \pm 4.37) | 1 (1.67) | 5 (8.33) | 54 (90.00) |
| Erythropoietin storage (11.37 \pm 1.85) | 2 (3.33) | 4 (6.67) | 54 (90.00) |
| Erythropoietin therapeutic follow-up (10.68 \pm 4.32) | 18 (30.00) | 22 (36.67) | 20 (33.33) |

The over management level of erythropoietin, according to the majority of the 75 directors of the SDHPH, was perceived as low (52.00%). The aspect of budget for erythropoietin management was rated as low by 70.67% of the SDHPD directors, followed by the general management (58.67%). The aspect of materials and devices management was rated as moderate by the SDHPH directors (65.33%) (Table 4).

Table 4 Practice level on erythropoietin management among directors of sub-district health promoting hospitals (N = 75).

| Practice aspects (mean score \pm SD) | Number (%) of directors of SDHPHs by level of practice | | |
|--|--|------------|------------|
| | Low | Medium | High |
| Overall practice (48.39 \pm 16.34)* | 39 (52.00) | 32 (42.67) | 4 (5.33) |
| Individual aspects | | | |
| Overall drug management (14.39 \pm 5.47) | 36 (48.00) | 37 (49.33) | 2 (2.67) |
| Drug budget management (9.25 \pm 4.30) | 53 (70.67) | 20 (26.67) | 2 (2.67) |
| Drug administration device management (14.09 \pm 4.64) | 16 (21.33) | 49 (65.33) | 10 (13.33) |
| Overall management (10.65 \pm 5.19) | 44 (58.67) | 24 (32.00) | 7 (9.33) |

* A possible total score of 105 points.

Among 60 staff members, those with experience in erythropoietin management were more likely to have a high level of practice with a statistical significance (P -value = 0.048) (Table 5).

Table 5 Association between experience and practice of erythropoietin management among staff members of sub-district health promoting hospitals in Petchaburi province (N = 60).

| | Number (%) of staff members by erythropoietin management level | | P-value |
|--|--|-----------------|---------|
| | High | Low to moderate | |
| Having experience of erythropoietin management | | | |
| Yes | 41 (95.30) | 2 (4.70) | 0.048* |
| No | 13 (76.50) | 4 (23.50) | |

* Fisher's exact test.

In terms of recommendation, 46 directors of SDHPH and 37 staff members responded to the open questions. There was a need for training to erythropoietin management and administration as reported by 60.87% of the directors and 59.46% of the staff members. Only 34.78% of the directors reported that their SDHPHs were ready for taking care of CKD patients while 72.97% of the staff members did so.

Discussions and Conclusion

In this study, we investigated the level of knowledge and practice of erythropoietin management regarding budget, devices, and overall management, among staff members and directors of tambon, or sub-district, health promoting hospitals (SDHPHs) in Petchaburi province. Half of the respondents (49.34%) agreed that the policy of providing erythropoietin injection service at the nearby SDHPH offered safety and compliance to the treatment regimen for CKD patients. This finding was consistent with that from the work of Pirkle et al¹⁴ where a US government-sponsored home visit to provide injection was associated with an improved HbA1C level and medication compliance among CKD patients with CAPD.

In terms of erythropoietin management, most SDHPH staff members demonstrated a moderate overall level of knowledge (68.18%). This moderation was not uncommon since it was also found among healthcare providers in the US.¹⁵ Zelenetz and colleagues reported that more than half of providers including physicians, nurses and pharmacists (55%) lacked a knowledge about biosimilar products which included erythropoietin.¹⁵ Therefore, even in the developed countries like USA, a lack of knowledge to manage erythropoietin administration has been evident.

Regarding specific knowledge, transportation and storage were the two aspects of erythropoietin management found with the highest knowledge level (94.67% and 88.00%,

respectively). Since erythropoietin is a biological product, it needs a cold-chain distribution. In Petchaburi province, vaccines which are also biological products, have been distributed to all SDHPHs from the center hospitals, mostly community hospitals (or district hospitals). Most of the staff members at the SDHPHs are therefore familiar with erythropoietin transportation and storage, mostly at a high level. The finding of high knowledge level on keeping erythropoietin at 2 – 8 degree Celcius was consistent with the works of Eakanunkul and colleagues¹⁶ and Thamnakphol¹⁷ where healthcare providers responsible for the storage of biological and vaccine products demonstrated at least 80% of such knowledge.

In addition, most SDHPH staff members responsible for erythropoietin management, especially storage, were nurses (44.00%). This finding was consistent with that of Mateeapiruk¹⁸ where nurses working at SDHPHs were responsible for vaccine management and cold-chain distribution. Nurses long been working at SDHPHs had been trained and evaluated on the matter on a regular basis. Distribution and storage of erythropoietin had thus been well understood and conducted. All findings from studies of ours and other's suggested that staff members at SDHPHs possessed knowledge about cold-chain products as mandated by the standards for primary pharmaceutical care.¹⁹ This set of standards indicated that SDHPHs a stock of cold-chain products including vaccine and insulin products be kept at 2 – 8 degree Celcius at all time.

The knowledge level regarding indication of erythropoietin for CKD was on the other hand found at the lowest among erythropoietin management topics (48.00%). This could be attributable to the fact that erythropoietin is a drug in Schedule E2 in the National Drug List of which the prescription is restricted only to specialists practicing in the hospitals. As a result, staff members at the SDHPH were less familiar with the indication of erythropoietin than those at the hospitals at the district level or higher. In addition, the knowledge level about blood pressure measurement on patients receiving erythropoietin injection was low (52.00%). This suggested that the lack of this knowledge could have led the patient face a raised blood pressure. Based on the US National Kidney Foundation anemia guidelines "K/DOQI" 2012, it is recommended that an increase in blood pressure should be regularly monitored especially in the first three months of the erythropoietin regimen.⁶ The Nephrology Society of Thailand

suggested that with the erythropoietin related hypertension in hemodialysis patients, the patient's blood pressure should be closely monitored.⁷ A lack of blood pressure monitoring during erythropoietin administration was also evident among healthcare providers in other countries. Barbosa and colleagues found that most nurses at the dialysis center responsible for erythropoietin management demonstrated a lack of knowledge about the increased blood pressure after erythropoietin injection (87.50%).²⁰

In terms of the practice on erythropoietin management, most staff members reported a high level of the management (88.33%). Specifically, drug preparation, drug administration and storage were the three practice aspects with the high level. This could be due to the fact that most staff members from 44 SDHPHs responsible for erythropoietin injection were nurses (44.00%). This is not surprising since it has been widely known that nurses needed to have a competency as required by the nursing professional standards. The findings also suggested that staff members with an extensive experience had a high score of the practice.

In terms of monitoring therapeutic outcomes, the majority reported a moderate level of such practice (36.67%). Monitoring hemoglobin and hematocrit levels was reported only in 30.00% of the staff members. This was because hemoglobin and hematocrit levels were available on the laboratory reports from the network's node hospitals only once at the first referral to the SDHPH. As a result, the staff members were not informed about periodical levels of hemoglobin and hematocrit of the CAPD patients receiving erythropoietin at their SDHPHs. This circumstance demonstrated a disrupted chain of communication between staff members at SDHPHs and the network's node hospitals. This poor communication could impose poor therapeutic outcome and safety on the patients. The poor practice did not meet the standards set forth by the CKD clinic guideline of Petchaburi province.²¹

This poor communication of patient data within the network of hospitals in Petchaburi was also shown in the study of Boonmunag and colleagues where databases of patients' laboratory information were not linked with those of the patients' medical records.²² Thus the continuous healthcare service within the network could not be achieved.

Information for the patient understanding is also critical for the success of erythropoietin use. The UK National Institute for Health and Care Excellence "NICE guidelines"(2015)²³ and

the US Food and Drug Administration (2007)²⁴ have recommended the protocol to encourage the patient understanding on the use and risk of erythropoietin and related healthcare providers in anemia treatment among CKD patients. As a result, responsibility of providers at primary and secondary healthcare settings was issued.²³ Unfortunately, such guideline on provider's responsibility has not been officially created.

For the management of erythropoietin, the majority of SDHPH directors perceived a low level of overall management (52.00%). This indicated that the performance according to the kidney disease service plan of the Ministry of Public Health of these SDHPHs was far from perfect. The most problematic aspect of the performance was a low level of budget allocation (70.67%). This could be due to the fact that the budget for erythropoietin management had been bundled with those of non-communicable disease (NCD) clinic. According to the studies of Kaitwatcharachai and Kaitwatcharachai²⁵, and of Boonlakorn²⁶, the problems found in the management of SDHPH included in adequate budget. Despite a cooperation between SDHPHs and their network node hospitals, financial support at SDHPHs was insufficient. Only 0.70% of SDHPHs were provided budget specific to erythropoietin management service from the central government; while 13.70% were support financially by their node hospitals.²⁶ For materials and devices, directors of SDHPHs thought that the support was in moderate level (65.33%). Based on the Ministry of Public Health policy, network node hospitals were required to advise their SDHPHs on cold-chain distribution and storage and devices necessary for the care of patients receiving erythropoietin injection such as sphygmomanometer and hematocrit centrifuge.²⁷

In terms of improvement, most of the directors and staff members of SDHPHs reported a need for practical training on erythropoietin management (60.87% and 59.46%, respectively). This findings was consistent with that of Taengum where training was critical for improving quality of care at SDHPHs.²⁸ In our study, 72.97% of staff members at SDHPHs perceived themselves as ready for providing CKD care while only 34.78% of their chiefs did so. However, both parties agreed that having professional nurses would further help better the service for CKD patients (26.09% and 29.73%, respectively). This finding was in agreement with that of Faith and co-workers where nurses taking of patients with non-communicable diseases at primary care units could provide a

quality care and were accepted by patients and other healthcare colleagues alike.²⁹

This study had few limitations. With a response rate of 64.10%, there was a room for improvement regarding representativeness for SDPHs in Petchaburi province. The multiple choice format of some questions could allow for guessing which could result in the unrealistic extreme high or low scores. Finally, the questions on the staff members' practice were self-reported not the direction observation.

Findings from our study suggested that network node hospital should determine the staff members' performance after training on erythropoietin administration and therapeutic monitoring. Data between SDPHs and their network node hospital should be shared. Certain outcomes including number of erythropoietin administration and target hemoglobin concentration should be tested. A more practical and systematic guideline on erythropoietin management of Petchaburi could be developed.

In conclusion, 49.34% of tambon, or sub-district, health promoting hospitals (SDPHs) in Petchaburi province provided erythropoietin injection to the patients, with a median of one patient for each SDPH. There was a room for improvement on knowledge and practice of erythropoietin management in certain aspects among the staff members. With no specific guideline for erythropoietin management for SDPHs in Petchaburi, the network node hospital should provide training on the topic for its network hospital members. In addition, patient information should be linked within the network to enhance the effectiveness of the seamless care for patients with chronic kidney disease.

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Editorial note

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