

Original article

A pilot evaluation of the online rabies exposure reporting system (R36) and post-exposure rabies immunization in clinical practice in selected hospitals in the upper north of Thailand in fiscal year 2016

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Objectives The study aimed to evaluate the online rabies exposure reporting system (R36) and rabies post-exposure prophylaxis (PEP) in clinical practice.

Methods A cross-sectional pilot study was conducted in Wiang Kaen, Chiang Khong and Song Khwae Hospitals during mid-January 2017. Records for the 2016 fiscal year were reviewed and stakeholders were interviewed. Quantitative and qualitative attributes of the reports were evaluated. The administration of rabies PEP was also evaluated including the percentage rate of non-compliance with the Thai-CPG for rabies guidelines 2016 and pitfalls in actual practice. A few factors associated with the pitfalls were selected for analysis by multivariate logistic regression.

Results Only the Wiang Kaen and Chiang Khong Hospitals used the online R36 reporting system. Ratings of the sensitivity, completeness and validity of the online R36 reports were 73.08%, 98.25% and 70.18%, respectively, for Wiang Kaen Hospital and 37.12%, 73.47% and 36.73% for Chiang Khong Hospital. The median time from the first dose to submission of the online report was 91 days in Wiang Kaen Hospital and 38 days in Chiang Khong Hospital. The rates of inappropriate PEP, i.e. under- or over-dosage of rabies vaccination/immunoglobulin injections, were 34.62%, 55.30% and 44.44% in the Wiangkaen, Chiang Khong and Song Khwae Hospitals, respectively. Factors associated with non-compliance with the guidelines occurred most frequently in 13-18 years old patients, head and neck injuries, laceration wounds and no history of previous adequate rabies vaccination.

Conclusion The time to report in Wiang Kaen Hospital and the quality of the reports (sensitivity, completeness and validity) in Chiang Khong Hospital needed improvement. Overall, the incidence of inappropriate PEP was high for this fatal disease, indicating a need for physicians and health care teams to pay closer attention to patients who have the risk factors. **Chiang Mai Medical Journal 2020;59(4):187-95.**

Keywords: rabies, report evaluation, clinical practice, risk factors, post exposure prophylaxis

Introduction

Rabies is an acute form of encephalitis or meningoencephalitis caused by infection with a Lyssavirus (1). The disease is fatal once clinical signs appear, but it can be prevented through timely immunization following exposure to the virus (2). The virus is found in the saliva of rabid mammals and is transmitted by bites, scratches or licking wounds or other mucosal surfaces (3). Rabies is present worldwide and it is estimated to

cause more than 59,000 deaths annually (4). The estimate mortality is highest in Asia and Africa. Dogs are responsible for 99% of human cases (4,5).

Although rabies is currently an uncommon disease in Thailand, deaths of people and domestic mammals from rabies occur every year. Investigations have found that the major cause of death is unawareness of the need to seek rabies immunization in a hospital (6). Sadly, one patient died

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because they went to a private clinic for treatment after a dog bite, but did not received rabies vaccination (6). In response to the disease burden, Thailand has a vision of eliminating rabies in the country by the end of 2020, a vision which has received both government and the royal support (the “Animals Free of Rabies; Humans Safe from the Disease Project” under the wish of Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol”). A number of government ministries have responded to the royal project. The third strategic plan of the royal project concerns rabies surveillance, prevention, control and human patient care (7). An online rabies exposure reporting system (R36) is currently administrated by the Division of Communicable Diseases, Department of Disease Control, Ministry of Public Health, Thailand. Health personnel in hospitals are requested to enter the history and medical information of patients who have been bitten, scratched or licked wounds or mucosal surfaces by mammals into the web-based program. Details of the situation, quality of treatment (whether adequate or inadequate) and rabies control measures can be monitored by health personnel at the hospital, provincial, regional and national levels. The Office of Disease Prevention and Control region 1, Chiang Mai (the local branch of Department of Disease Control, Ministry of Public Health responsible for the upper North of Thailand) conducted a pilot evaluation of the online R36 system and post-exposure rabies immunization in clinical practice to assess the effectiveness of the reporting system and the quality of rabies post-exposure immunization.

Objectives

1. To conduct a quantitative and qualitative evaluation of the online rabies exposure reporting system (R36).
2. To evaluate post-exposure rabies immunization in clinical practice.

Methods

A cross-sectional pilot study was conducted by an evaluation team from the Office of Disease

Prevention and Control Region 1, Chiang Mai (ODPC1) in mid-January 2017. Three district hospitals in the upper north of Thailand were selected for this pilot evaluation. The selected hospitals were in the three districts which reported the highest number of rabies positive mammals in the 2016 fiscal year via Thairabies.net, a system of rabies surveillance of the Department of Livestock Development of Thailand. The three districts, Wiang Kaen, Chiang Khong and Song Khwae, had reported a total of 26, 10 and 10 rabid mammals, respectively. Wiang Kaen Hospital, Chiang Khong Hospital and Song Khwae Hospital were selected for the study. A two-day review of the 2016 fiscal year medical records of each of those hospitals, including interviews with stakeholders, were conducted.

The evaluation report was based on the 2001 US-CDC guidelines for evaluating surveillance systems (8). Assessment of rabies post-exposure immunization followed the Thai Department of Disease Control (Thai-DDC) Clinical Practice Guideline (CPG) for rabies 2016 (9). Although the WHO published new rabies guidelines in 2018 (10), the Thai Ministry of Public Health (Thai-MOPH) has recommended that practitioners follow the Thai-DDC CPG 2016 for cases of rabies post-exposure immunization (11).

Medical records from the 2016 fiscal year were selected using the following criteria:

1. ICD10 code W53 (bitten by rat), W54 (bitten or struck by dog) and W55 (bitten or struck by other mammals).
2. Living in the sub-district where the hospital is located.

Quantitative and qualitative attributes were described in the report evaluation. Quantitative attributes included sensitivity, predictive value positive, completeness of data, validity of data and representativeness. The qualitative attributes were usefulness, acceptability, simplicity, flexibility and stability. The quality of rabies post-exposure immunization was also presented as a percentage of non-compliance with the CPG and details of pitfalls in actual practice. Non-compliance with the CPG included prescription of other than

recommended dosages of rabies vaccine/immunoglobulin as well as provision of more or less than the recommended number of injections. Selected factors associated with the pitfalls were analyzed using multivariate logistic regression.

This pilot evaluation received permission from the directors of the Wiang Kaen, Chiang Khong and Song Khwae Hospitals for access to medical records and the online R36 database. The R36 database included the same time frame and study population as the medical records. Individual records were extracted from the R36 program using username and password, then the data from the two sources were compared and evaluated.

Results

Among the three hospitals in this pilot evaluation, only two, Wiang Kaen and Chiang Khong, used the online R36 reporting system. However, all three hospitals were evaluated for quality of rabies post-exposure immunization.

The data flow of the online R36 reports of the Wiang Kaen and Chiang Khong Hospitals is shown in Figure 1.

At the Wiang Kaen and Chiang Khong Hospitals, a total of 78 and 132 medical records, respectively, met the selection criteria. The quantitative attributes of the online R36 reporting system in the two hospitals showed a low level of sensitivity, but the predictive value positive of the reports were 100% for both hospitals. Regarding data

completeness and validity, staff of Wiang Kaen Hospital performed very well, although they took longer to report than the staff of Chiang Khong Hospital. Quantitative attributes are described in Table 1.

Executives and practitioners who were relevant to the use of the online R36 reporting system in the two hospitals were interviewed. They realized the importance of the program and had agreed to report. There were some limitations in use of the program as shown in Table 2.

Evaluation of post-exposure rabies immunization was based on physicians' notes and orders in the medical records (Table 3). Because many records related to the health status of the animal at the end of ten-day observation period as well as physicians' guidance regarding further vaccination were not available, the researchers agreed to use administration of at least three doses of PEP vaccination as indication of adequate treatment in this study. The proportion of vaccinations with and prescription of rabies immunoglobulin (RIG) that did not adhere to the 2016 Thai CPG for rabies was high in all three hospitals. Pitfalls identified included inadequate doses of rabies vaccine for the category of the wound, too many or too few booster doses, and not prescribing RIG for new cases or patients who had had insufficient immunization in the past.

Factors associated with non-compliance with the Thai-CPG for rabies guidelines 2016 in all

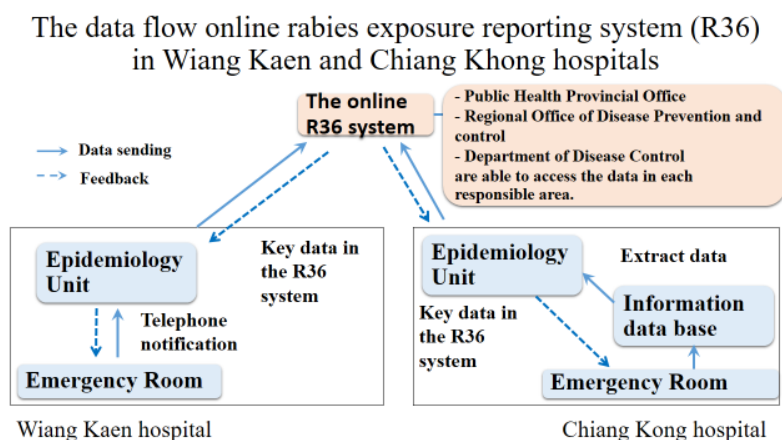


Figure 1. The data flow of the online R36 report of Wiang Kaen and Chiang Khong Hospitals.

Table 1. The quantitative attributes of the online R36 reporting system in the two selected hospitals

Quantitative attributes	Wiang Kaen Hospital	Chiang Khong Hospital
1. Sensitivity (proportion of the true cases detected by the R36 reporting system)	73.08% (57/78)	37.12% (49/132)
2. Predictive value positive (proportion of the R36 reported cases that are the true cases)	100% (57/57)	100% (49/49)
3. Completeness of data filling in the R36 reporting system	98.25% (56/57)	73.47% (36/49)
4. Validity of data in the R36 reporting system	70.18% (40/57)	36.73% (18/49)
5. Median time form first shot of vaccination to report	91 days (IQR: 81) Range: 33 to 252 days	38 days (IQR: 77) Range: 2 to 152 days
6. Representativeness*	Same distribution of age groups** and exposure month between the online R36 report and active case finding from medical record	Different distribution of age groups** and exposure month between the online R36 report and active case finding from medical records

*The researchers intended to describe the representativeness of the online R36 report in text for limitation of excess figures in this article

**Age groups were classified as preschool (0-5 years old), primary school (6-12 years old), high school (13-18 years old), adults (19-59 years old) and elderly (≥ 60 years old)

Table 2. The qualitative attributes of the online R36 reporting system in the two selected hospitals

Qualitative attributes	Wiang Kaen Hospital	Chiang Khong Hospital
1. Usefulness	<ul style="list-style-type: none"> Report to the provincial public health office Surveillance and warning information to relevant networking such as local administration and Chiang Rai livestock office Information for logistic planning in following year Information during activation of Emergency Operation Center (in situation of rabies positive in animal/human) 	
2. Acceptability	The users realized the importance of the online R36 report and agreed to report	
3. Simplicity	<ul style="list-style-type: none"> The users' need was that the online R36 is able to automatically extract data from the hospital information system. In case of referral to a Sub-District Health Promotion Hospital (SDHPH) for 2nd-4th or 5th dosage of rabies vaccination, the SDHPH staff was unable to key in the data of additional vaccination. Too much information 	<ul style="list-style-type: none"> The users' need was that the online R36 is able to automatically extract data from the hospital information system. The username and password to access the online R36 took time to obtain. They should be fixed for the hospital and not be rely on an individual because the responsible staff has frequently changed. Too much information
4. Flexibility	The system was able to operate even if there were modifications of case definitions or technology, and variations in funding or reporting sources.	
5. Stability	The system was able to operate although a new responsible staff has performed.	

Table 3. The evaluation of rabies post-exposure immunization in the three selected hospitals

The clinical practice of rabies post exposure immunization	The percentage of non-compliance with the Thai-CPG for rabies 2016 and the detail of the pitfalls in clinical practice (Based on the medical records)		
	Wiang Kaen Hospital	Chiang Khong Hospital	Song kwae Hospital
1. Vaccine aspect	24.36% (19/78) <ul style="list-style-type: none"> No vaccination or inadequate doses (received < 3 doses in new cases/insufficiency immunization in the past): 16.67% (13/78) 3 dose booster in patients who received rabies vaccination in the past: 7.69% (6/78) 	31.06% (41/132) <ul style="list-style-type: none"> No vaccination or inadequate doses (received < 3 doses in new cases/ insufficiency immunization in the past): 25.76% (34/132) 1 dose booster in patients who received rabies vaccination more than 6 month in the past: 3.79% (5/132) 3 dose booster in patients who received rabies vaccination in the past: 1.52% (2/132) 	25.93% (14/54) <ul style="list-style-type: none"> No vaccination or inadequate doses (received < 3 doses in new cases/ insufficiency immunization in the past): 22.22% (12/54) 1 dose booster in patients who received rabies vaccination more than 6 month in the past: 1.85% (1/54) 3 dose booster in patients who received rabies vaccination in the past: 1.85% (1/54)
2. Rabies immunoglobulin (RIG) aspect	11.54% (9/78) No RIG given in category 3 exposure among new cases	35.61% (47/132) No RIG given in category 3 exposure among new cases	25.93% (15/54) No RIG given in category 3 exposure among new cases
Total percentage of either vaccination or prescribing RIG that non-adherence to the Thai CPG 2016	34.62% (27/78)	55.30% (73/132)	44.44% (24/54)

three selected hospitals are presented in Table 4. The combined total number of cases of compliance and of non-compliance with the Thai-CPG for rabies 2016 were 140 and 124, respectively. There was a higher incidence of physicians not following the CPG for treatment among high school age patients and adherence was higher for the preschool age group than the adult group. Head and neck injuries, laceration wounds and either no history of rabies vaccination or fewer than three doses of rabies vaccination in the past were significantly associated with non-compliance with the CPG.

Discussion

Rabies is an important notifiable disease in many countries, including Thailand. Rabies surveillance systems are necessary for initiation of appropriate responses to outbreaks of the disease. However, a national reporting system for rabies

exposure is absent in many countries. For example, there is currently no national reporting system for rabies exposure in the United States, although some state health departments do provide animal bite or post-exposure prophylaxis (PEP) reports (12). A descriptive assessment of rabies PEP reporting in four Asian countries (Bangladesh, Bhutan, Cambodia and Sri Lanka) in 2017-2018 showed no national reporting system for rabies exposure in any of those countries (13).

In the present study, some cases which just met the criteria were included in the online R36 system (low sensitivity reports), especially patients in the Chiang Khong Hospital. There was no online R36 reports from the Song Khwae Hospital; in that hospital, the staff did not have the necessary username and password to access the program and it appeared that the staff were insufficiently supervised by zoonotic program managers in the provincial public health office. The completeness

Table 4. Multivariate analysis of factors associated with non-compliance with the Thai-CPG for rabies 2016 in all three selected hospitals

Factors	Pooled medical records of all the three selected hospitals (n=264)	
	Adjusted OR	95% CI (p value)
Age groups (years old)		
Preschool (0-5)	0.32	0.13-0.78 (0.01)*
Primary school (6-12)	0.52	0.21-1.30 (0.16)
High school (13-18)	4.63	1.12-19.11 (0.03)*
Adults (19-59)	Reference	Reference
Elderly (≥ 60)	0.79	0.34-1.84 (0.59)
Male	1.32	0.74-2.36 (0.35)
Body area of exposure		
Head and neck	6.41	1.32-31.03 (0.02)*
Trunk	1.10	0.32-3.82 (0.88)
Extremities	Reference	Reference
No rabies vaccination or having less than 3 dose vaccination in the past	6.24	2.82-13.80 (< 0.00)*
Laceration wound	9.00	4.73-17.13 (< 0.00)*
Hospital visit more than 2 days after exposure	0.73	0.21-2.54 (0.62)

*Statistical significant at $p < 0.05$

and validity percentages of reports by the Wiang Kaen Hospital was relatively high, while the validity of reports by the Chiang Khong Hospital were seriously in need of improvement. Similar incomplete PEP reports have been identified in US hospitals, e.g., at the Emergency Department in King County, Washington and Cook County, Illinois (14,15). The overall reporting completeness in King County was 62%, while in Cook County the overall reporting completeness was 25.4% before intervention, rising to 54.1% after intervention (14,15).

The median time from first vaccination to online reporting was longer than would be desired in both the Wiang Kaen and Chiang Khong Hospitals. The median times were 91 days (IQR 81 days) and 38 days (IQR 77 days), respectively. Reports should ideally be submitted the next day following treatment for medical providers using the online R36 program or within 30 days, i.e., after completion of a series of vaccinations, if reports are submitted in batches. Stakeholders using the online R36 reporting system realize the importance of the program and agree to report. On the other hand, it was found that in nine of the states which were

assigned to be “model” states for Rabies-Related Animal Control (RRAC) in the US, none required both animal bite and PEP reporting, two mandated animal bite reporting, five mandated PEP reporting and two had neither animal bite nor PEP reporting requirements (16).

Human error in manual entry of medical record data into the online R36 program was a major impediment to validity and completeness. Data input to the online R36 system could be improved by automatic data transfer from hospital information systems directly to the online R36 program. The online R36 reporting system is not yet required by Thai law and is not a requirement for eligibility for reimbursement under the Thai National Health Security Office, resulting in sub-optimal reporting.

Although rabies is a fatal disease, the percentages of vaccination and prescribing RIG that did not adhere to the Thai CPG 2016 in Wiang Kaen, Chiang Khong and Song Khwae Hospitals were unexpectedly high. An example of over-treatment is giving three booster doses to a patient who has received at least three doses of vaccine at some time in the past. Although the three booster

doses can protect the patient from rabies, this practice shows that the physician did not review the patients' rabies immunization history, resulting in unnecessary extra doses and extra cost. A number of studies also showed a high proportion of improper rabies PEP treatment. A 2006 study in the Emergency Department of Ramathibodi Hospital revealed that "under treatment" occurred in 71.5% of cases (wound category 2 treated as category 1, wound category 3 treated as category 1 and wound category 3 treated as category 2) and that "over treatment" happened in 1.6% of cases (wound category 1 treated as category 2 and wound category 2 treated as category 3) (17). Another study of 48 hospitals in eastern Thailand, the area with the highest national prevalence of rabies, reported that just 70% of the rabies exposure patients received at least three doses of PEP vaccination and only 15% of patients with category 3 wounds received RIG (18). In Vietnam during 2014-2016, among 14,095 patients who were exposed to potentially rabid mammals and received a first dose of PEP vaccination only 64.76% received at least three doses of PEP vaccination (19).

A study in Australia reported that severe wounds of the face and head were associated with post-exposure management failure (20). In contrast, a study in Delhi showed that wound category 2 exposures were significantly associated with non-adherence to anti-rabies vaccine schedules when compared to patients with wound category 3 (21). Patients who have a new rabies exposure or who have had insufficient immunization in the past need to receive a full vaccination schedule of at least three doses if the suspect animal remains healthy for ten days. However, in this study, a number of patients with lacerations or wounds of the head and neck did not receive RIG and therefore, these category 3 exposure cases received significantly inappropriate treatment. A quarter of our study subjects had not received vaccine or had received inadequate PEP vaccination, and thus were in the significant risk group of non-adherence to the Thai CPG for rabies 2016.

The risk of inappropriate PEP discontinuation in different age groups has been evaluated several different studies. The present study found that the high school age group (13-18 years old) were a significantly high risk group for inappropriate treatment, while the pre-school age group had a higher chance of receiving appropriate care. In other Thai studies, 16-45 year old patients were found to be more likely to discontinue PEP protocol, while in Viet Nam patients who were at least 15 years old had a higher risk of incomplete PEP (18,19).

Conclusions

The online R36 reporting system was accepted and implemented in the Wiang Kaen and Chiang Khong Hospitals. However, the time to report an incidence at the Wiang Kaen Hospital needed improvement and the quality of the reporting (sensitivity, completeness and validity of the report) in the Chiang Khong Hospital was in need of enhanced supervision by zoonotic program managers at the provincial and/or regional levels. Overall, the incidence of inappropriate PEP according to the Thai CPG for rabies 2016 was unexpectedly high for this highly fatal disease. Risk factors associated with non-compliance with the guideline can mostly be classified into two groups. The first group is category 3 exposures (head and neck or laceration wounds) requiring RIG administration. The second group is patients with no history of immunization or who received inadequate immunization in the past. These patients have a higher risk of incomplete vaccination, i.e., of receiving only one or two doses, than patients who have received adequate immunization in the past. Physicians should keep in mind the risk factors that can lead to inappropriate treatment. Health care teams should also increase patients' awareness of the need to strictly adhere to vaccination schedules to prevent incomplete treatment.

Limitations of the study

This evaluation was based on records in the online R36 program and hospital information

systems, so some actual practices might not have been recorded.

Also, the classification category of a wound could vary, e.g., an abrasion wound might be recorded as a laceration wound and vice versa.

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Conflicts of interest

All authors declare no conflicts of interest.

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การประเมินนำร่องระบบรายงานออนไลน์ผู้สัมผัสโรคพิษสุนัขบ้า (ร. 36) และเวชปฏิบัติในการให้ภูมิคุ้มกันโรคพิษสุนัขบ้าหลังสัมผัสโรค ของโรงพยาบาลที่ถูกเลือกในเขตภาคเหนือตอนบนของประเทศไทย ปีงบประมาณ พ.ศ. 2559

สุรเชษฐ์ อรุณทอง, นภักสรณ์ บงจกร และ กนกวรรณ ทองชุม
สำนักงานควบคุมโรคเขต 1 จังหวัดเชียงใหม่

วัตถุประสงค์ เพื่อประเมินระบบรายงานออนไลน์ผู้สัมผัสโรคพิษสุนัขบ้า (ร. 36) และเวชปฏิบัติในการให้ภูมิคุ้มกันป้องกันโรคพิษสุนัขบ้าหลังสัมผัสโรค

วิธีการ การศึกษานำร่อง แบบภาคตัดขวางในโรงพยาบาลเวียงแก่น เชียงของ และสองแคว ในช่วงกลางเดือนมกราคม พ.ศ. 2560 โดยใช้ข้อมูลของปีงบประมาณ พ.ศ. 2559 และสัมภาษณ์ผู้เกี่ยวข้อง ข้อมูลของการประเมินระบบรายงานนำเสนอในรูปแบบคุณลักษณะเชิงปริมาณและคุณภาพ สำหรับการประเมินและเวชปฏิบัติในการให้ภูมิคุ้มกันโรคพิษสุนัขบ้าหลังสัมผัสโรคนำเสนอในรูปของร้อยละและอธิบายข้อผิดพลาดของการดูแลรักษาที่ไม่ปฏิบัติตามแนวทางเวชปฏิบัติโรคพิษสุนัขบ้าของประเทศไทย พ.ศ. 2559 ส่วนปัจจัยที่สัมพันธ์กับการรักษาที่ไม่เป็นไปตามแนวทางเวชปฏิบัติได้ทำการถูกวิเคราะห์โดยวิธีการถดถอยโลจิสติกแบบพหุกลุ่ม

ผลการศึกษา พบว่ามีเพียง 2 โรงพยาบาลที่ใช้ระบบรายงานออนไลน์ผู้สัมผัสโรคพิษสุนัขบ้า (ร. 36) คือ โรงพยาบาลเวียงแก่น และเชียงของ ค่าความครอบคลุมของการรายงาน ความครบถ้วน ความถูกต้องของการรายงาน และค่ามัธยฐานของเวลาที่ใช้ในการรายงานนับจากการที่ผู้ป่วยได้รับวัคซีนป้องกันโรคพิษสุนัขบ้าเข็มแรก คือ ร้อยละ 73.08, 98.25, 70.18, และ 91 วัน สำหรับโรงพยาบาลเวียงแก่น และร้อยละ 37.12, 73.47, 36.73, และ 38 วัน สำหรับโรงพยาบาลเชียงของตามลำดับ การรักษาที่ไม่เป็นไปตามแนวทางเวชปฏิบัติ เช่น การให้วัคซีน หรืออิมมูโนโกลบูลินที่มากหรือน้อยเกินไปพบร้อยละ 34.62, 55.30 และ 44.44 ในโรงพยาบาลเวียงแก่น เชียงของ และสองแคว ตามลำดับ โดยปัจจัยเสี่ยงที่สัมพันธ์กับการรักษาที่ไม่เป็นไปตามแนวทางเวชปฏิบัติ คือ กลุ่มอายุ 13-18 ปี, การได้รับบาดเจ็บบริเวณศีรษะ และลำคอ บาดแผลฉีกขาด และการที่ไม่มีประวัติการได้รับวัคซีนป้องกันโรคพิษสุนัขบ้าที่เพียงพอในอดีต

สรุป เจ้าหน้าที่โรงพยาบาลเวียงแก่นควรปรับปรุงเรื่องระยะเวลาการรายงาน ส่วนเจ้าหน้าที่โรงพยาบาลเชียงของ ควรปรับปรุงเรื่องความครอบคลุม ความครบถ้วน และความถูกต้องของการรายงาน สำหรับเรื่องอัตราส่วนการไม่ปฏิบัติตามแนวทางเวชปฏิบัติที่มีค่าสูง แพทย์ และคณะผู้ดูแลรักษา ควรให้ความสนใจเป็นพิเศษในผู้ป่วยที่มีประวัติเสี่ยงดังกล่าว **เชียงใหม่เวชสาร 2563;59(4):187-95.**

คำสำคัญ: โรคพิษสุนัขบ้า การประเมินระบบรายงาน เวชปฏิบัติ ปัจจัยเสี่ยง การป้องกันโรคหลังสัมผัส