



Health Literacy and Medication Adherence Among Persons with
Chronic Obstructive Pulmonary Disease, Xishuangbanna Dai
Autonomous Prefecture, the People's Republic of China*
ความรอบรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยา
ในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรัง เขตปกครองตนเองชาติไท
สิบสองปันนา สาธารณรัฐประชาชนจีน*

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Abstract

Low rates of adherence to medication behaviors are expected among persons with chronic obstructive pulmonary disease (COPD). Health literacy may influence engagement in adherence to medication behaviors. This descriptive correlational study aimed to examine the relationship between health literacy and medication adherence among COPD patients. The sample included 120 ethnic minority participants with COPD in Xishuangbanna Dai Autonomous Prefecture. Research instruments included 1) a demographic information form; 2) the Chinese version of the Functional, Communicative, and Critical Health Literacy Scale (FCCHL); and 3) the Medication Adherence Scale and Inhaler Adherence Scale (MAS and IAS). The Cronbach's alpha coefficients of the Chinese version of the FCCHL for each component were .82-.84, and the Medication Adherence Scale and Inhaler Adherence Scale correlation coefficient (r) values were .83. Using descriptive statistics and Spearman's rank-order correlation, the data were analyzed.

The results demonstrated that the overall comprehensive health literacy mean score was 11.58 (SD = 3.86), and the average of overall medication adherence was 5.69 (SD = 2.70). Total health literacy strongly correlated with medication adherence ($r = .589$, $p < 0.01$).

The results of this research provide baseline information regarding the association between health literacy and oral and inhaled medication adherence among Chinese people with COPD.

Keywords: Chronic obstructive pulmonary disease; Health literacy; Medication adherence

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บทคัดย่อ

ความร่วมมือที่ต่ำในการรักษาด้วยยา เป็นปัญหาที่พบได้ในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรัง ความรู้ด้านสุขภาพอาจมีผลต่อการความร่วมมือในการรักษาด้วยยา การศึกษาเชิงพรรณนาหาความสัมพันธ์ครั้งนี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างความรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยา กลุ่มตัวอย่างคือ ผู้ที่เป็นโรคปอดอุดกั้นเรื้อรังที่เป็นชนกลุ่มน้อย จำนวน 120 คน ในเขตปกครองตนเอง ชาติไทย ลีบสองปันนา เครื่องมือที่ใช้ในการเก็บรวบรวมข้อมูล ได้แก่ 1) แบบสอบถามส่วนบุคคล 2) แบบประเมินความรู้ด้านสุขภาพขั้นพื้นฐาน ปฏิสัมพันธ์ และวิจารณ์ญาณ ฉบับภาษาจีน (FCCHL) และ 3) แบบประเมินความร่วมมือในการรักษาด้วยยาและยาพ่น (MAS และ IAS) คุณภาพของแบบประเมิน FCCHL ฉบับภาษาจีน มีค่า Cronbach's alpha coefficients ในแต่ละองค์ประกอบอยู่ระหว่าง .82-.84 และแบบประเมิน MAS และ IAS มีค่า correlation coefficient (r) ที่ .83 วิเคราะห์ข้อมูลโดยใช้สถิติพรรณนา และสถิติ Spearman's rank-order correlation

ผลการศึกษาพบว่า คะแนนเฉลี่ยของความรู้ด้านสุขภาพโดยรวมเท่ากับ 11.58 (SD = 3.86) คะแนนเฉลี่ยของความร่วมมือในการรักษาด้วยยาโดยรวมเท่ากับ 5.69 (SD = 2.70) ความรู้ด้านสุขภาพโดยรวมมีความสัมพันธ์ในระดับสูงกับความร่วมมือในการรักษาด้วยยา ($r = .589, p < 0.01$)

ผลการศึกษานี้ แสดงถึงข้อมูลพื้นฐานเกี่ยวกับความสัมพันธ์ระหว่างความรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยารับประทานและยาสูดพ่น ในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรังชาวจีน

คำสำคัญ: โรคปอดอุดกั้นเรื้อรัง ความรู้ด้านสุขภาพ ความร่วมมือในการรักษา

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Background and significance

Chronic obstructive pulmonary disease (COPD) ranks as the sixth main cause of death in China, with a prevalence of 13.7% among those 40 years of age or older (Wang et al., 2018). In 2015, 3.2 million individuals in Xishuangbanna Dai Autonomous Prefecture died due to COPD which was expected to affect 104.7 million men and 69.7 million women worldwide (Naghavi et al., 2017). For Chinese people with COPD, maintaining a consistent medication schedule is an essential part of disease treatment. Various medications are recommended to control COPD symptoms, for example, inhaled COPD treatment, which consists of bronchodilators, anti-muscarinic drugs, and combination therapy (including long-acting beta2-agonists (LABA), antimuscarinics (including long-acting antimuscarinic antagonists (LAMA), and inhaled corticosteroids (ICS) (Chronic Obstructive Pulmonary Disease Group of Chinese Thoracic Society [CTS], 2021).

For illness prevention and improved quality of life, it is crucial to have a clear grasp of how to administer these medications and of their significance in daily use. Unfortunately, among the Chinese COPD population, only 10.8% of people take their medication as directed. Those who use inhaled bronchodilators have shown adherence rates of 36.3%, and ICS/LABA combination patients have adherence rates of 26.4%. Those using oral medicines have been shown to present adherence rates of just 1.7% (Chen et al., 2020). Medication adherence refers to the extent to which a person with COPD follows the prescribed dose, uses an interval inhaler, and follows oral medication regimens.

Numerous factors influence patient adherence to COPD treatment, including socioeconomic variables (e.g., age, sex, level of education, physical and mental condition) and health literacy (Brown et al., 2016). Notably, compared to individuals with adequate health literacy, patients with low health literacy were likely to forget and take fewer medications as recommended by the physician (Mayo-Gamble & Mouton, 2018).

The health literacy of patients with COPD reflects their cognitive and social abilities, which determine the motivation and ability of those individuals to gain access to, comprehend, and use information as well as to utilize health-promoting information, and it has three dimensions (levels): functional, interactive, and critical health literacy (Nutbeam, 2008). Patients with COPD usually have numerous comorbidities, and they require intricate treatment plans and numerous medical consultations (Smith & Wrobel, 2014) which require extensive knowledge and skills that assist patients in better understanding pharmacological therapy and in using medications appropriately. In addition, COPD states are associated with complex medication regimens (CTS, 2021). This complexity of medication use requires patients to manage it using knowledge, understanding, and skills.

There are 25 ethnic minority groups besides the Han ethnic group in Yunnan province. Every ethnic group has its own unique culture, religion, diet, and lifestyle, which leads to beliefs for



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เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

each ethnic minority group (Liu et al., 2020). According to Agarwal et al. (2021), medication adherence may be hampered by the beliefs of patients from their various racial and cultural backgrounds. Even though there have been studies concentrating on the relationship between health literacy and medication adherence for other states, the findings cannot be generalized to ethnic minorities in China. Therefore, the relationship between health literacy and medication adherence among ethnic minority COPD patients must be investigated.

These findings will enable nurses to have a better understanding of the health literacy and medication adherence of patients with COPD, as well as of the link between these two variables. Identification of predictors of medication adherence might help in the use of interventions that could improve medication adherence in the COPD population.

Objectives

1. To explore the health literacy among persons with COPD in Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China.
2. To explore medication adherence among persons with COPD in Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China.
3. To examine the relationship between health literacy and medication adherence among persons with COPD in Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China.

Conceptual framework

The study framework incorporated Nutbeam's theory of health literacy (Nutbeam, 2008) along with a review of the literature on medication adherence. Medication adherence for COPD is the extent to which a person with COPD follows the prescribed inhaler and oral medication regime, including dosing, timing, taking, and persistence (Bethany & Ahna, 2014). There is a complexity of medication used, including oral medication and various inhalation therapies. Health literacy refers to the social and cognitive ability of persons with COPD, which, in turn, influence the motivation and ability to access, assimilate, and apply health-promoting information. It is composed of functional, interactive, and critical health literacy. COPD patients with lower health literacy find reading and understanding related inhaler and oral medication information more challenging. As a result, these persons will not be able to make optimal use of available information about COPD to consider critically what is best for them, which will create more barriers when interacting and communicating with their health care providers regarding inhaler and oral medication treatment, leading to poorer knowledge about their condition(s) and about medication management. In addition, individuals with COPD and lower rates of health literacy may have lower medication adherence rates. In contrast, those with a higher level of health literacy are more likely to adhere to their medications.



Methodology

This was a descriptive correlation study.

Population and sample

Patients with COPD receiving outpatient treatment at the People's Hospital of Xishuangbanna Dai Autonomous Prefecture (PHXSBNDAP) and The First People's Hospital of Jinghong City (FPHJC) were recruited using purposive sampling.

Computer software (G * Power 3.1.9.7) and the G * Power analysis were used to confirm the sample size. A correlation coefficient of 0.25 was adapted for effect size. The conventional standard for power ($1-\beta$) was 0.8, and the type I error (α) was set at 0.05 (Polit & Beck, 2003). The calculated sample size was 120, and purposive sampling was used to select the sample from each hospital according to the proportion of the population, resulting in 80 patients from the People's Hospital of Xishuangbanna Dai Autonomous Prefecture and 40 from the First People's Hospital of Jinghong City.

The following were the criteria for inclusion: 1) having had a COPD diagnosis for over six months, at any stage, and over 35 years old; 2) having no cognitive impairment as screened by the Six-Item Screener (SIS) > 4; 3) using both inhaler and oral medication for treating COPD; 4) having the capacity to comprehend and speak Chinese; and 5) willingness to participate in the present study.

The exclusion criteria were as follows: 1) persons with COPD who were in acute exacerbation and dyspnea and could not answer or be interviewed, and 2) persons with COPD who had been diagnosed with psychological problems or who were taking antipsychotic medication.

Research instruments

There were four instruments used in this study: 1) the Cognitive Impairment Screening Instrument Including the Six-Item Screener (SIS) (Callahan et al., 2002); 2) the Demographic Data Form, designed by the researcher; 3) the Chinese version of the Functional, Communicative, and Critical Health Literacy scale (FCCHL), devised by Ishikawa et al. (2008) and translated by Zhang et al. (2018); and 4) the Medication Adherence Scale and Inhaler, created by Dolce et al. (1991). In this investigation, the Cronbach's alpha for the 14-item FCCHL was .94.

The FCCHL scale is composed of 14 items which are categorized into three levels: low, moderate, and high health literacy. The range of total item scores was 14 to 56, with a choice of 1 = never, 2 = rarely, 3 = sometimes, or 4 = frequently for each item. Higher scores indicated a higher level of health literacy (Ishikawa et al., 2008). The scores were classified into low, moderate and high level by using the class interval.

The Medication Adherence Scale and the Inhaler Adherence Scale consist of two subscales: The Medication Adherence Scale (MAS) and the Inhaler Adherence Scale (IAS), the first of which is for oral medications and the second to monitor inhaler use. Each scale consisted of six items



Health Literacy and Medication Adherence Among Persons with Chronic Obstructive Pulmonary Disease, Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China

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เขตปกครองตนเองชาติไท ลีซวงปันนา สาธารณรัฐประชาชนจีน

that answered straightforward yes-no questions (no = 1; yes = 0; scale score = total of "no" replies). A total score between 0 and 12 was calculated from the numeric replies to the 12 items. A 'yes' response received a score of 0 and a 'no' response received 1, with a higher score indicating inhaler adherence (Dolce et al., 1991).

Ethical considerations

The ethics committees, including the Faculty of Nursing, Chiang Mai University, Thailand (EXP058/2021); The People's Hospital of Xishuangbanna Dai Autonomous Prefecture; and The First People's Hospital of Jinghong City, China, approved of the study. In addition, participants received a pamphlet describing the objectives of the study, and participation was completely voluntary. They were informed that whether they participated, their treatment as patients would not be affected, and that they could withdraw from the study at any time and for any reason.

Data collection

The researcher submitted the research proposal, ethics approval document, application letter requesting permission to collect the data, and copies of the data collection instruments to the directors of each hospital to request permission to collect data.

The researcher visited the head nurses and directors of outpatient respiratory medicine of each hospital. The data collection process proceeded after receiving approval from each hospital director. The researcher provided information about the study goals, advantages, and data collection process.

While outpatients for respiratory medicine were waiting in the reception room to see their doctor, the researcher recruited individuals who fulfilled the inclusion requirements for the study.

The researcher explained the objectives and benefits of the study to participants who were also informed about the confidentiality and anonymity of the individual responses. Those willing to participate in the study were required to complete an informed consent form. Those who could not write their name were asked to give fingerprints on the informed consent form. Completing these two questionnaires took approximately 10-20 minutes. The researcher read each question repeatedly but without explanation, then select the corresponding option based on the participant's answer. Clinical and demographic data were extracted from patients' medical records and were confirmed with the patients.

Data analysis

The selected significance level was .05. and the 13th edition of the English version of the Statistical Package Software was used to analyze the data and determine the mean, standard deviation (SD), and range of continuous variables. Frequency and percentage were applied to categorical variables to characterize them. Kolmogorov-Smirnov testing was used to assess the normality of the health literacy and medication adherence data, revealing that the data distribution was not normal. Consequently, Spearman's rank-order correlation test was used. The correlation coefficient (r) value among the variables was considered, as follows: $r < 0.30$: weak



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เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

relationship; $0.30 \leq r \leq 0.50$: moderate relationship; and $r > 0.50$: strong relationship (Burns & Grove, 2009).

Results

According to the findings, most participants were male (86.67%), with ages ranging from 41 to 78 years old (mean = 67.6, SD = 6.98); almost half (45.83%) were between the ages of 60 and 70. Most participants were married (92.5%) and had an elementary school education level (70%). Thirty-six percent were from the Dai Ethnic Minority Group, while 24% were from the Hani Ethnic Minority Group, and over half of them lived in rural areas (57.5%). Regarding monthly incomes, 34.16% of participants earned between 1500 and 3000 CNY each month.

Thirty-five percent of participants had been undergoing COPD for over ten years, and 34.16% had had the disease for one to five years. All of them (100%) were enrolled in health insurance. About 71.67% of the participants were classified into GOLD spirometry, stage III-IV, and 28.33% were classified into GOLD spirometry, stage I-II. Overall, 35.84% of participants had smoked for more than ten years. Most participants reported one single comorbidity in addition to COPD (61.67%), while 38.33% had more than one single comorbidity. About 40% of participants used two different drugs, and 30% used only one drug.

Overall, the health literacy of the participants was moderate, with a mean score of 28.83 (SD = 7.24). Regarding each level of health literacy, the greatest level of functional health literacy was moderate, with a mean of 11.58 (SD = 3.86). The mean access to interactive and crucial levels was moderate and low, with scores of 10.57 (SD = 3.77) and 6.68 (SD = 1.85), respectively (Table 1).

Table 1: The Level of Health Literacy, Possible Score, Mean and Standard Deviation of Health Literacy of the Sample (n = 120)

Health literacy	Possible score	n	%
Functional health literacy (M = 11.58, SD = 3.86)	5-20		
Low level	5-10	51	42.50
Moderate level	10.01-15	45	37.50
High level	15.01-20	24	20.00
Interactive health literacy (M = 10.57, SD = 3.77)	5-20		
Low level	5.01-10	52	43.33
Moderate level	10.01-15	60	50.00
High level	15.01-20	8	6.67



Health Literacy and Medication Adherence Among Persons with Chronic Obstructive Pulmonary Disease, Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China
 ความรอบรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยาในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรัง
 เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

Table 1: The Level of Health Literacy, Possible Score, Mean and Standard Deviation of Health Literacy of the Sample (n = 120) (continue)

Health literacy	Possible score	n	%
Critical health literacy (M = 6.68, SD = 1.85)	4-16		
Low level	4.01-8	96	80.00
Moderate level	8.01-12	24	20.00
High level	12.01-16	0	0
Totally health literacy (M = 28.83, SD = 7.24)	14-56		
Low level	14-28	56	46.67
Moderate level	28.01-42	62	51.67
High level	42.01-56	2	1.66

The total medication adherence mean score was 5.69 (SD = 2.70), while the mean score for oral adherence and inhaler adherence was 2.88 (SD = 1.50) and 2.80 (SD = 1.78), respectively (Table 2).

Table 2: The Level of Medication Adherence, Possible Score, Mean, and Standard Deviation of the Health Literacy of the Sample (n = 120)

Medication adherence	Possible score	Mean (SD)
Oral adherence	0-6	2.88 (1.50)
Inhaler adherence	0-6	2.80 (1.78)
Totally medication adherence	0-12	5.69 (2.70)

The results demonstrate a significant positive correlation between overall health literacy and oral medication adherence ($r = .448, p < 0.01$), inhaler medication adherence ($r = .501, p < 0.01$), and total medication adherence ($r = .589, p < 0.01$).

Functional health literacy had a weak positive relationship with oral adherence ($r = .263, p < 0.01$) and a moderate positive relationship with inhaler adherence and total medication adherence ($r = .306, r = .398, p < 0.01$). There was a moderate positive relationship between communicative health literacy and oral adherence, inhaler adherence, and total medication adherence ($r = .413, r = .428, \text{ and } r = .492, p < 0.01, \text{ respectively}$). Moreover, there was a moderately positive relationship between critical health literacy and oral adherence, inhaler adherence, and total medication adherence ($r = .313, r = .357, \text{ and } r = .390, p < 0.01, \text{ respectively}$) (Table 3).



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 เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

Table 3: The Relationships between Each Health Literacy Item and Medication Adherence of the Sample (n = 120)

	Oral adherence (MAS)		Inhaler adherence (IAS)		Totally medication adherence	
	Spearman rank	P-value	Spearman rank	P-value	Spearman rank	P-value
	Functional health literacy	.263*	p < 0.01	.306*	p < 0.01	.398*
Communicative health literacy	.413*	p < 0.01	.428*	p < 0.01	.492*	p < 0.01
Critical health literacy	.313*	p < 0.01	.357*	p < 0.01	.390*	p < 0.01
Total health literacy	.448*	p < 0.01	.501*	p < 0.01	.589*	p < 0.01

Note. * Correlation is significant at the 0.01 level (2-tailed)

Discussion

This research revealed that the overall health literacy of the participants was at a moderate level. Compared with a previous study in the Netherlands (Heijmans et al., 2015), our findings indicated that health literacy was lower than that of patients with chronic illness (Mean = 42.3). As participants were recruited from five ethnic minority groups, only 70% of them had an elementary school education. Because of these relatively low education levels, participants in this study may have had difficulty understanding many patient education materials, including instructions for taking prescription medications.

Furthermore, in this study, functional health literacy scored the highest among the three subdimensions of health literacy, followed by interactive health literacy and critical health literacy. These findings are consistent with earlier research in other fields supporting the FCCHL framework which was initially proposed to reflect the increasing demands of cognitive and social skills along the spectrum as one advances from basic literacy to communicative skills and the capacity to critically analyze health-related information (Nutbeam, 2008). Patients need help considering any information's applicability, validity, and reliability when collecting information to make health decisions (Zhang et al., 2018).

However, there was a contrasting outcome across the three health literacy subscales: The highest mean score was for interactive health literacy instead of functional health literacy. This difference may mainly be due to participants with COPD being GOLD III/IV (71.1%) in this study. The GOLD system categorizes airflow limitations into stages. In patients with FEV1/FVC <0.7: GOLD III - severe: 30% ≤ FEV1 <50% predicted; and GOLD IV - very severe: FEV1 <30% predicted CTS,



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เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

2021). Severe symptom burdens (such as breathing difficulties) can influence physical and social interactions (Marin et al., 2011), affecting interactive health literacy levels.

Our findings identified levels of medication adherence in the COPD population demonstrating that participants had a low level of adherence which indicates that they may forget, change, stop, miss doses, and sometimes take less medication based on the medication and inhaler adherence scales. In individuals with asthma and COPD, multiple inhaler use is related to greater non-adherence than single inhaler use (Mäkelä et al., 2013). Forty percent of the participants in this study used three varieties of inhalers, while 30.83 % used two.

These results are consistent with previous studies documenting low adherence to inhaled and oral medication among COPD patients, regardless of medication class (Chen et al., 2020; Humenberger et al., 2018). A reasonable explanation of low adherence relates to the participants' demographic data. In the current study, all participants had a comorbidity, and 38.30% had more than one single comorbidity. A high comorbidity burden is among the most critical predictors of poor adherence, according to previous research (Vetrano et al., 2017).

Interestingly, a study by Chen et al. (2020) in Guangdong province showed that adherence to inhaled bronchodilator (36.3%) and ICS/LABA combination (29.2%) was higher than that for oral medication (1.7%). Contrariwise, in this study, the level of adherence to inhaler medication (2.80 ± 1.78) was lower than that to oral medication (2.88 ± 1.50). A cause of this discrepancy may be the relatively higher monthly costs. Inhaled medications are more expensive (out-of-pocket costs) than oral medications. The household monthly income for most participants in the present study (68.3%) was below 3000 CNY (about 14,688 THB). However, according to the data from the Guangdong Provincial People's Government (2023), the monthly income per capita is 3922 RMB. Therefore, the participants are likely more concerned about the cost than the drug's efficacy.

Our results also revealed that health literacy is associated with medication adherence, which supports the evidence for a positive relationship between them ($r = .589$). This result is consistent with earlier research (Freeze et al., 2020). COPD patients with lower health literacy skills find it more challenging to read and understand inhaler and oral medication information. Therefore, they are more likely to make mistakes in interpreting medication instructions and warning labels, and it may be more difficult to control the inhaler technique, increasing the risk of unintentional dosing and timing adherence with medication regimes. In addition, this population have more barriers when interacting and communicating with their healthcare providers regarding inhalers and oral medication treatment which could lead to poorer knowledge about their condition(s) and medication management.

However, there are also different data published on the influence of health literacy on medication compliance among COPD patients (Lee et al., 2017), in which the correlation coefficient ($r = 0.25$) was lower than that in the present study ($r = 0.589$). The different instruments



Health Literacy and Medication Adherence Among Persons with Chronic Obstructive Pulmonary Disease, Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China

ความรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยาในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรัง
เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

might explain this difference. This study measured health literacy by The Functional Communicative and Critical Health Literacy Scale (FCCHL), which includes three dimensions. In comparison, previous studies have measured this metric using The Short Test of Functional Health Literacy in Adults (STOFHLA).

Consistent with studies among patients with non-communicable diseases such as diabetes (Heijmans et al., 2015), we found stronger relationships between communicative and critical health literacy and medication adherence compared to functional health literacy and outcome measures, indicating that higher-order skills are more essential for medication adherence than functional skills. People with communicative health literacy can readily act on new information and interact with information providers, such as healthcare professionals, more confidently. Critical health literacy emphasizes more advanced cognitive and social skills for analyzing information critically and employing it to exert greater control over life events (Nutbeam, 2008). Given this description, it is not unexpected that stronger connections between critical health literacy, communication, and medication adherence were discovered.

Overall, the results are consistent with many previous studies on health literacy and medication adherence which have proved that health literacy and its three dimensions positively correlate with medication adherence in persons with COPD, which provides the basis for improving the health literacy of persons with COPD and enhancing their medication adherence.

Conclusions and recommendations

This study may serve as a baseline for future research on the relationship between health literacy and medication adherence among patients with COPD from ethnic minority groups in Xishuangbanna Dai Autonomous Prefecture. Clinical nurses could provide health education to enhance knowledge, change unhealthy behaviors, and promote adherence to inhalers and oral medication regimens for COPD patients.

Application of research findings

This study showed that among minority ethnic groups in Xishuangbanna Dai Autonomous Prefecture, efforts to improve health literacy rates may aid in medication adherence. However, as the study was conducted with a small sample and the gender was predominantly male, future studies should include a larger sample size and account for gender proportions.

Suggestions for further research

The level of each component of health literacy among persons with COPD is inconsistent in different countries, and even in different provinces in China. For future research, it will be helpful to identify the health literacy of COPD patients in various districts. Medical providers should focus on effective interventions for health literacy to improve medication adherence among COPD patients. Improving health literacy may be critical to increasing medication



adherence in COPD patients by conducting practical interventions.

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Health Literacy and Medication Adherence Among Persons with Chronic Obstructive Pulmonary Disease, Xishuangbanna Dai Autonomous Prefecture, the People's Republic of China

ความรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยาในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรัง
เขตปกครองตนเองชาติไท ลีบสองปันนา สาธารณรัฐประชาชนจีน

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Health Literacy and Medication Adherence Among Persons with Chronic Obstructive
Pulmonary Disease, Xishuangbanna Dai Autonomous Prefecture,
the People's Republic of China

ความรู้ด้านสุขภาพและความร่วมมือในการรักษาด้วยยาในผู้ที่เป็นโรคปอดอุดกั้นเรื้อรัง
เขตปกครองตนเองชาติไท สิบสองปันนา สาธารณรัฐประชาชนจีน

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