The Relationship between Health Literacy and Self-Care Behaviors in Persons with Lung Cancer Receiving Chemotherapy*
ความสัมพันธ์ระหว่างความรอบรู้ด้านสุขภาพและพฤติกรรมการดูแลตนเอง ในผู้ที่เป็นมะเร็งปอดที่ได้รับเคมีบำบัด*

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Abstract

Health literacy plays a critical role in enhancing self-care behaviors in persons with lung cancer receiving chemotherapy. Improving health literacy can empower patients to better understand and manage side effects of chemotherapy, leading to more effective self-care behaviors. This descriptive study aimed to explore the relationship between health literacy and self-care behaviors among lung cancer patients undergoing chemotherapy. The participants were 161 lung cancer patients receiving chemotherapy at the first affiliated hospital of Kunming Medical University and the network hospitals. The tools used for data collection included a demographic data record form, the Chinese version of the Functional Communication Critical Health Literacy Scale (FCCHL), and the Chinese version of The Leuven Questionnaire for Patient Self-care during Chemotherapy (L-PaSC). The Cronbach's alpha coefficients of the two questionnaires were 0. 0.97 and 0.77, respectively. Descriptive statistics and Spearman's rank correlation were employed for data analysis.

The results of this study revealed the following:

1. The average health literacy score was 2.13 (SD = 0.88, range = 1-4). The average score for functional health literacy was 2.33 (SD = 1.04, range = 1-4). The average score for communication health literacy was 2.16 (SD = 1.04, range = 1-4). The average score for critical health literacy was 1.85 (SD = 0.91, range = 1-4).

2. The average score for self-care behaviors was relatively low, with an overall mean score of 42.60 (SD = 0.20, range = 12-94). The average score for adherence to treatment recommendations and management of treatment-related events was 32.40 (SD = 0.25, range = 0-93). The average score for symptom relief was 88.63 (SD = 0.25, range = 0-100).

3. Health literacy was found to have a high correlation with self-care behaviors (r = .518, p < .01). Additionally, functional health literacy (r = .437, p < .01), communication health literacy (r = .437, p < .01), and critical health literacy (r = .537, p < .01) were all significantly associated with self-care behaviors.

These research findings highlight the opportunity to improve self-care behaviors among persons with lung cancer receiving chemotherapy by focusing on enhancing health literacy.

Keywords: Lung cancer; Chemotherapy; Health literacy; Self-care behavior

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บทคัดย่อ

    ความรู้ด้านสุขภาพ มีบทบาทสำคัญในการเสริมสร้างพฤติกรรมการดูแลตนเองของผู้ป่วยมะเร็งปอดที่ได้รับ เคมีบำบัด ความรู้ด้านสุขภาพที่ดีสามารถช่วยให้ผู้ป่วยเข้าใจและจัดการกับผลข้างเคียงของเคมีบำบัดได้ดีขึ้น ส่งผล ให้มีพฤติกรรมการดูแลตนเองที่มีประสิทธิภาพมากขึ้น การศึกษาเชิงพรรณานี้มีวัตถุประสงค์เพื่อสำรวจ ความสัมพันธ์ระหว่างความรู้ด้านสุขภาพและพฤติกรรมการดูแลตนเองของผู้ป่วยมะเร็งปอดที่ได้รับเคมีบำบัด กลุ่มตัวอย่างเป็นผู้ป่วยมะเร็งปอดที่ได้รับเคมีบำบัด จำนวน 161 ราย ในโรงพยาบาลในเครือแห่งแรกของ มหาวิทยาลัยการแพทย์คุนหมิง และโรงพยาบาลในเครือข่าย เครื่องมือที่ใช้ในการรวบรวมข้อมูล ได้แก่ แบบฟอร์ม บันทึกข้อมูลประชากร แบบสอบถามความรู้ด้านสุขภาพที่สำคัญในการสื่อสารเชิงฟังก์ชันฉบับภาษาจีน และ แบบสอบถามพฤติกรรมการดูแลตนเองฉบับภาษาจีน ค่า Cronbach's alpha coefficient ของ แบบสอบถาม ทั้งสองฉบับ เท่ากับ 0.97 และ 0.77 ตามลำดับ วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา และสถิติ Spearman's rank correlation

    ผลการศึกษาพบว่า

    1. คะแนนเฉลี่ยความรอบรู้ด้านสุขภาพ เท่ากับ 2.13 (SD = 0.88, range = 1-4) คะแนนเฉลี่ยความรอบรู้ ด้านสุขภาพเชิงหน้าที่ เท่ากับ 2.33 (SD = 1.04, range = 1-4) คะแนนมัธยฐานความรอบรู้ด้านสุขภาพด้าน การสื่อสาร เท่ากับ 2.16 (SD = 1.04, range = 1-4) คะแนนเฉลี่ยความรอบรู้ด้านสุขภาพเชิงวิพากษ์ เท่ากับ 1.85 (SD = 0.91, range = 1-4)

    2. คะแนนเฉลี่ยพฤติกรรมการดูแลตนเองอยู่ในระดับค่อนข้างต่ำ มีคะแนนรวมเฉลี่ยเท่ากับ 42.60 (SD = 0.20, range = 12-94) คะแนนเฉลี่ยของการปฏิบัติตามคำแนะนำการรักษาและการจัดการเหตุการณ์ที่เกี่ยวข้องกับ การรักษา เท่ากับ 32.40 (SD = 0.25, range = 0-93) คะแนนเฉลี่ยของการบรรเทาอาการ เท่ากับ 88.63 (SD = 0.25, range = 0-100)

    3. ความรอบรู้ด้านสุขภาพมีความสัมพันธ์ในระดับสูงกับพฤติกรรมการดูแลตนเอง (r = .518, p < .01) นอกจากนี้ ความรอบรู้ด้านสุขภาพเชิงหน้าที่ (r = .437, p < .01) ความรอบรู้ด้านสุขภาพด้านการสื่อสาร (r = .437, p < .01) และความรอบรู้ด้านสุขภาพเชิงวิพากษ์ (r = .537, p < .01) มีความสัมพันธ์อย่างมีนัยสำคัญกับ พฤติกรรมการดูแลตนเอง

    ผลการวิจัยครั้งนี้ แสดงถึงโอกาสในการปรับปรุงพฤติกรรมการดูแลตนเองในผู้ป่วยมะเร็งปอดที่ได้รับเคมี บำบัด โดยเน้นที่การส่งเสริมความรอบรู้ด้านสุขภาพ

คำสำคัญ: มะเร็งปอด เคมีบำบัด ความรอบรู้ด้านสุขภาพ พฤติกรรมการดูแลตัวเอง

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Background and significance

Lung cancer is one of the most common cancers in the world. In 2020, there were an estimated 2.2 million new lung cancer cases and 1.8 million lung cancer deaths worldwide. According to Sung et al. (2021), lung cancer ranks as the top cause of cancer incidence and mortality in men, while in women it ranks third in incidence (after breast cancer and colorectal cancer) and second in mortality (after breast cancer). Many lung cancer patients are diagnosed at an advanced stage, making surgery inoperable. Consequently, chemotherapy has become a widely used treatment option (Patel et al., 2007). A substantial rise in the number of patients requiring first-line chemotherapy is expected, from 9.8 million to 15 million between 2018 and 2040, representing a 53% increase (Wilson et al., 2019). Global estimates suggest that lung cancer will constitute the most prevalent chemotherapy indication by 2040, accounting for 16.4% of cases (Wilson et al., 2019).

In most cases, lung cancer does not produce any signs or symptoms in its early stages. As the disease progresses, symptoms like hemoptysis, pain, cough, loss of appetite, and fatigue may become apparent (Cooley, 2000). Patients should receive aggressive treatment immediately after the diagnosis of lung cancer. However, the physical and psychological effects of chemotherapy can significantly impact patients' well-being (Ellis, 2012). Both the disease itself and the side effects of treatment can lead to a decline in functional abilities, affecting self-care behaviors. In order to reduce the effects of illness and chemotherapy, patients should have appropriate self-care behaviors (Prutipinyo et al., 2012). Self-care behavior can alleviate the pain caused by the side effects of chemotherapy, thereby improving quality of life and promoting the mental health of cancer chemotherapy patients.

Self-care behavior among lung cancer patients receiving chemotherapy encompasses proactive actions taken by patients to manage their health, including adverse events and treatment-related complications (Coolbrandt et al., 2013). This behavior comprises two key dimensions: 1) adherence to therapeutic recommendations and effective management of side effects, and 2) proactive symptom relief (Coolbrandt et al., 2013). Poor self-care behavior of cancer chemotherapy patients will lead to unmitigated symptoms (Papadakos et al., 2018). The low level of self-care behaviors among chemotherapy patients is due to insufficient information being given to patients about the side effects of chemotherapy and how to mitigate them (Moursy & Ead, 2014). Furthermore, there are other challenges to improving patients' self-care behaviors, one of which is health literacy. Patients' ability to care for themselves depends on their level of health literacy (Baumann & Dang, 2012).

Health literacy is defined as the cognitive and social skills that determine an individual's motivation and ability to acquire, understand, and use information related to lung cancer in a manner that promotes and maintains good health (Nutbeam, 2000). According to Nutbeam (2000), it is comprised of three dimensions: functional health literacy, communicative health literacy, and critical health literacy. Given the complex nature of chemotherapy treatments and the potential side effects, individuals with low health literacy may struggle to comprehend treatment options

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and effectively perform self-care. As Erünal and Mert (2020) suggest, this reduced capacity for self-care can lead to suboptimal outcomes for patients with lung cancer. This can hinder their ability to engage in self-care behaviors, thereby leading to poorer outcomes (Papadakos et al., 2018).

Despite the prevalence of lung cancer and its treatment with chemotherapy, limited research has explored the health literacy of patients undergoing this therapy. While studies on other chronic diseases, such as diabetes and hypertension, have demonstrated a link between health literacy and selfcare behaviors (Mohammadpour et al., 2018; RobatSarpooshi et al., 2020). A study conducted in 2020 on the relationship between health literacy and self-care behavior in diabetes patients revealed a significant correlation ($r = .152$ $p < .05$), indicating that individuals with higher self-care literacy tend to exhibit better self-care behaviors (RobatSarpooshi et al., 2020). The specific relationship between these factors in the context of lung cancer chemotherapy remains understudied. The aim of this study was to investigate the correlation between health literacy and self-care behaviors in individuals with lung cancer who are receiving chemotherapy.

Research objectives

The objectives of this research include to investigate health literacy, self-care behaviors, and the relationship between the two in individuals with lung cancer undergoing chemotherapy.

Conceptual Framework

This study investigated the relationship between health literacy and self-care behavior of patients with lung cancer receiving chemotherapy. Health literacy refers to the ability of patients with lung cancer receiving chemotherapy to gather, communicate, and apply information related to chemotherapy for the promotion and maintenance of health. It includes 1) functional health literacy; 2) communication health literacy; and 3) critical health literacy (Nutbeam, 2000). Health literacy has an effect on the level of self-care behaviors, and those with low health literacy may have lower ability regarding self-care behaviors. Self-care behavior, in terms of lung cancer chemotherapy patients, refers to appropriate actions taken regarding their health issues (adverse events, complications), and it includes 1) adherence to therapeutic recommendations and management of adverse events associated with treatment; and 2) relieving symptoms of illness (Coolbrandt et al., 2013). This study emphasized the relationship between health literacy and self-care behavior among patients with lung cancer chemotherapy. The health literacy of these patients might influence their self-care behaviors, so collecting information about their health knowledge and self-care behaviors will help them to reach the best health status over their course of chemotherapy. Therefore, the present study hypothesized that there was a positive correlation between self-care behavior and health literacy in cancer patients

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Methodology

Population and sample

The target population included patients with lung cancer who had received at least one course of chemotherapy in Kunming, Yunnan Province, PRC. This study used proportional stratified sampling to determine the sample size for each hospital.

Sample sizes were collected at the First Affiliated Hospital of Kunming Medical University and the Third Affiliated Hospital of Kunming Medical University. The data was collected from July to October 2021. G * power analysis (G * power 3.1.9.7) was used to calculate the sample size. This study was a correlation study, using a two-tailed test, and there are no relevant earlier findings. A moderate size of 0.3 was adopted for effect size. The risk of a type I error (α) is usually employed at 0.05, and the conventional standard for power (1-β) was 0.95 (Polit & Beck, 2004). Then, the sample size was calculated as 134. The researchers determined an additional 20% to compensate for potential loss. Thus, the sample size was 161. The sample was obtained partly from 200 patients with lung cancer who received chemotherapy at Kunming Medical University's Third Affiliated Hospital and from 50 patients with lung cancer who received chemotherapy in the First Affiliated Hospital of Kunming Medical University.

The sample size of the Cancer Hospital in Kunming Medical University, Third Affiliated Hospital, was 129, and that of the First Affiliated Hospital of Kunming Medical University was 32. The target population for this study, in total, was 161 in Kunming city, China. The investigators and assistants obtained the consent of the two hospitals to collect the sample and identified eligible lung cancer chemotherapy patients based on the inclusion criteria. Patients who agreed to participate in the study were invited to participate. The researcher and assistant explained the purpose of the study, benefits, human rights protections, data collection, and duration of the study.

Inclusion criteria included the following: participants must be 1) at least 18 years of age; 2) receiving chemotherapy treatment for at least one cycle; 3) diagnosed with primary non-small cell lung cancer, stage I–III; 4) able to read and write Chinese; and 5) able to undertake activities of daily living independently, as assessed by the Barthel Index (score ≥91).

Exclusion criteria: 1) patient developed severe fatigue after chemotherapy. Frailty level was assessed using the Frail Scale, and patients scoring 3–5 were excluded; 2) Patient diagnosed with small cell lung cancer.

Research instruments

The instrument is a questionnaire including five parts as follows:

1. The Demographic Data Form (Chinese version) developed by the researcher consisted of two parts: demographic and clinical data. The demographic data was made up of the participant's data, such as age, sex, educational level, and household income; the clinical data included the length of time the patient was diagnosed with lung cancer, the name of the chemotherapy that the patient was taking, and the stage of lung cancer.

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2. The Functional Communication Critical Health Literacy Scale (FCCHL) (Ishikawa et al., 2008) was employed to evaluate the health literacy of patients suffering from chronic diseases. In 2015, Zhang Xiaofei and colleagues translated the FCCHL into Chinese, followed by a further evaluation in 2018.

The Content Validity Index (S-CVI/AVE) for the FCCHL was an average of 0.97. The Cronbach α coefficients were 0.91, 0.90, and 0.90 for the whole scale. According to Nutbeam (2000), it consists of three dimensions: (1) functional health literacy; (2) communication; and (3) critical health literacy. The scale consists of 14 items, each rated on a four-point Likert scale, from 1 (never) to 4 (frequently). The average scale score was calculated by adding the (reversed) item scores and dividing them by the total number of items, giving a score from 1 (low health literacy) to 4 (high health literacy). Functional HL scores will reverse, with higher scores indicating higher HL. Permission to use this scale was sought from the original author.

3. The Leuven Questionnaire (L-PaSC) of Patient Self-care, created by Annemarie Coolbrandt et al. in 2013, may be used for evaluating the self-care behaviors of patients during the course of chemotherapy and includes two dimensions: (1) adhering to treatment recommendations and managing treatment-related adverse events and (2) relieving symptoms. The Content Validity Index (CVI) was 0.78-1.00, and the questions had an item difficulty index ranging from 0.17 to 0.89. Internal consistency was considered acceptable (Cronbach alpha = 0.76), and the L-PASC showed good content and psychometric performance. Permission to use this scale was sought from the original author.

The Visual Analogue Scale (VAS) also poses a two-part question. In the first part, the participants were asked if they had been prescribed anything, and in the second part, they were asked to indicate a percentage that they felt they had followed the prescription. An example of a two-part VAS question in L-PaSC is, "Does your treatment also include oral chemotherapy?", and if the participant says "Yes", they move on to the second question, "How many times have you taken the correct dose at the correct time?" There are, therefore, three issues concerning VAS.

The L-PaSC score was based on the conversion of correct responses/appropriate self-care to binary relative scores, with 1 = proper/sufficient self-care and 0 = wrong/inadequate self-care behaviors. Detailed information on manual conversion of L-PaSC responses is available in Coolbrandt et al. The score was between 0 and 100, and the higher the score, the better the patient's self-care behaviors. Its internal consistency was 0.77.

The Leuven Questionnaire (L-PaSC) was translated into Chinese using the back-translation method. The English and L-PaSC versions have been validated by the original investigators (Coolbrandt et al., 2013). These instruments were not modified for this study; therefore, the validity was not checked again.

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4. The Barthel Index has a total score of 100 and is divided into five levels. 1) complete dependence: 0-20 points; 2) heavy dependence: 21-60 points; 3) moderate dependence: 61-90 points; 4) mild dependence: 91-99 points; and 5) total independence: 100 points.

5. The Frail scale includes five components: fatigue, resistance, walking, disease, and loss weight (Morley et al., 2012). The frailty scale scores ranged from 0 to 5 (0 = best, 5 = worst), representing weak (3-5 points), pre-weak (1-2 points), and health (0 points).

Ethical considerations

The proposal was submitted to the Nursing Research Ethics Committee at Chiang Mai University in Thailand for approval before data collection (Study code: 2021-EXP050) which was approved by both Kunming Medical University's First and Third Affiliated Hospitals. Participants were informed that they had the right to participate, decline, or withdraw from the study at any time. Before data collection, all participants received an informed consent form that explained the study's purpose and procedures. Participants who agreed to take part completed a questionnaire. All responses were kept anonymous, and no identifying information was disclosed in research reports or publications.

Data collection

The study employed a two-part questionnaire package. The first part included informed consent and study information forms while the second contained the research instruments: the Demographic Data Form, Barthel Index, Frail Scale, FCCHL, and L-PaSC. After obtaining informed consent, researchers invited participants to a multimedia classroom. Participants completed the questionnaires individually at their own pace, with breaks offered as needed. All 161 eligible participants (100% response rate) completed the questionnaires.

Data analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) 23.0 as follows:

1. Demographic data were analyzed and presented in terms of frequency, percent, mean, range, and standard deviation.

2. Health literacy and self-care behaviors data of patients with lung cancer who were receiving chemotherapy were analyzed by percentage, average, range, and standard deviation.

3. The Kolmogorov-Smirnov Z test was used to investigate the distribution of data after completion of data collection (health literacy and self-care behavior).

4. The two datasets were not normally distributed; therefore, Spearman's rank correlation was used.

Results

The ages of participants ranged from 30 to 82 years old, with a mean of 59 (SD = 11.51). The majority of the subjects were male (n =94), accounting for 58.39%. Among them, 87 patients (54.03%) had received primary education, 41 patients (25.47%) had received higher education, and only 33 patients (20.50%) had received higher education. Among those who participated in

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the survey, one- third of them earned between 10,000 and 30,000 yuan a year, which was considered a "low" income. Eighty-one participants (50.31%) had been diagnosed with lung cancer for at least a year (Table 1).

Table 1 Demographic characteristics of the sample (n = 161)

Demographic Characteristics	Frequency (n)	Percentage (%)
Gender		
Female	94	58.39
Male	67	41.61
Age (years) (Mean = 59.19, SD = 11.51, Range = 25-82)		
Educational level		
Primary education	87	54.03
Junior high school education	41	25.47
Higher education	33	20.50
Family income (Yuan per year)		
10000-30000	52	32.29
30000-50000	78	48.45
50000-70000	25	15.53
70000-90000	6	3.73

In terms of clinical data, 7 participants (4.35%) were diagnosed with stage I NSCLC, 37 (22.98%) were diagnosed with stage II NSCLC, and 117 (72.67%) had stage III NSCLC. Patients who had been diagnosed for more than 6 months and over 2 years were nearly identical. Regarding chemotherapy agents, 128 patients received cisplatin, while fewer numbers received carboplatin, vinorelbine, and taxol (29, 26, and 24, respectively). Etoposide, gemcitabine, and pemetrexed were also given to two patients each (Table 2).

Table 2 Clinical characteristics of the sample (n = 161)

Clinical information	Frequency (n)	Percentage (%)
Time since lung cancer diagnosis:		
Less than 3 months	17	10.56
More than 6 months	32	19.88
More than 1 years	81	50.31
More than 2 years	31	19.25
Stage of lung cancer		
Stage I non-small cell lung cancer	7	4.35
Stage II non-small cell lung cancer	37	22.98
Stage III non-small cell lung cancer	117	72.67

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Table 2 Clinical characteristics of the sample (n = 161) (continue)

Clinical information	Frequency (n)	Percentage (%)
Name of the chemotherapy drug used (multiple choice)		
Cis-platinum	128	
Carboplatin	29	
Etoposide	2	
Vinorelbine	36	
Paclitaxel	24	
Gemcitabine	2	
Other	2	

The average health literacy score was 2.13 (SD = 0.88) while functional health literacy had an average of 2.33 (SD = 1.04). The average score for communication health literacy was 2.16 (SD = 1.04), and the average score for critical health literacy was 1.85 (SD = 0.91) (Table 3).

Table 3 Health literacy in patients with lung cancer chemotherapy (n = 161)

Scale/Sub-Scale	M	SD	Min-Max
Total FCCHL	**2.13**	**0.88**	**1.00-4.00**
Functional	2.33	1.04	1.00-4.00
Communicative	2.16	1.04	1.00-4.00
Critical	1.85	0.91	1.00-4.00

The average self-care behaviors score of patients with lung cancer was 42.64 (SD = 0.20). The average score for adherence to treatment recommendations and management of treatment-related events was 32.40 (SD = 0.25). the average score for symptom relief was 88.63 (SD = 0.25) (Table 4).

Table 4 Self-care behaviors in patients with lung cancer chemotherapy (n = 161)

Scale/Sub-Scale	M	SD	Min-Max
Total P-LaSC	**42.64**	**0.20**	**12-94**
Adhering to treatment recommendations and managing treatment-related events	32.40	0.25	0-93
Relieving symptoms	88.63	0.25	0-100

There was a significant correlation between health literacy and self-care behavior (adherence to treatment recommendations and treatment events, and symptom relief) (p < .01) (Table 5).

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Table 5 The Relationship Between Health Literacy and Self-Care Behaviors (n = 161)

Dimension of FCCHL	Dimension of L-PaSC		
	Total score for self-care behavior	Scores for Dimension 1	Scores for Dimension 2
Total health literacy score	r =.518**	r =.517**	r = -.079
Scores for Dimension 1	r =.437**	r =.436**	r =-.057
Scores for Dimension 2	r =.437**	r =.426**	r =-.025
Scores for Dimension 3	r =.537**	r =.569**	r =-.063

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

Discussion

In this study, functional health literacy had the highest subscale score (M = 2.33, SD = 1.04), followed by communication (M = 2.16, SD = 1.04) and critical health literacy (M = 1.85, SD = 0.91). These findings support Nutbeam's model, suggesting that critical health literacy is the most complex dimension.

Similar to another study (Lee et al., 2018), we showed that the health literacy level of lung cancer chemotherapy patients is low. Research in South Korea has shown that the functional health literacy level of elderly lung cancer chemotherapy patients, low-education lung cancer chemotherapy patients, and low-income lung cancer chemotherapy patients is low, which is basically the same as our research results. In this study, the average age of cancer chemotherapy patients was 59 years old, and the number of people with low educational levels accounted for 54% of the total. Low- and middle-income households account for 80% of the total. The economic challenges and declining physical health faced by people with lung cancer chemotherapy can impair their decision-making abilities and hinder their ability to manage their health. Given the complex care requirements of cancer, these factors may contribute to persistent poor health outcomes. Our findings suggest that health literacy plays a significant role in this context.

In the survey on communicative health literacy, we found that 63% of lung cancer patients never or rarely sought knowledge about the disease. The average age of all participants in this study was 59 years old, and most of them came from rural areas. A possible reason is that with the increase of age, they do not have strong desire to change and recover their health status, and they are not good at using various media to obtain information related to their health, such as newspapers, books, and the Internet. With the growth of age, especially for elderly patients over 65 years old, although most of them also pay attention to health, some of them have a relatively fixed thinking mode, find it difficult to accept new things and new ideas, adhere to their own experience, and are not willing to change their original behavior and living habits. Although some elderly patients have the subjective desire to learn, they have cognitive difficulties due to their own physical function, cognitive, and behavioral ability decline, resulting in a low level of health literacy in communication.

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Critical health literacy scores were the lowest among the three dimensions. In this study, only 28% of patients reported that they often or sometimes evaluated the accuracy of health information or used this knowledge to make decisions regarding their treatment. Critical health literacy refers to the more advanced skills of using critical thinking to analyze and reflect on information or advice received and using information to better control life events and situations. In Nutbeam's health literacy model, critical health literacy is the most difficult to achieve. Once lung cancer chemotherapy patients have sufficient critical health literacy, they can change unhealthy behaviors and have the ability to choose the treatment and exercise that is right for them. Therefore, when lung cancer chemotherapy patients have enough critical health literacy, their chemotherapy side effects will be reduced. In this study, the complexity of the disease itself and treatment made it more difficult for patients to extract, compare, communicate, and critically analyze information. In addition, the average age of the sample size is relatively large, the educational level is relatively low, and the socioeconomic status is not high, resulting in low critical health literacy.

Few studies have explored functional, communicational, and critical health literacy in patients undergoing chemotherapy for lung cancer. Only one study on health literacy in lung cancer patients undergoing chemotherapy have focused on functional health literacy, the score of functional health literacy in this study is not high (Lee et al., 2018). At present, most studies on the health literacy of lung cancer patients only focus on functional health literacy, and there are not enough data to support communicational health literacy and critical health literacy.

This study found that the mean total score of self-care behavior in patients was 42.64. Regarding the first dimension, patients receiving chemotherapy for lung cancer in this study scored 32.40 in adherence to treatment recommendations and management of treatment-related events. Only 17.39% of patients drank at least 1.5 liters of water daily during the treatment, 27.77% brushed their teeth at least twice a day, and no one properly disposed of used toilet paper or sanitary napkins in plastic bags. These behaviors were recorded from the first day of chemotherapy through several days after each treatment cycle. In this subscale, patients are required to immediately inform doctors when they experience nausea, vomiting, shortness of breath, fever, or numbness of fingers during treatment. However, in this study, regarding the ability of patients to inform doctors in a timely manner during treatment, 29.19% of patients feeling shortness of breath, 32.27% feeling fever, and 22.36% feeling numbness in fingers could do so. Patients scored slightly higher on adherence to treatment recommenda-tions.

The proportion of patients who could correctly take medicine as prescribed was 45.96%. Among the self-care suggestions received or read by patients, 50.31% were able to follow more than 80% of them. The reason Ratients scored low on the first dimension could be because of Chinese people's cultural beliefs and values which can affect self-care behavior (Jaarsma et al., 2017). Chinese people are heavily influenced by Buddhism. They believe that illness is natural, and they do not fight or take action which is consistent with the Buddhist way. This finding agrees

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with that of a study in Thailand which found that chemotherapy patients also chose to do nothing when they experienced discomfort, such as weakness or pain, because Thailand is also a country heavily influenced by Buddhism (Piamjariyakul et al., 2010). Another reason may be that nurses in Yunnan province have heavy workloads and spend little time on health education for patients.

On another subscale, the study showed that lung cancer patients scored higher on relieving symptoms, with an average score of 88.63%. If nausea/vomiting, fatigue, or pain occurred during treatment, a majority of patients could take correct actions (68.32%, 65.22%, and 60.87%, respectively). The authors who created the L-PaSC scale believed that effort and self-care activities formed the basis of the L-PaSC score, rather than efficacy or symptom relief. If patients had mild side effects from chemotherapy, "inaction" was also considered sufficient self-care behavior. If chemotherapy side effects are moderate or severe, appropriate actions are considered adequate self-care behaviors. For example, reporting symptoms to health care professionals when they occur is considered an adequate act of self-care. Therefore, in this subscale study, lung cancer patients scored higher on self-care behavior. Most patients will immediately inform their healthcare provider if they experience constipation, nausea, vomiting, weakness, or pain.

However, the findings of this study on the self-care behavior of lung cancer chemotherapy patients are inconsistent with those of a Korean study (Lee et al., 2018). Studies in South Korea have shown a higher level of self-care behavior in lung cancer patients undergoing chemotherapy. These discrepancies may be attributed to differences in the measurement tools employed. Given the paucity of research on self-care behaviors in this population, further investigations are warranted to elucidate the variability in self-care practices across diverse cultural contexts.

In this study, it was found that there was a strong correlation between health literacy and self-care behavior (r = .518, p < .01). Furthermore, functional (r = .437, p < .01), communicational (r =.437, p < .01), and critical (r =.537, p < .01) health literacy among lung cancer chemotherapy patients were significantly correlated with self-care behavior. The findings are in line with an Iranian study on health literacy and self-care behavior among breast cancer patients (Ahmadzadeh et al., 2021). Ahmadzadeh and team discovered a positive correlation between reading and comprehension and self-care behavior in breast cancer patients (r = .74, p < .05), leading the author to conclude that patients with a higher level of health literacy exhibit improved self-care behavior.

In this study, a correlation between functional health literacy and self-care behavior was found in patients undergoing chemotherapy for lung cancer (r = .437, p < .01). Adequate functional health literacy can help these patients read and understand drug labels and prescriptions, so that once they have enough functional health literacy, lung cancer chemotherapy patients can obtain more and more effective disease-related information to reduce the side effects of chemotherapy (Heijmans et al., 2015).

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In this study, we discovered a correlation between communicative health literacy and self-care behavior in patients receiving chemotherapy for lung cancer (r = .437, p < .01). According to Nutbeam (2000), communicational health literacy involves developing sophisticated communicative and social skills that are necessary for extracting and deliberating information with others. One characteristic of lung cancer patients receiving chemotherapy who have good communication skills is that they have the confidence and ability to take action based on the advice of medical staff, successfully and effectively communicating with them which can modify their negative behaviors and slow down the advancement of the disease (Heijmans et al., 2015).

Some relationships were found between critical health literacy and self-care behavior in the current study. For patients undergoing chemotherapy for lung cancer, health-related information includes how to prevent and mitigate side effects of chemotherapy, how to properly take medications while in the hospital, and personal social skills, including how to interact with professionals and choose the appropriate way of exercise and diet to mitigate side effects of chemotherapy. Once lung cancer chemotherapy patients have mastered sufficient critical health literacy, they can change unhealthy behaviors and have the ability to choose the treatment that is right for them (Heijmans et al., 2015).

In this study, a significant correlation was observed between health literacy and its subscales, and self-care behaviors among patients undergoing chemotherapy for lung cancer. However, we found no significant relationship between health literacy and its subscales and the symptom relief subscale of self-behavior. The reason may be that in the L-PaSC scale, in evaluating the symptom relief of chemotherapy patients, if the patient has mild or even no adverse reactions to chemotherapy, clinical intervention for chemotherapy adverse reactions can be avoided. We also consider that the patient has self-care behavior. Perhaps this scoring standard led to high scores in symptom relief for patients in this study.

In addition, Lee's (2019) study found no significant correlation between functional health literacy and self-care behaviors among lung cancer chemotherapy patients. This finding may be attributed to the utilization of distinct scales. Furthermore, the authors of another study (Papadakos et al., 2018) concluded that there was no correlation between health literacy and chemotherapy self-care behaviors which is inconsistent with our findings. Despite the existence of substantial evidence linking health literacy and self-care behaviors in other chronic diseases, the amount of evidence regarding an association between health literacy and self-care behaviors in cancer patients undergoing chemotherapy is still relatively scarce, with health literacy and self-care behaviors being a relatively new concept in this patient group.

Besides tumor research, studies on other chronic diseases have also discovered a positive correlation between patients' health literacy and self-care behavior. RobatSarpooshi et al. (2020) discovered a significant correlation between self-care behavior and health literacy among diabetic patients (P < 0.05) with a positive correlation observed. Moreover, that study found that a higher level of health literacy was associated with improved self-care behavior. In Farghadani et al.'s (2018)

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study, the authors discovered that functional health literacy was a crucial aspect of self-care behavior among patients with heart failure (β = 0.30, p = .014), highlighting the significant influence of health literacy on self-care practices. According to RobatSarpooshi et al. (2020), patients with insufficient health literacy may encounter difficulties in reading ability, interactive communication, and decision-making.

In short, we know little about the relationship between health literacy and self-care behavior in lung cancer patients undergoing chemotherapy, which is inconsistent with the results of other countries. However, this study has shown that health literacy and its three dimensions are positively correlated with self-care behaviors in this patient group. This provides a basis for improving the health literacy of patients undergoing chemotherapy for lung cancer and enhancing their self-care ability.

Conclusions and implications

This research is the first study in China to explore the relationship between health literacy and self-care behavior of patients receiving chemotherapy. Therefore, the findings provide a fundamental insight into the health literacy and self-care behaviors of this group of patients. This information has the potential to encourage oncology nurses and other healthcare providers in various areas of health literacy and self-care. It will assist them in the development of practical plans to effectively manage health literacy and self-care in patients undergoing chemotherapy.

Suggestions for further research

1. Future research may be done by testing the predictive factors.
2. Further research should extend the sample size to verify its generalizability.

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