


# Prevalence and risk factors of loneliness among patients with hematological malignancies

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## Abstract

To identify independent factors for predicting loneliness in patients with hematological malignancies. It is an observational cross-sectional study. 157 patients with hematologic malignancies were enrolled between March 2020 and May 2020. The sociodemographic characteristics and psychometric properties (coping styles, self-esteem, big 5 personality traits, and hope) were tested for correlation with loneliness. Multivariate hierarchical regression analysis was then utilized to identify independent risk factors for loneliness. The patients exhibited a mean global score of 36.25 that corresponded to a moderate degree of loneliness. The sociodemographic factors, including occupation, family earning, living areas, times of hospitalization, were significantly related to loneliness. In addition, the coping styles, levels of self-esteem, the big 5 personality traits, and levels of hope were significantly correlated with the degrees of loneliness. Furthermore, sociodemographic factors (occupation) and psychometric properties (coping styles and hope) were identified as independent predictors for loneliness in patients with hematological malignancies. Loneliness is highly prevalent in patients with hematological malignancies. Notably, occupation, times of hospitalization, family earning, coping styles, self-esteem, big 5 personality traits, and hope are all independent risk factors for loneliness.

**Abbreviations:** HHI = the herth hope index, PCS = positive coping style, SCSQ = the simplified coping style questionnaire, SD = standard deviation, SES = self-esteem scale, UCLA = university of California at Los Angeles.

**Keywords:** big five personality traits, coping style, hematological malignancy, hope, loneliness, self-esteem

## 1. Introduction

Hematological malignancies are among the most common cancers worldwide, and are comprised of a large group of malignancies in the hematopoietic system that mainly includes acute and chronic leukemia, malignant lymphoma, multiple myeloma, and myelodysplastic syndromes. It is a collective term for a group of malignant clonal diseases derived from hematopoietic tissues and organs.<sup>[1,2]</sup> It has been noted that the incidence of hematological malignancies has increased rapidly over the past ten years, and the related deaths are still on the rise.<sup>[3,4]</sup> In China, hematological malignancies are also one of the most common cancers and the mortality of leukemia is particularly high.<sup>[5]</sup> Among the treatment options available for hematological malignancies, chemotherapy has shown effectiveness and is extensively used to treat patients with hematological malignancies. On the other hand, chemotherapeutic agents often induce serious adverse effects (e.g., gastrointestinal reactions, bone marrow suppression, neurotoxicity).<sup>[6–8]</sup> To avoid bacterial infections during chemotherapy treatment, patients with hematological malignancies usually undergo isolation to avoid life-threatening complications. In addition, due to the disease, immunity is usually low in patients who are prone to infection.

Therefore, it is necessary to employ protective isolation with such patients.

Exposure to multiple negative stressors may place patients with hematological malignancies under tremendous psychological pressure, which can induce or aggravate their psychological problems to a certain extent.<sup>[9]</sup> As such, patients with hematological malignancies often complain about loneliness, the persistence of which may also contribute to various mental health problems.<sup>[10]</sup> Loneliness, a subjective feeling, is generally considered an unpleasant experience, occurring when an individual is socially isolated with deficient social relations.<sup>[11,12]</sup> It has been well-documented that loneliness can lead to detrimental effects on both physical and mental health, including sleep disorders, anxiety, depression, suicide, immune dysfunction, cognitive impairments, cardiovascular disease, etc.<sup>[13,14]</sup> These adverse effects highlight the importance of identifying risk factors association with loneliness. Although previous studies have identified a number of factors influencing loneliness, less is known about the exact risk factors for patients with hematological malignancies. Previous studies have mainly focused on studies of loneliness in the elderly, left behind children and college students.<sup>[15–17]</sup> Until now, similar investigations in patients with hematological malignancies remain largely unexplored.

Informed written consent was obtained from the patient for publication of this report.

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

The present study was reviewed and approved by the Institutional Review Board (IRB) of Aerospace Center Hospital (No20200108-BSYJS-01.). All participants provided their informed consent prior to this study.

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Previous studies showed that demographic data, the coping styles, self-esteem, the big 5 personality traits, and hope were the influencing factors of loneliness in patients with other cancers. So we hypothesized that these variables would also affect loneliness in patients with hematological malignancies. The purpose of the study is to identify factors for predicting loneliness in patients with hematological malignancies.

## 2. Materials and methods

### 2.1. Aim

In this study, we aimed to examine the relationship of socio-demographic characteristics and psychometric properties with loneliness, and to identify risk factors significantly associated with loneliness in patients with hematological malignancies. The findings gained from this study may have important implications for health interventions in patients at high risk of loneliness.

### 2.2. Design

This study is a cross-sectional survey.

### 2.3. Participants

By convenience sampling, patients who were diagnosed with hematological malignancies in the Department of Hematology between March 2020 and May 2020 were screened for their eligibility. During patient enrollment, the following inclusion criteria were utilized: age > 18 years; diagnosed with hematological malignancies; be informed of the diagnosis, and; understanding and being capable to complete the questionnaire; willingness to participate in this study. However, patients who had the following conditions were excluded from this study: severe disease; severe cardiac, hepatic and renal insufficiency; mental or psychological disorders; cognition impairments or dementia.

### 2.4. Data collection tools

**2.4.1. Evaluation of loneliness using university of California at Los Angeles (UCLA) loneliness scale.** The UCLA loneliness scale, one of the most commonly used measures for loneliness, was used to evaluate loneliness levels in this study.<sup>[12,18]</sup> The UCLA loneliness scale consists of 20 items and responses were comprised of a 4-point Likert scale (from 1-hardly ever to 4-always). The total scores were the sum of all single-item scores, ranging from 20 to 80 with higher scores reflect higher degrees of loneliness. According to the Perry classification, the 4 degrees of loneliness were defined as follows: low degree of loneliness (scores, 20–34), moderate degree of loneliness (scores, 35–49), moderately high degree of loneliness (scores, 50–64), and severe degree of loneliness (scores, 65–80). Internal consistency (Cronbach's alpha) in the study subjects was 0.889.

**2.4.2. The simplified coping style questionnaire.** The Simplified Coping Style Questionnaire (SCSQ) is a widely used scale for evaluating the coping style in individuals who encounter adverse events. In this study, the coping style of the study subjects were tested using the SCSQ, as previously reported.<sup>[19]</sup> The SCSQ consists of a total of 20 items, and includes 2 dimensions: the positive coping style (Items 1–12) and the negative coping style, (Items 13–24) using a 4-point Likert scale (from 0-hardly ever to 3-always). The Cronbach coefficient of the scale was 0.854.

### 2.5. Self-esteem scale

The self-esteem scale (SES) was developed by Rosenberg in the year of 1965, and is extensively used for the evaluation of

esteem. SES was translated into Chinese by Ji and colleagues and published previously.<sup>[20]</sup> The self-esteem scale consists of 10 items with a higher global score denoting a higher degree of self-esteem. In SES, scores of < 25 are defined as a low degree of self-esteem, 26 to 32 as a medium degree of self-esteem, and > 33 as a high degree of self-esteem.

**2.5.1. The big 5 personality test.** The big 5 personality test, also well known as the 5-factor model, is widely used for personality traits. The big 5 personality test describes 5 main dimensions of personality: extraversion (also referred to as extroversion), agreeableness, openness, conscientiousness, and neuroticism. The model is well-validated for the evaluation of personality and has been previously translated into Chinese and published.<sup>[21]</sup> This test consists of 44 items with each item measured using a 5-point Likert scale [1 (strongly disagree) and 5 (strongly agree)] and is reverse-coded.

**2.5.2. Herth hope index.** The Herth Hope Index (HHI), an adaptation of the Herth Hope Scale initially developed by Herth, is an assessment of hope in 3 dimensions (temporality and future, positive readiness and expectancy, and interconnectedness). The HHI is comprised of 12 items and has been widely used as a precise scale in evaluating an oriented sense of hope. HHI was translated into Chinese in the year of 2000 as previously reported.<sup>[22]</sup> HHI has a global score ranging from 12 to 48, with single-item scores using a 4-point Likert scale [1 (strongly disagree) and 4 (strongly agree)] with #3 and # 6 reverse-coded. A higher score is indicative of higher levels of hope. Specifically, a global score of 12 to 23 denotes low levels of hope, 24 to 35 indicates medium levels of hope, and 36 to 48 represents high levels of hope.

### 2.6. Data collection

Before the beginning of this study, the investigators discussed the purpose and significance of the study to the patients. A paper version of the questionnaire was issued after obtaining written informed consent from each participant, according to the principles of voluntary participation. We obtained written informed consent from each participant. We invited 163 people to participate in the questionnaire survey, and 157 people agreed and completed the questionnaire successfully. It took about 15 minutes to complete the questionnaire, and the participants completed the questionnaire in the ward.

### 2.7. Ethical considerations

The ethical approval of the Institutional Review Board was obtained from the Hospital Ethics Committee.

### 2.8. Data analysis

All statistical analyses were performed using SPSS 20.0. Demographic characteristics and variables are expressed as the mean and standard deviation (SD) or percentages. Pearson correlation analysis was performed to evaluate the independent correlation between potential risk factors and loneliness. The absolute value of  $R \geq 0.80$ ,  $0.50 \leq R < 0.80$ , and  $0.30 \leq R < 0.50$  represented high, moderate and low correlations. An absolute value of  $R < 0.30$  indicated no correlation, while  $R > 0$  and  $R < 0$  indicated positive and negative correlations, respectively. A 1-way analysis of variance and independent samples *T* test were also performed. The demographic and social characteristics were subjected to multivariate hierarchical regression analysis to determine independent risk factors for loneliness in the patient population. A *P*-value less than 0.05 was considered statistically significant.

**2.9. Validity and reliability**

Measurement part: the reliability and validity of the questionnaire used is good. Cronbach’s alpha coefficients are all high. The questionnaire was filled out anonymously.

Data collection part: a pre-survey was conducted before the formal survey, and the survey method and questionnaire response time were pre-tested, and the quality of the questionnaire and the rate of invalid questionnaires were simply estimated. On the other hand, uniform training was conducted for the surveyors, including survey guidance, questionnaire issuance and collection time. Double check and input the returned questionnaire.

**3. Results**

**3.1. Sociodemographic characteristics of the study subjects**

We invited 163 people to participate in the questionnaire survey, and 157 people agreed and completed the questionnaire

**Table 1**  
Sociodemographic and clinical characteristics of patients with hematological malignancies.

Characteristics	N	Percentage (%)
Gender		
Male	89	56.7%
Female	68	43.3%
Age		
≤25	33	21.0%
26–49	89	56.7%
≥50	35	22.3%
Marital status		
Unmarried	39	24.8%
Married	117	74.5%
Divorced/Widowed	1	0.6%
Occupation		
Blue-collar worker	13	8.3%
Farmer worker	15	9.6%
White-collar worker	74	47.1%
Others	55	35.0%
Education level		
Primary school and below	6	3.8%
Middle school	23	14.6%
High school	40	25.5%
Associate College/University and above	88	56.1%
Family earning		
Lower class	70	44.6%
Middle class	87	55.4%
Living areas		
Rural areas	54	34.4%
Urban areas	103	65.6%
Disease duration (yrs)		
<1	19	12.1%
1–1.9	105	66.9%
≥2	33	21.0%
Hospitalization (Times)		
1	22	14.0%
2	33	21.0%
3	18	11.5%
≥4	84	53.5%
Payment of medial expense		
Self	28	17.8%
Covered by Government	5	3.2%
Medical insurance	124	79.0%
Family visit (Times)		
0	21	13.4%
1–2	6	3.8%
≥3	130	82.8%

successfully. The sociodemographic characteristics of these patients are summarized in Table 1. The mean age of the subjects was 36.4 years (SD, 13.86; range, 18–67), including 89 males (56.7%) and 68 females (43.3%). Notably, a majority of the study subjects were married, accounting for 74.5% of the total population. The remaining characteristics, including occupation, education level, family earning, living areas, duration of disease, times of hospitalization, pay for medical expense, and family visit, are listed in Table 1.

**3.2. Prevalence and degrees of loneliness among patients with hematological malignancies**

The UCLA loneliness scale was used to evaluate loneliness among patients with hematological malignancies. As a result, the mean total scores were 36.25 (SD, 10.22) with a mean single-item score of 1.81 (SD, 0.51). Based on the Perry classification of loneliness [low (20–34), moderate (35–49), moderately high (50–64), and severe (65–80) degrees of loneliness]. All patients with hematological malignancies also suffered from various degrees of loneliness, 71.34% of patients had a loneliness score greater than 35 among them.

**3.3. The coping styles, levels of self-esteem, big 5 personality traits, and level of hope in patients with hematological malignancies**

As shown in Table 2, the enrolled patients exhibited a mean score of coping styles of 1.88 (SD, 0.31). Interestingly, the mean positive coping style score was 2.18 (SD, 0.44) and was higher than the mean negative coping style score of 1.44 (SD, 0.42). These data suggested that patients with hematological malignancies were relatively positive in coping with adverse events.

We found that the mean total score of self-esteem was 32.16 (SD, 4.17) and the mean single-item score was 3.22 (SD, 0.42). According to the SES classification of self-esteem level (low: score < 25, medium: score 26–32 and high: scores > 33), the patients with hematological malignancies presented relatively high self-esteem.

The big 5 personality traits were assessed in patients with hematological malignancies and the results are summarized in Table 3. Of the 5 dimensions, including extraversion, agreeableness, conscientiousness, neuroticism, and openness, the highest score was identified for agreeableness (mean score, 3.93; SD, 0.46), while the lowest score was observed for neuroticism (mean score, 2.59; SD, 0.6). Together with the detailed scores for the remaining dimensions listed in Table 3, these data describe the big 5 personality traits among patients with hematological malignancies.

The HHI scale was used for an assessment of hope level in patients with hematological malignancies in 3 dimensions: temporality and future, positive readiness and expectancy, and interconnectedness. As shown in Table 4, the highest score was identified for interconnectedness (mean score, 3.38; SD, 0.39), while the lowest score was observed for positive readiness and expectancy (mean score, 3.34; SD, 0.43). The detailed scores for the remaining dimensions are also listed in Table 4. The mean global score was 40.36 (SD, 4.34), suggesting overall high levels of hope among patients with hematological malignancies.

**3.4. Effects of sociodemographic characteristics on levels of loneliness in patients with hematological malignancies**

Univariate analysis of the sociodemographic parameters was performed to explore risk factors for loneliness in the patients with hematological malignancies (Table 5). The occupation,

family earning, living areas, times of hospitalization were found to significantly influence the level of loneliness in patients with hematological malignancies ( $P < .05$ ) (Table 5). Further, we identified that a higher level of loneliness was significantly associated with the following sociodemographic factors: blue-collar workers versus white-collar workers; low family earning versus high family earning; rural areas versus urban areas; 1 time of hospitalization versus more than 1 time of hospitalization (Table 5).

**3.5. Correlation between the psychometric properties and loneliness in patients with hematological malignancies**

We examined the correlation of coping styles, level of self-esteem, big 5 personality traits, and level of hope with degrees of loneliness in the patients with hematological malignancies, and the results are summarized in Table 6. A correlation coefficient  $< 0.4$  was considered a weak correlation,  $0.4$  to  $0.7$  a moderate correlation, and  $> 0.7$  a strong correlation. There was a significant negative correlation between coping styles and the level of loneliness as measured by the total scores ( $r = -0.48$ ,  $P < .01$ ). A significant negative correlation was also observed between the level of self-esteem and loneliness ( $r = -0.482$ ,  $P < .01$ ), between the big 5 personality traits and the level of loneliness ( $r = -0.461$ ,  $P < .01$ ) and between overall hope and the level of loneliness ( $r = -0.514$ ,  $P < .01$ ). These results indicated that the coping styles, the level of self-esteem, the big 5 personality traits, and the level of hope were significantly correlated with the degrees of loneliness in patients with hematological malignancies (Table 6).

**3.6. Multivariate hierarchical regression analysis of independent risk factors for loneliness in patients with hematological malignancies**

The factors significantly associated with loneliness were utilized in the multivariate hierarchical regression analysis to determine independent risk factors for loneliness in patients with hematological malignancies. The resulting data are presented in Table 7.

Notably, the sociodemographic factors (occupation, times of hospitalization, family earning), coping styles, self-esteem, big 5 personality traits were identified as independent risk factors for loneliness in patients with hematological malignancies (all  $P < .01$ ).

**4. Discussion**

To the best of our knowledge, this study for the first time examines the level of loneliness and the associated risk factors in patients with hematological malignancies. The major findings of this work are summarized as follows: Patients with hematological malignancies suffer from various degrees of loneliness with a mean global score was 36.25; Sociodemographic characteristics, including occupation, family earning, living areas and times of hospitalization significantly affected the level of loneliness in patients with hematological malignancies; Correlation analysis revealed a significant correlation of coping styles, the level of self-esteem, big 5 personality traits, and the level of hope with the degree of loneliness in patients with hematological malignancies; The sociodemographic factors (occupation, times of hospitalization, family earning), coping styles (positive coping style), self-esteem and big 5 personality traits (agreeableness) and hope (interconnectedness) were identified as independent risk factors for loneliness in patients with hematological malignancies; The independent risk factors identified in this study predicted a large proportion of loneliness in need of intervention. Thus, these independent risk factors have the potential to be predictors for identifying which patients with hematological malignancies are in need of interventions for loneliness.

In this study, we initially assessed the degrees of loneliness in patients with hematological malignancies whom exhibited a total score of 36.25. According to the Perry classification of loneliness (see methods), the patients with hematological malignancies in this study experienced a moderate degree of loneliness. The severity of loneliness in these patients is similar to that in cancer patients, whom exhibited a weighted average total loneliness score of 38.26, as was recently reported in a meta-analysis on risk factors for loneliness in cancer patients.<sup>[23]</sup> The total scores of 36.25 and 38.26 in patients with hematological malignancies and cancer patients, respectively, correspond to a moderate degree of loneliness. The occurrence of cancers is a major negative life event.<sup>[24]</sup> The diagnosis of malignancy and the pain of the cancer itself constitute a strong reminder of the possibility of death, which can easily lead to adverse psychological problems in patients.<sup>[25]</sup>

Notably, when evaluating the relationship between sociodemographic factors and loneliness in patients with hematological malignancies, we found that occupation, family earning, living areas, and times of hospitalization were significantly related to loneliness. In this sense, a higher level of loneliness was significantly associated with an occupation being classified as blue-color workers, low family earning, living in rural areas

**Table 2**  
Coping styles of patients with hematological malignancies.

Coping styles	Score range	Total scores (Mean ± SD)	Single-item scores (Mean ± SD)
PCS	0–36	26.13 ± 5.23	2.18 ± 0.44
NCS	0–24	11.50 ± 3.34	1.44 ± 0.42
Coping styles	0–60	37.63 ± 6.25	1.88 ± 0.31

PCS = positive coping style, NCS = negative coping style, SD = standard deviation.

**Table 3**  
Evaluation of the big five personality traits in patients with hematological malignancies.

Personality traits	Range	Total scores (Mean ± SD)	Mean scores (Mean ± SD)
Extraversion	8–40	26.93 ± 4.88	3.37 ± 0.61
Agreeableness	9–45	35.40 ± 4.16	3.93 ± 0.46
Conscientiousness	9–45	33.24 ± 5.48	3.69 ± 0.61
Neuroticism	8–40	20.69 ± 4.78	2.59 ± 0.60
Openness	10–50	34.89 ± 5.35	3.44 ± 0.53
Big 5 personality	44–220	150.65 ± 11.65	3.42 ± 0.26

SD = standard deviation.

**Table 4**  
Level of hope among patients with hematological malignancies.

	Range	Global score (Mean ± SD)	Single-item score (Mean ± SD)
Temporality and future	4–16	13.36 ± 1.71	3.34 ± 0.43
Positive readiness and expectancy	4–16	13.48 ± 1.72	3.37 ± 0.43
Interconnectedness	4–16	13.53 ± 1.55	3.38 ± 0.39
Hope	12–48	40.36 ± 4.34	3.36 ± 0.36

SD = standard deviation.



**Table 5**  
**Analysis of sociodemographic characteristics associated with loneliness in patients with hematological malignancies.**

Characteristics	Loneliness	t/F	P value	Comparison
Gender				
Male	36.51 ± 9.96	0.342	.73	
Female	35.94 ± 10.61			
Age				
≤25	36.12 ± 9.52	0.525	.59	
26–49	36.89 ± 10.47			
≥50	34.80 ± 10.34			
Marital status				
Unmarried	36.03 ± 9.16	1.007	.37	
Married	36.46 ± 10.54			
Divorced/Widowed	36.52 ± 22.00			
Occupation				
Blue-collar worker	40.92 ± 16.49	4.020	<b>.01</b>	Blue-collar workers > white-collar works
Farmer worker	37.67 ± 7.33			Others > white-collar workers
White-collar worker	33.45 ± 8.11			
Others	38.56 ± 10.79			
Education level				
Primary school and below	38.00 ± 11.12	1.030	.38	
Middle school	35.52 ± 8.84			
High school	38.55 ± 9.90			
Associate College /University and above	35.30 ± 10.62			
Family earning				
Lower class	40.43 ± 10.40	4.912	<b>&lt;.01</b>	
Middle class	32.91 ± 8.78			
Living areas				
Rural areas	40.43 ± 10.43	3.859	<b>&lt;.01</b>	
Urban areas	34.08 ± 9.44			
Disease duration (yrs)				
<1	35.16 ± 10.39	2.865	.06	
1–1.9	35.29 ± 10.51			
≥2	40.00 ± 8.41			
Hospitalization (Times)				
1	42.09 ± 13.26	3.684	<b>.01</b>	1 > 2
2	35.79 ± 10.45			1 > 3
3	32.00 ± 7.87			1 > 4 and above
≥4	35.83 ± 9.15			
Payment of medial expense				
Self	39.93 ± 8.19	2.320	.10	
Covered by Government	33.60 ± 3.05			
Medical insurance	35.54 ± 10.65			
Family member visit (Times)				
0	36.43 ± 6.89	0.539	.58	
1–2	7.35 ± 3.00			
≥3	36.43 ± 10.77			

and experiencing fewer instances of hospitalization. The finding that lower family earning was associated with a higher degree of loneliness is consistent with other previous studies<sup>[26,27]</sup> and suggests that financial burden in a low earning family could be a contributing factor to loneliness. This may be related to the lack of life satisfaction from low family earning.

It may merit attention in this study that psychometric properties, including coping styles, self-esteem, big 5 personality traits and hope were significantly correlated with the degree of loneliness in patients with hematological malignancies. Specifically, the correlation coefficients were  $r = -0.48$  for the relationship between coping style and loneliness;  $r = -0.482$  for the relationship between level of self-esteem and loneliness;  $r = -0.461$  for the relationship between the big 5 personality traits and level of loneliness; and  $r = -0.514$  for the relationship between overall hope and level of loneliness. These data suggest that such psychometric properties exhibit a moderate adverse correlation with loneliness in patients with hematological malignancies. The findings that higher levels of self-esteem were associated with less severe loneliness in patients with hematological malignancies are similar with a previous report.<sup>[28]</sup> We postulated that individuals with higher levels of

**Table 6**  
**Correlation of coping style, self-esteem, big five personality traits, and level of hope with degree of loneliness in the study subjects.**

Factors	Degree of loneliness
Positive coping style	-0.603**
Negative coping style	0.045
Coping styles	-0.480**
Self esteem	-0.482**
Extraversion	-0.482**
Agreeableness	-0.541**
Conscientiousness	-0.299**
Neuroticism	0.417**
Openness	-0.210**
Big 5 personality	-0.461**
Temporality and future	-0.386**
Positive readiness and expectancy	-0.375**
Interconnectedness	-0.597**
Hope	-0.514**

Note:  
 \*\* $P < .01$ .

**Table 7****Multivariable hierarchical regression analysis of the risk factors associated with loneliness in patients with hematological malignancies.**

Factors	Bcoefficient (1)	$\beta$ coefficient (2)	Bcoefficient (3)	Bcoefficient (4)	Bcoefficient (5)
Occupation	-4.545**	-2.355	-2.508	-3.133*	-3.180*
Times of hospitalization	8.312**	3.940	5.035*	4.479*	3.103
Family earning	-6.512**	-3.221*	-3.207*	-1.989	-1.448
Positive coping style		-0.994**	-0.702**	-0.611**	-0.612**
Self esteem			-0.613**	-0.378*	-0.093
Agreeableness				-0.740**	-0.542**
Interconnectedness					-1.687**
F	7.493**	13.436**	14.353**	16.414**	16.524**
R squared ( $R^2$ )	0.288	0.451	0.496	0.555	0.579
Adjusted R squared ( $R^2$ )	0.250	0.418	0.461	0.521	0.544
$\Delta R$ squared	0.288	0.163	0.045	0.059	0.024

Note:

\* $P < .05$ ,\*\* $P < .01$ .

self-esteem are generally positive about life, themselves, and other people, which may largely increase their resilience in coping with ups and downs in life and may thus reduce their level of loneliness. Additionally, we found that some big 5 personality traits (agreeableness) and hope (interconnectedness) were associated with less severe loneliness in patients with hematological malignancies. We proposed that people classified with the personality traits of agreeableness and interconnectedness generally exhibit a feeling of interconnectedness with others, a sense of mutuality and sharing and social interactions and network support, which may contribute to a lower degree of loneliness.

#### 4.1. Limitations

The present study may have several limitations that should be noted. Firstly, 1 limitation is related to this work being a single-center study performed in a Tier 3, hospital, according to the 3-titer system classification in China. Given diversities in the geographical areas and population of China, a multi-center clinical study is needed to externally validate the findings of the present study in the future. Secondly, this was a cross-sectional study and the results denote the relationship between variables. Cohort studies will be required in the future to identify which factors affect the level of loneliness among patients with hematological malignancies. Finally, in this study, we included patients at different stages of treatment, such as newly diagnosed patients, patients undergoing chemotherapy/radiotherapy, and we studied the psychological characteristics of these patients. Subgroup analyses of patients at different treatment stages are forthcoming.

In conclusion, the findings of this work indicate that loneliness is prevalent in patients with hematological malignancies. Notably, occupation, times of hospitalization, family earning, coping styles, self-esteem, big 5 personality traits, and hope are all independent risk factors for loneliness. Our findings may have implications for nursing management in the sense that the independent risk factors may assist healthcare providers in identifying patients who may require interventions for loneliness. In clinical work, medical service providers should understand the degree of loneliness and its influencing factors in patients with hematological malignancies, and take patient-centered and targeted interventions to remove adverse incentives, reduce the level of loneliness of patients, reduce negative psychological emotions, and improve treatment compliance and quality of life. Therefore, the findings have important implications for health interventions in patients at high risk of loneliness.

#### Author contributions

**Conceptualization:** Junye Yu.

**Data curation:** Junye Yu, Huanhuan Song.

**Formal analysis:** Huanhuan Song.

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