ORIGINAL ARTICLE

The Relationship between Health Literacy and Rehospitalization among Patients with Myocardial Infarction

Navid Mohammadi[1], MD; Zahra Soroosh[2], MD; Marzieh Nojomi[3], MD, MPH; Maryam Motamedkhah[4], BSc

[1]Department of Community Medicine, School of Medicine, Children Growth Research Center, Research Institute for Non-Communicable Diseases, Qazvin University of Medical Sciences, Qazvin, Iran
[2]Department of Community and family Medicine, Social Determinants of Health Research Center, School of Medicine, Birjand University of Medical Sciences, Birjand, Iran
[3]Clinical Epidemiology (U.W, Seattle), Department of Community and Family Medicine, School of Medicine, Preventive Medicine and Public Health Research Center, Psychosocial Health Research Institute, Iran University of Medical Sciences, Tehran, Iran
[4]Rajaie Cardiovascular Medical and Research Center, Iran University of Medical Sciences, Tehran, Iran

Correspondence:
Zahra Soroosh, MD;
Department of Community and family Medicine, Social Determinants of Health Research Center, School of Medicine, Birjand University of Medical Sciences, Birjand, Iran
Tel: +98 56 32381535
Fax: +98 56 32381509
Email: zahrasorosh.zs@gmail.com
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Abstract

Background: Cardiovascular disease, the first leading cause of death worldwide, is associated with different consequences, including rehospitalization. Health literacy (HL) is a factor with potential effects on rehospitalization. This study aimed to examine the relationship between HL and rehospitalization among patients with myocardial infarction (MI).

Methods: This prospective cohort study was conducted in 2015–2017. Participants were 366 hospitalized patients with MI who were conveniently recruited from four teaching hospitals in Tehran, Iran. A demographic questionnaire and the Health Literacy for Iranian Adults instrument were completed for participants at the time of their hospital discharge. One month after hospital discharge, thirty-day rehospitalization was assessed over telephone. The SPSS program (v. 16.0) was used to analyze the data through the Chi-square test, independent-sample *t* test, one-way analysis of variance, Pearson's correlation analysis, and logistic regression analysis.

Results: The total mean score of HL was 53.08±16.64 (in the possible range of 0–100). Most participants (78.6%) had inadequate or barely adequate HL. At the time of rehospitalization assessment, fifteen participants were inaccessible. Among the remaining 351 participants, 28 (8%) reported thirty-day rehospitalization. The mean scores of HL among the participants with and without rehospitalization were 55.36±19.06 and 53.08±16.53, respectively. Logistic regression analysis showed that after adjusting the effects of potential confounders, HL had a significant relationship with rehospitalization (odds ratio=1.05; 95% confidence interval: 1.007–1.1; P=0.024).

Conclusion: Most hospitalized patients with MI have limited HL, and their HL has a significant relationship with rehospitalization.

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Introduction

Cardiovascular disease is a major global health problem. Its burden is progressively increasing worldwide due to the aging of population.[1] Cardiovascular disease is the first leading cause of death in most low- to moderate-income countries such as Iran.[2, 3] Myocardial infarction (MI) is the main consequence of cardiovascular disease and is a leading cause of disability and death in the world. MI is defined as any myocardial necrosis due to myocardial ischemia. It can be the first clinical manifestation of cardiovascular disease and may frequently happen among patients with stable conditions.[4] According to the report of the Ministry of Health of Iran, the mortality rate of MI

in Iran in 2012 was 85 cases per 100000 people.[2] A study also reported that the incidence of MI in Iran is 73.3 cases per 100000 people, which is greater than the rates reported for some countries in the Eastern Mediterranean Region.[2]

Rehospitalization is one of the main consequences of MI.[5] According to the Centers for Medicare and Medicaid Services, rehospitalization is defined as hospitalization in any hospital setting during the first thirty days after hospital discharge. Almost one fourth of patients with chronic heart failure and one fifth of patients with MI experience rehospitalization during the first thirty days after hospital discharge.[6] A study reported that a rehospitalization rate of 19% was associated with an annual cost of more than seventeen billion dollars.[7] Therefore, preventing rehospitalization is a top healthcare priority.

Health literacy (HI) is one of the factors with potential effects on MI-related consequences such as rehospitalization. By definition, HL is "the degree to which people are able to access, understand, appraise, and communicate information with the demands of different health contexts in order to promote and maintain good health across life course."[8] Estimates show that 776 million adults in the world, i.e. 16% of the global adult population, do not have basic HL skills, including reading, writing, and understanding.[8] People in low- to moderate-income counties often lack knowledge about the risk factors of health problems.[1]

Low HL has many different consequences. Studies show that HL is a significant factor affecting cardiac patients' understanding about treatment procedures and guidelines.[9] People with low HL usually have lower health status, are more frequently hospitalized, show lower adherence to treatment regimens, are more likely to experience medication errors, and less frequently use preventive services.[6, 8, 10-12] A systematic review showed that the costs associated with low HL is around 3-5% of all annual health-related costs.[8] Low HL is also related to rehospitalization.[6] A study reported HL as an independent predictor of thirty-day rehospitalization.[13] Several studies also showed that HL significantly correlated with thirty-day rehospitalization rate,[14] use of healthcare services,[15, 16] health-promoting behaviors among Iranian elderly people,[17] and recovery time among patients in cardiac surgery intensive care unit.[18]

Although many studies have been conducted on the relationship between HL and rehospitalization, there is limited information about this relationship among patients with MI. The present study was conducted to address this gap. The aim of the study was to examine the relationship between HL and rehospitalization among patients with MI.

Methods

Participants

This prospective cohort study was conducted from June 2015 to March 2017. During the study, 366 hospitalized patients with MI were conveniently recruited from the cardiac care units of four teaching hospitals affiliated to one of the Universities of Medical Sciences, Tehran, Iran. All patients who met the inclusion criteria were included in the study by convenient sampling method. Inclusion criteria were no previous history of hospitalization for cardiovascular problems, definite diagnosis of MI established by a cardiologist, stable physical health conditions, no history of cognitive or psychiatric problems, no previous history of MI and rehospitalization, and accessibility via telephone. Unwillingness to fill out the study instruments and incomplete questionnaire were the exclusion criteria.

Sample size was determined based on the results of a former study which reported that the rate of post-MI rehospitalization was 20%.[19] Accordingly, with a p of 0.2, a d of 0.04, and a type one error of 0.05, the sample size was calculated to be 380.

Material and Procedure

At the time of hospital discharge, a demographic questionnaire and the Health Literacy for Iranian Adults (HELIA) were completed for participants using their medical records and through interviewing them. The demographic questionnaire included items on age, gender, educational level, employment status, marital status, place of residence, and ethnicity. It also included a question about the method for obtaining health information. HELIA, the other study instrument, was developed and validated by Montazeri et al. in 2014.[20] This questionnaire has been standardized and approved by content validity and construct validity methods. Cronbach's alpha of the items also ranged from 0.72 to 0.89. The reliability of the questionnaire in our study was also estimated using Cronbach's alpha. The alpha values for the subscales of reading, access, understanding, appraisal, and decision and behavior were 0.6, 0.7, 0.79, 0.7, and 0.84, respectively. It includes 33 items in five main dimensions, namely reading (items 1–4), access (items 5–10), understanding (items 11–17), appraisal (18–21), and decision and behavior (items 22–33). Items 1-4 are scored on a five-point Likert scale as follows: "Very difficult": 1; "Difficult": 2; "Neither difficult, nor easy": 3; "Easy": 4; and "Very easy": 5. Items 5–33 were also scored on a five-point Likert scale as follows: "Always": 1; "Often": 2; "Sometimes": 3; "Rarely": 4; and "Not at all": 5. Subscale scores were calculated and changed into a 0-100 scale, and then the total score of HELIA was calculated through summing subscale scores and dividing the result by 5. Changing the raw scores of HELIA subscales to the 0-100 scale was done using the following formula:

$$Finalscore = \frac{Rawscore - Lowestrawscore}{Highestrawscore - Lowestrawsco}$$

Based on the total HELIA score, HL was classified as inadequate (scores 0–50), barely adequate (scores 50.1–66), adequate (scores 66.1–84), and excellent (scores 84.1–100). Thirty days after hospital discharge, the participants were asked over telephone about disease recurrence and rehospitalization.

This study was approved by the Ethics Committee in a University of Medical Sciences, Tehran, Iran (code: IR.IUMS.REC.1395.9411220001). Written consent was obtained from all participants, and they were ensured that their data would be handled confidentially.

Data were analyzed using the SPSS program (v. 16.0). The relationships between categorical variables were tested through the Chi-square test, while the relationships of the HL score with two-level and multi-level variables were tested through the independent-sample *t*-test and one-way analysis of variance (with the Scheffe post hoc test), respectively. The correlation between numerical variables was tested using the Pearson's correlation analysis. Moreover, the logistic regression analysis (with the backward stepwise method adjusted for covariates) was used to determine the relationship of HL and other factors with rehospitalization (yes vs. no). The level of significance was set at less than 0.05.

Results

Demographic Characteristics

The mean age of the participants was 54.31±8.94. Their level of education in terms of the number of years of study was 9.05±5.19. Full details of the participants' characteristics are shown in Table 1**.** Most participants were married (94.8%), employed (56%), and urban dwellers (92.1%). Moreover, 44.5% of them had a positive history of hypertension, and 31.1% of them had a positive history of diabetes mellitus.

Table 1: Demographic characteristics of the study population

Characteristic	Value
Age, Mean (SD)	54.31 (8.94)
Education (year), Mean (SD)	9.05 (5.19)
Gender, n (%)	
Male	291 (79.5)
Female	75 (20.5)
Marriage status, n (%)	
Single	13 (3.6)
Married	345 (94.8)
Divorced	2 (0.5)
Widow	4 (1.1)
Employment status, n (%)	
Employed	205 (56)
Unemployed	29 (7.9)
Retired	66 (18)
Other	65 (17.8)
Residence area, n (%)	
Urban	337 (92.1)
Rural	29 (7.9)

1HL

As to HL adequacy, most of the participants had inadequate HL, and only a few of them had excellent health literacy. The level of health literacy ranking is shown in Figure 1. The total mean score of HL was 53.08±16.64. The mean raw scores of HELIA subscales were as follows: Reading (11.57±3.48), Access (17.91±5.1), Understanding (22.75±6.09), Appraise (11.67±3.8) and Decision and behavior (42.84±10.39). The level of HL in subgroups of participants is shown in Table 2. There was no statistically significant relationship between age, sex, marital status and history of underlying diseases with health literacy levels (p=0.8, 0.8, 0.8, 0.19, respectively). The results also showed that the differences between different educational levels as to HL total mean score and level of HL were statistically significant (P>0.001). Moreover, the total mean score of HL and HL level had a significant relationship with the participants' employment status (P<0.001). In addition, the HL mean score and the level of participants who lived in urban areas was significantly greater than those who lived in rural areas (P<0.001).

Rehospitalization

Among 366 participants, fifteen died during the

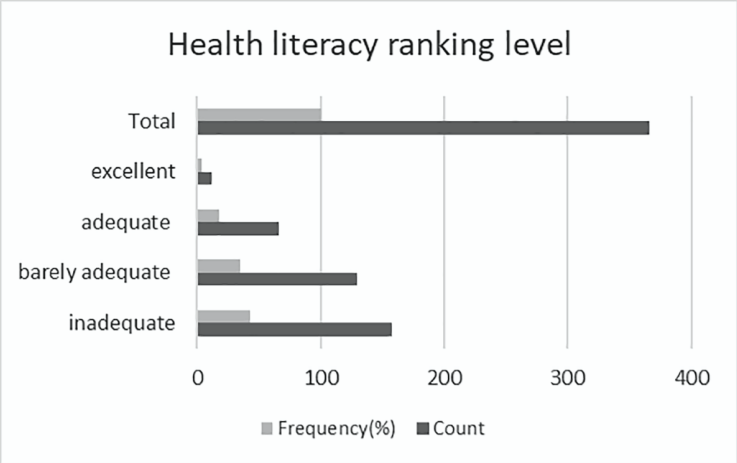

Figure 1: Health literacy ranking level

Table 2: Characteristics of the participants by level of health literacy

Patient Characteristics	Health Literacy					
	Inadequate	Barely adequate	Adequate	Excellent	P value	Total
	n=158	n=129	n=66	n=12		
Socio-demographic Characteristics						
Age, mean (SD)	54.6 (9.4)	55.2 (7.9)	51.8 (9.3)	54.5 (7.9)	0.85	365
Gender, n (%)						
Female	34 (45.3)	24 (32)	15 (20)	2 (2.7)	0.8	75
Male	124 (42.8)	105 (36.2)	51 (17.6)	10 (3.4)		290
Education, n (%)						
Illiterate	36 (97.3)	1 (2.7)	0 (0%)	0 (0%)	<0.001	37
Primary school	62 (59)	35 (33.3)	8 (7.6)	0 (0%)		105
Secondary school	48 (31.4)	74 (48.4)	29 (19)	2 (1.3)		153
University	12 (17.1)	19 (27.1)	29 (41.4)	10 (14.3)		70
Employment status, n (%)						
Employed	89 (43.6)	74 (36.3)	36 (17.6)	5 (2.5)	<0.001	204
Unemployed	19 (65.5)	7 (24.1)	3 (10.3)	0 (0%)		29
Retired	17 (43.1)	26 (39.4)	16 (24.2)	7 (10.6)		66
Other	32 (49.2)	22 (33.8)	11 (16.9)	0 (0%)		65
Marriage status, n (%)						
Single	6 (46.2)	4 (30.8)	2 (15.4)	1 (7.7)	0.8	13
Married	149 (43.3)	121 (35.2)	63 (18.3)	11 (3.2)		344
Divorced	0 (0%)	2 (100)	0 (0%)	0 (0%)		2
Widow	1 (25)	2 (50)	1 (25)	0 (0%)		4
Residence area, n (%)						
Urban	133 (39.6)	127 (37.8)	65 (19.3)	11 (3.3)	<0.001	336
Rural	25 (86.2)	2 (6.9)	1 (3.4)	1 (3.4)		29
History of Underlying diseases (Diabetes,Hypertention,Copd and others) (+)	10 (40.2)	94 (36)	53 (20.3)	9 (3.40	0.19	105
History of rehospitalization (+)	11 (7.3)	9 (7.3)	6 (9.4)	2 (16.7)	0.66	28

Table 3: Mean, SD, and the results of the logistic regression analysis to determine the relationship between HL and rehospitalization

Variables	Rehospitalization					Multiple logistic regression		
	Yes (Reference)		No			95.0% C.I.for EXP (B)		
	Mean	SD	Mean	SD	P value	Odds ratio	Lower	Upper
Score of the understanding subscale	25.26	6.863	22.53	6.06	0.000	1.191	1.089	1.302
Score of the decision and behavior	40.63	10.44	43.03	10.46	0.008	0.942	0.902	0.984
Education (year)	8.75	4.7	9.16	5.24	0.037	0.899	0.813	0.994

HL: Health literacy

first thirty days after hospital discharge or did not answer our telephone contacts for rehospitalization assessment. Therefore, the rehospitalization-related data of 351 participants were included in the final analysis (response rate=96%). Only 28 out of 351 participants reported rehospitalization, resulting in a rehospitalization rate of 8%. The mean score of HL among participants with and without rehospitalization was 55.36±19.06 and 53.08±16.53, respectively, using Chi-square test. Rehospitalization had no significant relationship with HL level (P=0.66), gender (P=0.2), employment status (P=0.38), educational level (P=0.77), marital status (P=0.16), place of residence (P=0.71), history of chronic diseases (P=0.66), HL mean score (P=0.49), and age (P=0.89).

Logistic regression analysis with the backward stepwise method was used to remove the effects of potential confounders from the relationship of HL and rehospitalization. Findings showed that after adjusting the effects of age, gender, occupation, marital status, and place of residence, the relationship of rehospitalization and HL was statistically significant only in some subscales. In this model, the relationship of rehospitalization with educational level and with the understanding and decision and behavior subscales of HL was statistically significant (P<0.05; Table 3).

Discussion

This study examined the relationship between HL and rehospitalization among patients with MI. The total mean score of HL in the present study was 53.08±16.64, and most of the participants had low HL. In agreement with these findings, a study in Iran reported that most patients with cardiovascular disease had inadequate or borderline HL, and only 10% of them had adequate HL.[21] Another study on cardiac patients in Iran reported that 50.4% of them had inadequate HL, and only 28.4% of them had adequate HL.[22] Similarly, a study in five provinces in Iran found that 28.1% of the participants had

adequate HL, 15.33% had borderline HL, and 56.6% had inadequate HL.[23] All these findings confirm low HL in the Iranian society.

The study findings also revealed that patients with higher educational levels and those who were retired or employed obtained higher HL scores. These findings may be related to their better access to healthcare services and health information. In line with these findings, a former study in the United States reported that lower educational level and unemployment were associated with lower HL.[15] Another study in the United States also found that most patients with low HL were unemployed and had low educational level.[14] Similarly, a study in Germany showed that HL had a significant relationship with educational level and social status.[24] A study in Iran also revealed that cardiac patients with higher educational level had a higher HL.[18] Another study in Iran on elderly people showed that HL had a significant relationship with employment status, educational level, and place of residence.[22] Another finding of the present study was the insignificant relationship of HL with age and gender. Similarly, a study in Iran reported no significant differences among different age and gender groups as to HL.[18]

Our findings also showed that only 8% of the participants (n=28) experienced rehospitalization during the first thirty days after hospital discharge. Rehospitalization rate in several previous studies ranged from 20-30%.[14, 15, 25] Another study reported that one fourth of hospitalized patients with chronic heart failure and one fifth of those with MI are rehospitalized during the first thirty days after their hospital discharge.[6] The lower rehospitalization rate in the present study compared with other studies may be due to the small sample size of the study and short follow-up period. several studies have considered a longer follow-up period.[25-27] The present study did not reveal a significant relationship between HL score and rehospitalization, whereas a former study reported that patients with lower HL had a higher rehospitalization rate.[13] Similarly, several earlier studies showed that lower HL was significantly associated with higher rehospitalization rate,[11, 14, 15, 26] higher outpatient medical visit rate,[15] and poorer health-related outcomes.[24] Perhaps this lack of statistical significance in the relationship between health literacy and rehospitalization is due to insufficient sample size as well as a short one-month follow-up period, so that a weak relationship could not be found during the 30-day follow-up period. Further, readmission after cardiovascular events, including acute myocardial infarction is multifactorial and depends on several factors. However, two studies on patients with heart failure showed no significant relationship between HL and rehospitalization.[25, 27]

Logistic regression analysis in the present study revealed a significant relationship between the understanding (odds ratio=1.1; 95% confidence interval: 1.089–1.3; P=0.000) and decision and behavior (odds ratio=0.94; 95% confidence interval: 0.9–0.98; P=0.000) subscales of HL and rehospitalization. This finding indicates that patients with higher understanding scores were more likely to be hospitalized. This finding can be interpreted that people have not received adequate training from the health system in the field of health awareness and information related to health and self-care. As a result, this level of training has not led to a change in behavior. In addition, despite the greater understanding, limited access to health services can justify this relationship. As the regression analysis of the present study showed, people with higher decision and behavior scores had fewer readmissions, which confirms our previous interpretation. These individuals have experienced less readmission because they have reached the decision-making and behavior change stage based on the behavior change model (Maybe because of getting better information and awareness). No relevant study was found to examine the relationship between HL subscales and hospital readmission. Only one study examined the relationship between numeracy skills and cognitive impairment with readmission in addition to health literacy,[27] which in our study were not investigated. In contrast to the findings of our study, a former study reported that patients with lower HL had higher rehospitalization rate.[13] Similarly, several earlier studies showed that lower HL was significantly associated with higher rehospitalization rate,[11, 14, 15, 26] higher outpatient medical visit rate,[15] and poorer health-related outcomes.[24] However, two studies on patients with heart failure showed no significant relationship between HL and rehospitalization.[25, 27] These differences may be due to differences in study design, including different sampling methods and sample sizes. In addition, in the regression analysis performed in this study, a significant relationship was seen between education (per year) and rehospitalization, so that people with more years of education had a lower rehospitalization (odds ratio=0.89; 95% confidence interval: 0.813–0.99; P value=0.03). In several studies mentioned earlier, this finding was similar to our study.[11, 13, 25] However, there were studies that are not in line with our findings.[12, 14, 16, 27] Moreover, while we found no significant relationship between HL and underlying conditions, two previous studies reported that patients with low HL had more medical problems.[13, 27] This contradiction may be due to the differences between the studies in terms of the classification of the underlying conditions and participants' age.

Conclusion

This study suggests that most patients with MI have

inadequate HL, but their HL is not significantly associated with their thirty-day rehospitalization. In our study, a limited number of patients had rehospitalization, which may have increased with the addition of other hospitals to the study and changes in the study design (participants and study method), and a significant relationship was seen between health literacy and readmission. Given the low health literacy in this study and significant relationship of HL with rehospitalization rate and health-related outcomes in other studies, healthcare policymakers need to develop and implement programs to improve public HL, thereby promoting public health. Low HL and limited self-care education for patients during their hospital stay and at the time of hospital discharge may result in early rehospitalization and highlights the great need for patient and public education about self-care skills. It is noteworthy that the present study was conducted in the capital city of Iran, i.e., Tehran, where people have better access to healthcare services. Therefore, findings may not be easily generalizable to people in other areas of Iran.

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