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# Impact of Health Literacy, Self-efficacy, and Outcome Expectations on Adherence to Self-care Behaviors in Iranians with Type 2 Diabetes

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**ABSTRACT**

***Objectives:*** Diabetic patients with higher health literacy (HL) may feel more confident in their ability to perform self-care behaviors and may have strong beliefs that diabetes-related behaviors will lead to specific outcomes. Our study aimed to document the relationships between HL, self-efficacy, outcome expectations, and diabetes self-care of patients with type 2 diabetes mellitus (T2DM) in Iran. ***Methods:*** We conducted a cross-sectional observational study of 187 patients with T2DM. Participants completed the Functional Communicative and Critical Health Literacy scale, the Summary of Diabetes Self-Care Activities, the Diabetes Management Self-Efficacy Scale, Outcome Expectations Questionnaire, and a demographic questionnaire. ***Results:*** Participants who received diabetes education ($t = 5.79$, $p<0.001$) and were married ($F = 3.04$, $p<0.050$) had better diabetes self-care behavior. There was a significant positive correlation between self-care behaviors and communicative HL ($r = 0.455$, $p<0.010$), critical HL ($r = 0.297$, $p<0.010$), self-efficacy ($r = 0.512$, $p<0.010$) and outcome expectations ($r = 0.387$, $p<0.010$). Diabetes education and marital status accounted for 16.9% of the variance in diabetes self-care. Self-efficacy, outcome expectations, communicative, and critical HL explained 28.0%, 1.5%, 3.7%, and 1.4% of the variance, respectively. ***Conclusions:*** This study revealed that the potential impact of self-efficacy, outcome expectations, communicative, and critical HL should be considered in the education program for patients with diabetes. We found self-efficacy to be the most important predictor of diabetes self-care. Therefore, the use of self-efficacy theory when designing patient education interventions could enhance diabetes self-care. It is essential that health care providers assess patient's HL levels to tailor health-related information specific to a domain of HL. This would fully inform patients and promote empowerment rather than simple compliance.

Diabetes mellitus is a chronic condition and a global health problem,[1] that affects close to 285 million people worldwide.[2,3] The prevalence of type 2 diabetes mellitus (T2DM) is increasing at an alarming rate, especially in developing countries.[4–6] T2DM has a prevalence of 1.2–14.6% in Asia, 4.6–40% in the Middle East, and 1.3–14.5% in Iran.[7] Diabetes is a lifelong condition and leads to chronic complications if blood glucose is constantly elevated.[3,5] Although living with diabetes affects all aspects of a patient's life, it is possible for the patient to have a normal life[8] if they perform self-care activities designed to control their symptoms and avoid long-term complications.[9] Self-care behaviors that patients with T2DM must learn or modify include eating healthily, undertaking physical activities, following a prescribed medication regimen, and self-monitoring their blood glucose level.[10] Despite general agreement on the benefits of self-care behaviors, previous literature has shown most Iranian patients with T2DM did not perform self-care activities appropriately, and only 15.1% had good adherence to self-care behaviors.[11]

Several studies suggest that health literacy (HL) plays a significant role in adherence to diabetes self-

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care and outcomes.[12,13] As patients are required to participate in more complicated health care and navigate more complex health systems, the need for them to be 'health literate' in today's society is greater than ever before.[14]

The World Health Organization (WHO) Health Promotion Glossary defines HL as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways that promote and maintain good health".[15] In light of this, Nutbeam[15] proposed a three-tiered framework of HL. The first tier, functional HL, refers to having basic skills in reading and writing, sufficient to be able to manage health effectively in everyday situations. The second tier, communicative HL, refers to having advanced cognitive and literacy skills, and a greater ability to obtain relevant information, derive meaning and apply new information to changing circumstance. The final and third tier is critical HL, this is the most advanced cognitive skills, and can be used to critically analyze information, and to use this information to exert greater control over life events and situations.

Previous studies mainly focused on functional HL, and the other levels of HL have received insufficient attention. However, findings in recent studies suggest that communicative and critical HL contribute to better self-care behaviors more than functional HL and plays a significant role in better diabetes management and optimal health.[16]

It is assumed that being health literate enables patients to engage in health-related behavior such as diabetes self-care. This means that patients with higher HL may feel more confident about their ability to accomplish self-care behaviors.[16,17] Therefore, how diabetic patients perform self-care activities can be predicted by the beliefs that they hold about their abilities to organize and execute the actions required to manage their disease.[18] This is referred to as self-efficacy.[19] The concept of self-efficacy, derived from Bandura's social cognitive theory, provides a link between self-perceptions and individual actions.[20]

Self-efficacy is frequently discussed in the chronic disease literature,[21] and is becoming increasingly important in diabetes care.[22] For example, one study showed that self-efficacy explained 4% to 10% of the variance in diabetes self-care behaviors beyond that accounted for by patient characteristics and health beliefs about barriers.[23] In another study, self-efficacy was positively correlated with diabetes self-care ($r = 0.39$, $p<0.001$) and together with marital status explained 16.7% of the variance in self-care behaviors.[18]

Within the social cognitive theory, although self-efficacy can act independently, it had a greater effect when combined with outcome expectations.[24] Bandura defined outcome expectations as "a person's estimate that a given behavior will lead to certain outcomes".[20]

Outcome expectations influence behavior by serving as incentives (positive outcomes) or disincentives (negative outcomes).[25] Outcome expectations provide the motivation for behavior while self-efficacy provides the confidence to overcome barriers.[26] Individuals are more motivated to engage in behaviors if they believe there will be beneficial consequences (more positive outcomes and fewer negative outcomes) from those behaviors.[27]

In the literature, self-efficacy has received the most consistent support as a strong determinant of diabetes self-care[28] and outcome expectations for those behaviors have received limited attention. A few studies have examined self-efficacy and outcome expectations together and have discussed the dual roles of these constructs. For example, Iannotti et al,[27] found that self-efficacy and the interaction of self-efficacy with positive outcome expectations were significantly associated with diabetes self-management, adherence, and glycemic control in older adolescents. In another study conducted in Taiwan, self-care behavior was significantly and positively correlated with self-efficacy and outcome expectations.[29]

In this study, we investigated the unique contributions of HL, self-efficacy, and outcome expectations on self-care behaviors. We anticipate that patients with higher HL may feel more confident in their ability to perform self-care behaviors and may have more motivation for performing these behaviors.

We attempted to document the relationships between HL, self-efficacy, outcome expectations, and self-care behaviors in patients with T2DM.

## METHODS

This study used a cross-sectional, correlational design and survey methods. Ethical approval for the study was obtained from Isfahan University of Medical Sciences in Iran.

This study was conducted between April and June 2014. Based on Cochran's formula, at least 183 participants were required. During the study period, a total of 200 patients with T2DM were referred to the diabetes clinic at Hazrat-Ali Health Center (in the city of Isfahan, Iran).

Patients were selected by the convenience sampling method. From this total, 13 patients did not agree to participate and returned the survey; the final sample consisted of 187 patients. Patients were included in the study if they were aged 25 years and above, had been diagnosed with T2DM for one year or more, had no physical problems to stop them answering the questions, had no cognitive problems or mental disease, and were willing to participate in the study. All participants provided their written informed consent.

The multidimensional scale of Functional Communicative and Critical Health Literacy (FCCHL) scale, developed by Ishikawa et al,[30] was used to assess HL skills. The FCCHL measures HL for patients with T2DM including the three constructs of HL introduced by Nutbeam. FCCHL was one of the first self-report questionnaires to measure more than functional HL in 14 items. The FCCHL has five items for each of the functional and communicative HL subscales, and four items for the critical HL subscale. Response options were rated on a four-point Likert scale ranging from 'never' to 'often'. Mean scale scores were obtained by summing the item scores and dividing them by the total number of items. A total score was calculated with higher scores indicating higher levels of HL. The scale showed satisfying internal consistency with Cronbach's alpha values of 0.84, 0.77, and 0.65 for the functional, communicative, and critical dimensions, respectively. Cronbach's alpha of the total HL scale was reported as 0.78. The simplicity and comprehensibility of the items were tested and found to be acceptable. Correlation analysis showed that the three dimensions are fairly independent.

For the Persian version of the scale, the Cronbach's alpha was acceptable (0.82), and it was also acceptable for the functional, communicative, and critical dimensions (0.91, 0.80, 0.76, respectively). The test-retest reliability coefficient was 0.85 ($p$<0.010). Principal components factor analysis was used to estimate the factor structure of the FCCHL. The analysis revealed three factors with an Eigenvalue greater than one, which jointly accounted for 65.8% of the total sample variance and all items loaded above 0.40.

The Diabetes Management Self-Efficacy Scale (DMSES) was used to assess patient's judgment of his or her ability to perform a recommended self-care routine. The original scale consisted of 20 items with response options ranging from "0 = I cannot do at all" to "10 = I strongly can do." The answers were summed to obtain an overall self-efficacy score, ranging from 0 to 200. Higher scores represented a greater self-efficacy in diabetes self-care. The DMSES was previously validated for use in Persian patients with T2DM.[31] The Persian version includes 19 items, which measure the degree of confidence an individual with T2DM has in performing self-care activities. It had an adequate internal consistency score (0.83). The test-retest reliability was also adequate, with moderate agreement between the test-retest scores (r = 0.86, $p$< 0.001). In our study, adequate alpha coefficient (Cronbach's alpha = 0.85) suggests that the scale is internally reliable, and the outcomes of reliability analyses show that the DMSES is stable over time (r = 0.83, $p$< 0.001).

A 20-item questionnaire previously used by Skelly et al,[32] assessed participants' belief about the consequences of performing regimen behaviors. Three items addressed the general benefits of adherence, and the remaining items assessed blood-glucose testing (five items), diet (four items), exercise (four items), and medication (four items). Participants were asked how much they agreed or disagreed with each statement. For each item, patients chose a response ranging from 0 (totally disagree) to 100 (totally agree). The total score was a summation of the items' scores. Higher scores reflected strong beliefs that diabetes-related behaviors would lead to specific outcomes. The Cronbach's alpha coefficient for the instrument in our study was 0.80.

To measure diabetes self-care behaviors, we used the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire. The tool comprised of core items measuring self-care tasks and additional items measuring patients' perceptions of self-care recommendations provided by their health care providers. In this study, we used 11 core items, which assessed the frequency with which a patient followed a diabetes routine over the previous seven days in five domains: diet (items 1–4), exercise (items 5–6), blood-glucose testing (items 7–8), foot care (items 9–10), and smoking status (item 11). The response

options ranged from 0–7 to correspond to the number of days in a week. The eleventh item focused on smoking habits and assessed the average number of cigarettes smoked per day. For this analysis, only diet, exercise, blood glucose testing, and foot care were used since no participant reported smoking. The Cronbach's alpha internal consistency coefficients were 0.79 for the overall scale and 0.65, 0.79, 0.69, and 0.85 for the diet, exercise, blood glucose testing, and foot-care subscales, respectively. The test-retest reliability coefficient was 0.78 ($p$<0.010) for the whole scale.

Sociodemographic attributes, including age, sex, marital status, education level, T2DM duration, and previous diabetes education were collected. Levels of education were categorized into four groups: illiterate, primary school (1–5 years of schooling), secondary/high schooling (6–12 years of schooling) and education above high school. The number of years between the diagnosis of diabetes and point of data collection was recorded as T2DM duration.

The internal consistency of the measurements was calculated using Cronbach's alpha coefficient. Pearson correlation coefficient was used for test-retest reliability. Thirty subjects completed the questionnaires twice, with a two-week interval between assessments. Construct validity was examined by performing principal axis factoring with a promax rotation method. Descriptive statistics, the mean, standard deviation (SD), and percentage, were used to describe the participants' sociodemographics and study variables. Pearson correlation was performed to analyze the relationship between continuous variables. Bivariate associations between the SDSCA, DMSES, outcome expectations, and sociodemographic characteristics were tested using one-way ANOVA and independent sample $t$-tests. Hierarchical regression was used to determine the relationships between the three HL subscales, self-efficacy, outcome expectations, demographics, and diabetes self-care behaviors. All statistical analyses were performed using SPSS Statistics (SPSS Inc., Chicago, US) version 17.0.

## RESULTS

The mean age of the patients was 57.4±11.1 years (range = 28–84), with an average of 8.4±6.8 years since diagnosis. A total of 127 (67.9%) were women and 107 (57.2%) had a primary school education. Most participants (54.0%) had T2DM for more than five years, and 80.5% were married. Ninety (48.1%) of the participants had received previous diabetes patient education.

The mean SDSCA score was 3.8±1.6, indicating that patient's adherence to self-care tasks was about four days in the week. The mean subscale scores were 4.0±1.3 for diet, 2.5±2.1 for physical activity, 1.7±2.0 for blood-glucose testing, and 3.3±2.2 for foot care. The results indicated that during the week patients had best adherence to diet and worse adherence to blood-glucose testing. The mean scores for functional, communicative, and critical HL were 2.0±1.0, 2.4±0.7, and 2.4±0.8, respectively. Among the three subscales, communicative HL had the highest mean score and functional HL had the lowest.

The total DMSES scores averaged at 96.6±34.6, indicating that patients had low self-efficacy in diabetes self-care. More than half of patients (65.2%) lacked confidence (a score below five) in following a healthy eating pattern when they were on holiday, followed by a lack of confidence in taking more exercise and adjusting their eating plan when taking more exercise. Most participants (79%) reported that they were more confident (a score above five) in taking their medication as prescribed. Patients were also confident in dealing with hyper or hypoglycemia episodes.

The mean outcome expectations score for the overall sample was 70.4±6.7, indicating that patients had strong beliefs that diabetes-related behaviors would lead to specific outcomes. Almost all participants (92%) agreed that they would be healthier in the long-term if they followed their diet. Most patients (85.6%) also believed that adhering to diabetes self-care activities would improve their diabetic control, and 80.7% believed that taking diabetes medication would make them feel better. Over three-quarters (77.5%) agreed that if they tested their glucose level daily, their diabetes would be better controlled. However, 84% of patients disagreed that testing their glucose levels several times a day would make them feel any better, and 77% disagreed that regularly taking their diabetes medication would cost them a lot of money over the next several months.

Participants who received diabetes education ($t$ = 5.79, $p$<0.001) and were married (F = 3.04, $p$<0.050) had better diabetes self-care behavior. HL scores in

**Table 1:** Correlation matrix of functional, communicative and critical health literacy (HL), self-efficacy, outcome expectations and self-care activities (n = 187).

| Variable | Functional HL | Communicative HL | Critical HL | Self-efficacy | Outcome expectations | Self-care behaviors |
|---|---|---|---|---|---|---|
| Functional HL | 1 | | | | | |
| Communicative HL | –0.06 | 1 | | | | |
| Critical HL | 0.07 | 0.764** | 1 | | | |
| Self-efficacy | 0.390** | 0.373** | 0.436** | 1 | | |
| Outcome expectations | –0.09 | 0.304** | 0.325** | 0.363** | 1 | |
| Self-care behaviors | –0.03 | 0.455** | 0.297** | 0.512** | 0.387** | 1 |

*** Correlation is significant at the 0.010 level (two-tailed).*

communicative (F = 2.9, $p$<0.050) and critical (F = 7.8, $p$<0.010) subscales were found to be significantly higher in married participants than participants who were living alone. Age was negatively associated with functional (r = –0.2, $p$<0.050) and critical (r = –0.2, $p$<0.050) HL. Low levels of HL in functional (F = 23.2, $p$<0.001), communicative (F = 9.8, $p$<0.001) and critical (F = 9.6, $p$<0.001) subscales were found to be more prevalent in participants who had low educational attainment. Neither sex nor diabetes duration was associated with HL levels. Duration of diabetes (r = 0.26, $p$<0.001) and educational attainment (F = 6.6, $p$<0.001) were both positively correlated with self-efficacy. A significant difference was found in outcome expectations for diabetes education ($t$ = 5.8, $p$<0.001) and educational attainment (F = 4.0, $p$<0.010).

Pearson correlation coefficients of FCCHL, self-efficacy, outcome expectations, and diabetes self-care behaviors are presented in Table 1. Based on this data, there was a significant positive correlation between self-care behaviors, self-efficacy (r = 0.512, $p$<0.010), outcome expectations (r = 0.387, $p$<0.010), communicative (r = 0.455, $p$<0.010), and critical HL (r = 0.297, $p$<0.010). Functional HL (r = 0.390, $p$<0.010), communicative HL

**Table 2:** Hierarchical multiple regression analysis for self-efficacy, outcome expectations, communicative, and critical health literacy (HL) on diabetes self-care (n = 187).

| Diabetes self-care | $R^2$ | Adjusted $R^2$ | Change in $R^2$ | Overall F | Change in F |
|---|---|---|---|---|---|
| **Model 1**<br>Diabetes education<br>Marital status | 0.169 | 0.160 | 0.169 | 18.395 | 18.395** |
| **Model 2**<br>Diabetes education<br>Marital status<br>Self-efficacy | 0.452 | 0.443 | 0.283 | 49.514 | 93.042** |
| **Model 3**<br>Diabetes education<br>Marital status<br>Self-efficacy<br>Outcome expectations | 0.467 | 0.455 | 0.015 | 39.186 | 4.945* |
| **Model 4**<br>Diabetes education<br>Marital status<br>Self-efficacy<br>Outcome expectations<br>Communicative HL | 0.504 | 0.490 | 0.037 | 36.189 | 13.371** |
| **Model 5**<br>Diabetes education<br>Marital status<br>Self-efficacy<br>Outcome expectations<br>Communicative HL<br>Critical HL | 0.518 | 0.501 | 0.014 | 31.653 | 4.953* |

*$p \leq 0.050$; **$p \leq 0.010$.

(r = 0.373, $p$<0.010), critical HL (r = 0.436, $p$<0.010), and outcome expectations (r = 0.363, $p$<0.010) were positively correlated with self-efficacy. Outcome expectation was associated with communicative (r = 0.304, $p$<0.010) and critical HL (r = 0.325, $p$<0.010), but not with functional HL.

Table 2 presents the results of the hierarchical regression analysis. For the dependent variable of diabetes self-care behaviors, five hierarchical models were developed. Based on the statistical significance of the results from one-way ANOVA and *t*-tests analysis, diabetes education and marital status were introduced in the first model as predictive factors. These factors accounted for 16.9% of the variance in diabetes self-care. Self-efficacy and outcome expectations were added systematically in model two and three and explained an additional 28.0% and 1.5% of the variance in diabetes self-care, respectively. Communicative and critical HL were entered in model four and five and accounted for an additional 3.7% and 1.4% of the variance.

## DISCUSSION

We investigated the relationships between HL, self-efficacy, outcome expectations, and self-care behaviors in patients with T2DM.

Based on our findings, Iranian diabetic patient's adherence to self-care tasks was about four days a week, and in the seven days since filling out the questionnaire, they had the best adherence to diet and the worst adherence to blood-glucose testing. Similar results were obtained in a study conducted at a public diabetes clinic in the Marshall Islands.[18] These findings indicate that checking blood glucose levels was performed less than recommended, and it is an important area that should be considered in future diabetes education.

Similarly to findings of a previous study, of the three HL subscales, communicative HL had the highest mean score and functional HL had the lowest.[33] Limited functional HL in our target group could be a consequence of low educational attainments, and the deterioration of visual ability as an accompanying complication of chronic diabetes. In busy clinics with a large number of referring patients, healthcare providers often rely on written materials to provide patient education. However, the limitation of patients reading comprehension should be considered.

Other results indicate that patients had low self-efficacy in performing diabetes self-care behaviors, which is contrary to our findings in a previous study where patients with T2DM had a high level of self-efficacy in managing diabetes.[18] This difference may be due to limited attention to self-efficacy enhancing strategies in patient education in Iran. Thus, using self-efficacy as an intervention basis can be beneficial and a potential area of educational intervention. According to other results, most patients had strong beliefs that diabetes-related behaviors would lead to specific outcomes. Although these beliefs provide the motivation for better adherence to self-care behaviors, low levels of self-efficacy may be a barrier to good adherence.[19,20]

Patients who had received diabetes education had a better diabetes self-care. Although diabetes education is accessible in diabetes clinics in Iran, according to previous studies, knowledge alone is not enough for empowering patients to incorporate the necessary self-care skills into their daily lives.[22,34] Therefore, researchers recommend that diabetes education should include some psychosocial factors such as the patient's self-efficacy, which might have a significant effect on patient's adherence to self-care behaviors. We found that married patients had better diabetes self-care behaviors. These findings affirm the role of family as an important source of support and support a large body of research[35] that suggests marital status and support from others can enhance coping ability and compliance with medical regimens and disease management.

Our results also revealed interesting associations between self-efficacy, outcome expectations, and self-care behaviors. Our finding supports the evidence for a positive relationship between self-efficacy and self-care behaviors.[23,36–38] Consequently, patients with increased confidence in their ability to select appropriate behaviors seemed to improve adherence to self-care tasks. Consistent with previous studies, self-efficacy was also associated with outcome expectations in bivariate analysis, and outcome expectations was significantly correlated with self-care behaviors.[29,39] As a result, having a sense of self-efficacy and strong beliefs in the beneficial outcomes of self-care tasks can improve the patients' adherence.

Similar to other studies, communicative, and critical HL was positively and significantly associated with self-efficacy[40] and diabetes self-care management.[33] Functional HL was not associated

with diabetes self-care. However, it was moderately associated with self-efficacy. According to this finding, it is possible that this factor has an indirect effect on diabetes self-care through an association with diabetes self-efficacy. Further studies are necessary to investigate this particular factor and confirm this association.

Numerous studies[23,24,27,36] reported self-efficacy is a valuable predictor of diabetes self-care. In our study, if we look at the coefficient of determination in all models, we observed that in the case of self-efficacy, the value was greater than other variables. Therefore, it seems that self-efficacy is the most important predictor of diabetes self-care activities. Although self-efficacy can act in the absence of high outcome expectations, like other studies,[27,29] we found that the combined effects of self-efficacy and outcome expectations were greater, and when self-efficacy and outcome expectations both were taken into account they could better explain the variance in diabetes self-care. Therefore, during education sessions with patients, diabetes educators should emphasize the short- and long-term benefits of diabetes management and encourage patients to perform diabetes regimens through self-efficacy strategies. Other results indicated that communicative and critical HL and related skills are needed for better diabetes self-care. Therefore, tailored education according to communicative and critical HL levels may be helpful to improve self-care behaviors. Since, our results demonstrated the strongest role of communicative HL on self-care adherence, particular attention to this dimension of HL is recommended.

Among Iranian diabetic patients, self-efficacy, outcome expectations, communicative, and critical HL are the most important factors associated with self-care behaviors, and these factors predicted more of the variance in self-care adherence of diabetic patients than the demographic characteristics of patients.

Our study has several limitations. Firstly, this was a cross-sectional study, and conclusions about causality cannot be drawn. Secondly, it is possible that patients with very low HL declined to participate in this study, and we have no data on socio-demographic characteristics of those who refused to participate. Thirdly, the self-report nature of the FCCHL subscales could lead to social desirability and an overestimation of the HL level, as individuals often are ashamed of their inability to read and try to hide it. Fourthly, this study was conducted at a single health center in the city of Isfahan, and it is possible that our findings may not be representative of other diabetic patients across the nation.

## CONCLUSION

According to our findings, patients with T2DM who were married and had received diabetes education performed self-care regimens successfully. Communicative and critical health literate patients had better self-care activities; therefore, the tailoring patient's information in line with their level of communicative and critical HL is vital. Although functional HL was not associated with diabetes self-care, a positive correlation between functional HL and self-efficacy for diabetes management was found. Patients with high self-efficacy levels had better diabetes self-care, so an indirect effect of functional HL on diabetes self-care through an association with diabetes self-efficacy is probable. Self-efficacy-enhancing strategies should be considered by healthcare providers to overcome the barriers imposed by low levels of HL. The combined effect of self-efficacy and outcome expectations were more important in self-care adherence. While high self-efficacy is consistently associated with self-care, adherence to self-care behaviors is enhanced by positive outcome expectations. These findings support the use of these two concepts in the design of diabetic patient education.

***Disclosure***

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