

APhA Foundation Incentive Grant Final Report

Health Literacy and its Effects on Lowering A1c in Prediabetes and Type 2 Diabetes Mellitus

Kailen R. Kelly, PharmD; Jannelle R. Marriott, PharmD Candidate; Madeline G. Moses, PharmD, BC-ADM; Daniel M. Golembeski, PharmD; Nicole L. Olenik, PharmD, CDCES, BC-ADM, LDE

Background

The American Heart Association considers diabetes to be one of the seven major controllable risk factors for cardiovascular disease, yet many adults are living with uncontrolled diabetes.¹ Many times this is due to patients not fully comprehending how it is affecting their body. Furthermore, they do not have the self-efficacy to make lifestyle modifications to lower A1C. Many times, this can be attributed to inadequate health literacy. Health literacy is the degree to which individuals have the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions.² The National Assessment of Adult Literacy reports only 12% of adults have proficient health literacy; in other words, nearly nine out of ten adults lack the skills needed to manage their health and prevent disease.³ Health literacy is dependent on a myriad of factors such as communication skills, knowledge of health topics, culture, and demands of the healthcare systems.² Health literacy often affects one's ability to share personal information, such as health history with healthcare providers, ability to understand mathematical concepts such as probability and risk, and lastly, ability to engage in self-care and chronic-disease management.²

Objective

Various studies found many factors like inadequate health literacy contribute to patients having elevated A1Cs.^{2,4} Literature has shown that health literacy and self-efficacy are closely related.⁵ Self-efficacy reflects confidence in the ability to exert control over one's own motivation.⁶ Self-efficacy also refers to an individual's belief in his or her capacity to execute the self-care behaviors necessary to produce specific performance attainments like decreasing A1C.⁶ Though there is enough literature available indicating people with adequate health literacy are more motivated to make lifestyle modifications to decrease A1C than those with inadequate health literacy,⁷ there are gaps remaining in literature exploring the reasons why. The objective of this study was to characterize the reasons why patients with prediabetes or type 2 diabetes with different health literacy levels report different levels of self-efficacy which in turn affects A1C.

Methods

Study Design and Participants

This qualitative study included patients of the Mathes Diabetes Center in New Albany, IN. Mathes Pharmacy and Diabetes Center is a family owned and operated pharmacy, diabetes center, and home care center serving southern Indiana since 1931. Sixty-one patients of the diabetes center were contacted via phone calls to ask if they would like to participate in this qualitative study. A maximum of three attempts to contact patients were made and voicemails were left if possible. Eighteen participants initially were interested in partaking in this study, but later some decided to withdraw. Though we ended up only having eleven participants, thematic saturation was still achieved. After patients agreed to participate, they were scheduled to come to Mathes. Data was collected in two parts: one-on-one Newest Vital Sign (NVS) health literacy assessment and a 30-minute interview. This study was approved by the Purdue University Institutional Review Board.

Study Population

Data collected from patients were eligible for study inclusion if they completed four weeks of diabetes education classes and at least three months of follow-up appointments with the Mathes Diabetes Center within the years of 2015 to 2019. Data was included if the patient was an English-speaking adult 18 years of age or older and had a diagnosis of either prediabetes or type 2 diabetes mellitus. Data collected from patients was excluded from the study if they had a diagnosis of type 1 diabetes, did not complete four weeks of diabetes education classes with the Mathes Diabetes Center, or completed less than three months of follow-up appointments with the Mathes Diabetes Center.

Data Collection

The Newest Vital Sign health literacy assessment is based on a nutrition label from an ice cream container that is accompanied by six questions and takes about three minutes to complete. Once participants arrived to Mathes, they were directed to the private Mathes conference room with the co-investigator for their one-on-one interviewer-administered assessment. Each participant was provided a pen and piece of paper with demographic questions and the NVS label on the backside. They were instructed to answer the demographic questions first. The final questions were regarding two A1Cs: first one being the A1C when the patient was referred to the Mathes Diabetes Center (baseline A1C) and the second one being the most recent A1C the Mathes Diabetes Center had on record in the patient chart (recent A1C). This was one of two quantitative measures of this study. In order to answer the A1C questions, participants were given a slip of paper that had those two A1Cs specific to them recorded by one of the practitioners of the diabetes center. Once participants were done answering the demographic questions, the health literacy assessment began. The NVS assessment was the second quantitative measure of this study. Participants were asked six questions about the nutrition label. Participants could refer to the label while answering questions. The questions were asked verbally, and the verbal responses were recorded by the co-investigator on a special score sheet, which contained the correct answers. Subjects were provided scratch paper and a calculator upon request only. Based on the number of correct responses, the patients' health literacy level was assessed as either likelihood (50% or more) of limited literacy, possibility of limited literacy, or adequate literacy. These three health literacy categories were combined into two categories: adequate health literacy and inadequate health literacy. Subjects were not told what their score or health literacy level was.

After each of the subjects completed the NVS assessment, they had their 30-minute interview with the same co-investigator. Currently, there is not a validated method to quantitatively measure self-efficacy; therefore, in this study, we used a qualitative method (an interview) to explore and characterize self-efficacy. The interview questions were based on the Health Belief Model with questions coming from four categories: perceived benefits, perceived barriers, cues to action, and self-efficacy. The questions were designed to further assess those four categories. If a patient did not wish to answer a question, it was skipped and the co-investigator moved on to the next question. All one-on-one interviews were audio recorded and later transcribed by the transcription company, Infraware.

Data Analysis

For quantitative data analysis of demographic characteristics, SPSS statistics software was used. The co-investigators also analyzed whether A1Cs decreased (difference greater than 0.5%) or not for each participant within the different health literacy groups. Then for quantitative data analysis of health literacy assessments, the number of correct and incorrect answers were recorded by the co-investigator in the boxes at the bottom of the assessment. The co-investigator then assessed the number of correct responses using the following score interpretation:

Score of 0-1 High likelihood (50% or more) of limited literacy

Score of 2-3 Possibility of limited literacy

Score of 4-6 Adequate literacy

For this research study, high likelihood (50% or more) of limited literacy and possibility of limited literacy were combined into one category defined as inadequate health literacy.

For qualitative data analysis of interviews, first the interviews were transcribed by Infracore transcribers. Once transcriptions were completed, using the coding software NVivo, deductive coding was used initially where the themes came from the four categories of the Health Belief Model: perceived benefits, perceived barriers, cues to action, and self-efficacy. After further analysis of transcriptions, inductive coding was done. From each of the original four categories, new themes emerged. These new themes discovered during the inductive coding process were diabetes a controllable disease (perceived benefit), lack of education and costs (perceived barrier), healthcare and family/friends support (cues to action), and lifestyle modifications and motivating factors (self-efficacy). If the co-investigators had any disagreements during the inductive coding process, the senior author was available to settle any disputes or discrepancies.

Results

A total of eleven participants partook in this study. Majority of participants were Caucasian females between the ages of 41-75 years old with type 2 diabetes. Majority of participants reported not attending classes elsewhere and did not attend classes more than once (**Table 1**). Most of the participants tested to have adequate health literacy. The average baseline A1C in the adequate health literacy group was 7.1% and average recent A1C was 6.5%. The average baseline A1C in the inadequate health literacy group was 8.8% and average recent A1C was 7.7% (**Table 2**).

Table 1. Participant Demographic Characteristics	
Characteristic, n=11	Responses
Gender, n (%)	
Male	3 (27)
Female	8 (73)
Prefer not to answer	0 (0)
Age (years), median (range)	
	72 (38)
Race, n (%)	
Caucasian (White)	10 (91)
Non-White	1 (9)
Diagnosis, n (%)	
Prediabetes	1 (9)
Type 2 Diabetes Mellitus	10 (91)
Attendance of Classes Elsewhere, n (%)	
No Classes Elsewhere	9 (82)
Classes Elsewhere	2 (18)
Attendance of Multiple Classes with Mathes Diabetes Center, n (%)	
Did Not Attend Classes More Than Once	10 (91)
Attended Classes More Than Once	1 (9)

Table 2. Health Literacy and A1C	
Characteristic	Responses
Health Literacy Level, n=11	
Adequate, n (%)	8 (73)
Inadequate, n (%)	3 (27)
A1Cs in Adequate Literacy Group, n=8	
Average Baseline ^A A1C, n (%)	7.1%
Average Recent ^B A1C, n(%)	6.5%
A1Cs in Inadequate Literacy Group, n=3	
Average Baseline ^A A1C, %	8.8%
Average Recent ^B A1C, %	7.7%
Adequate Literacy A1C Change, n=8	
No Change in A1C, n (%)	6 (75)
Decrease ^C in A1C, n (%)	2 (25)
Inadequate Literacy A1C Change, n=3	
No Change in A1C, n (%)	1 (33)
Decrease ^C in A1C, n (%)	2 (67)

^A A1C when the patient was referred to the Mathes Diabetes Center

^B Most recent A1C the Mathes Diabetes Center had on record in the patient chart

^C Difference greater than 0.5%

Interviews

Perceived Benefit: Diabetes a Controllable Disease

Participants found relief in knowing that their prediabetes or diabetes is not a death sentence. They recognized that they have the capability to be 100% in control. *“There is stuff you can control...I have read about people that have been controlled and then were cut back on medications and some do not even take their medicine at all anymore.”* They also felt that a huge benefit of controlling diabetes is being able to take control of other coexisting conditions as well. *“Just for general health, if I feel good about my diabetes, with it controlled and everything, my other conditions don’t hurt as bad. It helps just give me less pain and everything.”*

Perceived Barriers: Lack of Education and Costs

When it came to barriers, participants felt that lack of education and costs were the main culprits. One participant shared the experience she had with her doctor and why that led to her not knowing what to do for her diabetes for the longest time. *“My first doctor did not share with me what I should do once I was diagnosed. There was not enough time I guess. He just breezed in, told me, and sent the dietary person in. So I did not get a whole lot of information from them, but I got more from you all.”* Some participants even shared the difficulties of living off just one income and the challenges that creates. *“Definitely one barrier is cost since I don’t work just my husband does so it’s only a one person income we have to live off of...Meijer use to have it where you got your metformin free but they’re no longer doing that, so I don’t know what my insurance is going to pay on it yet. Medicines and healthier foods have higher costs which makes it difficult.”*

Cues to action: Healthcare and Family/Friends Support

We learned that participants’ support came from various sources that could be grouped as support from healthcare providers or family/friends. Some of the participants felt that the Mathes Diabetes Center pharmacists played a significant role as supporters. *“If I have a question then I can call here and they’ll answer or help me out so you all have been a big part of me being able to manage my diabetes.”* Many participants also stated that their family/friends were a key component of their support group. *“My husband came along with me to the classes and so you know because of that sometimes I will do something and he’ll go and say are you sure you should be doing that? So it was good for me and him to both go through the classes.”*

Self-efficacy: Lifestyle Modifications and Motivating Factors

By completing the diabetes education classes with the Mathes Diabetes Center, participants felt they were given the tools to guide them down the path to better, optimal health. *“It helped me with the direction I needed to take. So, I’ve been trying to keep doing that since I’ve been doing the class, my food habits.”* During the classes, they also remembered reflecting on why it is important for them personally to control their condition. *“Family. I want to be around for my grandkids so that motivates me...it would also be nice to get off medications and it would be nice to feel better myself.”*

Discussion

Self-efficacy and self-care behaviors relatively influence glycemic control in patients with type 2 diabetes.⁵ Modifying self-care behaviors have been demonstrated to be the most essential for improving glycemic control.⁵ We learned from this study, majority of participants want to better control their conditions in order to spend more time with loved ones and just feel better overall. However, barriers such as lack of education, costs, and the lack of a strong support group seemed to be significant reasons why certain participants’ struggled controlling their diabetes. Therefore, to improve self-care behaviors, healthcare providers should target improving self-efficacy by helping patients establish support groups

to help hold them accountable. Healthcare providers should also use more of an empowerment approach rather than an authoritative approach that emphasizes patient compliance in managing patients with type 2 diabetes.⁵ Previous studies indicated that the people with higher health literacy were more empowered and those with higher empowerment were more likely to eat healthy foods and exercise.⁷ However, after completing this study, it cannot be concluded that health literacy level determines the amount of self-efficacy that one has. Instead, self-efficacy seems to be more dependent on how supported one is and whether or not they are held accountable.

Limitations

The first few interviews audio recorded were of poor sound quality, so after Infracore transcribers completed the transcriptions, the co-investigator had to also listen to the recordings to fill in the blanks. Another limitation is that during the second class of the Mathes Diabetes Center Diabetes Self-Management Education program, patients are taught how to read and interpret food nutrition labels. The Newest Vital Sign Health Literacy Assessment is a nutrition label from a pint of ice cream, so participants had an advantage to do better with this assessment having the prior knowledge and skill to read nutrition labels. Lastly, the study sample represented a geographically limited population in southern Indiana from one independent pharmacy location.

Conclusion

The authors concluded that regardless of health literacy level, patients overall want to have control over their prediabetes or diabetes to feel better, avoid serious complications, and spend more time with friends and family. Self-efficacy is less dependent on health literacy level and more dependent on individual factors and the support an individual has. This is useful information for healthcare providers especially in the community setting because they can start implementing the role of a supporter and encourager for patients that may not have that support from others. As the healthcare provider, patients are guaranteed an educator, but as the encourager and supporter, patients can also be guaranteed someone to hold them accountable.

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