HbA1c and Scores on DNT-15

James Smith
University of Illinois College of Medicine at Peoria

THE UNIVERSITY OF ILLINOIS
COLLEGE OF MEDICINE
PEORIA CHICAGO ROCKFORD URBANA

RSPP
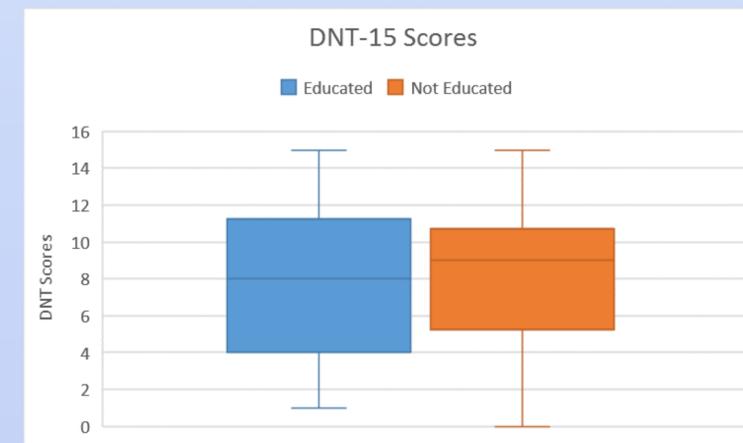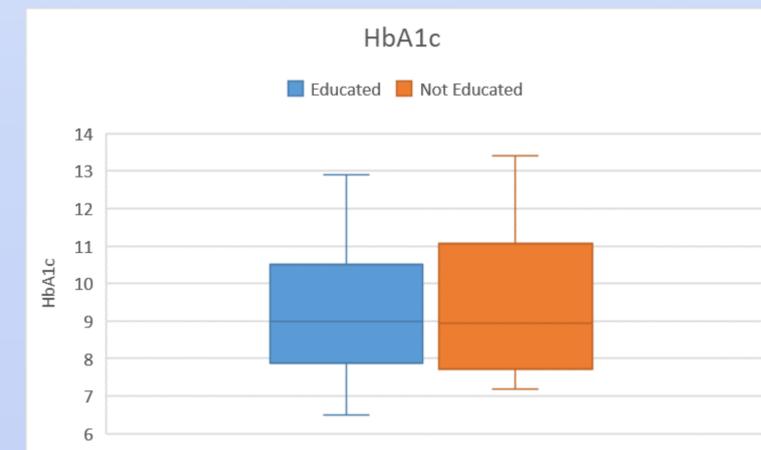RURAL STUDENT PHYSICIAN PROGRAM

Introduction/Background

The CDC estimates the prevalence of diabetes in the United States to be 29.1 million. Diabetes has significant morbidity and mortality and costs $245 billion annually. Diabetes increases a person's risk for complications of end organ damage. These complications include things such as neuropathy, blindness, kidney disease, heart disease and impaired wound healing. Due to the risks associated with diabetes, there are established guidelines to minimize the impact of the disease process including annual eye exam, foot exam and HbA1c testing. The HbA1c test assesses a person's overall glucose control from the past few months by indicating the amount of red blood cells that have been glycosylated. Controlling HbA1c levels has shown to decrease the risks of developing complications. In a study comparing the performance for Diabetes Quality Indicators between a rural and urban setting, the urban patients had higher performance. 48.6% of urban patients had a HbA1c less than 7% as compared to the rural patients who only had 33.3%. The urban setting also showed a higher rate of people that had a HbA1c level measured in the past 3 months at 55.1% while the rural setting reported 47.1%. Low literacy and numeracy has been associated with difficulty in properly managing blood sugar levels. This is in part related to the fact that medication dosing requires knowledge about disease, decision-making ability and simple arithmetic. To help maximize the treatment for diabetes, a physician needs to understand the factors that affect the patient, and identifying deficiencies in numeracy could provide information about how to effectively treat the patient.

Methods

These methods were adapted from the methodology of Cavanaugh et al 2008. The study took place in the Gibson City Area Hospital (GAH) System. Seventy patients who have "diabetes mellitus" on their problem list participated in a two-part survey. The first portion asked the participant demographic information such as age, gender, education, diabetic management and symptoms. This information was self-reported. The second part was the 15-question Diabetes Numeracy Test (DNT-15). They were given 30 minutes to complete the survey and told they could use any calculator that they had on them (phone, iPod, tablet, etc). The participant was informed that they could stop the survey at any time. Statistical analysis was done using SPSS v22 and Microsoft Excel.

HbA1c vs DNT-15 Scores

$y = -1.829x + 25.031$
$R^2 = 0.6612$
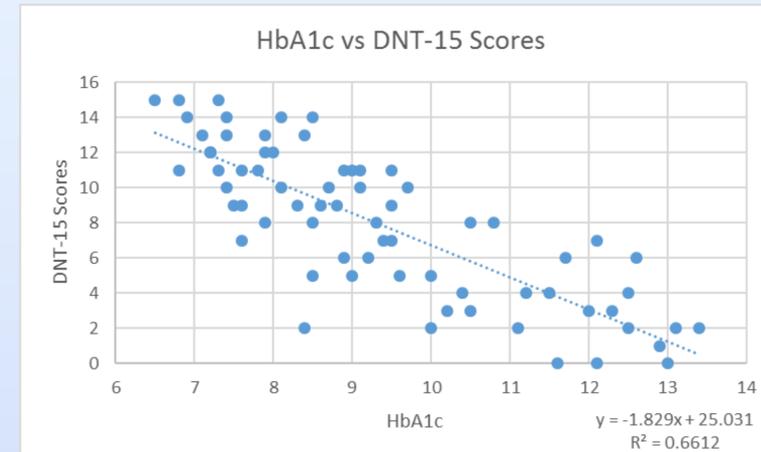
Statistics

	Score	Hba1c	Age	Years with DM
Mean	7.9714	9.3271	65.2000	16.0286
Median	8.5000	8.9500	66.5000	14.5000
Mode	11.00	7.20[a]	86.00	8.00[a]
Minimum	0.00	6.50	28.00	1.00
Maximum	15.00	13.40	98.00	35.00
Percentile 25	4.0000	7.7500	47.0000	7.7500
50	8.5000	8.9500	66.5000	14.5000
75	11.0000	10.5750	79.0000	26.5000

HbA1c — Educated, Not Educated

DNT-15 Scores — Educated, Not Educated

Results

There were 70 participants who filled out the survey. All of the participants had their diabetes managed by their primary care doctor who was Family Medicine trained. These values were self-reported or looked up in the EMR by the nurse at the facility. The average score on DNT-15 was 7.97 with a median score of 8.5. A t-test showed statistically significant at the 0.01 level that the scores on the DNT-15 were moderately correlated to HbA1c levels with an $R = -0.813$ and $R^2 = 0.661$. No other variable showed any statistically significant correlation with score on the DNT-15. When comparing people who received education from a health care worker on diagnosis and those who did not receive education, there was no statistically significant difference in the scores or HbA1c.

Conclusions

Management of diabetes is multifactorial and there are many components, some of which are modifiable and some that are not. To effectively treat a person with diabetes, a physician has take into account each individual's factors. There was some correlation showing that higher scores on the DNT-15 resulted in lower HbA1c levels. However, the coefficient of determination shows that the score on the test is not the only factor involved in predicting HbA1c because it only accounted for about two-thirds of the changes. Moving forward, it is important for health care providers to consider the content of the education and make sure it is beneficial and covers the needs of the individual.

References

• Menke, A., Casagrande, S., Geiss, L., & Cowie, C. C. (2015). Prevalence of and trends in diabetes among adults in the United States, 1988-2012. Jama,314(10), 1021-1029.
• Centers for Disease Control and Prevention. National Diabetes Fact Sheet: national estimates and general information on diabetes in the United States. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2005 . Available at: http://apps.nccd.cdc.gov/ddtstrs/template/ndfs_2005.pdf. Accessed December 20, 2016.
• Tuttle KR, Bakris GL, Bilous RW, Chiang JL, de Boer IH, Goldstein-Fuchs J, et al. Diabetic kidney disease: a report from an ADA Consensus Conference. Diabetes Care. 2014;37(10):2864–83. doi: 10.2337/dc14-1296.
• Cavanaugh, K., Huizinga, M. M., Wallston, K. A., Gebretsadik, T., Shintani, A., Davis, D., ... & Pignone, M. (2008). Association of numeracy and diabetes control. Annals of internal medicine, 148(10), 737-746.
• Cavanaugh, K., Huizinga, M. M., Wallston, K. A., Gebretsadik, T., Shintani, A., Davis, D., ... & Pignone, M. (2008). Association of numeracy and diabetes control. Annals of internal medicine, 148(10), 737-746.
• Huizinga, M. M., Elasy, T. A., Wallston, K. A., Cavanaugh, K., Davis, D., Gregory, R. P., ... & Buse, J. (2008). Development and validation of the Diabetes Numeracy Test (DNT). BMC health services research, 8(1), 96.