Diabetic Self-Management as a Function of

Health Insurance Status

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Abstract

Diabetes is a costly chronic illness that affects millions of Americans. Proper management of this disease is crucial to preventing potentially serious health complications. The present study analyzes whether patients without health insurance are less likely to properly manage their condition than their insured counterparts. Towards this end, factors such as hemoglobin A1C levels, body mass index and total cholesterol levels were examined to check for differences based on insurance status. While the uninsured did have higher (and therefore worse) hemoglobin A1C averages, data on the other variables was inconclusive.

Background/Introduction

Numerous studies have shown a link between patients' active participation in their own healthcare and positive treatment outcomes (Gao et al., 2013). This is especially true for many chronic conditions such as diabetes (Nwasuruba, Khan, Egede, 2007)(1,8,10,11, ?). Consequently, finding ways to engage patients in positive health behaviors is of paramount importance in alleviating the burden of over 25 million American diabetics whose condition cost $174 billion annually according to 2011 research[1]. Proper management of diabetes would help to prevent the serious complications that can arise and lead to the astronomical costs mentioned above (Wild, 2012). However, finding the proper motivating factors that will elicit positive health-seeking behaviors is a complicated process and one that would seem to be dependent on the particular population being targeted (Mahdavi, 2013).

Research has also demonstrated that the uninsured in particular tend to be less active treatment seekers and have more negative health outcomes (Bradley et al., 2011). These findings are even more pronounced in racial minority population groups (Komenaka et al., 2010). Certainly health insurance status may be linked with other factors at play in healthcare such as socioeconomic status and education level (Juarez et al., 2012). But regardless of whether insurance serves as a proxy for some

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[1] Taken from NIH website: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3616351/

other factor, it seems a fruitful avenue to explore for potential impact on disease management. And because diabetes strikes racial and ethnic minorities at a higher rate, addressing motivational issues within these subsets is extremely important (Otiniano et al., 2012).

The current study seeks to identify possible differences in the course of diabetes management between uninsured and insured patients at a community health center serving a predominately uninsured, low-income, Spanish-speaking population. Aside from standard physician care, the center offers bilingual health education classes on topics including diabetes management and provides an on-site counselor to address psychosocial issues that may affect disease course. By isolating specific factors that correlate with poor self-management, it is hoped more targeted interventions can be developed that circumvent problem areas within certain subsets of patients (Klein et al., 2013). In particular, health insurance status will be correlated with diabetes progression. Lacking health insurance, as the vast majority of the sample population for this study do, may have a profound impact on how people view their personal health and their duty to maintain that health. It is the hypothesis of this paper that uninsured patients will display signs of diminished diabetic self-maintenance due to an undervalued sense of health brought on by lack of health insurance.

Methodology

The approach to studying the central question posed by this paper was a two-pronged strategy. First, data was provided with some relevant laboratory values for all the diabetic patients who visited Wesley Community Health Center in downtown Phoenix, Arizona between January 1st and June 30th, 2013. Aside from dates of visit and basic demographic information, the data set also listed such items as: hemoglobin A1C percentages, blood pressure, height, weight, body mass index (BMI) and cholesterol (including separate measures of LDL, HDL, triglycerides and total cholesterol). The hemoglobin A1C (also known as glycated or glycosylated hemoglobin) numbers were used as the primary metric in analyzing diabetic self-maintenance as these figures reflect blood sugar levels over the course of the previous

months. Higher percentages of glycated hemoglobin indicate higher glucose levels in the blood which in turn are linked with more serious diabetic complications. Because it can be easily probed with a simple blood test and because it is a great measure of diabetic status, the physicians at Wesley use A1C percentages as the standard indicator of diabetic disease status. Consequently, this value was also used as the primary measure of diabetic self-management for the purposes of this report.

In addition to this, however, other variables were utilized in an attempt to gather information about overall health behaviors. Chief amongst these was body mass index. Certainly it must be allowed that genetics plays a part in body shape and dimensions but diet and exercise are virtually undisputed ingredients in determining this index. Therefore, a comparison between groups on this variable is also presented as evidence of health maintenance. Similarly, total cholesterol levels were analyzed to see if significant differences existed between the insured patients and their uninsured counterparts.

Some of the patients in the sample had multiple visits during the six month period comprising the data set, which resulted in multiple measures of some of the aforementioned variables. To analyze the three items of interest, averages and corresponding standard deviations for the insured group and the uninsured group were first calculated. However, to avoid contaminating these values with multiple measures from the same patient, only one encounter per patient was used to factor into the overall calculation. Amongst the uninsured group, only the encounter with the lowest (and therefore "best") A1C value was used in establishing a mean and standard deviation. Conversely, the insured group data was edited so that the highest (or "poorest" in other terms) A1C figure factored in. This was done to ensure any finding of significant differences would be less easily discounted. After all, in following with the hypothesis, it was expected that uninsured patients would have higher A1C values while their insured cohorts would produce lower numbers. By eliminating "outliers" and using a contracted data set that skewed more towards the mean, significant differences would indicate a higher probability of

real population variability outside of chance. Aside from the means and standard deviations, t-tests were run on A1C, BMI and total cholesterol levels.

This between-groups tabulation was supplemented by a within-groups analysis. For patients with multiple encounters that resulted in multiple A1C readings, the percent change in A1C level was calculated between the most recent and the first reading for which numbers were available. These numbers were then averaged and compared between the groups.

The second prong used to analyze data between the groups involved a survey that was handed out during the diabetic education classes. The survey was intended to gather information relating to the status of the patient's disease and also how the patient felt about the disease and his or her ability to manage it. A copy is provided in Appendix A. The survey was divided into two parts, each consisting of ten questions.

The first ten (comprising "Part A") are short answer and "yes/no" questions. For question one, which asked when the patient was diagnosed with diabetes, responses were formatted in number of years since diagnosis. The second question, about health insurance status, was used to classify patients into the two groups studied by this paper. Items 3, 4, 5 and 8 were regarded as indicators of positive health behaviors and a "yes" response resulted in a point while a "no" response earned zero points. Items 6 and 7 were measures of frequency. For checking blood sugar, regular checks (arbitrarily defined as at least weekly) earned a full point while any checks during a year earned half a point. Times exercising during a week was coded as is so that each instance of exercise during the week received a point. The final questions from this part were also of the "yes/no" variety but associated with negative health outcomes and thus were inversely scored, meaning a "yes" response generated zero points while a "no" response garnered a point.

"Part B" of the survey utilized a Liekert scale to have patients agree/disagree with a series of statements. "Strongly disagreeing" was associated with one point while at the other end "strongly

agreeing" was tied to five points with three values between the two poles. Items 13 and 15, however, were reverse scored as they were written as measures of low self-efficacy and pessimism about health. Thus for these questions, a 5 response would have been scored as 1, 4 as 2 and vice versa with a 3 remaining a 3 in the middle.

At the end, all the items were added together according to the above rules. Scores were totaled and compared between the insured and uninsured groups. Higher scores were taken to indicate more positive health behaviors and better attitude towards diabetes management while lower scores marked the opposite.

Results

To begin, some basic demographic data. As mentioned, the data set comprised diabetic patient encounters spanning from January 1, 2013 to June 30th, 2013. There were a total of 843 encounters with 452 unique patients. Of these, 64 had some form of health insurance while the remaining 388 were listed as uninsured. This works out to an 85.8% uninsured rate amongst the sample population. Anecdotal evidence from leadership at the health center indicates this is in line with the general rate of insurance coverage which hovers within a range usually bounded from 84% to 88%.

The average hemoglobin A1C value for the uninsured population was 8.65% (standard deviation 0.02%). This compares to a measure of 8.09% (standard deviation also 0.02%) for the insured patients. For reference, patients are diagnosed as diabetic if they have two separate readings of 6.5% or higher[2]. At Wesley Health Clinic, readings under 5.7% are considered normal for the non-diabetic population. Amongst diabetics, the aim is for an A1C reading less than 7% while anything above 9% is considered uncontrolled. A one-tailed t test was run on the data for the two groups with a corresponding p-value of 0.044. This would indicate a significant difference between the two conditions at the commonly accepted 0.05 level.

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[2] Taken from Mayo Clinic Website: http://www.mayoclinic.com/health/a1c-test/MY00142/DSECTION=results

Body mass index (BMI) was another variable for which the insured and uninsured populations were compared. Current standards hold that BMIs of 25 and above are considered overweight while those that reach 30 in particular meet the criteria for obesity[3]. In this sample, the average BMI for uninsured patients totaled 30.7 with a standard deviation of 5.7. Meanwhile, for the insured patients, their BMI reached 33.1 on average with a standard deviation of 9.0. This greater variability in the insured population most likely reflects a small sample size, an issue that will be addressed at length later. But with that caveat always in mind, another one-tailed t test produced a p-value of 0.012 reflecting a very significant difference between the insured and uninsured patients on this parameter.

The final category used to assess differences between groups was total cholesterol. Cholesterol management is an important part of diabetes management because of the complications high cholesterol can produce for which diabetics are already at increased risk (namely heart disease and stroke). The goal for diabetics is to keep their total cholesterol below 200 mg/dl[4]. In this instance, total cholesterol averaged 201.3 mg/dl for the uninsured and 199.9 mg/dl for the insured group. Standard deviations were 49.6 mg/dl and 42.2 mg/dl, respectively. As with the other two measures, a one-tailed t test was run which yielded a p-value of 0.452. Thus, cholesterol levels showed no significant differences between the insured and uninsured populations of this study. For results from these three variables, please see Appendix B.

While these previous results constituted between-groups analyses, with-in groups results were also looked at to discern any significant differences amongst the patients in each condition. For the purposes of this study, this took the form of measuring the percentage change in hemoglobin A1C value for patients who had multiple readings taken across the six-month study period. In the uninsured population, the average percentage change in A1C was an 8.71% decrease between the earliest and most recent readings (within the timeframe of January 1st to June 30th, 2013). For the insured patients,

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[3] Taken from NIH Website: http://www.nhlbi.nih.gov/guidelines/obesity/BMI/bmicalc.htm
[4] Taken from NIDDK Website: http://diabetes.niddk.nih.gov/dm/pubs/complications_control/index.aspx

there was an average 0.17% decrease in A1C. A one-tailed t test using the data sets for this variable gave a p-value of 0.119. As before, small sample size may have had a serious effect on these figures. There were only 11 insured patients with multiple measures that were able to be analyzed while there were 63 who met the criteria amongst the uninsured population. While these are small numbers it can be noted that the proportion of insured to uninsured works out to 85.1% which is much in line with general patient population statistics.

Unfortunately, the survey was only completed by six individuals. While intended to be distributed during the diabetic education classes, it was only made available during one of those classes. As such, results are particularly unhelpful. Just for reference, however, the average sum was 45.5 with the insured patients as compared to 44.0 with the uninsured survey-takers. The average number of years since diagnosis was 5.8 years and fairly consistent between the two with insured patients living with diabetes for 5 years and uninsured for 6 years. These dates were especially skewed by one patient with 16 years between initial diagnosis and present, as well as two others with one and two years of illness in the uninsured group.

Discussion

The central question of this research was whether patients who lack health insurance would value and appraise their health differently than those who were insured. In other words, would self-efficacy in terms of diabetic self-management hinge on insurance status? It was thought that the uninsured would feel their healthcare needs were less important and thus adopt a pessimistic attitude toward caring for even a serious chronic illness. Such individuals might feel "doomed" to a life of poor health because they do not have access to the same medical options as their insured peers. Therefore, measures of positive health behaviors should be lower in this population as they lack the resources, both financial and motivational, to properly care for themselves (Gresenz, Rogowski & Escarce, 2006).

To probe this, a number of different variables were collected and analyzed to look for differences between insured and uninsured cohorts.

As has been touched upon, hemoglobin A1C value is a paramount measure of diabetic state and the primary value Wesley Community Health Center utilizes to assess progression of the disease. Consequently, it seems a fitting tool to provide insight into patient management of their diabetes. For this reason, A1C values figured prominently into the analysis provided by this paper. The data showed that both uninsured and insured diabetic patients had elevated A1C readings at 8.65% and 8.09% respectively. Again, the goal for diabetic patients is to be around 7% but anything under 9% is considered controlled. Thus both groups were not at goal but still can be considered to have their disease somewhat managed. It is probably best to keep in mind that even the insured population comprised many individuals who were economically disadvantaged, racial/ethnic minorities. As mentioned earlier, these factors have been correlated with poorer health in and of themselves which makes the elevated A1C findings less surprising (Shrivastava, Shrivastava & Ramasamy, 2013).

Still, a statistically significant difference was found with the uninsured having higher A1C readings. Certainly it would be natural to think that confounding variables could be at work in producing these results. Everything from socioeconomic status to education level to English literacy could be at play in differentiating the insured from uninsured group (Olah, Gaisano & Hwang, 2013). However, if the two groups were relatively homogenous except for health insurance status, that could better establish that this single variable was crucial in producing the statistically significant difference found. The present study did not analyze income, educational achievement or other such measures between the two groups and a follow-up study looking at these measures could be greatly informative.

Another area looked at was patient body mass index (BMI). The insured population topped out at an average of 33.1 while the uninsured reached 30.7. However, the insured had a wider range of variance (with a standard deviation of 9.0 as compared to 5.7 compared to the uninsured). The higher

BMI for insured patients is contrary to what would be expected given the study hypothesis. It was supposed that uninsured patients would engage in less positive health behaviors. While BMI certainly encompasses a genetic component outside the control of the patient, healthy activities such as diet and exercise are also contributory factors and thus it would seem people with better health management would have lower BMIs. Additionally, it is worth pointing out that both averages fall within the obese range (which occurs at BMI 30.0 and above). So even if there was a genuinely statistically significant result, neither group could be considered healthy.

Results from total cholesterol levels were also at odds with preconceived notions. While, as expected, insured patients had lower cholesterol readings than their uninsured counterparts (199.9 mg/dl versus 201.3 mg/dl respectively), this difference was not statistically significant (p-value = 0.452). Cholesterol levels are another variable that should correlate with diet and exercise. But the numbers obtained for this dimension cannot be used to demonstrate that individuals with health insurance are leading healthier lives and engaging in more positive health management activities. Once more, it should be noted that a goal in the treatment of diabetics is to keep their total cholesterol levels below 200 mg/dl. So again we see borderline to poor results for both groups on this measure.

Taken together, these three variables paint a picture that suggests the diabetic patients at Wesley Health Center are in marginal to poor health. Again, given the demographics of the patient population at large, this should not be surprising. And the fact that these individuals developed diabetes is probably indicative of previous poor health behaviors. Certainly there are genetic components to diabetes but lifestyle also has a role to play and those who develop diabetes are likely suffering the consequences of at least some unhealthy choices (Li et al., 2013). In light of this, the elevated averages on BMI and total cholesterol, as well as slightly increased hemoglobin A1C, should make sense. However, it was the premise of this investigation that the insured population should be healthier relative to the uninsured cohort.

One serious problem with the data set was the issue of sample size, particularly with regard to the insured population. Again, the general patient population at Wesley Health Center has an uninsured rate somewhere in the high 80s. Consequently, getting enough data sets on insured patients was difficult, but especially so with some of the variables. For example, the A1C data was fairly strong with 388 readings amongst the uninsured and 64 insured data points. However, BMI and total cholesterol were not always measured along with A1C. This meant that for BMI the numbers were only 268 uninsured and 42 insured patients. For total cholesterol the subjects only managed to number 180 uninsured and 21 insured. These increasingly smaller sample sizes make the statistical results less reliable.

Another method to analyze diabetic self-management involved looking at the percent change in hemoglobin A1C value over the course of multiple measurements. This was applied to patients who had multiple readings taken over the six month study period of January 1st to June 30th, 2013. Of those, the uninsured managed to drop their value an average 8.71% while the insured barely moved, dropping on average 0.17%. The same issue with sampling arose here, with only 63 uninsured patients having multiple measures to be analyzed while an even more paltry 11 insured patients fit the category. Simple inspection of these values, however, belies the supposedly stable nature of the readings implied by the average changes reported above. In fact, many people shifted quite dramatically, either up or down, between measurements. In the future, it might prove interesting to analyze a larger sample merely to ascertain the average change of all diabetic patients at Wesley Community Health Center. According to the hypothesis of this paper, it would have been expected that insured patients, being more health conscious, would be more proactive in seeking to lower their A1C readings than their uninsured peers. However, another line of thinking might hold that patients lacking health insurance would have higher A1C readings and thus more "room for improvement." Simple changes could have more dramatic effects in lowering A1C values in this population as opposed to others who already had their diabetes

somewhat managed (Williams, Freedman & Deci, 1998). This may explain the drastic differences seen here, although sampling concerns and the lack of statistical significance (p-value = 0.119) do not allow for strong conclusions to be drawn.

The survey could be an interesting tool to assess patient attitude and behavior. Unfortunately, it was not completed by a sufficient number of patients to merit any strong interpretation. The numbers that were recorded demonstrated a higher average in the insured versus uninsured population. This was expected as a higher average was taken to indicate more positive attitudes and healthy behaviors. However, again the sample size hampers putting any real stock in these results.

Recommendations

The main recommendation is for the study to be repeated but with larger sample sizes to eliminate any biases that entered into results. This is especially true with the insured population. However, care must be taken to match the two groups based on other demographic factors. In addition, looking at percentage change in hemoglobin A1C levels across conditions might yield fruitful resuls.

Conclusion

The hypothesis put forward here that uninsured patients would value their health less and therefore engage in fewer positive healthcare behaviors cannot be supported by the results of this study. While statistically significant results along this line were seen for hemoglobin A1C values, similar variables like body mass index and total cholesterol levels did not produce similar findings. Low sample size, especially as pertains to insured patients, hampered the validity of the data. In addition, regardless of health insurance status, all patients studied were found to have marginal to poor health.

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Appendix A
A copy of both the English and Spanish surveys

![Wesley Community & Health Center logo]

Wesley Diabetes Survey

Part A

1) When were you diagnosed with diabetes?

2) Do you have health insurance?

3) Do you attend the diabetes group meetings?

4) Are you taking insulin for your diabetes?

5) Do you take your diabetes medication regularly as directed by your doctor?

6) How often do you check your blood sugar?

7) How many times do you exercise in a week?

8) Do you watch what you eat (limit your sugar, eat fruits and vegetables)?

9) Have you had episodes of nausea, sweating or chills in the last two weeks?

10) Have you ever been hospitalized due to your diabetes?

Part B

11) I feel that I can take care of my diabetes by myself

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

12) I feel that my doctor cares about making my diabetes better

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

13) My diabetes cannot be controlled

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

14) I am willing to make significant changes to my life in order to control my diabetes

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

15) The cost of taking care of my diabetes is too high

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

16) My diabetes is a serious problem

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

17) I set goals for improving my health

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

18) I am optimistic about my future

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

19) My diabetes cannot be allowed to get any worse

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

20) Health insurance is an important tool that keeps people healthy

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Encuesta para personas con Diabetes

Parte A

1) ¿Cuándo fue diagnosticado con diabetes?

2) ¿Tiene seguro médico?

3) ¿Asiste al grupo de diabetes?

4) ¿Utiliza insulina para el tratamiento de su diabetes?

5) ¿Toma sus medicamentos para el control de su diabetes, según las indicaciones de su médico?

6) ¿Con qué frecuencia revisa su azúcar en la sangre?

7) ¿Cuántas veces hace ejercicio en la semana?

8) ¿Controla lo que come? (limita el azúcar, come frutas y verduras)

9) ¿Ha tenido episodios de náuseas, sudoración o escalofríos en las últimas dos semanas?

10) ¿Ha estado alguna vez hospitalizado debido a su diabetes?

Parte B

11) Creo que puedo cuidar de mi diabetes por mí mismo

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

12) Creo que mi médico se preocupa por ayudarme a controlar mi diabetes

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

13) Mi diabetes no puede ser controlada

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

14) Estoy dispuesto a hacer cambios significativos en mi vida con el fin de controlar mi diabetes

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

15) El costo de cuidar de mi diabetes es demasiado alto

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

16) Mi diabetes es un problema serio

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

17) Me pongo metas para mejorar mi salud

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

18) Soy optimista sobre mi futuro

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

19) Mi diabetes no se puede permitir que empeorar

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

20) El seguro médico es una importante herramienta que mantiene a la gente sana

Muy en desacuerdo	No estoy de acuerdo	Neutral	Estoy de acuerdo	Muy de acuerdo
1	2	3	4	5

Appendix B

Variable	Insured	Uninsured	t-test
A1C	8.09%	8.65%	0.044
BMI	33.1	30.7	0.012
Cholesterol	199.9	201.3	0.45