Improving Glycemic Control among Incarcerated Men

Paula Kelly Ranson and Lauren Outland

Abstract— **In the California state prison environment, many diabetic inmates have poor glycemic control and are at risk for complications which include heart disease, retinopathy, renal failure and peripheral vascular disease. An established program permitted diabetic inmates to carry a glucometer and perform their own blood glucose finger sticks. As a quality improvement process, in addition to allowing inmates to carry a glucometer one institution developed an individualized interdisciplinary educational program. The purpose of this report is to summarize a Quality Improvement project assessing the addition of a health promotion educational program, and to retrospectively compare existing data to determine if such a program might improve glycemic control among participating inmates. In a prison setting where no dietary modification is provided, it is important to identify strategies which have been shown to promote glycemic control in this population. Additionally, with the increasing incidence of diabetes taking both an economic and human toll, successful glycemic control strategies should be incorporated into the design of care models.**

Keywords-diabetes control; glucometer; prisoner; institution.

I. BACKGROUND

In California's state prison system, many diabetic inmates have poor blood glucose (BG) control as evidenced by glycosylated hemoglobin levels (HbA1c) of 7% or greater [1] Patients with an elevated HbA1c are at higher risk for both complications and death than their diabetic counterparts with glycemic control [2]. Complications from poorly controlled diabetes include heart disease, retinopathy, renal failure and peripheral vascular disease, In addition to causing premature death, these complications can erode the quality of life in those still alive [3]. In addition to the negative impact on the incarcerated diabetic individual, there are broader societal consequences as well. Chronic illness and complications from poor glycemic control significantly increase the taxpayer's financial burden related to costs of care in the correctional environment. With recognition of both the individual and societal consequences of poor glycemic control in diabetic inmates, the California Correctional Health Care Services and California Department of Corrections and Rehabilitation jointly developed a policy which permitted qualifying inmates to carry glucometers and to test their own BG levels. This policy was permissive in nature, which meant that Wardens in each prison could determine if their institution would participate. One prison opted to dispense glucometers and provide training on correct testing procedures. Another prison provided glucometers and training, and added an educational component. The purpose of this report is to evaluate the effectiveness of education program in improving glycemic control.

II. METHODOLOGY

Policy implementation in dispensing glucometers to inmates in California state prisons began in September of 2013. The last datum was collected March of 2014 for purposes of this initial evaluation and report. Patients were enrolled in the glucometer program progressively and the program is ongoing as of report submission date. Inmates were allowed to participate in this program if they a) desired to participate, b) were able to utilize the equipment, c) were deemed psychologically fit. Inmates who were participants in the Mental Health Program with significant safety concerns but who desired to participate were evaluated by mental health providers, who then recommended inclusion or exclusion. Patients attended medical appointments as usual and per protocol where HbA1c levels were drawn. The time span between glycosylated hemoglobin level draws ranged from every three months to one year.

A. Intervention

One of the state prisons developed an innovative approach to the care of medication-dependent diabetic patients as a Quality Improvement project. Research by Osborn & Egede identified[4] a strong link between the

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quality of information provided to a patient, the resultant strength of their motivation to change, and development of behavioral skills in determining their success at sustaining the change. Therefore, a registered nurse (RN) Care Manager met with eligible diabetic patients and explained the nature of the program as well as potential benefits to the participant including autonomy, knowledge, and the potential for improved health. Glycosylated hemoglobin (HbA1c) levels were drawn at regular intervals. Changes in HbA1c were documented and strategies for glycemic control were discussed with the participant. Participants were encouraged to perform finger-stick tests frequently throughout the day to improve their knowledge about how meals, exercise, alcohol and snacks affected their blood glucose (BG). The standardized blood glucose log was modified to permit the RN Care Manager to calculate and document mean morning, noon, afternoon and bedtime and monthly BG readings as a feedback mechanism, assisting the participant to correlate activities and food with BG responses.

A Registered Dietician met with participants at enrollment into the program if requested to by the inmate. Medical and mental health providers encouraged the participant's efforts during routine appointments, and custody staff ensured that there be no barriers to accessing care. Pharmacists reviewed each participant's progress, provided education to the RN care managers and offered providers medication adjustment recommendations.

The RN care manager met with participants daily to review the BG and food documentation log, and to recommend diet control, avoidance or reduction of specific foods, and importance of exercise and fluid intake. To increase autonomy and self-management, the RN care managers avoided "don't eat" statements and instead encouraged participants to notice how specific consumption and exercise practices affected finger stick results. Participants were taught sick day rules and when to initiate urgent health care appointments. In housing areas where other inmates were also participants in the program, informal peer support groups were permitted to meet and share personal strategies for success. Routine RN Care Manager appointments were no longer scheduled when the participant expressed an ability and desire to manage his own care. Further interaction was at the discretion of the participant.

III. Evaluation

For the purposes of this program evaluation, the outcome measure of interest was HbA1c. This blood test of glycosylated hemoglobin was drawn at intervals determined by the medical provider, and varied widely, from every three months to once annually. To best determine if the educational component improved glycemic control, average HbA1c results were compared between the two prisons, one with the *intervention* (Group 1) and the other without this component.

Participants incarcerated in the second prison received glucometers and testing supplies as the policy allowed and were offered standardized patient education during RN and Medical provider appointments, but were provided no other intervention (Group 2). Initial HbA1c levels were calculated from an average of at least three values.

The average HbA1c in the Student T-Tests were performed on each of the prison groups, the group that used glucometers and the health promotion intervention and the group that used glucometers only. Comparison of two independent samples t – test for the two groups quantified the impact of the intervention. Alpha was set a priori to 0.05 and as such statistically significant results were found when $p < 0.05$. Thirty-seven inmates met criteria for inclusion in the statistical sampling: twenty-two from the group 1 and fifteen from Group 2. Glycemic control was not improved for participants who were issued a glucometer with no other intervention as determined by two-tailed P value (Group 2, $p = 0.2586$). However, participants significantly improved their glycemic control when an interdisciplinary education and support program was provided (Group 1, $p = 0.0018$).

A repeated measures ANOVA was conducted to test for mean differences in HbA1c between each of the prison groups, the group that used glucometers only and the group that used glucometers and the health promotion intervention, before and after the intervention. Results indicated a statistically significant effect of time indicating that all participants experienced a reduction in HbA1c between the two measurement periods, $F(1, 35) = 10.42$, $p < .001$. After controlling for time the difference between groups approached significance, $F(1, 35) = 3.23$, $p = 0.081$. The rate at which Average HbA1c fell was not statistically different between the two groups, $F(1, 35) = 1.75$, $p = 0.19$; however, the observed power for this effect was .25, indicating that it would be unlikely to detect a difference even if one were present. Inspection of means for between the two groups across the two time periods shows a larger decrease was achieved in the group that received the intervention (mean difference = 0.96) compared to the group that did not receive the intervention (mean difference = 0.40) (see Fig. 1).

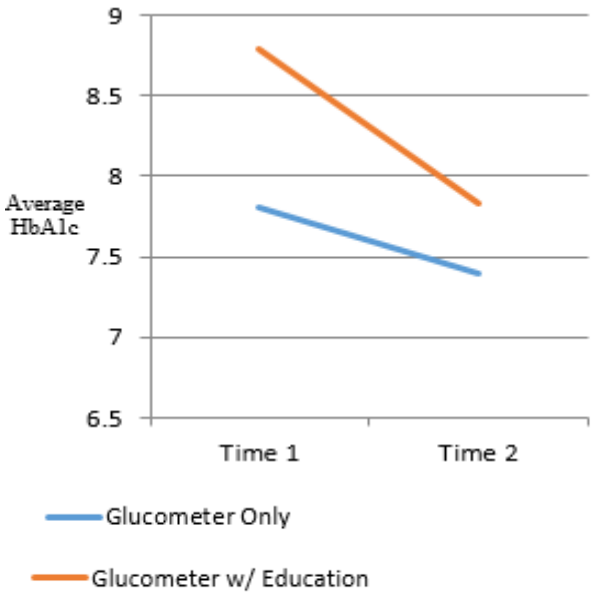

Figure 1. A comparison of the average decrease of HbA1c in two prison groups, one receiving glucometers with education, and one receiving only glucometers.

IV. Discussion

There are significant limitations to the interventions that were developed and the information that is included in this report. Because each prison acts as a semi-autonomous entity, the number of participants who were available for inclusion in the data analysis was small. As this program is ongoing, and the effect size can be approximated, future reports can include sample sizes large enough to detect significant changes. Additionally, no individually identifiable information was approved for inclusion in this report. Because published information was limited to aggregate (mean) values, analysis of response to interventions is limited.

However, despite its limitation, this study does support efforts to improve diabetes management among incarcerated diabetics and should include increasing autonomy among inmate peers. It is also probable that ongoing education by various disciplines is helpful as well. It appears that when barriers to compliance are reduced and autonomy is increased, inmates respond to education by improving their health. It also appears that when they are able to test their BG at will, knowledgeable participants modify their diet and exercise even if institutional modifications to a standardized meal are not made.

V. Summary

Participants in Group 1, who were issued a glucometer and standardized education during medical or RN appointments did not demonstrate improvement in BG control as evidenced by reduction in HbA1c. Group 2 participants, who received interdisciplinary support and ongoing nurse-led education, significantly improved their BG control (Table 1).

Table 1

Group 1 – Glucometer

Paired *t* Test results

p value and statistical significance

The two-tailed p value equals 0.0018

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Group One minus Group Two equals 0.964
95% confidence interval of this difference: From 0.403 to 1.524

Intermediate values used in calculations

t = 3.5769

df = 21

Standard error of difference = 0.328

	Pre-intervention	Post-intervention
Mean HbA1c	8.800	7.836
SD	1.502	1.145
SEM	0.320	0.244
N	22	22

Group 2 – Glucometer & Education

Paired *t* Test results

p value and statistical significance

The two-tailed p value equals 0.2586

By conventional criteria, this difference is considered to be statistically significant.

Confidence interval:

The mean of Group One minus Group Two equals 0.387
95% confidence interval of this difference: From-0.318 to 1.091

Intermediate values used in calculations

t = 1.1777

df = 14

Standard error of difference = 0.269

	Pre-intervention	Post-intervention
Mean HbA1c	7.813	7.427
SD	1.314	1.354
SEM	0.339	0.350
N	15	15

REFERENCES

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AUTHORS' PROFILE

Paula Kelly Ranson, MSN, PHN, CCHP is the Chief Nurse Executive at Kern Valley State Prison in central California. She has presented her reports at regional, national, and international conferences, and continues to facilitate improvements to prison health care.

Lauren Outland, DrPH, MSN, CNM is an Associate Professor of Nursing at California State University Dominguez Hills. Her area of expertise is in health promotion and weight homeostasis.