

ORIGINAL ARTICLE

Can follow-up phone calls improve patients self-monitoring of blood glucose?

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Aims and objectives. To evaluate the effectiveness of follow-up phone calls in improving frequency of glucose monitoring over a three month period in two groups of patients with type 2 diabetes with the goal to lower haemoglobin A1C.

Background. Telephone intervention has been successfully used in improving adherence to diabetes self-management and other chronic disease conditions.

Design. A quality improvement study.

Methods. Forty one Type 2 diabetic patients with HA1C $\geq 7.5\%$ were included in the study. The patients were assigned to two groups. The first group of patients received standard diabetic care (Group 1) and the second group of patients (Group 2) received standard diabetic care plus follow-up phone calls within two weeks after a monthly clinic visit over a three month period. A haemoglobin A1C if indicated was done at the initial study visit.

Results. There were no statistically significant differences in the baseline haemoglobin A1C between the two groups or the three month haemoglobin A1C of the two groups. There were no statistically significant differences in mean haemoglobin A1C change between Group 1 and Group 2. The analysis revealed that there were no statistically significant differences between groups in the number of patients who kept logs of their blood glucose readings throughout the study.

Conclusion. The intervention using telephone follow-up calls did not show a statistically significant improvement in overall HA1C, but there was a clinically significant change in HA1C in the group of patients that received follow-up phone calls.

Relevance to clinical practice. The clinical significance of the change in A1C in the follow-up phone call group (Group 2) supports that frequent contact by telephone may likely improve adherence to diabetes self-management.

What does this paper contribute to wider global clinical community?

- Increase patient and provider partnership.
- Increase patient self-management of chronic conditions.

Key words: follow-up phone calls, glucose self-monitoring

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Introduction

Diabetes is a major concern in the USA and around the world and is associated with a high mortality and morbidity rate. According to the Center for Disease Control (CDC), in 2012 over 12.3% of people age 20 and older in the USA were diagnosed with diabetes (CDC 2014). Poorly controlled type 2 diabetes may have a lasting effect on patients and on the healthcare system. Diabetes is also a major risk factor for other comorbid conditions such as kidney and cardiovascular disease. Complications from micro-vascular damage are also indicated as a leading cause of amputation of lower extremities in diabetic patients. According to the World Health Organization Bulletin (2013), there are over 300 million people worldwide affected by diabetes and it is projected that by 2030 diabetes will be the seventh leading cause of death worldwide.

There are a plethora of studies suggesting that patients with diabetes do best when they are engaged in diabetic self-management such as monitoring their blood sugar routinely. Poor glycaemic control is often associated with lack of self-monitoring of blood sugars and not taking prescribed medications. This often leads to increased healthcare utilisation and hospital admissions. Multiple studies that have been conducted on follow-up phone calls on chronic diseases suggested that this improves patient self-management of their chronic illnesses and therefore improves health outcomes (Wong *et al.* 2005, McMahon *et al.* 2012, Zolfaghari *et al.* 2012).

In the internal medicine clinic, it was noted that there were many Type 2 diabetic patients who did not bring their log booklets to their office visits and had haemoglobin A1C (HA1C) levels >7.5%. These findings led to two clinical questions: are patients monitoring their blood sugar levels routinely and would patients' HA1C levels improve if they received a follow-up phone call two weeks after an office visit? This led to the main aim of our research, which is to evaluate the effectiveness of follow-up phone calls in improving HA1C levels.

Background

A comprehensive literature review was performed using Cumulative Index of Nursing and Allied Health Literature and Publisher/Public Medline database. Key words used were: telephone interventions in chronic disease care, type 2 diabetes follow-up care, self-efficacy and diabetes care. Both databases were searched for literature published within the last five years. A few relevant research studies

greater than five years were deemed significant to support the research.

According to the American Diabetes Association Standard of Medical Care in Diabetes (2014), diabetes is defined as an A1C $\geq 6.5\%$, a two hour glucose tolerance test of ≥ 200 mg/dl after ingesting 75 anhydrous grams of glucose or a random glucose of ≥ 200 mg/dl. The diagnosis of diabetes is usually made after repeated results are abnormal. Diabetes is a worldwide epidemic and affects individuals from every ethnicity. According to the literature empowering patients to perform diabetic self-management and engaging them in their care is the most effective way of achieving better health outcomes and reducing the comorbid conditions that are associated with this disease. In 2010, the CDC rated diabetes as the seventh leading cause of mortality in the USA and accounts for 245 billion dollars in healthcare expenditure and about 69 billion dollars in reduced productivity (CDC 2014).

'Self-efficacy or the confidence in which patients participate in their own care is important, because it leads to improved glycaemic control' (Piettek *et al.* (2000)). There are multiple research studies indicating that patients who have self-efficacy often have better outcomes in managing their chronic illnesses. Nurse initiated telephone follow-up call was effective in increasing self-efficacy in management of dyspnoea (Wong *et al.* 2005). Multiple researchers have identified that perception of health also affects health outcomes and self-management of chronic disease (Mitchie *et al.* 2002, Nundy *et al.* 2013). Nundy, Dick, Solomon & Peek further state that participants in the study described becoming more aware of their diabetes and having more control of their illness and the physiological changes in their condition. Previous studies have shown that patients tend to manage their chronic conditions better after having follow-up phone calls with a healthcare provider. A randomised trial conducted by McMahon *et al.* (2012) concluded that, 'online, telephone-based care management, and web training for diabetes patients with elevated HA1C were associated with a substantial improvement over a 1-year period' (p. 1060). This was further supported by research conducted by Walker *et al.* (2011) found that the frequency of telephone calls by health educators showed a greater though moderate improvement in HA1C as compared with an intervention given printed material. The literature has also shown that telephone follow-up calls with diabetic patients have resulted in enhancing greater adherence to diabetes outcomes such as lowering HA1C (Nesari *et al.* 2010, Zolfaghari *et al.* 2012). Further review of the literature confirmed that patients that received monthly care coordination telephone calls or home tele-monitoring

along with active medication management resulted in a reduction in their HA1C. However, those patients with home tele-monitoring and active medication management had an even greater improvement in HA1C (Stone *et al.* 2010).

Engaging patients in diabetic self-management could potentially decrease overall healthcare expenditure as patients with better glycaemic control tend to have fewer comorbid conditions and fewer hospitalisations. One study in the literature review did a cost analysis of the cost effectiveness of telephonic intervention and concluded, 'the costs of telephonic intervention for diabetes self-management support are moderate and commensurate to modest associated improvement in glycaemic control' (Schechter *et al.* 2012, p. 2156). As cited in the literature review telephone follow-up phone calls are significant in empowering patients in diabetic self-management. This leads to improved self-efficacy and overall improvement in health thus decreasing the cost burden on the healthcare system.

Methods

A quality improvement study involving two groups of type 2 diabetic patients was conducted over four months from January–April.

Participants

The study population consisted of patients with type 2 diabetes with a HA1C $\geq 7.5\%$ who failed to monitor their blood glucose readings or bring their blood glucose log sheet to the clinic at the time of their visit. The patients' age ranges from 25–79 years old. The inclusion criteria are: adult type 2 diabetic patients with a HA1C $\geq 7.5\%$, a patient of the internal medicine clinic, noted failure monitoring blood glucose readings at least once daily and who do not keep a log sheet of their readings. Exclusion criteria include any the following: an HA1C $< 7.5\%$, not being a patient of the internal medicine clinic, not agreeing to follow up as scheduled as well as keep a blood sugar log sheet, not having access to a telephone, unable to speak or understand English, not having a glucometer and is currently cared for by an endocrinologist for diabetes. There were a total of 60 patients who had met the eligibility criteria and were recruited for the study. A total of 19 patients did not complete the study due to not following-up or unable to contact by telephone. The final sample size consisted of 41 patients, which allowed for inferential statistics to determine if there is a difference in the groups. The group sizes were feasible for our time frame of

three months. The participants were placed in groups based on the numerical order of their medical record number (MRN). Twenty-one patients were assigned to receive standard diabetic care (Group 1) and 20 patients were assigned to receive standard diabetic care plus follow-up phone calls within two weeks after clinic visit to encourage blood sugar monitoring and documentation in the log (Group 2). Both groups were provided with written information concerning diabetic self-management and they were also given a blood glucose log sheets to document their blood sugars. Both groups were instructed to bring the log sheet with them at their follow-up visits.

Intervention

Initially, patients filled out a survey pertaining to how often they monitor their blood glucose readings. The provider informed the patient of the importance of monitoring their blood glucose numbers and documenting as well as bringing the log to every office visit for diabetes. A HA1C if indicated was done at the initial study visit. The primary intervention was a scripted follow-up phone by the nurse practitioner in the clinic call within two weeks after their initial study visit. Patients in the intervention group were called and asked if they had been checking their blood glucose and documenting the readings on the blood glucose log sheet since their last office visit. Patients were also reminded to bring their blood glucose log with them to their office visit (Table 1).

Procedures and measures

Prior to the intervention, patients basic demographic information was collected and documented on an excel spreadsheet. A baseline HA1C was done if needed and was repeated at the end of the study to assess for the improvement from baseline. At the beginning of the study patients filled out a 12 question survey pertaining to their knowledge of diabetic self-management. The provider informed patients of the importance of monitoring their blood glucose readings and documenting as well as bringing the log to every diabetic office visit. The provider kept a log of patients called with a reminder and the patients who were not called with a reminder to monitor their blood glucose levels. Two weeks following the phone calls and within four weeks after the clinic visit the patient were seen again for a re-evaluation of the blood glucose monitoring. At the end of three months of phone calls and follow-up visits, an HA1C was repeated to assess for improvement in HA1C from baseline. A post survey with same 12 questions as the

presurvey was given to the patient to re-assess changes in knowledge of diabetic self-management behaviours.

Ethical consideration

Approval from the hospital Internal Review Board was obtained. Human subject protection was insured by eliminating any identifiable characteristics of the participants. All electronic data were stored in a password protected data base on password protected computer in a locked office. Only the principal investigator and co-investigator will have access to the data. Data gathered during study were destroyed following the Hospital Policy.

Statistical analysis

The Statistical Program for the Social Science (SPSS, IBM Corp., Version 21.0., Armonk, NY) software was used for the analysis of the data. A chi-square analysis was performed to identify the differences in the proportion of patients who kept a log based on whether or not they received a phone call. An independent *t*-test was incorporated to compare the mean HA1C for those patients who had a phone call compared to those who did not receive a phone call. A paired *t*-test to compare overall change in pre/post survey scores was also performed. The analysis of improvement in blood glucose monitoring was done not only to compare the differences between the standard of care group and the follow-up phone call group but also to evaluate the effectiveness of the 2-week follow-up phones calls. A comparison was made between the numbers of patients who presented blood glucose logs prestudy period versus the number of patients who presented their blood glucose logs during the study. An independent *t*-test analysis was used for this analysis. Patients had to present a log of their blood glucose levels during the clinic visit to be credited for documenting their blood glucose monitoring. This information was documented in the electronic medical record. Patients who monitored their blood glucose at least four of seven days of the week were given credit for monitoring their blood glucose. Patients who monitored their blood glucose less than four of seven days of the week were not credited for monitoring their blood glucose.

Results

Socio-demographic

The baseline characteristics of the patients in the standard care group and the telephone group were similar except for

age. The results revealed that baseline characteristics of age showed there was a significant difference between the two groups of patients ($p = 0.001$). The group that received the standard of care had a mean age of 59.8 years (SD = 8.98) while those patients in the telephone follow-up group had a mean age of 47.8 years (SD = 9). A chi-square analysis revealed that there was not a significant difference in gender ($p = 0.66$), educational level ($p = 0.52$) and race ($p = 0.32$) between the two groups (Table 1).

Haemoglobin A1C

The mean baseline HA1C for the standard care group was 10.23% (SD = 2.40) and for the telephone follow-up call group was 11.08% (SD = 1.98). There were no statistically significant differences between the baseline HA1C of the two groups ($p = 0.23$) or the three month HA1C between the groups ($p = 0.70$). The standard care group mean HA1C after three months was 9.06% (SD = 1.65) and the follow-up phone call group mean HA1C after three months was 9.26% (SD = 1.58) at the end of the three month study period. There were no statistically significant differences in mean HA1C change ($p = 0.34$) between the standard care group (1.05%) and the follow-up care group (1.79%). The statistical analysis also revealed that there was variability in HA1C values within both groups of patients (SD = 2.39 and 2.19 respectively).

Keeping blood glucose log readings record

The analysis revealed that there were no statistical significant differences between groups in the number of patients who kept logs of their blood glucose readings throughout the study. During visit one, there were 42.9% of patients who kept a log sheet of their blood glucose in the standard care group and 20% in the follow-up phone call group ($p = 0.12$). During visit two, 81% of patients in the standard of care group kept records of their blood glucose readings while 73.7% of patients in the follow-up phone call

Table 1 Effect of intervention on change in mean haemoglobin A1C after three months

Variable	Mean	SD	<i>p</i> -value
Baseline haemoglobin A1C			
Group 1	10.23	2.40	0.23
Group 2	11.06	1.97	0.22
Three month post haemoglobin A1C			
Group 1	9.06	1.65	0.70
Group 2	9.26	1.58	0.70

group ($p = 0.58$) kept records of their blood glucose readings. Visit three analysis revealed that 100% of patients seen in the standard care group kept records of their blood glucose readings and the follow-up phone call group 84.2% of patients kept record of their blood glucose readings ($p = 0.08$).

Follow-up phone calls

For visit one, 80% of patients were called within 14 days of their clinic visit and 20% of the patients were contacted after 14 days. The patients who were contacted after 14 days were either hospitalised or there were difficulties reaching them via telephone. Approximately, 95% of patients in visit two were contacted within 14 days of their clinic visit and 5% of were called after 14 days due to difficulties in contacting them. After visit three, 100% of patients who were seen in clinic had a follow-up telephone call within 14 days of the clinic visit.

Medication adjustment

Medication adjustments were made in 100% of patients in both the standard care group as well as the telephone follow-up call group.

Evaluation of knowledge of diabetes self care management

There were no statistical significant differences in baseline knowledge score ($p = 0.98$) for the standard of care group ($M = 1.72$, $SD = 1.74$) and those who were receiving follow-up phone calls ($M = 1.75$, $SD = 1.55$). There were statistical significant differences in changes in pre- and post-test scores within the standard of care group and within the follow-up phone call group ($p = 0.001$ and $p < 0.01$ respectively). For the standard of care group the average pretest score was 10.2 ($SD = 1.76$) and the average post-test score was 11.9 ($SD = 0.24$). The average pretest score for the follow-up care group was 10.25 ($SD = 1.55$) and the average post-test score was 11.9 ($SD = 0.24$).

Limitations

The first limitation of this study is the short time frame selected as the study was conducted over a three month period. It is difficult to predict if patients would consistently keep a log of their blood glucose readings over a longer period of time. A second limitation was the study population was not diverse. There were 95.2% of African

American patients and 4.8% Caucasian American patients in the standard of care group. In the follow-up phone call group 100% of the patients were African Americans. African Americans often have lower incomes and are disproportionately faced with many barriers to health care such as lack of insurance and access to transportation. The sample size was also small for this study but inferential statistics were still utilised. The sample size was limited to those patients who could be enrolled over a three month time limit. The limited sample size did not allow for power to show a difference between the groups. Given a longer time frame to conduct the study and recruitments and more diverse patient population, it is likely that the results could have been different. During the study, there were two patients who had difficulties obtaining their medical diabetic supplies. This impacted the ability for patients to consistently monitor their blood glucose and thus keep logs of their blood glucose readings during the study. It would be difficult to predict if the same level of behavioural changes would occur in a different setting with a different ethnic group. In this study, there was a significant difference in age between the standard of care group and the follow-up phone call group which could be seen as a limitation. This difference in age is likely attributed to patients being placed in groups based on the numerical order of their MRNs. Patients in the standard of care group tend to have shorter MRN numbers thus were more established patients and were likely older. Using the last four digits of the MRN may have resulted in less bias and more likely a variation in ages within each group. A fourth limitations to the study is that it was difficult to verify if the blood sugar levels on the logs that were brought into the office visits were accurate as there was no real time uploading of the results electronically. The fourth limitation of this study was patient failure to present to the clinic for follow-up due to inclement weather. There was a high no show rate and rescheduling of appointments during the study period, which is most likely related to severe weather disturbances thus prolonging the duration of the study.

Discussion

Unlike previous studies that have shown that patients tend to manage their chronic conditions better after having follow-up phone calls with a healthcare provider, the overall finding of this study did not indicate that follow-up telephone calls statistically significantly improved HA1C over a three month period, but there is clinically significant improvement in HA1C for those patients who received

follow-up phone calls after their clinic visit. McMahon *et al.* (2012) in their study concluded that there was a substantial improvement in HA1C after a one year with online, telephone-based care management and web training. Perhaps conducting this study over a longer period of time could have yielded more statistically significant findings. The patient in the follow-up phone call group had a greater decline in their mean HA1C from baseline to the end of the three month study period which has some clinical significance. This finding was consistent with findings reported by Walker *et al.* (2011) which showed that the frequency of telephone calls by healthcare educators showed greater though moderate improvement in HA1C as compared with intervention given printed material. Stone *et al.* (2010). It could be postulated that patients receiving follow-up phone calls were more likely to take their medication as a result of actually having a visual of their blood sugar levels and expecting a call from the researchers. This study did not indicate any statistical significance between groups in the number of patients who kept logs of their blood glucose reading throughout the study. However there is strong clinical significance in both groups of patients keeping logs of their blood glucose readings as the study progressed. At the conclusion of the research 100% of the standard group patients kept records of their blood glucose readings as compared to 42.9% during the beginning of the study. Approximately, 84% of patients in the follow-up phone call group at visit 3 were keeping a record of their blood glucose as compared to 20% at visit 1. This is clinically significant because it is implicating that frequent patient contact with provider improved their adherence to blood glucose monitoring and will likely change behaviour over time.

There were statistical significant differences in changes in pre- and post-test scores within the standard of care group and within the follow-up phone call group. This is a positive indicator that there was an improvement in the patients' knowledge of diabetic self-management after they were educated. However, there were no statistically significant differences in change in scores between patients in the standard of care group and patient in the follow-up phone call group.

Utilising ancillary staff such as medical assistants to conduct the follow-up phone calls would be more cost-effective in managing this patient group. The follow-up phone call did not discuss medication adjustment so this task falls within the medical assistant scope of practice. Utilising providers such as nurse practitioners to make these phone calls could be costly and could be seen as a barrier in implementing this practice in the healthcare settings.

During this study, a tremendous amount of time was spent by the nurse practitioners conducting this study calling patients at home reminding them to check their blood sugar and document it in their log book. Using medical assistants to make these calls could reduce the cost significantly.

Conclusion

In conclusion, the study did not show a statistically significant improvement in overall HA1C in either group of patients, but there was a clinically significant improvement in HA1C in the group of patients that received follow-up phone calls. Due to the small sample size and the limited power of this study, the nonsignificant statistical results should be considered in that context. This clinically significant result may indicate that patients who are in frequent contact with their healthcare providers do better in improving their diabetes self-management. There is also some positive indications that patients who have frequent follow-up with their healthcare provider may increase their adherence to blood glucose monitoring overtime as was evident in this study. With the growing number of patients with this disease, it is imperative that healthcare providers engage with their patients and provide support to improve management of their diabetes. Bringing self-awareness of self-management practices is vital for the education of the patient in the hopes of assisting in the management of their diabetes and preventing complication. Healthcare providers should encourage their patients to practice self-management of their diabetes, which should translate to having the patient feel empowered and wanting to take control of this chronic condition. Entering into a 'partnership' in care with the patient to promote self-management behaviours may be one of the ways to slow down the progression of this growing epidemic. Repeating this study and removing some of the limitations discussed may likely yield more statistically significant results.

Relevance to clinical practice

Although there were no statistical significant changes in the overall HA1C, the clinical significance of the change in HA1C in the follow-up phone call group supports that frequent contact by telephone may likely improve adherence to diabetes self-management. Any small positive change in managing this chronic disease condition should be seen as a victorious. Diabetes is very debilitating and having patients engaging in their care and showing positive results is a step in the right direction.

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Contributions

Study Design: CB-D, TB, CC, MM, AN, KW; Data Collection and analysis: CB-D, TB; Manuscript preparation: CB-D, TB, CC, MM.

Conflict of interest

There were no financial contributions or obligations involved in this study. There was no conflict of interest.

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