

Effect of a Telephone and Text Message Follow-Up Program on Medication Adherence among Patients with Diabetes Mellitus: A randomized controlled trial.

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Abstract: Medication adherence is an essential factor in effective management of patient with diabetic disease, especially in developing countries. Recently, telenursing program have various applications in health care services all over the world. This study determined the effect of a telephone and text message follow-up program on Medication Adherence among patients with diabetes mellitus. This was a controlled trial design on patients with diabetes who were hospitalized in the University of Benin Teaching Hospital, Benin-City, Edo State. This study was conducted among 100 diabetic patients through census method and the participants were randomly assigned to the experimental and control groups. Morisky Medication Adherence Scale (MMAS) was used for data collection. Data collected were analyzed using descriptive statistics and independent t-test, chi-square, and repeated measures analysis of variance (ANOVA) at 0.05 significant levels. Findings of the study shows that prior to the intervention, there is no significant difference in the medication adherence level of the two groups. However, it also shows that there is a significant difference between the mean score of the experimental and control group after intervention ($p < 0.001$). Thus, the telephone and text message follow up program is effective in promoting the level of medication adherence among diabetic patients.

Key: Diabetes mellitus, text messaging, patient, telephone, medication adherence.

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¶ Introduction

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.^[1] It is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys, and nerves.^[2] According to the IDF statistics, presently every seven seconds someone is estimated to die from diabetes or its complications, with 50% of those deaths occurring under the age of 60 years.^[3] This is against the background of a global diabetes prevalence of 8.8% (95% confidence interval 7.2-11.3%) of the world population in 2017, standardized for the age group 20-79 years.^[4] The prevalence is expected to further increase to by the year 2045.^[5] In total numbers, this reflects a population of 424.9 million people with diabetes worldwide in 2017 with an estimate of a 48% increase to 628.6 million people for the year 2045.^[6] Nigeria, with a population of 158 million people, is the most populous country in Africa and accounts for one sixth of Africa's population.^[7,8] Incidence and prevalence of diabetes in Nigeria today is one of the most significant troubles.^[9] According to the International Diabetes Federation (IDF), in 2015 out of 415 million people living with diabetes in the world, 75% are in poor and middle income countries, with Sub-Saharan Africa accounting for 14.2 million.^[10] Based on the available statistical report, the prevalence rate of diabetes in Nigeria is 1.9 percent for adults, and among the five million people that die from diabetes annually across the world, Nigeria accounts for more than 40,000.^[10, 11] Relatively, Nigeria leads in the number of incidence and mortality rate of diabetes in Africa and this was found to be as a result of poor medication adherence among diabetic patients.^[12] Adherence to long-term therapies in chronic disease is poor, and traditional interventions to improve adherence are complex and not widely effective.^[13] Mobile telephone and text messaging may be an accessible means to improve medication adherence. The use of mobile communication method in nursing to follow up patient saves time, cost effective and increase coverage^{[14, 15].}

The efficacy of telenursing through text message and telephone follow-up in the management of chronic diseases has been studied in a number of previous studies, but none seems to look at diabetes mellitus. However, need to determine the effectiveness of text message on medication adherence among diabetic patients, and its influences on clinical outcomes. Due to the gap noticed in the results of previous studies and the limited number of studies performed in this respect in Nigeria, the present study was performed with the aim of determining the effect of a text message and telephone follow-up program on medication adherence among diabetic patients.

II. Methodology

The present study was a clinical trial. The study subjects consisted of patients with Diabetes who were hospitalized in the University of Benin Teaching Hospital, Benin-city, Nigeria between January to August 2019 and met the inclusion criteria. This study was conducted among 100 diabetic patients through census method and the participants were randomly assigned to the experimental and control groups. (through the random selection of cards with the numbers 1 and 2 by the patients) divided into two groups of intervention (n = 50) and control (n = 50). The inclusion criteria consisted of diagnosis of Diabetes and registered with University of Benin Teaching Hospital, able to read and write, having stable physical condition, lack of any visual, speech, and hearing difficulties, having access to a telephone at home and in the his/her office. The exclusion criteria consisted of patients with Co-morbidities such as depression or other mental diseases that can affect their ability to understand and respond to questionnaire. Data collection was performed in the two groups of patients before, 3 months after, and 4 months after the beginning of the intervention. The data collection tool comprised two parts. The first part consisted of questions on demographic characteristics and information on the disease (age, gender, education level, and marital status, history of risk factors such as, hypertension, family history of diabetes, smoking, and history of hospitalization). The second part consisted of the Morisky Medication adherence scale (MMAS-8) which is made up of eight questions formulated to assess medication adherence among diabetic patients. The first seven questions are closed ended question with Yes or No answer. NO were scored as 1 while yes were scored as 0, except question 5 where reverse is the case in the scoring. The remaining one question is structured in a 5 point – scale, which is as follows: all the time, usually, and never, were scored from 1 to 5 respectively. The Morisky Medication adherence scale (MMAS-8) were rated as follows: patients with MMAS-8 score of zero (0) were rated as higher adherence, score ranges from 1-2 were rated as medium adherence and score range of 3-8 MMAS-8 score were rated as low adherence [1] The MMAS-8 Scale is a standard questionnaire, the reliability and validity of which have been approved by researches performed in Nigeria and other countries.[1] The Cronbach's alpha was used to test the reliability of the instrument, and the reliability coefficient in this study is 0.85.

The patients were informed of the goals of the study and informed consents were obtained from them. After primary data collection, the home telephone number and mobile number of the patients were obtained. To ensure that messages were sent, the researcher activated the delivery option in her mobile phone. During the 3 months of text message follow-up, six messages were sent to the subjects each week. In total, during the intervention period, 72 text messages were sent to each study subject. Each text message consisted of a maximum of 150 words. The context of the text messages sent to the intervention group comprised of a reminder on when, how, benefits of their drug and adverse effect of not taken the drug as prescribed.

Text message follow-up of the control group patients was achieved through messages with contents other than medication adherence messages, such as political messages. In the course of the 3 months of telephone follow-up, telephone calls were made two times per week during the first month and once a week during the second and third months. On average, the duration of each call was 15 min, and in total, 16 calls were made to each subject. Statistical analysis of data was conducted using Student's independent t-test, Chi-square, and repeated measures analysis of variance (ANOVA) using the Statistical Package for Social Science (SPSS) version 21.00 statistical software (IBM corp. released 2012). IBM SPSS statistics for windows, version 21.0 Armonk, NY: IBM Corp. Thus, data obtained from 50 patients in the intervention group and 50 patients in the control group were analyzed.

Ethical Considerations

The ethical approval was obtained from the university of Benin teaching hospital research and ethical committee, with approval reference Number: ADM/E22/A/VOL.V11/14738 on February 15th, 2019, the hospital where the study was conducted. Principle of voluntary participation was applied, and proper explanation of the purpose of the research was ensured. Consent form was given to the participants to seek verbal and written consent before data collection.

III. Results

TABLE 1: Demographic characteristics of Diabetic patients admitted to surgical and Medical Surgical Units at the University of Benin Teaching Hospital, Nigeria.

| VARIABLES | RESPONSES | Intervention Group | | Control Group | | Statistical Test | |
|----------------------------|----------------|--------------------|----|---------------|----|------------------------------|---------|
| | | N | % | N | % | Chi-square (X ²) | p-value |
| Gender | Female | 21 | 42 | 20 | 40 | 0.07 | 0.79 |
| | Female | 29 | 58 | 30 | 60 | | |
| AGE | Above 35 years | 29 | 58 | 28 | 56 | 0.87 | 0.38 |
| | 19-34 years | 18 | 36 | 20 | 40 | | |
| | Below 18 years | 3 | 6 | 2 | 4 | | |
| Marital status | Married | 37 | 74 | 39 | 78 | 1.6 | 0.45 |
| | Divorced | 5 | 10 | 4 | 8 | | |
| Family History of Diabetes | Widow | 8 | 16 | 7 | 14 | 0.08 | 0.35 |
| | Yes | 34 | 68 | 36 | 72 | | |
| History of Hypertension | No | 16 | 32 | 14 | 28 | 0.56 | 0.62 |
| | Yes | 28 | 56 | 30 | 60 | | |
| History of Viral illness | No | 22 | 44 | 20 | 40 | 0.25 | 0.27 |
| | Yes | 33 | 66 | 32 | 64 | | |
| History of Smoking | No | 17 | 34 | 18 | 36 | 1.24 | 0.78 |
| | Yes | 11 | 22 | 14 | 28 | | |
| Over weight | No | 39 | 78 | 36 | 72 | 0.08 | 0.35 |
| | Yes | 24 | 48 | 19 | 38 | | |
| | No | 26 | 52 | 31 | 62 | | |

Mean age of study participants in the intervention group was 57.8 years with a standard deviation of 7.04. In the control group, it was 55.2 years with a standard deviation of 9.9. The results of independent chi-square(X²) showed no significant difference between the two groups in terms of mean age (X²= 0.07, P = 0.79). Moreover, the results showed that the two groups were not significantly different in respect to gender, marital status, and family history of diabetes and other history factors such as hypertension, viral illness, smoking, and overweight.[table 1]

Table 2:Independent t-test analysis for intervention and control group in 3 and 4 months

| Time | Group | Intervention | | Control | | Independent t- test | |
|-----------------------------|-------|--------------|-----|---------|-----|---------------------|---------|
| | | Means | SD | Means | SD | t | p-value |
| Before the intervention | | 30.5 | 8.3 | 31.9 | 5.7 | 0.29 | 0.45 |
| 3 months after intervention | | 43.5 | 5.6 | 32.8 | 7.5 | 15.17 | 0.001 |
| 4 months after intervention | | 45.1 | 3.1 | 31.8 | 9.6 | 23.40 | < 0.001 |

Independent t-test showed that before the intervention, mean of medication adherence scores of the two groups were not significantly different (P = 0.45). However, 3 months and 4 months after the beginning of the intervention, mean of medication adherence score of the intervention group was significantly higher than the control group (P = 0.001, P< 0.001) respectively.[table 2]

Table 3:One way Analysis of Variance (ANOVA) of repeated measures

| variables | Mean | SD | f | p-value |
|-----------------------------|------|-----|-------|---------|
| Control Group | 30.5 | 8.3 | 0.29 | 0.53 |
| 3 months after intervention | 43.5 | 5.6 | 13.17 | 0.001 |
| 4 months after intervention | 45.1 | 3.1 | 20.1 | < 0.001 |

ANOVA: Analysis of Variance, SD: standard deviation.

Repeated measures ANOVA showed that mean medication adherence score of the control group at the three times of data collection did not significantly differ (P = 0.53). Nevertheless, it showed that this score significantly differed between the three times data collection times in the intervention group (P = 0.001). It also shows that the mean score obtained 4 months after the beginning of the intervention was significantly higher than that obtained 3 months after the beginning of the intervention (P< 0.001) [table 3]

IV. Discussion

The aim of the present study was to determine the effect of a telephone and text message follow-up program on medication adherence among patients with diabetes. No significant differences were found between the intervention and control groups in terms of demographic variables, information on the disease, and mean medication adherence score before the intervention. This is in agreement with Saba and Mahin studied on the efficacy of a text message intervention program on cardiac self-efficacy of patients with coronary artery disease admitted to ShahidCharmran Hospital, Isfahan, Iran and found that there is no significant difference between the two groups in terms of demographic variables, information on the disease, and cardiac self-efficacy.^[16]

The results of the present study showed that 3 and 4 months after the beginning of the intervention mean medication adherence score of the intervention group was significantly higher than the control group. This is in agreement with Park et al, a studied on the Pharmacologic treatment for secondary prevention of coronary heart disease, a randomized controlled trial, to compare antiplatelet and statin adherence among patients with coronary heart disease who received text messages for medication reminders, for 30 days, and analyzed medication adherence with electronic monitoring devices [Medication Event Monitoring System (MEMS)] by one-way ANOVA and Welch tests, two-way text messages response rates by t-tests, and self-reported adherence (Morisky Medication Adherence Scale) by Repeated Measures ANOVA, and found that the patients who received text messages for antiplatelets had a higher percentage of correct doses taken ($p = 0.02$).^[17] Moreover, this is further supported by a study carried out by Armstrong et.al who conducted a randomized, controlled trial of the effect of an electronic text-message reminder system on adherence to sunscreen application. Adherence to daily sunscreen use was evaluated using a novel electronic monitoring device. Seventy participants constituted a volunteer sample from the general community, half of the participants received daily text-message reminders via cellular telephone for 6 weeks, and the other half did not receive reminders. At the end of the study period, the 35 participants who did not receive reminders had a mean daily adherence rate of 30.0% (95% confidence interval, 23.1%-36.9%). In comparison, the 35 participants who received daily text-message reminders had a mean daily adherence rate of 56.1% (95% confidence interval, 48.1%-64.1%) ($P < .001$), and concluded that using existing cellular telephone text-message technology offers an innovative, low-cost, and effective method of improving adherence to sunscreen application.^[18]

Nevertheless, this study was faced with some limitations such as the information about diabetes mellitus which was obtained from other sources such as the physicians, nurses, pharmacist and media which could affect patients' medication adherence and could not be controlled by the researcher, could be responsible for the improvement noticed in medication adherence level. Furthermore, improvement or worsening of patients' symptoms during this study could affect their medication adherence level results, and this factor could not be controlled by the researcher. Another limitation of the present study was the coverage of the research. Therefore, to increase the generalizability of findings, it is suggested that further studies be conducted in this respect with more coverage.

V. Conclusion

Based on the findings of the current study, telenursing is an appropriate method for promotion of medication adherence among patients with Diabetes. Due to the high incidence of diabetes and importance of long-term follow-up in patients with diabetes, simple and cost-effective follow-up methods are required for the promotion of medication adherence level of patients. We recommend telephoning and text message follow-up as important tools in the promotion of medication adherence among patients with Diabetes mellitus. Thus, nurses, as the key members of the health and treatment team, can use these communication methods in promoting effective follow-up of patients with Diabetes.

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Conflicts of interest

Nothing to declare

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