

## Original Article



# Is Telenursing an Effective Method to Control BMI and HbA1c in Illiterate Patients Aged 50 Years and Older With Type 2 Diabetes? A Randomized Controlled Clinical Trial

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## Abstract

**Introduction:** Telenursing is a simple method to provide and maintain nursing care for patients with chronic illness such as diabetes. This study aimed to determine the effectiveness of telenursing on body mass index (BMI) and glycosylated hemoglobin (HbA1c) in illiterate patients aged 50 years and older with type 2 diabetes.

**Methods:** A randomized controlled clinical trial was performed. Sixty patients with type 2 diabetes who referred to Aligoodarz diabetes clinic (Lorestan, Iran) were randomly assigned to the intervention and control group. Each patient was assessed before and after intervention for the following clinical parameters: HbA1c by Drew-DS5 analyzer and weight by scale (Sahand BMI electronic scale /Iran). All patients received diabetes self-care training for 3 days before the study. Telephone follow ups were applied in intervention group for 12 weeks. The data were analyzed using chi-square, paired t test and independent t test by SPSS11.

**Results:** Results showed statistically significant decrease in BMI at the end of the training from 29.28 (3.29) to 28.35 (3.37) kg/m<sup>2</sup> and statistically significant decrease in HbA1c from 8.96 (1.24) to 7.56 (0.71) in the intervention group. The effect size base on Cohen's formula for BMI and HbA1c was Cohen's d=2.85, effect size r=0.81 and Cohen's d=2.04, effect size r=0.71, respectively.

**Conclusion:** The findings indicate that nurse-led telephone follow up can increase adherence from treatment program and has beneficial effects on HbA1c and BMI in illiterate patients aged 50 years and older with type 2 diabetes.

## Introduction

Type II diabetes is a metabolic disease in which chronic hyperglycemia leads to the dysfunction of vital organs.<sup>1</sup> It is the most common form of diabetes, which is associated with age factors, environmental changes and behavioral patterns.<sup>2,3</sup>

According to the International Diabetes Federation, quoted by Flor and Campos the estimated prevalence of diabetes worldwide is expected to rise from 382 million in 2013 to 592 million in 2035.<sup>4</sup> The prevalence of diabetes in Iran is estimated at 8.43% in 2013.<sup>5</sup> According to the latest statistics from the Iranian Diabetes Society, 7 million Iranians (8.9%) suffer from diabetes.<sup>6</sup>

Obesity is a risk factor for type 2 diabetes.<sup>5</sup> Recent evidence showed that even weight loss through medication and surgery have a positive impact on improving diabetic symptoms.<sup>7</sup> The European Office of the World Health Organization (WHO) has reported that overweight and obesity account for the prevalence of 80% of type 2

diabetes among European adults.<sup>8</sup> In addition, high body mass index (BMI) has been shown to be a risk factor for type 2 diabetes.<sup>9,10</sup> Studies have shown that obese patients with diabetes are more likely to develop diabetes-related complications than diabetic patients with normal-weight.<sup>11,12</sup> Therefore, weight loss is a fundamental step in the treatment of obese patients with diabetes.

Educational interventions have also been designed as programs to reduce diabetic complications.<sup>13</sup> Health care providers try to use these methods to educate diabetic patients.<sup>14</sup> Training programs often include group training sessions and in-hospital training; but it is not enough, because at different times, people have different needs to be aware of.<sup>15</sup> Videophone technology and regular telephone consultations (telemedicine) help patients to maintain education and treat themselves at home without the need to attend clinics.<sup>16</sup> Therefore, further studies are recommended to use new technologies to improve self-management and the benefits of treatment.<sup>17,18</sup>

Telephone follow-up and counseling are very effective in continuing the support and improvement of outpatient and chronic patients.<sup>19,20</sup> But the efficacy of the previously mentioned studies wasn't therefore clear.<sup>21</sup> More studies on up-to-date and cost-effective technologies are needed.<sup>22</sup> Studies reported that telenursing is able to improve metabolic parameters in type 2 diabetic patients.<sup>23, 24</sup> Study reported statistically significant reduction in BMI was observed in the intervention group as compared to the control group after 6 and 18 months follow up,<sup>25</sup> but other studies showed that no statistically significant change in BMI and body weight is observed during a 12- and 24 month follow-up using computer-tailored advice, pedometer and environmental changes to control nutrition and physical activity.<sup>26, 27</sup> Study found that a Web-Based Comprehensive Information System can be effective in improving the self-management of diabetic patients and a significant relationship observed between the number of accesses to eMOD (electronic Management of Diabetes) and glycosylated hemoglobin (HbA1c) level.<sup>28</sup> The Meta-analysis study showed that the use of telenursing (vs. usual care) was associated with a significant reduction in HbA1c levels compared to usual care, with a pooled 0.68%.<sup>22</sup>

Considering the increasing rate of diabetes incidence and its complications, it is necessary to develop new methods to improve the effectiveness of treatment and control the disease complications. telenursing as a follow-up caring technology can be a helpful method. Although several studies showed the positive effects of telenursing,<sup>25, 27, 29</sup> they did not assess the effectiveness of this method in illiterates' patients. A study showed literacy is a predictor of practicing foot care and illiteracy increased foot complications.<sup>30</sup> It is shown that illiterate patients have more frequent poor glycemic control.<sup>31, 32</sup> Uneducated people have fewer resources to learn from literate people. Al-Kaabi et al., suggested that effective strategies are required to improve the knowledge of illiterate patients about the disease and reducing diabetic complications.<sup>30</sup>

There are still illiterate people in the Third World countries, most of them are older adults. According to the statistical center of Iran in 2016, 8 795 553 people were illiterate out of a total of 71 506 392 people. In Lorestan province, among the 1 568 800 population, 266 480 were illiterate.<sup>33</sup>

Although various studies have investigated the efficacy of telemedicine in controlling diseases and their complications, few studies have investigated the effectiveness of telemedicine in illiterate older adults. Illiteracy and the elderly are both critical determinants of health care planning decisions, and they are essential in how care plans are designed. Given that most of the older adults in the Third World are illiterate, it can considerably affect the quality of health care planning decisions. Therefore, this study was performed to determine the effectiveness of telenursing on BMI and HbA1c in illiterate patients aged 50 years and older with type 2 diabetes.

## Materials and Methods

This study was a single blind randomized controlled clinical trial (identifier: IRCT2015052522406N1; <https://www.irct.ir/trial/19328>). The study population included 60 illiterate patients aged 50 years and older with type 2 diabetes who referred to Aligoodarz diabetes clinic (Lorestan, Iran) and met the inclusion criteria. In order to have equal sizes for the groups, random allocation rule was applied by independent researcher. In this method the allocation sequence was generated by randomly drawing one card from a set of 60 cards on which the letters A or B were written (30 cards for each letter) to indicate the intervention or control groups, respectively (Figure 1). Random allocation and blinding was used to control confounders. In this study both participants and study staffs were blinded in a way that random allocation and data gathering were applied by independent researchers. The inclusion criteria were having just a minimum level of primary education or lower, the age of 50 years and older, residence in our city or the surrounding villages, having a phone at home and a HbA1c greater than 7, while the exclusion criteria included psychological illnesses, speech and hearing problems, and the advanced forms of disease in vital organs.

The sample size was calculated as 23 according to the statistical formula for the values of  $\alpha=0.01$  and  $\beta=0.05$ , the values of  $S1=1$  and  $S2=0.9$ .<sup>34</sup> To increase the accuracy of the study, the number of patients in each group was increased to 30 people.

The data collection instrument used in this study consisted of a demographic and clinical characteristics checklist, including age, sex, height, weight, education level, marital status, income level, and BMI and HbA1c levels.

The HbA1c of all the blood samples was measured using high performance liquid chromatography method by Drew-DS5 analyzer. To measure weight and height, similar tool was also used at the entry of the study and 12 weeks after the intervention (Sahand BMI digital scales, with an accuracy of  $\pm 50$  g/Iran). The scale was standardized using a weight of 1 kg for each use. The weight of patients measures under the same conditions (i.e. after emptying the bladder and removing the shoes) in the Aligoodarz diabetes clinic.

Demographic questionnaire and patients' height, body weight, and HbA1c levels were measured and recorded before and after the study by an independent researcher. Then, all subjects completed the group self-management training for diabetes in three days; telephone follow-ups were performed for three months in the intervention group. The standard conversation contents were created by researchers based on the primary self-management training. The subjects received a phone call from the researcher to assess their adherence to the treatment plan (including exercise, diet and medication) twice a week in the first and second months and once a week in the

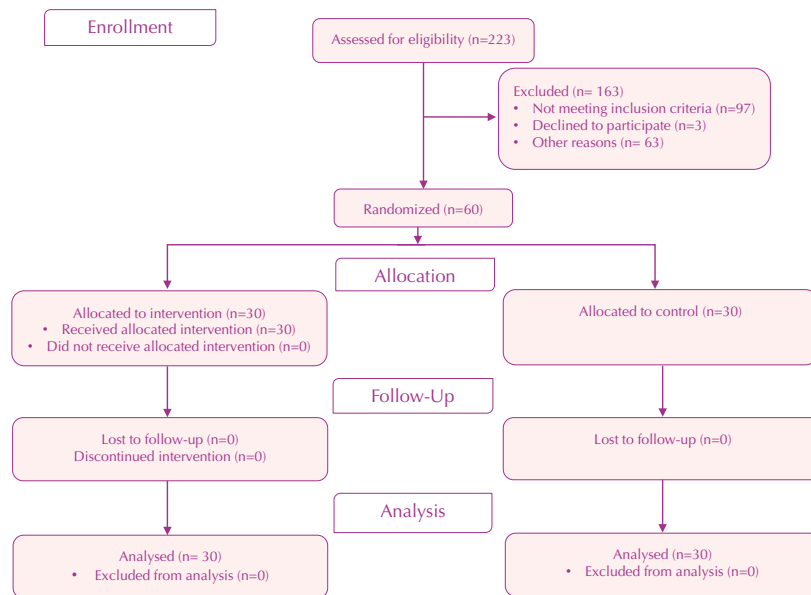


Figure 1. Flow chart of the study.

third month. After consultation with the samples, the best time to phone call was determined between 10 AM to 8 PM during the working days. The average length of each telephone conversation was considered to be 20 minutes. The content of the phone conversation included an assessment of the degree to which a sample adhered to the treatment plan, and solutions were proposed to the patient for instances of major non-compliance. Follow-up telephone calls for the intervention group were recorded in the form designed for each conversation session.

At the end of the 3-month intervention period, weight, height, BMI and HbA1c levels were measured for all subjects. The control group received the routine care of diabetes outpatient clinic during the study.

The statistical methods used to describe the characteristics of the subjects in each of the two groups were the indices of central tendency and dispersion (mean and standard deviation) and frequency distribution. The inferential chi-square test and Fisher's exact test were employed to evaluate the nominal and ordinal qualitative variables related to demographic data. We also used the independent t-test to compare the mean BMI and HbA1c between the two groups at the end of the intervention as well as the paired t test to compare the mean BMI and HbA1c in the control and intervention groups before and after the intervention. The data were finally analyzed using the SPSS 11 software. The significance level was considered to be less than 0.05.

## Results

The mean age of the study subjects in the intervention and control groups was 61.76 (9.61) and 63.50 (8.45) years, respectively. The frequency distribution of the subjects in terms of gender was found to be 9 (30%) men and 21

(70%) women in the intervention group. At the baseline, there were no statistically significant differences between the two groups in regard to age, sex, height, weight, marital status, income level, and BMI and HbA1c levels ( $P > 0.05$ ; Table 1).

A normal distribution of the data on BMI can be derived from the results of the normality of data distribution test, which was first performed to examine changes in BMI. Levene's test also showed the equality of variances. The results of the independent *t* test showed no significant difference between the BMI values before the intervention in both groups ( $P = 0.729$ ). The paired *t* test showed that a statistically significant decrease in BMI (from 29.28 (3.29) to 28.35 (3.37) kg/m<sup>2</sup>,  $P < 0.001$ ) in the intervention group after 3 months, whereas no statistically significant difference was observed in the control group (Table 2). The independent *t*-test showed significant differences between the two groups at the end of the study (0.92 (0.47) vs. -0.02 (0.08),  $P < 0.001$ ).

A normal distribution of the data on HbA1c can be derived from the results of the normality of data distribution test, which was first performed to examine changes in HbA1c. Levene's test also showed the equality of variances. The results of the independent *t*-test showed no significant difference between the HbA1c levels before the intervention in both groups ( $P = 0.86$ ). The paired *t* test showed a statistically significant decrease in HbA1c in the intervention group from 8.96 (1.24) to 7.56 (0.71) ( $P < 0.001$ ; Table 2). The independent *t* test showed significant differences between the two groups at the end of the study 1.40 (0.99) vs. -0.04 (0.18) ( $P < 0.001$ ). The effect size base on Cohen's formula for BMI and HbA1C was Cohen's  $d = 2.85$ , effect size  $r = 0.81$  and Cohen's  $d = 2.04$ , effect size  $r = 0.71$  respectively.

**Table 1.** Distribution of descriptive characteristics of individuals

Variable	Classification	Intervention No. (%)	Control No. (%)	P value
Gender	Female	21(96.7)	22(73.3)	0.744 <sup>a</sup>
	Male	9(3.3)	8(26.7)	
Marriage status	Single	1(3.3)	0(0)	0.313 <sup>a</sup>
	Married	29(96.7)	30(100)	
Job status	Housewife	21(70)	21(70)	0.952 <sup>a</sup>
	Self-employment	4(13.3)	3(10)	
	Employee	3(10)	3(10)	
	Retired	2(6.7)	3(10)	
Income range	Adequate	3(10)	2(6.7)	0.721 <sup>b</sup>
	Somewhat adequate	12(40)	10(33.3)	
	Inadequate	15(50)	18(60)	

<sup>a</sup> Chi-square; <sup>b</sup> Fisher's exact test.

**Table 2.** The effect of telenursing on HbA1c and BMI

Variable		Baseline	Post training	P value between <sup>a</sup>
HbA1c	Intervention group	8.96 (1.24)	7.56 (0.71)	< 0.001 <sup>a*</sup>
	Control group	8.90 (1.36)	8.94 (1.35)	
	P value within <sup>b</sup>	0.86 <sup>b</sup>	0.008 <sup>b*</sup>	
BMI	Intervention group	29.28 (3.29)	28.35 (3.37)	< 0.001 <sup>a*</sup>
	Control group	29.57 (3.18)	29.59 (3.17)	
	P value within <sup>b</sup>	0.729 <sup>b</sup>	0.002 <sup>b*</sup>	

Abbreviations: HbA1c, Glycosylated hemoglobin; BMI, body mass index.

<sup>a</sup> Paired sample t test; <sup>b</sup> Independent sample t test; \* Statistically significant.

## Discussion

The aim of this study was to assess the effect of telenursing on glycemic control in illiterate patients who are 50 years and older. Patients with low literacy have less diabetes-related knowledge and less desire to participate in medical decision making.<sup>35</sup> So selecting a simple method to motivate patients to participate in controlling their disease is necessary, in this study the researcher selected patients who are 50 years and older. Age is an important factor that causes differences between groups, for example, different age groups have different desires to learn about their disease and self-management.

The results of this study showed that although there were no statistically significant differences between the two groups in the baseline measures such as demographics, BMI and HbA1c levels, but BMI and HbA1c levels in the intervention group had a statistically significant reduction compared to the control group at the end of the study. Consistent with another two studies,<sup>25,36</sup> this study showed that the mean BMI for the intervention group decreased to 0.93 kg/m<sup>2</sup> after the study ( $P < 0.001$ ), but no significant reduction in BMI was observed after telephone follow-up in similar studies.<sup>26, 27, 37, 38</sup> It is shown that no statistically significant change can be observed in BMI, HbA1c, knowledge and self-efficacy in low numeracy/literacy diabetes patients who trained by Computer Multimedia Application,<sup>39</sup> the result may be affected by less use of

computer among people with low literacy. This study showed that the selected method to train low literacy patients is very important.

Automated telephone disease management can caused higher engagement, especially among patients with limited literacy.<sup>40</sup> No statistically significant change was observed in BMI and HbA1c levels after a follow-up of one year in two groups; interactive weekly automated telephone self-management support with nurse follow-up, and monthly group medical visits with physician and health educator facilitation,<sup>37</sup> which is considered to be due to the selection of samples with HbA1c levels equal to or greater than 8% as well as the use of weekly and monthly follow-up program. The effectiveness of this approach may be limited due to long follow-up intervals. In these studies the researchers consider the low literacy patients but they didn't focus on patients with specific ages.

A study showed that no statistically significant change can be observed in BMI and body weight during a 12 and 24 months follow-up using computer-tailored advice, pedometer and environmental interventions to control food intake and physical activity but significant reduction were observed for changes in waist circumferences both at 12 and 24 months follow up.<sup>26</sup> It can be demonstrated that the higher risk of obesity from fat rather than weight, and follow-ups have been reduced the central fat.

A study showed no statistically significant changes in BMI by a 12 weeks follow-up and suggested that more time should be spent to reduce the BMI and more content about weight loss should be included in patient education programs,<sup>38</sup> however the same period of 12 weeks follow up was used in our study as the content of the training and follow-up programs are considerably effective to achieve suitable results.

In addition, after 12 weeks of telephone follow-up, HbA1c in the intervention group decreased to 1.40% and was increased by 0.04% in the control group, which is consistent with the results of other studies<sup>21, 25, 27, 41</sup> that showed the positive impact of continuing care and follow-up on reduction of HbA1c in patients with type 2 diabetes. Different reductions have been found in HbA1c after telephone follow-up.<sup>25,27,41,42</sup> The difference in the reduced HbA1c levels could be attributed to the differences in training program, telephone follow-up procedures and cultural differences.

Today's, the majority of self-care training of patients with chronic disease such as diabetes is done by nurses. Telenursing can help patients to improve the process of self-care,<sup>43</sup> this positive effect is related to close relationship between patients and nurses and active participation of the patients in diabetic treatment plans.<sup>21</sup> This study shows that telephone follow-up with a special and regular program can provide an opportunity for continuing education in illiterate diabetic patients who are 50 years and older. Telephone follow-up is one available approach to monitor treatment and improve glycemic



control in diabetic patients at home. This method allows professionals to be more focused on patients who are most in need of medical care.<sup>44</sup>

Different results from numerous studies confirm the effectiveness of this approach; however, no study focuses on illiterate older adults. The results of this study support that telenursing seems to be a suitable method for illiterate older patients. One of the limitations of this study was selecting patients who refer to outpatients' clinic; these patients have more attention to their disease so that patients who have less desire to control their disease were not recruited in sampling. The last was selection diabetic patients' over than 50 years old instead of 60, this was because the study performed in the little city and the few appropriate sample who referred to outpatients clinic.

### Conclusion

The results of this study show that telephone follow-up is a convenient and effective method to improve blood sugar and BMI in illiterate patients aged 50 years and older with type 2 diabetes. It is an easy, available method compared to other training methods even in remote areas such as the study population and can be used at a broad geographical level. This approach by improving communication between nurses and patients allows to better control the disease and to save time, money and manpower and provides the ability to collect and record information continually that cause increase quality of care and patient satisfaction.

The researchers recommended another study to assess the effect of telenursing in specific groups such as oldest old people or mild cognitive impairment patients who have difficulty to medication adherence.

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### Ethical Issues

This study was approved by the ethics committee of Lorestan University of Medical Sciences and ethical No is 19/91. The written informed consent was obtained all of the participants.

### Research Highlights

#### What is the current knowledge?

Telephone follow-up is one of the methods for self-management support and continuous control in diabetic patients.

#### What is new here?

Telenursing is an effective method to promote self-management in illiterate older adults with type 2 diabetes.

### Conflict of Interest

There is no conflict of interest.

### Author's Contributions

Conception and design: ASH; Acquisition of data: ASH, MBB; Analysis and interpretation of data: ASH; Drafting the article: MBB; Review of article and find approval: ASH, MBB.

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