

# Pilot study on the effectiveness of telemedicine in improving the quality of diabetes care of the rural Nepal

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## ABSTRACT

The use of telecommunication in the field of medicine is very limited in Nepal. Despite huge potential of improving access of the sub-urban and rural communities with the urban-based health care professionals for expert consultation, the use of the telecommunication technology remains largely unexplored. In light of the facts, a comparative study was conducted at a rural community in Makwanpur. In total 40 patients (20 in each group) were selected for the study with an objective to test the feasibility and effectiveness of telemedicine in improving the quality of diabetes care in an experimental group and control group in Makwanpur district. In the intervention group, diabetes care was provided with tele-consultation for diabetes care mediated via local doctor. The outcome was compared with a control group based in an urban community with treatment as usual in their community. The study results showed that the use of telemedicine is a feasible alternative to provide diabetes care in rural Nepal. Overall fasting blood sugar was better controlled in the control group whereas there was significant improvements in micro albumin were observed in the interventional group. Similarly, the knowledge of the respondents on various aspects of the disease was also found to be better in the interventional group than in the control group. Majority of the respondents (90%) felt telemedicine service is less expensive than the service they had taken before.

**Key words:** Diabetes, rural, teleconsultation

## INTRODUCTION

The prevention and control of diabetes is a multifaceted and complex task for the least developed countries such as Nepal. Despite an excellent hierarchy of health units at different levels, the service seekers have difficulties accessing even the basic health services primarily due to difficult topography, economic constraints and skewed distribution of major health facilities in the urban areas. Moreover, consultation services on diabetes is an expensive feat for an average Nepalese. According to a study conducted in

selected outpatient clinics of Kathmandu on average, the consultation fee was approximately US\$ 4 per diabetic patient while per visit cost amounted to US\$ 11.<sup>[1]</sup>

The technological advancements in the field of science and technology have resulted in alteration of orthodox concept of imparting health care. Today patients and medical doctors do not have to meet in person for consultation, the use of telemedicine which may be via telephone or internet has helped connect professional health workers to the needy population.

In a study designed to evaluate the impact of a tele-assistance system on the metabolic control of type 2 diabetes patients it was found that the tele-assistance system using real-time transmission of blood glucose results with an option to make telephone consultations was feasible in the primary care setting as a support tool for family physicians in their follow-up of type 2 diabetes patients.<sup>[2]</sup> The basic functions of the telemedicine system can include tele-monitoring of

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patient's blood glucose data, self-management actions, and remote care from doctors to diabetes patients.<sup>[3]</sup> The use of telecommunications backed up by a paraprofessional outreach workers and an expert medical team of registered nurses and endocrinologists was really useful in enhancing quality of diabetes care which was manifested in the significant decrease in glycated hemoglobin to 7.2% from 9.6% ( $P = 0.001$ ) in a hispanic population of in United States of America.<sup>[4]</sup>

Till now there is no study in Nepal that has explored the possibility of using telemedicine to improve diabetes care. This pilot study was conducted to test the feasibility of telemedicine in improving the quality of diabetes care in rural Nepal.

## MATERIALS AND METHODS

This study is a comparative-cross sectional study between two groups of diabetes patients. An interventional group (at Manari Village Development Committee, a rural community in Makwanpur) was provided with tele-consultation for diabetes care mediated via local doctor was compared with a non-interventional group/control group (chosen from 23 km away urban area, Hetauda). In total 40 patients were selected for the study, 20 each from the intervention and the non-intervention group were selected purposively for the study.

Patients coming to Hetauda District Hospital were followed as usual by their local physician. All participants got regular monitoring of glucose and were given diabetes self-management education (DSME) both locally by local health care workers and by team from Kathmandu intermittently.

At the beginning of the study, a diabetes camp was organized in both Manari Primary Health Care Centre and Hetauda District Hospital. Fasting and postprandial blood glucose was done on the patients coming to the clinic. A colorimeter was used to do a blood sugar. People with known diabetes (already on one or more medications) and patients who fit the diagnosis of diabetes (based on World Health Organization definition of diabetes<sup>[5]</sup>) during screening were identified. Patients with diabetes were given option to enroll in the study and willing patients who consented were enrolled in the study. Patient below age 30 years and above 70 years and anyone with a history of kidney or liver disease were excluded. First 20 patients who gave consent to participate in the study were chosen.

Initially baseline data was collected to obtain information on smoking and alcohol intake habit, laboratory investigation data, as well as physical activity of the respondents. Patients were followed up for a year and at the end of the study data baseline date were recollected. End line data was compared to baseline data. Likewise, data comparison was done between experimental group and control group.

The project was approved by national health research council. An informed consent was obtained from each participant. All the forms, formats and questionnaire used in the study were pre-tested, and necessary modification was done.

Moreover, an initial 1 day workshop was organized for 20 health care workers and seven doctors on diabetes care from both the groups. Ongoing mentorship and supervision was provided to local doctor/local health care worker in the intervention group via tele-technology on medical, nutritional management of diabetes. Local doctor and health worker team intermittently provided -DSME.

Descriptive statistics was used. Frequency distribution, percentage analysis, means and standard deviation was used in descriptive statistics. The analysis was carried out by Statistical Package for Social Science 16.0 (ERAA Biochemistry Analyzer).

## RESULTS

The average age of the respondent in the interventional group was 45.3 years with standard deviation 8.4 years and in the control group was 50.4 years with a standard deviation 6.4 years [Table 1]. Almost, all the participants from both groups were married. Majority of the respondent from the interventional group and the control group were Aryan, and rest was Mongols [Table 2].

Most of the subjects felt, a telemedicine service is less expensive (90%) than the service they had taken before it, and they felt it was a useful service. Most of them also reported that telemedicine was significantly cost saving in terms of travel. All of them reported it is a useful service and felt there is a necessity of such service in their community, and they highly recommended such service to other similar communities.

In the interventional group, 30% of respondents had a smoking habit which did not change even at the end of the study. Alcohol consuming habit was similar in both groups and remained constant in the intervention group in the end, but interestingly it decreased in the control group [Table 3].

In the interventional group, more than half of the respondents were doing regular exercises which increased by the end of the study. The study results also showed that percentage of respondents performing strenuous activities like brisk walking, working in the garden, physical exercise, etc. increased in the intervention group in comparison to the control group (55% vs. 29%) [Table 4].

No significant difference was observed between groups in regards to the results of the laboratory investigation except significant improvements were observed in blood sugar in

the control group and improvement of micro albumin in the intervention group [Table 5].

Similarly, the knowledge of the respondents on various aspects of the disease was also found to be better in the interventional group than in the control group [Tables 6-8].

It the first telemedicine service experience for the interventional group. In the interventional group, before

**Table 1: Age and sex distribution of the respondents in percentage**

Demographic characteristics	Experimental group (n = 20)	Control group (n = 20)
Sex		
Women	30.0	15.0
Men	70.0	85.0
Age group		
30-40	20.0	5.0
40-50	55.0	40.0
50-60	15.0	40.0
60 and above	10.0	15.0
Mean age±SD	45.3±8.4	50.4±6.4

SD: Standard deviation

**Table 2: Caste/ethnicity and educational status of the respondents in percentage**

Socioeconomic characteristics	Experimental group (n = 20)	Control group (n = 20)
Caste/ethnicity		
Aryan	80.0	85.0
Mongol	20.0	15.0
Educational status		
Illiterate	25	20
Literate	75.0	80.0

**Table 3: Smoking and alcohol consumption habits of respondents**

Activity	Experimental group (n = 20)		Control group (n = 17)	
	Baseline	End line	Baseline	End line
Smoking habit	30.0	30.0	35.3	35.3
Soft drinking habit	20.0	40.0	41.2	29.4
Hard drinking habit	15.0	15.0	41.2	23.5

**Table 4: Utilization of leisure work by the respondents**

Physical activity of the respondents	Experimental group (n = 20)		Control group (n = 17)	
	Baseline	End line	Baseline	End line
Regular exercise	55.0	70.0	47.1	70.6
Utilization of leisure work by the respondent	Experimental group (n=20)		Experimental group (n=17)	
Activity	Baseline	End line	Baseline	End line
Mild intensity activities	10.0	0.0	0	0
Moderate intensity activities	65.0	20.0	47.1	17.6
Strenuous activities	25.0	80.0	52.9	82.4

**Table 5: Laboratory investigation**

Mean ± SD of the following	Experimental group		Control group	
	Baseline	End line	Baseline	End line
Blood sugar fasting <sup>b**</sup>	189±94.2	171.0±77.0	241.7±117.4	170.7±62.0
PP <sup>a*,b*</sup>	295.6±103.0	166.3±87.1	341±140.2	202.5±77.9
Creatinine <sup>a*,b*</sup>	98.0±15.1	83.2±15.2	96.8±15.6	88.8±17.9
SGPT <sup>b**</sup>	38.3±16.5	37.6±24.9	42.7±21.3	31.6±10.3
TC <sup>a*,b*</sup>	5.4±1.0	4.9±1.0	5.6±1.4	4.7±1.1
TG <sup>c**,d***</sup>	2.3±1.0	1.9±1.0	3.4±2.0	3.1±2.4
HDL <sup>a***,c***,d***</sup>	1.2±0.3	1.1±0.2	1.1±0.2	1.0±0.2
LDL <sup>d**</sup>	2.8±0.6	2.8±1.0	2.4±0.9	2.0±1.2
HBA1C <sup>b***</sup>	8.0±2.0	8.9±2.5	7.8±2.5	8.7±1.9
Micro albumin <sup>a***</sup>	85.9±109.4	40.3±60.7	54.5±59.0	53.4±67.8
Systolic blood pressure <sup>d**</sup>	121.5±23.2	122.9±18.2	132.9±21.1	138.3±22.4
Diastolic blood pressure <sup>c***,d**</sup>	76.5±11.8	74.1±9.9	83.8±11.7	82.1±12.1
Weight	63.4±11.2	62.5±10.6	66.6±11.2	66.5±11.2

\*Significant at 1%; \*\*Significant at 5%; \*\*\*Significant at 10%. <sup>a</sup>Significant increase/decrease from baseline to end line in the experimental group; <sup>b</sup>Significant increase/decrease from baseline to end line in the control group; <sup>c</sup>Significant increase/decrease from the experimental group to control the group in the baseline; <sup>d</sup>Significant increase/decrease from the experimental group to control the group in end line. SD: Standard deviation; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; HBA1C: Glycated haemoglobin; TC: Total cholesterol; TG: Triglyceride, SGPT: Serum glutamic pyruvic transaminase; PP: Post-prandial

**Table 6: Knowledge on diabetes in percentage**

Meaning of diabetes	Experimental group	Control group
Increased sugar in the blood	85.0	47.1
Increased sugar in the urine	10.0	0.0
Liver failure	5.0	0.0
Others	5.0	52.9
Part of the body affected		
Eye	100.0	88.2
Heart	100.0	64.7
Stroke	20.0	5.9
Kidney	100.0	70.6
Leg	100.0	17.6
Teeth	10.0	0.0
Should have to check eye	95.0	94.1

**Table 7: Methods of management before telemedicine in the experimental group**

Methods of management	Frequency	Percentage
Taking medicine	8	40
Regular exercise	4	20
Controlling food habit	7	35
Nothing were done	2	10
Total	20	100

**Table 8: Cost benefit of telemedicine in percentage**

Cost benefits understanding patients	Frequency	Percentage
As same as others	2	10
Less expensive than other	18	90
Total	20	100
Travelling expenses		
As same as others	1	5
Less expensive than other	19	95
Total	20	100

implementation of this service, they were attempting to manage their disease by following means 40% were taking medications, followed by diet control-35%, regular exercise-20%) and 10% of them did none of it.

## DISCUSSION

This study demonstrates that the use of telemedicine in management of diabetes in rural Nepal is feasible and comparable to treatment as usual in the urban area. The results do not show much difference between the biochemical parameters between the interventional and the control group except for the significant improvements observed in blood sugar in the control group and improvement of micro albumin in the intervention group. This could be due to small size or short period of the study. This study shows that the use of telemedicine in the diabetic population will lead to increase physical activity as well as increased understanding of disease and complications, which could ultimately translate to better outcome for these patients. Most of the subjects in this study felt that telemedicine service is less expensive and that it was a useful service. Most of them also reported that telemedicine was significantly cost saving in terms of travel. Most of the subjects felt that it is a useful and needed service which they would readily recommend to other similar communities. This clearly exhibits that the use of telemedicine is acceptable and useful tool for delivery of diabetic care in this population.

The finding of this study should be taken with caution as this study is very small (only 40 subjects).

## CONCLUSION

This pilot study demonstrates that the use of telemedicine in rural Nepal is feasible and can be useful tool to access specialized services in a rural community, especially where such services are not available. In future, larger, controlled studies are needed to exploit the full usefulness of telemedicine, which could be an important tool in delivery of specialized health care in country like ours where there are lot of rural communities with limited health care access.

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