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A Study to Evaluate the Effectiveness of Information & Communication Technology (ICT) on Diabetes Care and Importance of Adherence to Treatment in Terms of Knowledge among Diabetes Patients attending OPD in Selected Hospitals at Meerut

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Abstract: ***Background of the study: The diabetes capital of the world with as many as 50 million people suffering from type-2 diabetes, India has the challenge to face. According to a World Health Organization (WHO) fact sheet on diabetes, an estimated 3.4 million deaths are caused due to high blood sugar. Good management reduces the risk of developing complications, enhances health-related quality of life, and reduces hospital admissions. To make living with long-term illnesses as easy as possible, people have to regularly monitor the symptoms of their conditions, adapt their lifestyles, and adhere to treatment and regularly visit appointments. Aim: The main aim of this study is to evaluatewhether mobile phone applications such as Short Message Service (SMS) (also known as text messaging), mobile app, and emails can support people to better manage their long-term illnesses by sending medication reminders or supportive messages, or by offering a way for people to communicate important information to their healthcare providers and receive feedback. Methodology: An evaluative study research approach was conducted in the study to determine the effectiveness of Information Communication Technology (ICT) on diabetes care and the importance of adherence to treatment in terms of knowledge among diabetes patients. The research design selected for the study was a Quasi-experimental pre-test post-test control group design. 60 diabetic patients (30 in the experimental and 30 in the control group) were selected in the hospital setting by non-probability purposive sampling technique. The data was collected by structured knowledge questionnaire after taking the written consent including demographic profile. Information Communication Technology (ICT) was administered on diabetes care and the importance of adherence to treatment on day first to the experimental group diabetic patients. The data collection was done, analyzed, and interpreted in terms of the objectives of the study. The data were analyzed by using descriptive and inferential statistics. Major finding of the study: Maximum of the sample in the experimental group and control group were in the age group (49 or above) years i.e. 47% and 40% respectively. The study revealed that in the experimental group out of 30 samples, 24(80%) samples were male and 6 (20%) were female and in the control group out of 30 samples, 20(67%) samples were male and 10 (33%) were female. As per the qualification majority of the sample in the experimental group and control group were degrees i.e. 16 (53%) and 21 (70%) respectively. Regarding consultation from the physician regarding diabetes most of the sample in the experimental group and control group were following treatment strictly i.e. 12(40%) and 14 (47%). The maximum number of the sample in the experimental group and control group were having type-2 diabetes i.e. 28(93%) and 30 (100%) respectively. Regarding the duration of diabetes, most of the sample in the experimental group and control group were having since 1-5 yrs. i.e. 15(50%) and 18 (60%). The majority of the sample in the experimental group and control group family types were nuclear family i.e. 15(50%) and 16(53%). As per the monthly income in experimental group and control group were having (9001 – 11000) income 18(60%) and 19(63%) respectively. The majority of the sample in the experimental group and control group source of information regarding diabetes and importance of adherence to treatment were TV/Radio/Magazine i.e. 18(60%) and 21(70%). The study revealed that the mean post-test knowledge score of diabetic patients in the experimental group (16.33) and the mean post-test knowledge score of the control group (11.23). The mean difference between the post-test knowledge score of both the group was found to be (5.10). The 't' value of (4.37) for the df (29) was found to be statically significant at 0.05 level of significance. Thus it was inferred from the findings that the Information Communication Technology (Android mobile app) regarding diabetes and the importance of adherence to treatment was effective in increasing the knowledge of the experimental group of diabetic patients. Conclusion: The study concluded that there was a knowledge deficit in diabetic patients regarding diabetes and the importance of adherence to treatment before intervention and ICT was an effective method to improve the knowledge of Diabetic Patients.***

Keywords: Evaluate, Effectiveness, Information and Communication Technology (ICT), Diabetes Care, Reminder, Android App, adherence to treatment

1. Introduction

According to **WHO (2017),** Diabetes 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. The most common is type-2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin.

Effective management of diabetes requires multidisciplinary care and self-management by patients. Good management reduces the risk of developing complications, enhances health related quality of life and reduces hospital admissions. There is a need to implement adjunctive,

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innovativeapproaches to educate diabetes patients and to assist them for the treatment in form of reminders and self-care knowledge. So according to study researcher felt the need to implement Information Communication Technology (ICT) in assisting diabetes patients.

2. Literature Survey

P. S. Singh et.al. (2017) A study was planned to determine the prevalence of diabetes mellitus in rural community by health camp and door to door approach. Fasting capillary blood glucose was first determined using a glucose meter (SD check code free, SD biosensor Inc. Korea). All the adults were given 75gm of glucose dissolved in 200ml water which was drunk over a period of up to 5 minutes and the 2-hour post load capillary blood glucose was estimated. Diabetic status was confirmed by taking blood samples for fasting and postprandial blood sugar levels in a fluoride vacutainer. Fasting plasma glucose ≥126mg/dl and or 2-hour postprandial glucose ≥200mg/dl were taken as the diagnostic criteria for diagnosis. Prevalence of type 2 diabetes in the rural population was found to be 8.03%. Prevalence was higher in female population (9.91%) as compared to males (6.79%). 19.74 % of participants over 70 yrs. of age were diabetics while diabetes was present only in 2.95% of participants in the age group of 25-39 year. The maximum number of diabetes were in the age group of 50-59 years. 10.04 % of participants were diagnosed to be Prediabetics. 35.77% of the diabetics were newly diagnosed.

Rajdeep Tyagi, Sripriya S. et al. (2015) A study was conducted which proposes 3-level Integrated Telemedicine Network Infrastructure which would pave the way for an integrated telemedicine network in India. —In a country like India, with its huge population, diverse landmass and where there is a shortage of qualified health workers and specialists in rural areas, telemedicine is going to be the most optimal solution to deliver expert advice from a central part to remotest corners of the country. There have been various efforts by disparate entities like ISRO, C-DAC, DRDO, and Apollo Hospitals and so on, which now needs a uniform, coordinated efforts and a larger participation from other players in the field of medicine and ICT.

M. Vervloet et.al. (2012) A study was conducted to investigate the effect of these SMS reminders on adherence to oral antidiabetics in patients using RTMM and investigate patients' experiences with RTMM. Real Time Medication Monitoring (RTMM) combines real time monitoring of patients' medication use with SMS reminders sent only if patients forget their medication, aiming to improve adherence. The majority of patients reported positive experiences with RTMM and SMS reminders. RTMM with SMS reminders improves adherence of type 2 diabetes patients, especially the precision with which patients follow their prescribed regimen, and is well accepted by patients.

3. Statement of the Problem

"A study to evaluate the effectiveness of Information & Communication Technology (ICT) on diabetes care and importance of adherence to treatment in terms of knowledge among diabetes patients attending OPD in selected hospitals at Meerut."

Objectives

1) To develop and validate Information & Communication Technology (ICT) intervention on diabetes care and importance of adherence to treatment for diabetes patients.
2) To assess and evaluate the knowledge on diabetes care and adherence to treatment before and after the administration of Information & Communication Technology (ICT) among experimental group.
3) To compare the knowledge on diabetes care and adherence to the treatment between experimental group and control group.
4) To find out the association between post-test knowledge on diabetes care and adherence to treatment with selected demographic variables in both experimental and control group.

Research Hypothesis (Level of significance at 0.05)

- **H1-** There will be a significant difference between pre and post-test knowledge scores regarding diabetes care and importance of adherence to treatment in experimental group as evident from structured knowledge interview schedule.
- **H2-** There will be significant difference between post-test knowledge score in experimental and controlled group.
- **H3-** There will be a significant association between post-test knowledge score of diabetic patients regarding diabetic care and importance of

Assumptions

The study assume that

1) Diabetes patients may have some knowledge regarding diabetes care and importance of adherence to treatment.
2) ICT will improve the knowledge of diabetes patients regarding diabetes care and importance of adherence to treatment.
3) Reminder system will improve the adherence to diabetes treatment.

Conceptual Framework

The conceptual framework of the present study is based on General Systems Theory with input, process, output and feedback. This model was first introduced by Ludwig Von Bertalanffy and later modified by J.W Kenny (1999).

Operational Definitions

1) **Effectiveness:** According to Cambridge dictionary effectiveness means "the ability to be successful and produce the intended results" In this study, it refers to enhancing knowledge regarding diabetic care and importance to adherence to treatment after administration of ICT as evident from structured knowledge interview schedule.
2) **Information and Communication Technology (ICT):** In this study, it refers to the teaching program through android app for diabetes patients which provide information and reminders regarding diabetes care and importance of adherence to treatment.

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a) **Diabetes care:** In this study, it refers to self-care management of patients with high blood glucose level.
b) **Reminder:** Refers to SMS, phone call or mail that serves to remind diabetes patient to adhere regular treatment.
c) **Android app:** An android app (Diabetes Assist) is developed to educate regarding diabetes and importance of adherence to treatment among diabetic patients.

3) **Adherence to the treatment:** In this study, it refers to compliance to prescribed medical intervention and follow up care.
4) **Methodology**
a) **Research Approach:** The research approach used for this study was evaluative research to accomplish the objectives of the study.
b) **Research Design:** Non-equivalent control group design.
c) **Setting:** The setting for the present study was conducted in selected hospitals at Meerut. The pilot study and main study both was conducted in Chhatrapati Shivaji SubhartiHospital and SVBP Hospital, Meerut.
5) **Variables:**
a) **Independent Variable:** In this research study, independent variable is the Information and Communication Technology Intervention on diabetic care to diabetes patients.
b) **Dependent Variable:** In the present study, the dependent variable is knowledge on diabetes and importance of adherence to treatment of diabetes patients.

4. Results and Discussions

Table 1: Frequency and percentage distribution of diabetic patients and their selected demographic characteristics (**N=60(30 exp+30 control)**

Sample characteristics	Experimental group (N = 30)		Control group (N = 30)	
	Frequency	Percentage	Frequency	Percentage
1. Age group:			-	
19- 28 years	2	7	1	3
29-38 years	4	13	5	17
39-48 years	10	33	12	40
49 or above	14	47	12	40
2. Gender				
Male	24	80	20	67
Female	6	20	10	33
3. Qualification				
a. No formal education	0	0	2	7
b. Primary education	6	20	3	10
c. Secondary education	8	27	4	13
d. Degree and above	16	53	21	70
4. How often you go for consultation?				
a. Rarely	7	23	4	13
b. Strictly	12	40	14	47
c. Unscheduled	6	20	4	13
d. Symptoms seen	5	17	8	27
5. Type of Diabetes				
a. Type 1	2	7	0	0
b. Type 2	28	93	30	100
6. Duration				
a. 1-5 yrs.	15	50	18	60
b. 6-10 yrs.	9	30	8	27
c. 10-15 yrs.	4	13	3	10
d. Above 15 yrs.	2	7	1	3
7. Type of family				
a. Joint	9	30	8	27
b. Nuclear	15	50	16	53
c. Extended	1	3	2	7
d. Others	5	17	4	13
8. Income Monthly				
a. Less than 5000	1	3	0	0
b. 5001-7000	5	17	1	3
c. 7001-9000	3	10	8	27
d. 9001-11000	18	60	19	63
e. 11001 and above	3	10	2	7

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9. Source of information				
a. TV/Radio/Magazine	18	60	21	70
b. Health Personnel	7	23	2	7
c. Family/Friends	3	10	4	13
d. Others	2	7	3	10

Table 2: Mean, mean difference, standard deviation of difference, standard error of mean difference and 't' value of pre – test and post – test knowledge scores regarding diabetes and importance of adherence to treatment of diabetic patients in experimental group .

(N=30)

Knowledge Score Experimental Group	Mean	Mean Difference	SD_D	SE_{MD}	Paired 't' value
Pre test	10.63	5.70	2.57	0.47	12.124*
Post test	16 .33				

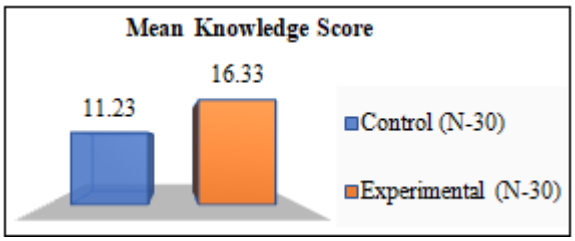
*df-29 ('table value' = 2.05), p<0.05 level of significant

The data presented in the table 3 show that in experimental group mean post – test knowledge score of diabetes patients (16.33) was higher than the mean pre –test knowledge score (10.63) with the mean difference of 5.70. The obtained mean difference was found to be statically significant as evident from the obtained 't' value (12.124) for df (29) at 0.05 level of significance. This shows that obtained mean differences was a true differences and not by chance. It can be inferred that the Information Communication Technology (ICT) by android mobile app for diabetes patients regarding diabetes was effective method for improving the knowledge of diabetes patients.

Table 3: Mean, and standard deviation of pre - test and post-test knowledge score of experimental group and control group, (N=60)

	Group	Mean	Standard Deviation
Pre – Test Knowledge Score	Control group (N = 30)	10.70	3.18
	Experimental group (N = 30)	10.63	3.35
Post – Test Knowledge Score	Control group (N = 30)	11.23	3.46
	Experimental group (N = 30)	16.33	4.56

Data represented in table 5 shows that the mean pre – test knowledge score of diabetes patients in experimental group was 10.63 and pre – test knowledge score of diabetes patients in control group was 10.70. This shows that group was homogeneous in nature and it also shows that the mean post – test knowledge score (16.33) of diabetes patients in experimental group regarding diabetes was higher than the mean post – test knowledge score (11.23) of diabetes patients in control group. There is a higher in the standard deviation from (4.56) to (3.46) which indicates that after Information Communication Technology (ICT) knowledge of diabetes patients increased in experimental group.



Bar graph shows the mean post – test knowledge score of experimental and control group.

Table 4: Frequency & percentage of knowledge scores of diabetic patients of experimental group and control group on diabetes and importance of adherence to treatment.

(N=60)

Knowledge score	Control group (post –test) N= 30		Experimental group (post-test) N = 30	
	Frequency	Frequency Percentage (%)	Frequency	Frequency Percentage (%)
Below Average (0-10)	13	43	3	10
Average (11-20)	17	57	21	70
Good Knowledge (21-30)	……	……..	6	20

Data represented in table 7 depicted that in post-test of experimental group 3 (10%) of diabetes patients were having below knowledge, 21 (70%) were having average knowledge and 6 (20%) were having good knowledge scores, whereas in control group post-test 13 (43%) were having below average knowledge and 17 (57%) were having average knowledge .Thus it indicated that the Information Communication Technology (ICT) was effective method to improve knowledge of diabetes patients regarding diabetes and importance of adherence to treatment.

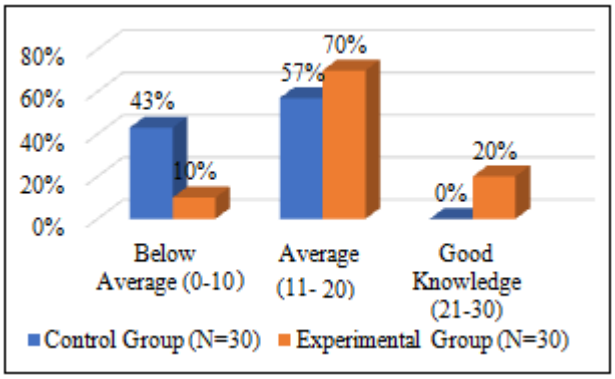


Figure shows that the Information Communication Technology (ICT) was effective method to improve knowledge of diabetes patients regarding diabetes and importance of adherence to treatment.

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Table 5: Showing association between post – test knowledge score of experimental group with selected demographic variables of diabetic patients, **(N=30)**

S.N	Demographic variables	Sample	Knowledge		chi sqrvalue		Df	Level of significance at 0.05
		Category	Below Mean	Above Mean	Cal.V	Table V.		
1	Age in years	19-28	1	1	1.45	7.81	3	NS
		29-38	3	1				
		39-48	7	3				
		49 & above	7	7				
2	Gender	Male	13	11	1.70	3.84	1	NS
		Female	5	1				
3	Qualification	No formal education	0	0	0.48	5.99	2	NS
		Primary	4	2				
		Secondary	4	4				
		Degree and above	10	6				
4	Type of family	Joint family	7	2	2.96	7.81	3	NS
		Nuclear family	8	7				
		Extended family	0	1				
		Other	3	2				
5	Family income	Less than 5000/-	1	0	4.39	9.49	4	NS
		5001-7000/-	2	3				
		7001-9000/-	1	2				
		9001-11000/-	13	5				
		Above 11001/-	1	2				
6	Source of Information	TV/radio	11	7	1.36	7.81	3	NS
		Health personnel	5	2				
		Family members and friends	1	2				
		Others	1	1				
7	How often you undergo for investigation or consultation	Rarely	5	2	3.44	7.81	3	NS
		Strictly according to schedule	8	4				
		Unscheduled	2	4				
		Symptoms of health problem seen	3	2				
8	Type of diabetes	Type-1	2	0	1.42	3.84	1	NS
		Type-2	16	12				
9	Duration of Diabetes	1-5 Yrs.	8	7	0.90	7.81	3	NS
		6-10 Yrs.	6	3				
		10-15 Yrs.	3	1				
		Above 15 Yrs.	1	1				

***At 0.05 level of significance**

The data presented in table-8 shows:

The chi square values obtained to find out the association between post – test knowledge scores of experimental group of diabetic patients selected variables.

It was found that there was no significant association between post – test knowledge with the selected demographic variables (Age , gender, qualification, type of family, income monthly, source of information, how often you undergo for consultation, type of diabetes, duration of diabetes) at 0.05 level of significance.

5. Conclusion

On the basis of the above findings of the study following conclusion could be drawn: There was knowledge deficit in diabetic patients regarding diabetes and importance of adherence to treatment. The Information Communication Technology (Android mobile app) was found to be effective in increasing the knowledge of diabetic patients in experimental group regarding diabetes and importance of adherence to treatment. The findings of the study suggest that it is needed to educate diabetes patients and to assist for the treatment in form of reminders and self-care knowledge. So according to study it is recommended to implement Information Communication Technology {ICT) in assisting diabetes patients.

6. Nursing Implications

Nursing Education: The students nurse should be provided with an opportunity to plan health education sessions on diabetes and importance of adherence to treatment in various setting like PHC, CHC in community, hence they can educate. The student nurse should be trained to use or implement the recent updates in Information Communication Technology (ICT).

Nursing Practice: Nursing personnel should plan a teaching program for diabetic patients to enhance their knowledge regarding diabetes and importance of adherence to treatment.If the diabetes patient's health status has to be improved, adequate guidance regarding diabetes and importance of adherence to treatment must be given to diabetic patients.Diabetic patients can adopt various methods of providing education regarding diabetes and importance of adherence to treatment.Individual discussion can be held in the community areas hospital for diabetic patients regarding diabetes and importance of adherence to treatment.Nursing administrator can use Information Communication Technology regularly for the diabetic

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patients to update knowledge regarding diabetes and importance of adherence to treatment.

Nursing Administration: Nursing administrators should formulate policies that will include all nurses posted in hospitals educate all diabetic patients regarding prevention of Diabetes and importance of adherence to treatment. Nursing administrators should concentrate on workshop and in- service education of nurses, who play a vital role in identification of diabetes and importance of adherence to treatment. Technology based education should be emphasized for nurses by nursing administration.

Nursing Research: There is need to conduct further research regarding diabetes and importance of adherence to treatment. Nursing research should be directed towards further exploration and update knowledge of nurses about Diabetes and importance of adherence to treatment. The finding of the study can be used to further justify the need for education of the people in the awareness and preventive aspects of health.

7. Recommendations

This study can be replicated in large samples so that finding can be generalized.

- A comparative study can be done to see the difference in the effect of the ICT regarding diabetes and importance of adherence to treatment. In government, urban and rural health centres.
- A follow up study can be conducted to assess the knowledge of diabetic patients regarding diabetes and importance of adherence to treatment.
- A study can be conducted to identify the educational need of diabetic patients on prevention of diabetes and importance of adherence to treatment.
- A similar study can be conducted by utilizing the other teaching strategies like ICT, computer assisted instructions, video films etc.
- A co-relational survey can be undertaken to find out the association between gain in knowledge and practice with selected factors like education, profession, category of diabetic patients and type of community centres.

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