MOBILE SMS: A TOOL FOR BEHAVIOUR AND LIFE STYLE MODIFICATION IN PRIMARY PREVENTION OF T2DM - A STUDY FROM KARACHI PAKISTAN

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DECLARATION

I hereby humbly declare that the thesis work entitled **'Mobile SMS: Mobile SMS: A Tool for Behaviour and Life Style Modification in Primary Prevention of T2DM - A Study from Karachi Pakistan'** a requirement for the degree of Master of Philosophy (MPhil) in Health Education and Health Promotion under the faculty of Biological Sciences, Dhaka University (DU), was carried out by me under the guidance of Professor (Dr) Liaquat Ali, Director, Bangladesh Institute of Health Sciences for the session 2011-2012.

No part of this work has been submitted elsewhere for any other academic purpose.

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CERTIFICATE

This is to certify that Mansoor Ahmed Siddiqui has completed his MPhil (Health Education & Health Promotion) thesis work entitled 'Mobile SMS: A Tool for Behaviour and Life Style Modification in Primary Prevention of T2DM - A Study from Karachi Pakistan' in the Bangladesh Institute of Health Sciences (BIHS), under Dhaka University, Dhaka under my guidance and supervision.

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This thesis entitled **'Mobile SMS: Mobile SMS: A Tool for Behaviour and Life Style Modification in Primary Prevention of T2DM - A Study from Karachi Pakistan'** is submitted by Mansoor Ahmed Siddiqui in partial fulfillment of the requirements for the degree of Master of Philosophy (Health Education and Health Promotion) under the Faculty of Biological Sciences, Dhaka University, for the Session 2011-2012. Acceptance of the thesis has been approved by:

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Mansoor Ahmed Siddiqui
MPhil Student

This thesis is dedicated to Prof. Abdul Basit and My Family

CONTENTS

ABBREVIATIONS

AMPS	Advanced Mobile phone Services
BIDE	Baqai Institute of Diabetology & Endocrinology
BIHS	Bangladesh Institute of Health Sciences
BMI	Body Mass Index
BP	Blood Pressure
CDMA	Code Division Multiple Access
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
EMS	Enhanced Messaging Services
GDM	Gestational Diabetes
GPRS	General Packed Radio Services
GSM	Global System for Mobile Communications
HP & HE	Health Promotion and Health Education
IDF	International Diabetes Federation
IGT	Impaired Glucose Tolerance
MMS	Multimedia Messaging Services
SEA	South East Asia
SMS	Short Message Services
SPSS	Statistical Package for Social Sciences
T1DM	Type1 Diabetes Mellitus
T2DM	Type2 Diabetes Mellitus
WHO	World Health Organization
WDD	Word Diabetes Day

ABSTRACT

Background

Mobile technology is an innovative way to communicate with patients regarding diabetes education. An interventional study therefore was conducted to determine the effectiveness of mobile Short Message Service (SMS) to improve knowledge and belief regarding diabetes among patients and relatives

Aim

To determine the effectiveness of mobile Short Message Service (SMS) to improve knowledge and belief regarding diabetes among patients and relatives

Methods

This interventional study was conducted among patients with diabetes and their relatives attending the out-patient department of Baqai Institute of Diabetology and Endocrinology (BIDE) a tertiary care diabetes center from July 2014 to April 2015.

The study subjects were selected by systematic randomly. Registered patients' data was collected from the electronic hospital database called Health Management System (HMS) against their medical record number, while the information of relatives was collected on a predefined questionnaire by trained diabetes educator. Even number (patients and relatives) were treated as SMS Group while odd number (patients and relatives) were treated as Non-SMS Group.

At baseline visit participant's knowledge and beliefs regarding diabetes were recorded on a predesigned questionnaire followed by an educational session given to both groups on one to one basis by a trained diabetes educator. Educational intervention regarding healthy lifestyle was repeated through SMS to the SMS Group. Two messages per days were sent to the SMS Group for two months. At the end of the study, same questionnaire was used for data collection, from both SMS and Non-SMS Group.

Statistical Package for Social Sciences (SPSS) version 17.0 was used for statistical analysis.

Results

We assessed 1040 participants for eligibility. 520 patients and 520 relatives recruited at tertiary care center. Out of 520 patients we selected 260 as a SMS Group and 260 as a Non-SMS Group similarly out of 520 relatives we selected 260 as a SMS Group (SMS) and 260 as a Non-SMS Group (Non-SMS). After SMS messaging we found that those who was getting SMS their knowledge and beliefs of becomes significantly increased.

Conclusion

We conclude that mobile phone messaging is an innovative and effective technology to improve knowledge and beliefs and reduce misconceptions regarding diabetes mellitus both among patients and relatives. Further large scale studies are needed to validate our findings.

CHAPTER 1
INTRODUCTION

INTRODUCTION

Diabetes mellitus (DM) is a major health problem all over the world leading to substantial clinical, social and economic consequences [1]. It is a common and costly chronic metabolic disease associated with significant premature mortality and morbidity requiring medical diagnosis, treatment and lifestyle changes. Burden of diabetes is increasing disproportionately in developing countries due to rapid demographic transition from traditional lifestyle to a westernized and urbanized culture. The International Diabetes Federation (IDF) indicates that the prevalence of diabetes mellitus has reached epidemic levels globally [1]. Worldwide 387 million people had diabetes in 2014 [1]; by 2035, it is estimated that more than 205 million people will have diabetes [1].

The burden of diabetes and diabetes related mortality disabilities are rising in South-East Asia (SEA). Close to one-fifth of all adults with diabetes in the world live in the South-East Asia Region. The regional prevalence of diabetes was 8.3% in 2014 and it is expected to rise to 10.1% (20-79 year of people) by 2035. In 2013, 72.1 million people had diabetes in SEA, by 2035 the number is expected to rise to 123 million. IGT regional prevalence was 2.7% in 2013 and it is expected that it will increase to 3.2% by 2035 (20-79 Years) [1]. SEA has the second highest number of deaths due to diabetes among the seven IDF regions, more than 1.1 million diabetes related deaths (20-79 years) occurred in this region in 2014 [1]. The healthcare spending on diabetes in the SEA region was estimated to be only USD 6.0 billion, which is less than 1% of the global total. This is despite the huge number of people with diabetes in this region [1].

Pakistan is a developing country located in South-East Asia where population is increasing, and health care system is debilitating [2]. Population of Pakistan is 161.66 million [3], 40% have no access to even the basic health services [4]. In 2014, prevalence of diabetes is 6.8% and it is estimated that Pakistan is among the top 10 countries which are estimated to have the highest numbers of people with diabetes in 2035. It is also estimated that diabetes related deaths in 2013 was 87354 in Pakistan [1].

Many studies have revealed that better glycemic control decreases the rate and number of diabetes-related difficulties. Facts advocate that patients who are more well-informed about diabetes self-care may be more expected to attain improved glycemic control [5]. Appropriate management needs patients to be aware of the nature of the disease, its treatment, its risk factors and its problems [6]. Patient education allows patients to get better their awareness and ability not only concerning their illness but also their treatment. It gets a better value of life, a superior therapeutic compliance and a decline in complication [7]. University of Venda study revealed that the outcome of diabetes depends primarily on the patient's self-management [8]. Health care experts therefore have main liabilities to help patients to obtain the necessary knowledge skills attitudes towards self-management [8]. But, non-adherence rates to therapies of chronic illness and to lifestyle changes are elevated with approximately ranging from 36% to 93% and averaging only 50% in developed countries [9]. A recent study among newly diagnosed type 2 diabetes in Pakistan reported 90% of patients had average to poor basic knowledge about their disease [10].

There are several components by which an individual can manage their diabetes which includes dietary adjustment, physical activity, self-monitoring of blood glucose, diabetes medications, behavioural strategies to promote lifestyle changes, and education on how to integrate these components and related healthy habits into daily living [11]. Education is likely to be effective if we know the characteristics of the patients in terms of knowledge, their attitude and practices about diabetes [12]. Age, sex, education, socioeconomic status, family history with diabetic background, media, capacity of receiving doctors advise-all these factors influences diabetic patients' and their relatives' knowledge about diabetes. In a developing country like Pakistan where total adult literacy rate (only can sign) is (54.9%) [13], the chances of improper guidance about disease are high due to the lack of understanding of patients characteristics. These can be managed properly, if the subjects are trained. Proper self-management requires patients to be aware of the nature and consequences of the disease course, its risk factors, dimensions of treatment and its complications [14, 15]. Information can help people to assess their risk of diabetes, motivate them to seek proper treatment and care, and inspire them to take charge of their disease for their lifetime [16].

Although patient education is an integral component of diabetes care, there remains uncertainness regarding the effectiveness of different methods of educational intervention. Educational Intervention through traditional health education (THE) imparted by health assistants is the usual practice to improve diabetes management, and can lower the risk for diabetes complications. THE is the set of educational interventions intended to provide individuals with information about health and to induce them to adopt attitudes and behaviours that are good for their health. Knowledge plays a vital role in any future disease development and its early prevention and detection [17]. A positive knowledge and belief are important for diabetic patients. These are interrelated and independent on each other. If output of one of these is better than it will affect the other positively. Knowledge and beliefs regarding diabetes greatly vary depending on socio-economic conditions, cultural beliefs and habits. As a result of this, diabetic education and counseling for the patient and family members are becoming important goals of diabetic patient care today.

In recent years, mobile phone interventions for health are an emerging, rapidly-evolving practice and have been used to improve delivery of health services in many countries of the world. It has been shown to have a significant influence in developing countries [18, 19]. This technology' has as of now been extensively accepted around the world; utilization of mobile and its technologies is increasing very fast, it is not only using for the purpose of social communication but also have important role in industries with finance, education, and marketing [18, 19]. It is also useful in different health related projects to promote health and avoid diseases [20]. Mobile health or mHealth is the use of mobile phone technology to use for the practice of medicine and public health support by mobile devices, which covers messaging of texts, videos, voice calling, and Internet etc. [19, 20, 21]. It can be a low cost solution to provide health education and increase adherence to treatment for people with chronic diseases like diabetes. Short message service (SMS) is a substitute technique for transfer of educational guidance and motivation to attain lifestyle modification in primary prevention [22], it is also useful for patient compliance. Mobile phone SMS have been shown to be an effective tool for providing diabetes health education, clinic and appointment reminders, medication reminder and for building awareness about the disease. This method has been shown to be effective in urban areas and among young educated population.

In 1995, people used to send SMS messages once in every two and half months [23]. Pakistan remained one of the leading countries having trend of generating great number of SMS by its users. On the year of 2010 more than 175 billion messages were sent in Pakistan alone [24]. It is also estimated that the average text messages generated by individual users were recorded 7 on daily basis whereas it reached to 200 on monthly basis till 2012 [25].

In many high-income countries the numbers of mobile phone subscriptions exceed the population, whereas in low-income countries the number is 89 per 100 inhabitants [26]. Because of the widespread ownership of mobile phones and the availability of automated messaging software, mobile phone-based interventions that encourage behavioural change could be delivered to many people at a low cost [26].

1.1 Rationale of the study

Diabetes (Type1 and Type2) is a lifelong disease, but patients can lead normal life if it is controlled. Its complications result in reduced life expectancy and key health expenses [27]. It has been proven that through continuous diabetes education knowledge, attitude and practice can be changed which, in turn, can help to improve life expectancy and can prevent complications. Diabetes can be prevented through lifestyle modification and awareness can increase life expectancy in patients through adherence to medicines. Traditionally, diabetes education has been provided on individual and group levels through conventional paper or model based tools and demonstrations with addition of fixed and static audiovisual technologies in some cases. In recent years development, availability and gradual affordability of the modern communication-based techniques (like mobile phones, television and internet based techniques) have revolutionized educational strategies particularly through its ability to approach an entire community in a synchronized manner. The use of such information & communication technology (ICT) based techniques has already been started in various areas of diabetes education particularly in developed countries and, also, in a limited way in developing countries. In diseases the impact of mobile messaging on knowledge assessment has been studied; but little work has been done to study the impact of knowledge and beliefs through SMS. Different studies proved that mobile messaging have strong impact on patient's adherence to treatment [9], adherence to oral medication [28], disease prevention, and lifestyle modification [29]. It has been

also proved that family and relatives have impact on treatment and lifestyle modifications [8]. Despite high and growing prevalence and proof that improved awareness is related to healthier results, Pakistan is facing deficiencies of planned education and knowledge based program for diabetic patients and for those who are at a high risk of the disease [30]. Very limited literature exists on the knowledge, beliefs and practices of people with diabetes in Pakistan. A study exploring at knowledge among diabetic patients in Karachi found significant deficits in the study population [31]. Another study suggested that knowledge, beliefs and practices of diabetic patients were less than satisfactory [30]. Pakistan has a high mobile phone density in Asia. In Nov 2014, there were 137,341,523 mobile phone subscribers in Pakistan, which is twice than there were in 2006 and 2007 [32]. Accordingly mobile phone based SMS can potentially be an effective tool for education of patients and their relatives in Pakistan. However this fact should not be taken for granted and the extent and dimensions in terms of different aspect of awareness) need to be explored in specific population groups and sub groups. In the above context the present study was undertaken to determine the effectiveness of Mobile SMS to improve knowledge and their belief regarding diabetes among patients and relatives.

1.2 Research Questions

- Does Mobile SMS improves knowledge on diabetes among patients and their relatives?
- Is Mobile SMS helpful for modifying believes regarding diabetes among patients and relatives?
- Is there any factors which may affect the effectiveness of mobile SMS in improving the knowledge and beliefs among patients and their relatives?

CHAPTER 2

OBJECTIVES

OBJECTIVES

2.1 General Objective

The general objective of the study was to determine the effectiveness of Mobile SMS to improve knowledge and belief regarding diabetes among patients and relatives

2.2 Specific Objectives

The specific objectives of the study were:

- To determine baseline and endline knowledge on diabetes among patients and relatives;
- To determine baseline and endline beliefs on diabetes among patients and relatives;
- To assess the effectiveness of Mobile SMS in improving knowledge on diabetes among patients and relatives;
- To assess the effectiveness of Mobile SMS to modify the beliefs on diabetes among patients and relatives; and
- To explore the factors that may influence the effectiveness of mobile SMS in improve the knowledge and beliefs among patients and their relatives.

CHAPTER 3
LITERATURE REVIEW

LITERATURE REVIEW

3.1 Short history of Diabetes

Diabetes is one of the oldest chronic disease and was described an Egyptian papyrus thousands of years ago. The best early evidence of a description of the symptoms of diabetes in the world's literature is recorded in the Ebers papyrus that appears to date from 1550 [33].

World Diabetes Day (WDD) is celebrated every year on November 14 initiated by the International Diabetes Federation (IDF) and World Health Organization (WHO). The day is illustrious of the global awareness of diabetes, its increasing rates around the world and how to put off the illness in most cases. The day marks the birthday of Frederick Banting who, along with Charles Best, was involved in the discovery of insulin in 1922 [34].

3.2 About Diabetes

Diabetes is a chronic but manageable disease which occurs due to the lack of insulin in body or when body cannot use insulin efficiently [35]. Due to the lack of insulin, glucose does not absorb properly, and glucose remains circulating in the blood which causes destructive body tissues after a while. This damage can lead to disabling and life-threatening health complications [1].

3.3 Classification of DM

Mainly, there are three types of diabetes; pre-diabetes is a period before diabetes. Impaired Glucose Tolerance (IGT) is a pre-diabetic condition of hyperglycemia where blood sugar level rises to a higher level than the standard range, but is still not high enough to be considered diabetes. Pre-diabetic patients may develop Type2 diabetes. It is a risk factor for mortality. Pre-diabetes can help keep from proceeding to an all-out conclusion of Type2 diabetes by watching their weight, physical practice and right food habits [36]. Most common forms of diabetes are three [1]:

- Type1 diabetes
- Type2 diabetes
- Gestational diabetes

3.3.1 Type1 Diabetes Mellitus (T1DM)

Type1 diabetes (juvenile diabetes or insulin-dependent) is the main and first type of diabetes. It is a long-lasting disorder in which the pancreas produces slight or not any insulin [37]. It comes about because of the dynamic devastation of pancreatic beta-cells. Genetics and exposure to certain viruses may contribute to Type1 diabetes [38]. Type1 diabetes begins as result of deficiency of insulin due to the obliteration of insulin-producing beta cells in the pancreas. Although it can develop at any age, but generally appears in children or adolescence. Survival of Type1 diabetic patients without insulin is impossible [1].

Usually type1 diabetes grows abruptly and can cause different indications such as [1]:

- Dry skin and mouth.
- Increased thirst
- Frequent urination
- Extreme hunger
- Unintended weight loss
- Mood changes
- Blurred vision
- Lack of energy
- Slow-healing wounds
- Repeated infections

With the help of insulin, healthy diet and regular exercise Type1 patients can lead normal and healthy life. Reason of developing Type1 diabetes is not known there can be several factors which can cause Type1 diabetes [1].

3.3.2 Type2 Diabetes mellitus (T2DM)

It is one of the most common and known type of diabetes, which usually occurs in adults but can happen at any age of life. It is a gradual disorder defined by insulin resistance and relative insulin shortage. Outset is generally more progressive than Type1 diabetes and may go unexplored for a period of time, leading to the growth of life-long difficulties preceding to diagnosis [39]. Although in Type2 diabetes insulin is produced, but either it is not adequate or the body is incapable to respond to its

effects. Reason of developing Type1 diabetes is still not known and there are numerous significant risk factors which are [1]:

- Weight: Overweight is a primary risk factor for Type2 diabetes.
- Inactivity: Lesser the physical activity, greater risk of Type2 diabetes.
- Family history: The risk of Type2 diabetes increases if parent or sibling has Type2 diabetes.
- Race: Ethnicity is another important factor.
- Age: The risk of Type2 diabetes increases as we get older, especially after the age of 45.
- Diet: It is another important factor due to which diabetes can occur
- High blood glucose during pregnancy affects the unborn child

3.3.3 Gestational diabetes mellitus (GDM)

It develops at the time of pregnancy due to insulin resistance and subsequent high blood glucose. It is likely to occur about the 24th week of pregnancy [1].

As gestational diabetes usually grows far along in pregnancy, the fetus is already well-formed but is still increasing. The instant threat to the baby is therefore not as severe as for those whose mother had Type1 diabetes or Type2 diabetes before pregnancy. Even so, uncontrolled GDM can have solemn values for both the mother and her baby [1].

Although gestational diabetes usually disappears after birth, those who have gestational diabetes are at a higher risk of developing gestational diabetes in subsequent pregnancies and can also develop Type2 diabetes later in life. Babies can also be affected and have higher lifetime risk of obesity and developing Type2 diabetes [1].

3.4 Impaired Glucose Tolerance (IGT) and Impaired Fasting Glucose (IGF)

IGT or IFG is also known as pre diabetes. It is condition when blood sugar level is higher than normal but not yet high enough to be classified as Type2 diabetes. IGT is demarcated as high blood sugar levels after intake; whereas IFG is demarcated as high blood sugar after a period of fasting. Without intervention, IGT is likely to become Type2 diabetes. IGT is associated with obesity, advancing age and the inability of the

body to use the insulin it produces which is same as Type2 diabetes. Effective lifestyle modification can prevent the progression to diabetes [1].

3.5 Complications of Diabetes

Complications of diabetes grow progressively but they can ultimately cause disabling and life-threatening health difficulties. Constantly high blood sugar can cause different diseases which can affect the heart, blood vessels, eyes, kidneys, and nerves. Infection is another higher risk factor for diabetic patients. Diabetes is a leading cause of cardiovascular diseases, blindness, kidney failure, and lower-limb amputation in most high income countries. Type2 diabetes prevalence is also increasing in middle and low income countries, which is impacting both humans and economy [1].

3.5.1 Cardiovascular disease (CVD)

People with diabetes have a higher chance of developing CVD. The term cardiovascular disease (CVD) includes heart disease, stroke and all other diseases of the heart and circulation. High blood pressure, high cholesterol, high blood glucose and other risk factors cause the risk of cardiovascular problems in the people with diabetes [1].

3.5.2 Kidney disease

Kidney disease is also known as nephropathy. Diabetes is a leading reason of chronic kidney disease. Nephropathy occurs due to the damage to small blood vessels due to which kidneys become less efficient, or fail altogether [1].

3.5.3 Eye disease

Diabetes may cause eye disease, which is known as retinopathy. Main cause of retinopathy is due to high blood pressure with high blood sugar and high cholesterol. Retinopathy can effect vision or provoke blindness [1].

3.5.4 Nerve damage

Neuropathy is the term used to define the nerve damage and it occurs when blood glucose and blood pressure are excessively high. Problems which can occurs due to nerve damage are digestion and urination, erectile dysfunction and a number of other functions [1].

3.5.5 Diabetic foot

Diabetic foot is one of the important and growing problems with diabetes patients, which occurs due to nerves and blood vessels damage. It can cause ulceration and infection which increases the risk of amputation. This risk of imputation is 25 times greater than in a person without diabetes [1].

3.5.6 Pregnancy complications

Uncontrolled or poorly planned pregnancy for diabetic women can be a risk factor of different complications for both mother and baby. High blood sugar during pregnancy can lead to fetal abnormalities. Regular high blood sugar in the womb can cause high risk of Type2 diabetes for the fetus later in the life [1].

3.6 Diabetes Prevention

Diabetes is the fourth or fifth leading cause of death in the high income countries and also affecting industrialized countries. Almost every country has diabetes patients. Without effective prevention and management programmes, the problem will become worldwide [1]. Prevention of diabetes comprises of supportive behavior change to modify food habits and physical activity intended at reducing obesity as well as the practice of certain glucose lowering medications. These interventions are attainable in all nations and cultures [40].

Though particularly aimed for those at risk of creating diabetes, such measures are of advantage to the health of the population overall, essentially for those at risk of creating diabetes or the individuals who as of now have the condition [40].

Complications of diabetes grow progressively and they can ultimately cause disabling and life-threatening health difficulties [1]. In treatment, prevention of complications in diabetes should be an important part. Diabetic patients can manage their life themselves that’s why they should be a part of the diabetes management team. As a result they'll make most decisions themselves to enhance their life [40].

3.7 Family Involvements to Control Diabetes

3.7.1 Role of the Family

Complete understanding of how individuals consider, and therefore deal with, their ailment must be arrived at by considering the social and family setting in which the

contemplations were produced [41]. The possible effect of the family connection on disease observations is especially significant for diabetes, as the vast majority of the self-administrative practices happen at home. Proof from a small number of studies recommends that the disease view of relatives may impact disease results. Contrasts among the disease impression of patients with chronic sickness and their spouses have been found to have a strong effect on patients' adaptive results [42], Physical, psychological, social and sexual well-being is found to be linked to the patient and spouse perceptions about the identity and consequences of MI [43]. Considerable contrasts have been found between relatives' and patients' impression of Type2 diabetes [44]. It has been observed that family members perceived diabetes as a very serious illness comparatively then the patients, which impacts the daily life [45].

3.7.2 Family Interventions in type2 diabetes

Different authors in different studies have noted that the part of family factor in diabetes intercession research has been ignored, especially in Type2 diabetes [46]. This is notwithstanding recent confirmation recommending that the incorporation of relatives in psychosocial intercessions for chronic illness may enhance sickness result [47]. A systematic review, which was on patient's family member in an intervention for patients with Type2 diabetes, was conducted in 2002. It found noteworthy weight reduction in both control and family groups. However, there was a noteworthy connection of patient management and gender, with females showing improvement over men when treated with their spouses instead of being dealt with alone [48].

3.8 Patient Knowledge and Belief to Control/Manage Diabetes

Uncontrolled high blood sugar can cause an evidently clear threat for different complications like heart disease, stroke, blindness, kidney failure, leg amputation and early death [49]. It is already scientifically verified that maximum diabetes-related pathologies are possibly preventable if best metabolic control is attained [50]. Best management of diabetes involves patients own capabilities to carry out self-management in their routine lives, and patient education is measured as a vital part of attaining this objective [51]. There is more proof that diabetic patients often have insufficient information about the nature of diabetes, its problems and other associated risks [31], and that this deficiency of awareness may be the primary reason affecting attitudes and practices towards its care [52].

Diabetes education is an essential part of diabetes care. It leads to provide better control of diabetes by improving knowledge, attitude and skill. [53]. While, it is key to note that if recommendations are to be actual, they must be sensitive to and applicable to the culture of the people expected to bring them out [54].

One latest study done in the urban areas of Bangladesh in 2014 is a good example. The study was about increasing diabetes knowledge, medication adherence, clinic attendance and glycemic control for Type2 patients by SMS which compared standard-of-care with standard-of-care plus a mobile phone-based SMS intervention. The study was conducted for six months and it was a single-centered randomized controlled intervention trial. In this study total 216 patients enrolled [9].

Another study was conducted in India in 2013 by using mobile phone messaging for prevention of Type2 diabetes by lifestyle modification in men. Total 8741 participants assessed for eligibility. 537 patients were randomly assigned to either the mobile phone messaging intervention (n=271) or standard care (n=266). The cumulative incidence of type2 diabetes was lower in those who received mobile phone messages than in controls: 50(18%) participants in the intervention group developed type2 diabetes compared with 73(27%) in the Non-SMS Group. The outcome was that mobile phone messaging is an effective method to deliver advice and support towards lifestyle modification to prevent Type2 diabetes in high risk men [29].

One more recent study in Netherlands conducted in 2012. 104 type2 diabetes patients with suboptimal adherence to oral anti-diabetics enrolled. 56 patients were randomized to receive SMS reminders if they forgot their medication, 48 patients received no reminders. Over the six-month study period, patients receiving SMS reminders took significantly more doses within predefined time windows than patients receiving no reminders: 50% vs. 39% within a 1-h window ($p = 0.003$) up to 81% vs. 70% within a 4-h window ($p=0.007$). It showed that SMS reminders improved adherence of Type2 diabetics and that it was well accepted by the patients [28].

3.9 Relatives Knowledge and Belief to Control/Manage Patients' Diabetes

Family connections assume a critical part in diabetes administration. Studies have demonstrated that low levels of clash, abnormal amounts of attachment and association, and great correspondence examples are connected with better regimen

adherence [55]. Greater levels of social backing, especially diabetes-related backing from mates and other relatives, are connected with better regimen adherence [56]. Social help additionally serves to cradle the unfriendly impact of weight on diabetes administration [57].

Studies have shown that good relationships within family, involving low levels of conflict, good communication patterns and high levels of diabetes-related support from spouse and other family members, result in better regimen adherence and serve to reduce the adverse effects of stress [57].

Self-management plays an important role for treatment of diabetes mellitus as most diabetics provide their own daily care [58]. According to research by DiMatteo, support from friends and family promotes adherence by encouraging optimism and self-esteem, which can buffer the stress of being ill and reduce patient depression [59]. However, some empirical studies have reported that social support can be a significant barrier to patients' self-management [60]

CHAPTER 4

SUBJECTS & METHODS

SUBJECTS AND METHODS

4.1 Study Design

A hospital based interventional study was conducted among diabetic subjects and their relatives attending the Baqai Institute of Diabetology and Endocrinology (BIDE) clinic in Sindh province of Pakistan. To determine the effectiveness of Mobile SMS to improve knowledge and belief regarding diabetes among patients and relatives, intervention would be the most appropriate design. The study aims to determine the effectiveness for modification of knowledge and belief regarding diabetes among patients and relatives. A questionnaire was prepared and pre and post data was collected. Blueprint of correct answers was given by local supervisor.

4.2 Study place

Study was conducted at the Baqai Institute of Diabetology & Endocrinology (BIDE) in Karachi, Pakistan. Karachi is a centre of research in biomedicine, with at least 30 public hospitals and more than 80 private hospitals. BIDE is one of the largest diabetes centers in Karachi which specializes in dealing with all types of diabetic patients. It is the only multidisciplinary diabetes hospital in Karachi. This organization has been recognized nationally and internationally as a centre of excellence for medical services and research. This clinic is providing tertiary level health care services to the patients referred from other clinics and centers. In outpatient department (OPD) patient's turnover is very high; not only from Karachi but also from all over Sindh patients are attending this clinic daily. It has a registered base of about 60,000 diabetes patients and its OPD is visited by about 40 patients every day. BIDE is providing OPD, in-patient and laboratory facilities to the patients.

4.3 Study population

The study population will be all those Pakistani peoples (men and women) who are visiting BIDE including their families and relatives.

4.4 Study Period

This study was conducted during the period of July 2014-April 2015. It included total duration from protocol development to final report submission.

4.5 Study subjects

All diabetic subjects, including Type1 and Type2 diabetic patients (both sexes) and their relatives who visited BIDE. Who was willing to participate, was selected systematic randomly.

4.6 Sample Size

Formula for the sample size for comparison of 2 proportions (one-sided) is as follows:

$((z\ \alpha + z\beta\ ))\ ^2 \times ((\pi1(1 - \pi1) + \pi2(1 - \pi2)))/(\pi1 - \pi2)^2$

Where

– n = the sample size required in each group (double this for total sample)
– $\pi1$ = first proportion=0.25,
– $\pi2$ = second proportion=0.35,
– $\pi2 - \pi1$ = size of difference of clinical importance = 0.10
– z α depends on desired significance level = 1.65 – zβ depends on desired power = 0.84

Inserting the required information into the formula gives: -
((1.65 + 0.84))^2 × (((0.25 × 0.75) + (0.35 × 0.65)))((0.10))^2 = 257 or 260

Which for each case i.e. 260 SMS Group patients, 260 Non-SMS Group patients, 260 SMS Group relatives and 260 Non-SMS group relatives, total sample size is 1040

4.7 Inclusion criteria

- Willing to participate
- Diabetes patients and their blood relatives.
- Ownership of mobile phone

4.8 Exclusion criteria

- Patients who were unwilling to participate
- Who can't read text messages of mobile phone
- Who are physically and mentally unfit

4.9 Sampling Technique

The study subjects were selected by systematic randomly. Patients who were visiting for the consultation at the OPD of BIDE were selected. After fulfilling the inclusion criteria, the registered patients' data was collected from the electronic hospital

database called Health Management System (HMS) against their code number, while the information of relatives was collected on a predefined form. Even number (patients and relatives) were treated as SMS Group while odd number were treated as Non-SMS Group.

4.10 Operational Definitions

Knowledge

From history till now knowledge has always been esteemed as the vital component in any civilization. However, and interestingly, there is still no unified definition of knowledge. This debate dates back to ancient Greece, when Plato made probably the very first attempt to define knowledge, as true and justified belief (Welbourne 2001; Chen et al. 2009).

According to oxford dictionary, knowledge is define as "Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject".

Belief

According to oxford dictionary, belief is define as "An acceptance that something exists or is true, especially one without proof"

Belief is the acceptance that comes from what we think is true in our minds, coupled with what we feel is true in our heart [61].

Diabetes: Diabetes occurs when the body cannot produce enough of the hormone insulin or cannot use insulin effectively [1].

Wrong: Wrong means completely wrong i.e. if there are 10 questions then all answers of these 10 questions are wrong.

Partially Correct: Partially correct means responded are disagree and giving wrong answers of the some questions i.e. if there are 10 questions then few of them are right and few are wrong.

Correct: Correct means completely correct or free from wrong answers i.e. if there are 10 questions then all answers of these 10 questions are correct.

Poor: Poor meanings 0-44.9% of score

Average: Average covers 45% to 59.9% score

Good: Good meaning 60% to 79.9% of score

Excellent: Excellent covers equal to or above 80% score

4.11 Variables

Following variables were studied:

4.11.1 Input Variables

4.11.1.1 Demographic Variables

1. Age
2. Sex
3. Marital Status
4. Ethnicity
5. Education
6. Nature of Employment
7. Socio Economic Status
8. Religion
9. Living with

4.11.1.2 Anthropometric Variables

1. Height (cm)
2. Weight (kg)
3. Blood Pressure
4. BMI

4.11.1.3 Disease and Therapeutic Variables

1. Diabetes
2. Hypertension
3. Family History
4. Obesity

4.11.1.4 Personal Variables

1. Name
2. Mobile No
3. City
4. How long using Mobile
5. Mobile Recharge
6. Attend education program prior
7. If Yes who give the program

4.11.2Outcome Variables

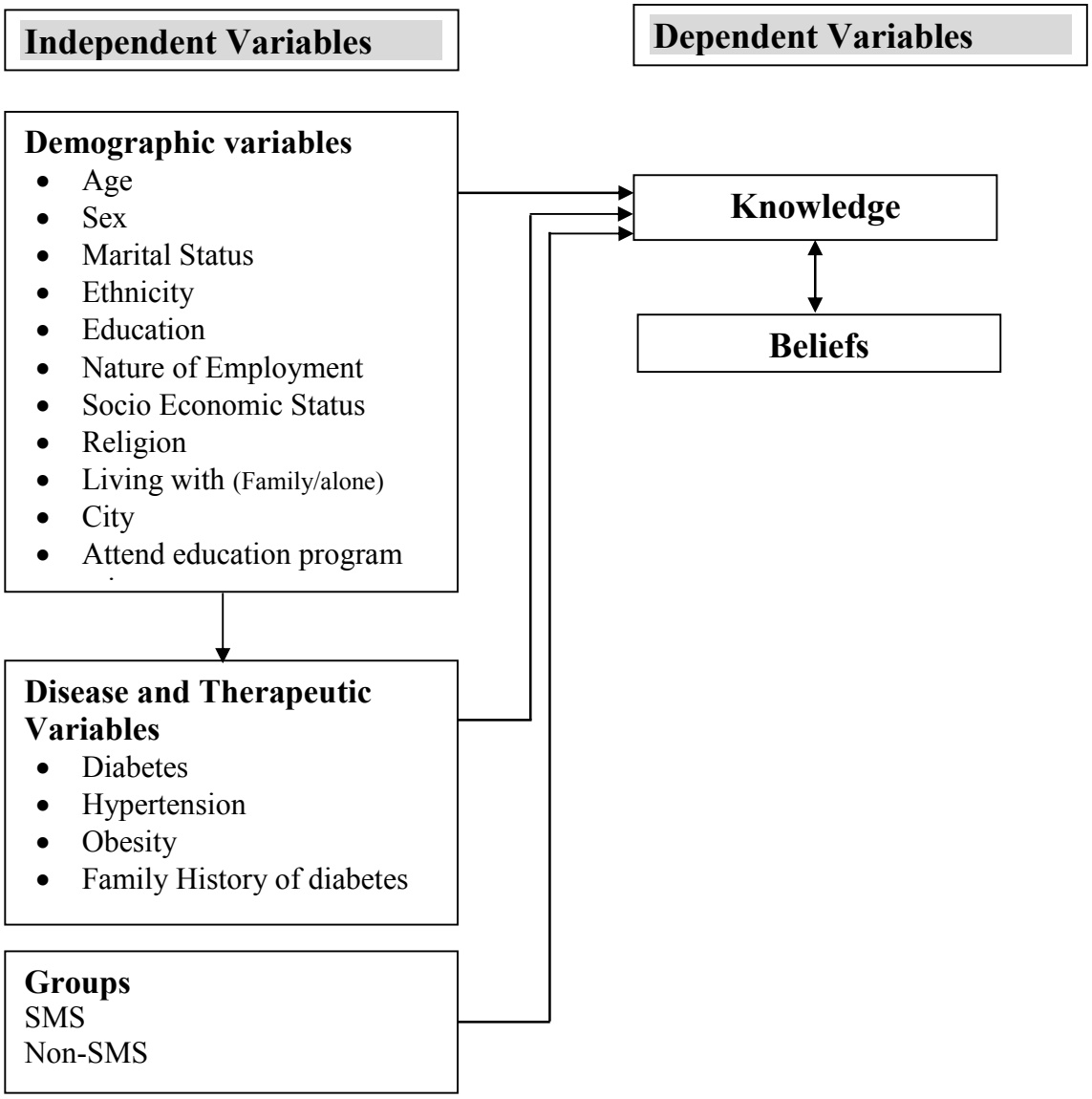
4.11.2.1 Knowledge

1. Curable Diseases
2. Blood sugar sign and symptoms
3. Causes of diabetes
4. Diagnosis of diabetes
5. Hyperglycemia Symptoms
6. Hypoglycemia Symptoms
7. Management of Diabetes
8. Diabetes consequences
9. Insulin Knowledge
10. Exercise facts

4.11.2.2 Belief

1. Lack of insulin causes diabetes
2. Sugar is a cause of diabetes
3. High blood pressure is a cause of diabetes
4. Diabetes transfer
5. Diabetes test by urine
6. Cure of diabetes
7. Sign of low blood sugar
8. Diabetes impacts hunger
9. Importance of medication in diabetes
10. Diabetes diagnosis through blood is painful
11. Those who are diabetic can't enjoy life like normal people
12. Blurred vision symptom of low blood sugar.
13. Exercise manages diabetes.
14. Insulin is addiction
15. Insulin syringe can't be reused
16. Sport for diabetic patients
17. Insulin impact kidney and heart
18. Fruit is healthy diet for diabetes
19. Diabetes cure is starvation
20. Diabetic male patient normal marital life
21. Special food for diabetics
22. Cold and cough for diabetics
23. Diabetic females can't conceive
24. Hyperglycemia extreme tiredness
25. Hyperglycemic acidity
26. Blurred vision symptom hypoglycemia
27. Morning headaches hypoglycemia
28. Diabetic patient and games

4.12 Conceptual Framework



4.13 Data Collection Method

Data was collected through a questionnaire.

4.14 Data Collection Instruments

4.14.1 Interview Administered Questionnaire

Data collected using semi-structured questionnaire based on the objective with simple and understandable language. The questionnaire was made on the basis of usual misconceptions and issues which patients and their relatives face. According to the specific objectives the variables were identified and an English questionnaire was drafted. The questionnaire included: Section A: General information, general examination, Anthropometric measurements (Height in centimeters, and Weight in kilograms) and disease history of the case. Section B: Knowledge regarding Diabetes. Section C: Beliefs regarding diabetes. Questionnaire was validated by local expert and was also made in local language.

4.14.2 Anthropometric Measurements

Height measurement - Height measured through standardized techniques and equipment. Weight measurement - Body weight measured on the stadiometer's weighing scale. Stadiometer is used for height and weight in all over the world.

Body Mass Index (BMI) - It is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m2).

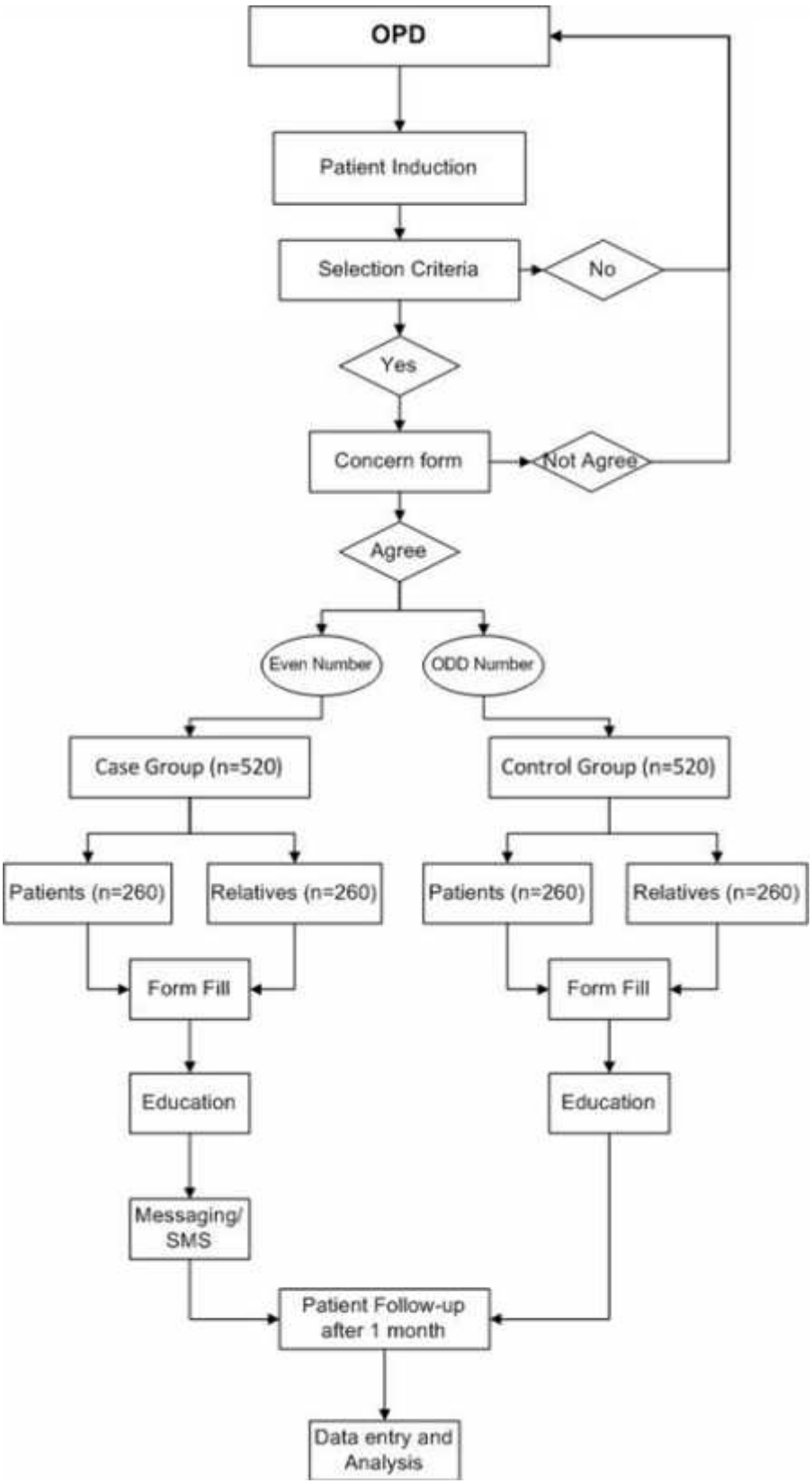
4.15 Pre-testing

To remove errors and ambiguities of data, pre-testing was done. Information was collected from 5 patients and then required modifications were done by the help of local supervisor before beginning of data collection.

4.16 Study Plan

- Patients who visited BIDE OPD and fulfilled the inclusion criteria were enrolled.
- The study was conducted among two groups: SMS and Non-SMS Groups. Consecutive subjects were assigned into SMS and Non-SMS Groups respectively.
- SMS and Non-SMS Groups included patients and one relative of each patient.
- At first, baseline data was collected over a period of one month. After collection of data an education intervention was given to both groups.
- After one month, educational intervention regarding healthy lifestyle was given through SMS to the SMS Group.
- At the end, end line data collected by using the same questionnaire.

4.17 Flow Diagram



4.18 Educational Intervention

This study with the aim to find out the effect of educational intervention based on knowledge and beliefs on 1040 patients and their relatives in BIDE Karachi Pakistan.

4.18.1 SMS Group

SMS Group consists of people with or without diabetes, to whom we are providing educational intervention through mobile messaging.

4.18.2 Non-SMS Group

Non-SMS Group consists of people with or without diabetes, to whom we are not sending interventional messages.

4.18.3 Methodology of educational intervention

At the beginning of the project, baseline data was collected over a period of one month from both SMS and Non-SMS Group. After collection of data an education intervention was given to both groups. After one month, educational intervention regarding healthy lifestyle was given through SMS to the SMS Group. Two messages per days were sent to the SMS Group for two months. At the end, end line data collected by using the same questionnaire, from both SMS and Non-SMS Group. For patients we provided a free OPD and for relatives we called them over phone.

4.19 Data management

Study records, including each volunteer's signed informed consent and other study related documents were kept in a secure area under the supervision of the local supervisor. All study data was recorded on paper based forms. Data was double-entered into computerized excel file. All personal subject identifiers were removed from the data set and all enrolled subjects were assigned a specific study number. Access to the excel file is restricted to head of BIDE research department and statistician. Data entry was done by my own. During data collection any modification to a written form or document was amended with a single line through the erroneous data. The correction was legibly entered as well as the initials and date of the person making the correction. After collection of data paper based forms were signed by the investigator.

4.20 Data analysis

All data was entered to MS-Excel from the hard copy of questionnaire and then imported in software package SPSS version 13.0 (Statistical Package for Social Sciences) for analysis.

The variables used in the study were age, gender, years of education and profession of the subjects, their socio-economics, ethnicity, type of living, marital status, religion, height, weight, body mass index, systolic and diastolic blood pressure, type of diabetes, family history of diabetes, duration of diagnosis, medication used for diabetes, hypertension, usage of mobile and mobile balance recharge history.

4.20.1 Descriptive statistics

Simple descriptive statistics were used for representing variables, that is, frequencies along with percentages or mean with standard deviation were necessary.

4.20.2 Inferential statistics

To analyze the change of before and after effects of intervention, Wilcoxon signed ranks test was used with two-tailed p-values < 0.05 considered significant. Total number of questions answered 'wrong', 'partially correct' or 'correct' were calculated of each respondent, and then analyzed for significance for before and after intervention.

4.21 Quality Control and Quality Assurance

As researcher, due to a shortage of time data collected by myself and a professional data recruiter, who was directly working under my supervision. Data entered by the professional data entry operator, which is dually checked by me, so there is least chance of quality deviation and bias.

4.22 Ethical consideration

4.22.1 Approvals

Ethical permission for this study was granted by ethical board of Baqai Institute of Diabetology and Endocrinology (BIDE). It is registered under Baqai Medical University.

4.22.2 Individual consent

Verbal and written consent was received from both patient and their relatives before data collection. The process and advantages and disadvantages of taking part were explained to all participants. Verbal consent was obtained, and participants were informed that they could stop taking part at any time.

CHAPTER 5

RESULTS

RESULTS

The overall findings of the study are described under following headings:

5.1. Socio-demographic, anthropometric and clinical characteristics of the study subjects
  - 5.1.1. Socio-demographic, anthropometric and clinical characteristics of patients
  - 5.1.2. Socio-demographic, anthropometric and clinical characteristics of relatives

5.2. Pre and post mean knowledge and belief scores for the patients

5.3. Pre and post mean knowledge and belief scores for the relatives

5.4. Level of knowledge distribution of the study subjects in Non-SMS and SMS group
  - 5.4.1. Level of knowledge distribution of the patients
  - 5.4.2. Level of knowledge distribution of the relatives

5.5. Level of beliefs distribution of the study subjects in Non-SMS and SMS group
  - 5.5.1. Level of beliefs distribution of the patients
  - 5.5.2. Level of beliefs distribution of the relatives

5.6. Association of knowledge and belief with age among patients

5.7. Age versus knowledge of patients in Non-SMS group

5.8. Association of knowledge and belief with age among relatives

5.9. Age versus beliefs of patients in SMS group

5.10. Determinants by linear regression analysis of knowledge and belief scores
  - 5.10.1 Determinants of selected factors by linear regression analysis of patients' knowledge in pre and post intervention
  - 5.10.2 Determinants by linear regression analysis of pre and post knowledge of the patients
  - 5.10.3 Determinants by linear regression analysis of pre and post knowledge of the relatives

5.11. Frequency distribution of the participants of the study subjects with individual question vise knowledge levels
  - 5.11.1 Frequency distribution of the patients with individual question vise knowledge levels
  - 5.11.2 Frequency distribution of the relatives with individual question vise knowledge levels

5.12. Frequency distribution of the participants of the study subjects with individual question vise beliefs levels
  - 5.12.1 Frequency distribution of the patients with individual question vise belief levels
  - 5.12.2 Frequency distribution of the relatives with individual question vise belief levels

5.1 Socio-demographic, anthropometric and clinical characteristics of the study subjects

5.1.1 Socio-demographic, anthropometric and clinical characteristics of patients

Table 1 shows the socio-demographic, anthropometric and clinical characteristics of patients. The mean age of patients in SMS group was 45.41±15.13 and 47.06±14.83 in Non-SMS group. There were 102 males and 86 females in SMS group, and 67 males and 72 females in Non-SMS group. Height, weight and BMI of subjects were approximately same in both groups. Majority of patients were married, living with family and had type2 diabetes; with no problem of hypertension. No significant difference was found between SMS and Non-SMS groups in any variable except for years of education (p=0.040) and living status (p=0.039).

Table1: Socio-demographic, anthropometric and clinical characteristics of patients with in the Non-SMS and SMS groups

Variables	**Non-SMS group (n=139)**	**SMS group (n=188)**	**p-value**
Age	47.06±14.83	45.41±15.13	0.329
Gender			
Male	67 (48.2%)	102 (54.3%)	0.279
Female	72 (51.8%)	86 (45.7%)	
Weight (Kg)	72.21±16.32	71.22±17.24	0.606
Height (cm)	160.75±10.41	161.58±9.80	0.466
Body mass index (Kg/m^2)	27.87±5.44	27.28±6.54	0.401
Systolic blood pressure (mmHg)	123.62±16.67	125.31±19.93	0.427
Diastolic blood pressure(mmHg)	75.64±9.80	77.45±10.04	0.111
Marital status			
Single	25 (18.0%)	31 (16.5%)	0.938
Married	109 (78.4%)	150 (79.8%)	
Others (Divorced, widow, etc.)	5 (3.6%)	7 (3.7%)	
Education (years)			
≤ 5	27 (19.4%)	36 (19.1%)	**0.040**
6 to 10	55 (39.6%)	50 (26.6%)	
11 to 14	48 (34.5%)	78 (41.5%)	
> 14 years	9 (6.5%)	24 (12.8%)	
Living Status			
Alone	8 (5.8%)	3 (1.6%)	**0.039**
Family	131 (94.2%)	185 (98.4%)	

Type of diabetes			
Type 1	16 (11.5%)	32 (17.0%)	0.284
Type 2	111 (88.5%)	156 (83.0%)	
Medications for diabetes			
Oral Hypoglycemic Agents	45 (32.4%)	52 (27.6%)	0.584
Insulin	50 (36.0%)	68 (36.2%)	
Both	44 (31.6%)	68 (36.2%)	
Hypertension			
Yes	26 (18.7%)	43 (22.9%)	0.618
No	109 (78.4%)	141 (75%)	
Do not know	4 (2.9%)	4 (2.1%)	

Data presented as number (percentage) or Mean ± SD, Comparison done by chi-square test for categorical variables and Students't-test for continuous variables, p-value < 0.05 was considered statistically significant

5.1.2 Socio-demographic, anthropometric and clinical characteristics of relatives

Table 2 shows the socio-demographic, anthropometric and clinical characteristics of relatives. The mean age of subjects was 34.58±11.91 in SMS group and 31.02±11.51 in Non-SMS group having a significant difference (p=0.008). Number of males was 102 and 64 respectively SMS and Non-SMS groups. Similarly, number of females was 86 in SMS group and 73 in Non-SMS group. In both groups, almost all of the subjects were living with family and were non diabetic; also, majority of them were married. Significant difference between SMS and Non-SMS groups was found in age (p = 0.008), weight (p<0.001), marital status (p=0.003) and years of education (p=0.023).

Table2: Socio-demographic, anthropometric and clinical characteristics of relatives with respect to Non-SMS and SMS group

Variables	Non-SMS group (n=137)	SMS group (n=188)	p-value
Age	31.02±11.51	34.58±11.91	**0.008**
Gender			
Male	64 (46.7%)	102 (54.3%)	0.179
Female	73 (53.3%)	86 (45.7%)	
Weight (Kg)	61.18±14.80	66.82±13.53	**<0.001**
Height (cm)	158.02±16.07	161.60±12.48	**0.028**
Body mass index (Kg/m^2)	24.79±6.04	25.74±5.70	0.159
Systolic blood pressure (mmHg)	133.70±27.94	133.31±26.03	0.902
Diastolic blood pressure (mmHg)	73.62±11.45	72.96±11.22	0.612
Marital status			
Single	56 (40.9%)	46 (24.5%)	**0.003**
Married	80 (58.4%)	136 (72.3%)	
Others (Divorced, widow, etc.)	1 (0.7%)	6 (3.2%)	
Years of education			
≤ 5	15 (10.9%)	20 (10.7%)	**0.023**
6 to 10	57 (41.6%)	51 (27.1%)	
11 to 14	49 (35.8%)	97 (51.6%)	
> 14 years	16 (11.7%)	20 (10.6%)	
Living Status			
Alone	4 (2.9%)	3 (1.6%)	0.417
Family	133 (97.1%)	185 (98.4%)	

Type of diabetes			
Type 1	1 (40.0%)	0 (0%)	0.342
Type 2	4 (80.0%)	4 (100%)	
Medications for diabetes			
Oral Hypoglycemic Agents	2 (40.0%)	0 (0%)	0.056
Insulin	1 (20.0%)	4 (100%)	
Both	2 (40.0%)	0 (0%)	
Hypertension			
Yes	4 (2.9%)	7 (3.7%)	0.671
No	129 (94.2%)	178 (94.7%)	
Do not know	4 (2.9%)	3 (1.6%)	

Data presented as number (percentage) or Mean ± SD, Comparison done by chi-square test for categorical variables and Students't-test for continuous variables, p-value < 0.05 was considered statistically significant

5.2 Pre and post mean knowledge and belief scores for the patients

Table 3 shows the comparison between total pre and post mean knowledge and belief scores of patients. In both SMS and Non-SMS group, the mean knowledge score from pre to post, shows a significant change which is p=0.001 for both, however, the change was higher in SMS group than Non-SMS group. Mean difference in Non-SMS group of pre and post is 15.11 while mean difference in SMS group of pre and post is 41.46. While similarly in belief both SMS and Non-SMS group, the mean belief score from pre to post shows a significant change which is p=0.001 for both, however, the change was higher in SMS group than Non-SMS group. Mean difference in Non-SMS group of pre and post is 14.46 while mean difference in SMS group of pre and post is 21.48.

Table3: Knowledge and beliefs scores of the **Patients** within the Non-SMS and SMS group

	Non-SMS Group (n=139)			**SMS Group (n=188)**			**Non-SMS Verses SMS**	
	Pre	**Post**	**p-value**	**Pre**	**Post**	**p-value**	**Pre p-value**	**Post p-value**
Knowledge	36.20 ± 11.69	51.31 ± 17.23	0.001	37.98 ± 11.09	79.44 ± 9.33	0.001	0.164	**0.001**
Beliefs	49.51 ± 13.58	63.97 ± 13.82	0.001	54.92±12.18	76.40 ± 7.98	0.001	**0.001**	**0.001**

The result is expressed as parametric test, mean ± SD, and number (%) where as an appropriate. Significant test is done by student' t'test.

5.3 Pre and post mean knowledge and belief scores for the relatives

Table 4 shows the comparison between total pre and post mean knowledge and belief scores of relatives. In both SMS and Non-SMS group, the mean knowledge score from pre to post, shows a significant change which is p=0.001 for both, however, the change was higher in SMS group than Non-SMS group. Mean difference in Non-SMS group of pre and post is 17.1 while mean difference in SMS group of pre and post is 41.86. While similarly in beliefs both SMS and Non-SMS group, the mean belief score from pre to post, shows a significant change which is p=0.001 for both, however, the change was higher in SMS group than Non-SMS group. Mean difference in Non-SMS group of pre and post is 15.41 while mean difference in SMS group of pre and post is 22.53

Table4: Knowledge and beliefs scores of the **Relatives** within the Non-SMS and SMS group

	Non-SMS Group (n=137)			**SMS Group (n=188)**			**Non-SMS Verses SMS**	
	Pre	**Post**	**p-value**	**Pre**	**Post**	**p-value**	**Pre p-value**	**Post p-value**
Knowledge	34.65 ±11.65	51.75 ±18.62	0.001	37.73 ± 11.22	79.59± 10.00	0.001	0.0167	**0.001**
Beliefs	48.18 ± 14.79	63.59±1 5.39	0.001	54.09±1 2.89	76.62± 7.26	0.001	**0.001**	**0.001**

The result is expressed as parametric test, mean ± SD, and number (%) where as an appropriate. Significant test is done by student's t-test.

5.4 Level of knowledge distribution of the study subjects in Non-SMS and SMS group

5.4.1 Level of knowledge distribution of the patients

Table 5 shows level of knowledge distribution of the patients at pre and post conditions. Out of 188 patients in SMS group, 141 had poor level of knowledge, 41 had average, 6 had good knowledge and none had excellent level of knowledge at baseline. Similarly for the Non-SMS group, of 139, 103 had poor, 34 had average, 2 had good knowledge and none had excellent level of knowledge. No significant difference was observed between SMS and Non-SMS group. At the end line, a huge change was observed in the SMS group. There was also a significant change in the Non-SMS group, but the change was very small as compared to the SMS group which can easily seen by the calculated p-value. Chi-square test was used for comparing SMS and Non-SMS group and two sample proportion z-test was used for comparing each level at pre and post. $p<0.05$ was considered statistically significant.

Table5: Level of knowledge distribution of **patients**

Level	Non-SMS group (n=139)			SMS group (n=188)			Non-SMS vs. SMS group	
	Pre	Post	p-value	Pre	Post	p-value	Pre p-value	Post p-value
Poor	103 (74.1%)	47 (33.8%)	<0.0001	141 (75.0%)	0 (0.0%)	<0.0001	0.533	<0.0001
Average	34 (24.5%)	45 (32.4%)	<0.0001	41 (21.8%)	7 (3.7%)	<0.0001		
Good	2 (1.4%)	42 (30.2%)	<0.0001	6 (3.2%)	85 (45.2%)	<0.0001		
Excellent	0 (0.0%)	5 (3.6%)	<0.0001	0 (0.0%)	96 (51.1%)	<0.0001		

Data presented as number (percentage), Chi-square and paired sample t-test was done, p-value < 0.05 was considered statistically significant

5.4.2 Level of knowledge distribution of the relatives

Table 6 shows level of knowledge distribution of relatives at pre and post conditions. Just like the patients, same level of knowledge was observed at baseline. On the other hand, in the Non-SMS group, of 137, 111 had poor, 25 had average, 1 had good knowledge and none had excellent level of knowledge. No significant difference was observed between SMS and Non-SMS group with $p<0.0001$. At the end line, a huge change was observed in the SMS group. There was also a significant change in the Non-SMS group, but the change was very small as compared to the SMS group which can easily seen by the calculated p-value. Chi-square test was used for comparing SMS and Non-SMS group and two sample proportion z-test was used for comparing each level at pre and post. $p<0.05$ was considered statistically significant.

Table6: Level of knowledge of **relatives**

Level	Non-SMS group (n=137)			SMS group (n=188)			Non-SMS vs. SMS group	
	Pre	Post	p-value	Pre	Post	p-value	Pre p-value	Post p-value
Poor	111 (81.0%)	48 (35.0%)	<0.0001	141 (75.0%)	1 (0.5%)	<0.0001	0.2130	<0.0001
Average	25 (18.2%)	38 (27.7%)	<0.0001	41 (21.8%)	7 (3.7%)	<0.0001		
Good	1 (0.7%)	45 (32.8%)	<0.0001	6 (3.2%)	78 (41.5%)	<0.0001		
Excellent	0 (0.0%)	6 (4.4%)	<0.0001	0 (0.0%)	102 (54.3%)	<0.0001		

Data presented as number (percentage), Chi-square and paired sample t-test was done, p-value <0.05 was considered statistically significant

5.5 Level of beliefs distribution of the study subjects in Non-SMS and SMS group

5.5.1. Level of beliefs distribution of the patients

Table 7 shows level of beliefs distribution of patients at pre and post conditions. Out of 188 patients in SMS group, 31 had poor, 83 had average, 74 had good belief and none had excellent level of belief at baseline. In the Non-SMS group, of 137, 42 had poor, 66 had average, 30 had good belief and 1 had excellent level of belief. At end line, there was a significant change observed in the SMS group at each level of belief. There was also a significant change in the Non-SMS group, but the change was very small as compared to the SMS group with $p<0.0001$. $p<0.05$ was considered statistically significant. Chi-square test was used for comparing SMS and Non-SMS group and two sample proportion z-test was used for comparing each level at pre and post.

Table7: Level of beliefs distribution of the **patients**

	Non-SMS group (n=139)			**SMS group (n=188)**			**Non-SMS vs. SMS group**	
Level	**Pre**	**Post**	**p-value**	**Pre**	**Post**	**p-value**	**Pre p-value**	**Post p-value**
Poor	42 (30.2%)	13 (9.4%)	<0.0001	31 (16.5%)	2 (1.1%)	<0.0001	0.0010	<0.0001
Average	66 (47.5%)	41 (29.5%)	0.0019	83 (44.1%)	3 (1.6%)	<0.0001		
Good	30 (21.6%)	72 (51.8%)	<0.0001	74 (39.4%)	127 (67.6%)	<0.0001		
Excellent	1 (0.7%)	13 (9.4%)	0.0010	0 (0.0%)	56 (29.8%)	<0.0001		

Data presented as number (percentage), Chi-square and paired sample t-test was done, p-value < 0.05 was considered statistically significant

5.5.2 Level of beliefs distribution of the relatives

Table 8 shows level of belief distribution of the relatives at pre and post conditions. Out of 188 relatives in SMS group, 34 had poor, 93 had average, 60 had good beliefs and 1 had excellent level of belief at baseline. Similarly for the Non-SMS group, of 137, 49 had poor, 57 had average, 31 had good beliefs and none had excellent level of belief. At end line, a huge change was observed in the SMS group. There was a significant change in the Non-SMS group, but the change was very small as compared to the SMS group having $p<0.0001$. $p<0.05$ was considered statistically significant. Chi-square test was used for comparing SMS and Non-SMS group and two sample proportion z-test was used for comparing each level at pre and post.

Table8: Level of beliefs distribution of the **relatives**

	Non-SMS group (n=137)			**SMS group (n=188)**			**SMS vs. Non-SMS group**	
Level	**Pre**	**Post**	**p-value**	**Pre**	**Post**	**p-value**	**Pre p-value**	**Post p-value**
Poor	49 (35.8%)	17 (12.4%)	<0.0001	34 (18.1%)	0 (0.0%)	<0.0001	0.0030	<0.0001
Average	57 (41.6%)	31 (22.6%)	0.0008	93 (49.5%)	8 (4.3%)	<0.0001		
Good	31 (22.6%)	75 (54.7%)	<0.0001	60 (31.9%)	121 (64.4%)	<0.0001		
Excellent	0 (0.0%)	14 (10.2%)	0.0001	1 (0.5%)	59 (31.4%)	<0.0001		

Data presented as number (percentage), Chi-square and paired sample t-test was done, p-value < 0.05 was considered statistically significant

5.6 Association of knowledge and belief with age among patients

Table 9 shows association between knowledge and belief scores of patients with their age. Significant association was found in post knowledge and belief scores of the Non-SMS group and post belief score in SMS group. $p<0.05$ was considered as statistically significant.

Table9: Association of age of **patients** with their knowledge and belief scores

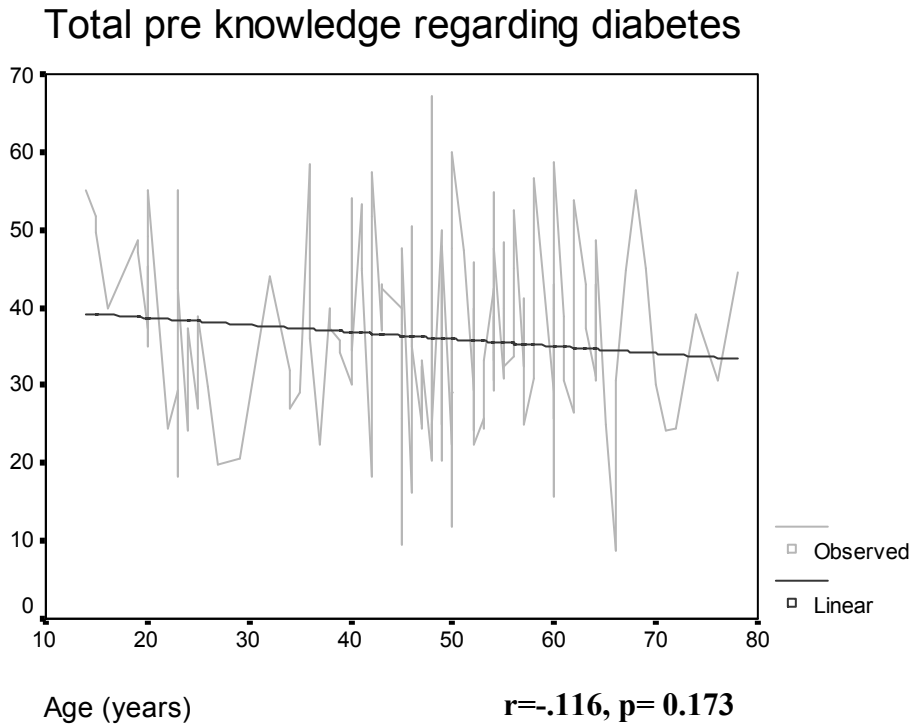
Variables	Non-SMS group		SMS group	
	Pre	**Post**	**Pre**	**Post**
	r/p	**r/p**	**r/p**	**r/p**
Knowledge	-0.116/0.173	-0.240/**0.004**	-0.098/ 0.183	0.041/ 0.540
Belief	-0.096/ 0.261	0.315/**0.001**	0.011/0.135	0.239/**0.001**

The level of significance at $p < 0.05$; r = correlation coefficient.

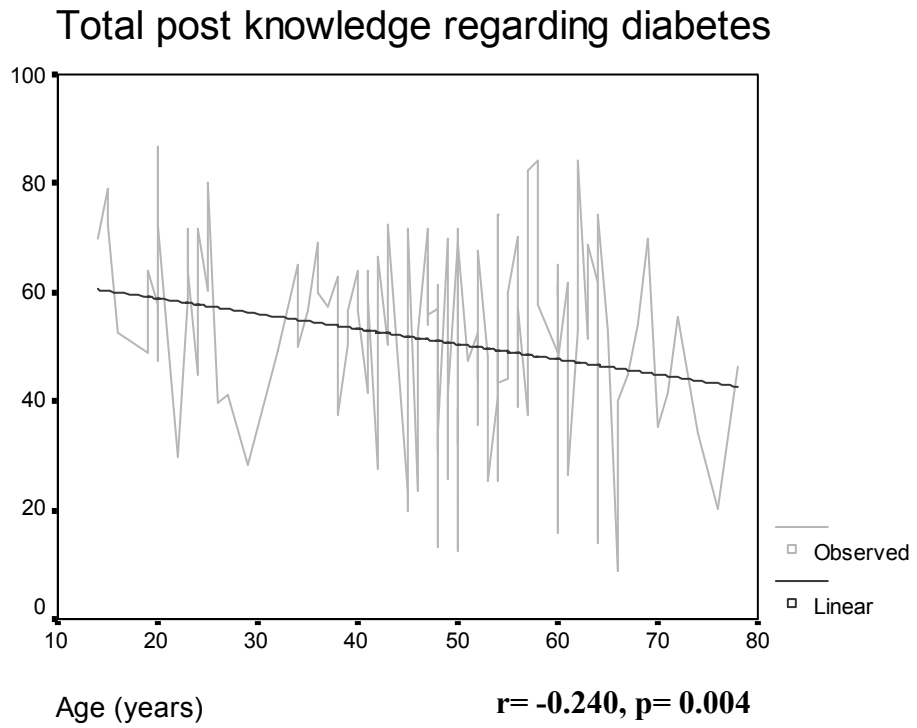
5.7 Age versus knowledge of patients in Non-SMS group

According to the results, it was found that there was a significant association of age with post knowledge and belief scores of patients in the Non-SMS group. Hence, in figure 1 and figure 2, a graphical illustration is presented which shows that, higher the age of patient, lower the post knowledge and belief score they will obtain.

Figure1: Age versus knowledge of **patients** in Non-SMS group (Pre and post)



r=-.116, p= 0.173



r= -0.240, p= 0.004

5.8 Association of knowledge and belief with age among relatives

Table 10 shows association between knowledge and belief scores of relatives with their age. Significant association was found in pre knowledge and post belief scores of the Non-SMS group and pre belief score in SMS group. $p<0.05$ was considered as statistically significant.

Table 10:Association of knowledge and belief with age among **relatives**

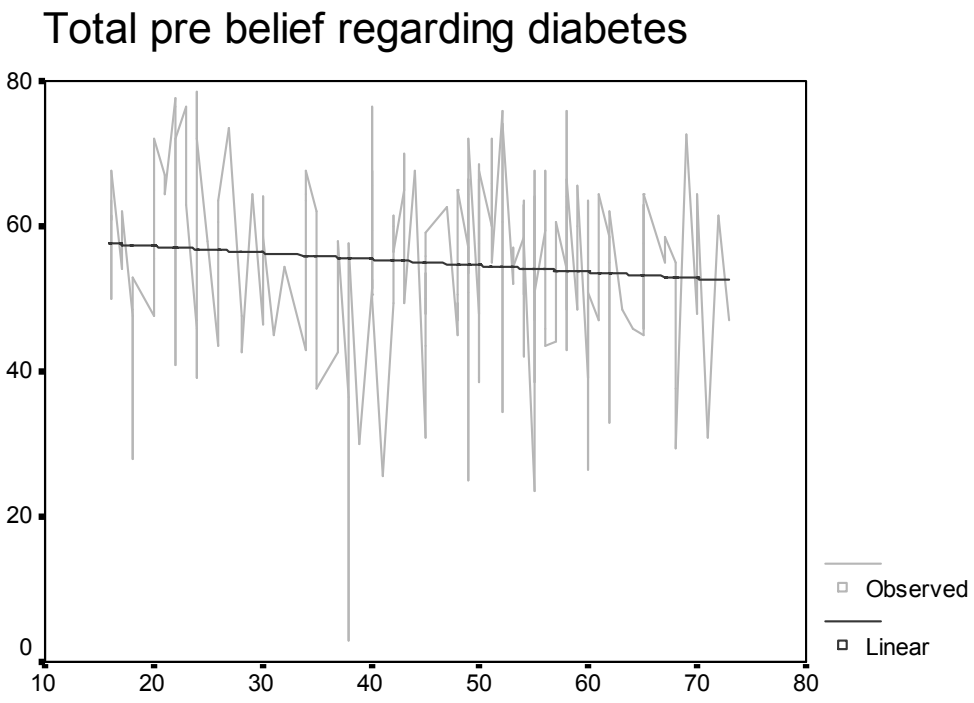
Variables	Non-SMS group		SMS group	
	Pre	**Post**	**Pre**	**Post**
	r/p	**r/p**	**r/p**	**r/p**
Knowledge	0.204/**0.019**	0.144/0.098	0.071/0.345	0.054/0.474
Belief	0.099/0.259	0.174/**0.046**	0.215/**0.004**	0.057/0.446

The level of significance at $p < 0.05$; r = correlation coefficient.

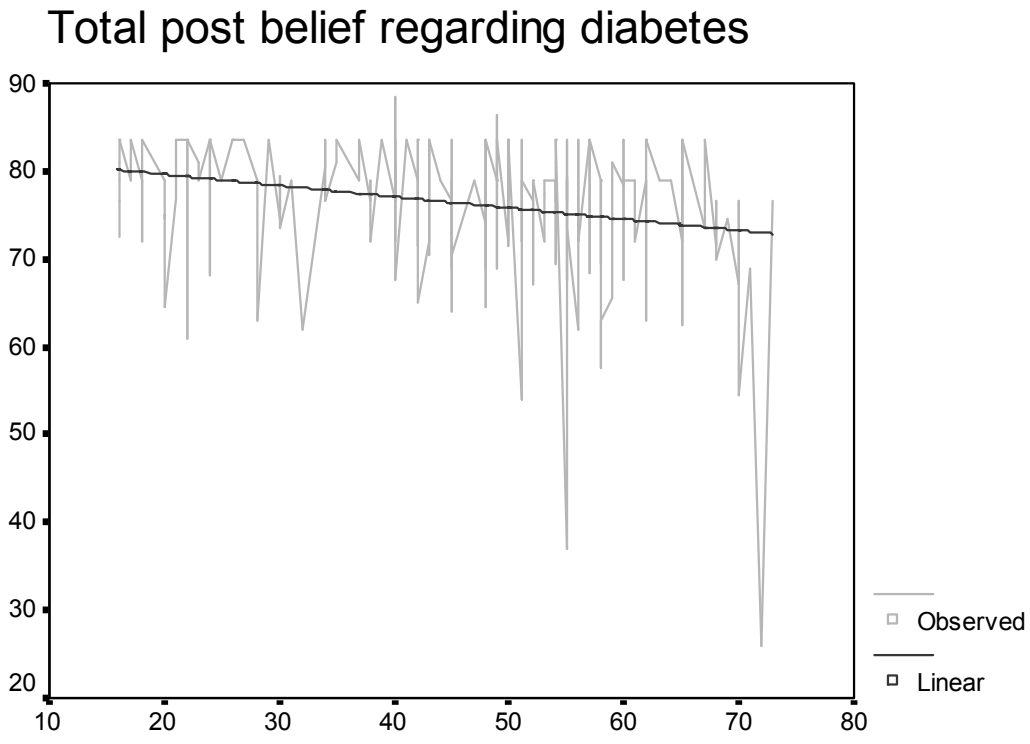
5.9 Age versus beliefs of patients in SMS group

According to the results in Figure 1 and 2, it was found that there was a significant association of age with post knowledge and belief scores of patients in the Non-SMS group. Hence, in figure 1 and figure 2, a graphical illustration is presented which shows that, higher the age of patient, lower the post knowledge and belief score they will obtain.

Figure 2: Age versus beliefs of **patients** in SMS group (Pre and post)



r= -0.011, p= 0.135



r= -0.239, p= 0.001

5.10 Determinants by linear regression analysis of knowledge and belief scores

5.10.1 Determinants of selected factors by linear regression analysis of patients' knowledge in pre and post intervention

Table 11 shows the specific selected independent variables, which we found have significant impact in table 12. In groups Non-SMS and SMS both have significant impacts in pre and post condition, but when we compare Non-SMS to SMS in pre to pre and post to post, in that condition only post have significant impact ($p<0.001$).

In gender and Medications used for diabetes in Non-SMS and SMS in pre and post conditions both have significant impact

Table11: Determinants of selected subgroup variables of **patients'** knowledge in pre and post intervention

Variables	Pre	Post	t/p
Group			
Non-SMS	36.20±11.69	51.31±17.29	-41.490/**<0.001**
SMS	37.97±11.09	79.44±9.33	-10.935/**<0.001**
t/p	1.384/0.167	17.45/<**0.001**	
Gender			
Male	36.88±10.53	67.62±18.34	-20.908/**<0.001**
Female	37.59±12.21	67.33±20.18	-18.264/**<0.001**
t/p	-0.562/0.574	0.137/0.891	
Medications used for diabetes			
Oral	35.10±10.16	66.59±20.00	-15.923/**<0.001**
Insulin	38.55±11.85	68.70±18.61	-21.714/**<0.001**
t/p	-2.599/**0.010**	-0.875/0.383	

5.10.2 Determinants by linear regression analysis of pre and post knowledge of the patients

Table 12 shows coefficients and their statistical significance; obtain by simple linear regression with dependent variable 'knowledge of relatives' and independent variables 'group (Non-SMS, SMS)', 'age', 'gender', 'marital status', 'BMI', 'Medication used for diabetes', 'weight', 'education', 'living with', 'type of diabetes' and 'Hypertension history'. Linear regressions were used; one with pre knowledge of relatives and other with post knowledge of relatives. The results suggest that each independent variable has no significance impact on knowledge score of relatives except for 'group (Non-SMS, SMS) (p =.001)'.

Table12: Determinants by linear regression of pre and post knowledge scores of the **patients**

Independent Variable	**Pre knowledge**		**Post knowledge**	
	β	**p-value**	**β**	**p-value**
Groups (SMS vs. Non-SMS)	-0.051	0.432	-0.753	**<0.001**
Age (years)	-0.077	0.417	0-.015	0.811
Gender (Male, Female)	0.049	0.463	0.045	0.315
Marital status (Single, Others*)	-0.061	0.513	-0.055	0.373
Body mass index (BMI)	-0.030	0.679	-0.041	0.403
Medication used for diabetes (Oral, Insulin)	0.156	**0.022**	-0.026	0.559
Education (Years) (up to 10, >10)	0.041	0.520	0.009	0.830
Living With (Alone, Family)	-0.044	0.498	-0.033	0.444
Type of diabetes (Type1, Type2)	0.131	0.151	0.008	0.891
Hypertension history (Yes, No)	0.045	0.490	-0.010	0.816
(Constant)		0.003		<0.001

β for standardized regression coefficient, patients knowledge was taken as dependent variable whereas other taken as independent variables
p-value < 0.05 was considered statistically significant
* Married, Divorced, Widow

5.10.3 Determinants by linear regression analysis of pre and post knowledge of the relatives

Table 13 shows coefficients and their statistical significance; obtain by simple linear regression with dependent variable 'knowledge score of relatives' and independent variables 'age', 'marital status', 'height',' weight' and 'years of education. Two linear regressions were used; one with pre knowledge score of relatives and other with post knowledge scores of relatives. The results suggest that each independent variable has no significance impact on knowledge score of relatives except for 'height'. However, the impact of height on knowledge scores of relatives in very small.

Table13: Linear regression of pre and post knowledge scores of **relatives**

Independent Variable	**Pre knowledge**		**Post knowledge**	
	β	**p-value**	**β**	**p-value**
Groups (SMS vs. Non-SMS)	-0.089	0.147	-0.660	**<0.001**
Age (years)	0.099	0.198	0.014	0.811
Gender (Male, Female)	0-.041	0.489	-0.029	0.513
Marital status (Single, Others*)	0.100	0.199	0.097	0.094
Body mass index (BMI)	-0.190	**0.003**	-0.095	0.**042**
Education (Years) (up to 10, >10)	0.082	0.176	0.059	0.189
Living With (Alone, Family)	0.057	0.342	0.014	0.753
(Constant)		0.012		<0.001

β for standardized regression coefficient, patients knowledge was taken as dependent variable whereas other taken as independent variables
p-value < 0.05 was considered statistically significant
* Married, Divorced, Widow

5.10.4 Determinants by linear regression analysis of pre and post beliefs of the patients

Table 14 shows coefficients and their statistical significance; obtain by simple linear regression with dependent variable 'belief score of patients' and independent variables 'years of education' and 'living'. Two linear regressions were used; one with pre belief score of patients and other with post belief scores of patients. The results suggest that 'years of education' has a significant impact on belief scores of patients; however, the impact is very small.

Table14: Linear regression of pre and post belief scores of **patients**

Independent Variable	Pre beliefs		Post beliefs	
	β	**p-value**	**β**	**p-value**
Groups (SMS vs. Non-SMS)	-0.190	0.006	-0.502	**<0.001**
Age (years)	-0.020	0.822	-0.204	**0.010**
Gender (Male, Female)	0.037	0.561	-0.006	0.911
Marital status (Single, Others*)	-0.208	**0.019**	-0.001	0.991
Body mass index (BMI)	0.074	0.288	0.012	0.848
Medication used for diabetes (Oral, Insulin)	0.053	0.412	-0.042	0.455
Education (Years) (up to 10, >10)	0.216	**0.001**	0.036	0.502
Living With (Alone, Family)	0.017	0.784	-0.013	0.810
Type of diabetes (Type1, Type2)	0.039	0.654	-0.049	0.524
Hypertension history (Yes, No)	-0.011	0.856	0.057	0.293
(Constant)		0.000		<.001

β for standardized regression coefficient, patients knowledge was taken as dependent variable whereas other taken as independent variables
p-value < 0.05 was considered statistically significant
* Married, Divorced, Widow

5.10.5 Determinants by linear regression analysis of pre and post beliefs of the relatives

Table 15 shows coefficients and their statistical significance; obtain by simple linear regression with dependent variable 'belief score of relatives' and independent variables 'age', 'marital status', 'height',' weight' and 'years of education. Two linear regressions were used; one with pre belief score of relatives and other with post belief scores of relatives. The results suggest that each independent variable has no significance impact on belief score of relatives except for 'height'. However, the impact of height on belief scores of relatives in very small.

Table15: Linear regression of pre and post belief scores of **relatives**

Independent Variable	Pre beliefs		Post beliefs	
	β	**p-value**	**β**	**p-value**
Groups (SMS vs. Non-SMS)	-0.092	0.119	-0.475	**<0.001**
Age (years)	0.196	**0.008**	0.060	0.372
Gender (Male, Female)	-0.018	0.746	-0.079	0.127
Marital status (Single, Others*)	-0.005	0.944	0.046	0.497
Body mass index (BMI)	-0.109	0.070	-0.066	0.223
Education (Years) (up to 10, >10)	0.266	**<0.001**	0.137	0.009
Living With (Alone, Family)	0.068	0.237	0.008	0.879
(Constant)		0.025		<0.001

β for standardized regression coefficient, patients knowledge was taken as dependent variable whereas other taken as independent variables
p-value < 0.05 was considered statistically significant
* Married, Divorced, Widow

5.11 Frequency distribution of the participants of the study subjects with individual question vise knowledge levels

5.11.1 Frequency distribution of the patients with individual question vise knowledge levels

Table16 shows the level of knowledge of patients for each of the 10 questions, answered among SMS and Non-SMS group. From each individual questions answered, it can clearly be seen that number of correct answers increases at end line in both groups but with different rate.

Table16: Level of knowledge of **patients** for each of the individual knowledge based questions

Level	Non-SMS group (n=139)		SMS group (n=188)	
	Pre	**Post**	**Pre**	**Post**
1. Which diseases are curable?				
Wrong	85 (61.2%)	59 (42.4%)	122 (64.9%)	17 (9.0%)
Partially correct	54 (38.8%)	72 (51.8%)	63 (33.5%)	35 (18.6%)
Correct	0 (0.0%)	8 (5.8%)	3 (1.6%)	136 (72.3%)
2.Sign & Symptoms of low blood sugar are:				
Wrong	54 (38.8%)	31 (22.3%)	56 (29.8%)	0 (0.0%)
Partially correct	64 (46.0%)	61 (43.9%)	99 (52.7%)	14 (7.4%)
Correct	21 (15.1%)	47 (33.8%)	33 (17.6%)	174 (92.6%)
3. What are the causes of diabetes?				
Wrong	37 (26.6%)	29 (20.9%)	68 (36.2%)	6 (3.2%)
Partially correct	102 (73.4%)	103 (74.1%)	120 (63.8%)	87 (46.3%)
Correct	0 (0.0%)	7 (5.0%)	0 (0.0%)	95 (50.5%)
4. Diabetes can diagnose through				
Wrong	11 (7.9%)	6 (4.3%)	10 (5.3%)	0 (0.0%)
Partially correct	83 (59.7%)	21 (15.1%)	113 (60.1%)	1 (0.5%)
Correct	45 (32.4%)	112 (80.6%)	65 (34.6%)	187 (99.5%)
5. Specific symptoms of hyperglycemia				
Wrong	12 (8.6%)	4 (2.9%)	13 (6.9%)	2 (1.1%)
Partially correct	123 (88.5%)	114 (82.0%)	164 (87.2%)	131 (69.7%)
Correct	4 (2.9%)	21 (15.1%)	11 (5.9%)	55 (29.3%)
6. Specific symptoms of hypoglycemia				
Wrong	10 (7.2%)	7 (5.0%)	14 (7.4%)	2 (1.1%)
Partially correct	95 (68.3%)	35 (25.2%)	124 (66.0%)	8 (4.3%)
Correct	34 (24.5%)	97 (69.8%)	50 (26.6%)	178 (94.7%)
7.Management of diabetes				
Wrong	67 (48.2%)	42 (30.2%)	88 (46.8%)	3 (1.6%)
Partially correct	66 (47.5%)	63 (45.3%)	91 (48.4%)	35 (18.6%)
Correct	6 (4.3%)	34 (24.5%)	9 (4.8%)	150 (79.8%)

8.Consequences of diabetes on human life				
Wrong	89 (64.0%)	57 (41.0%)	112 (59.6%)	7 (3.7%)
Partially correct	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Correct	50 (36.0%)	82 (59.0%)	76 (40.4%)	181 (96.3%)
9.Knowledge about insulin				
Wrong	96 (69.1%)	63 (45.3%)	132 (70.2%)	15 (8.0%)
Partially correct	41 (29.5%)	62 (44.6%)	54 (28.7%)	104 (55.3%)
Correct	2 (1.4%)	14 (10.1%)	2 (1.1%)	69 (36.7%)
10.Exercise				
Wrong	8 (5.8%)	7 (5.0%)	3 (1.6%)	2 (1.1%)
Partially correct	125 (89.9%)	127 (91.4%)	176 (93.6%)	183 (97.3%)
Correct	6 (4.3%)	5 (3.6%)	9 (4.8%)	3 (1.6%)

Data presented as number (percentage)

5.11.2 Frequency distribution of the relatives with individual question vise knowledge levels

Table17 shows the level of knowledge of relatives for each of the 10 questions answered among SMS and Non-SMS group. Just like previous table, it can clearly be seen that number of correct answers increases at end line in both groups but with different rate.

Table17: Level of knowledge of **relatives** for each of the individual knowledge based questions

Level	Non-SMS group (n=137)		SMS group (n=188)	
	Pre	**Post**	**Pre**	**Post**
1. Which diseases are curable?				
Wrong	91 (66.4%)	56 (40.9%)	114 (60.6%)	12 (6.4%)
Partially correct	45 (32.8%)	70 (51.1%)	68 (36.2%)	31 (16.5%)
Correct	1 (0.7%)	11 (8.0%)	6 (3.2%)	145 (77.1%)
2.Sign & Symptoms of low blood sugar are:				
Wrong	60 (43.8%)	31 (22.6%)	59 (31.4%)	1 (0.5%)
Partially correct	60 (43.8%)	53 (38.7%)	94 (50.0%)	19 (10.1%)
Correct	17 (12.4%)	53 (38.7%)	35 (18.6%)	168 (89.4%)
3.What are the causes of diabetes?				
Wrong	47 (34.3%)	31 (22.6%)	66 (35.1%)	6 (3.2%)
Partially correct	90 (65.7%)	96 (70.1%)	121 (64.4%)	78 (41.5%)
Correct	0 (0.0%)	10 (7.3%)	1 (0.5%)	104 (55.3%)
4. Diabetes can diagnose through				
Wrong	12 (8.8%)	7 (5.1%)	16 (8.5%)	2 (1.1%)
Partially correct	77 (56.2%)	25 (18.2%)	108 (57.4%)	3 (1.6%)
Correct	48 (35.0%)	105 (76.6%)	64 (34.0%)	183 (97.3%)
5. Specific symptoms of hyperglycemia				
Wrong	20 (14.6%)	5 (3.6%)	23 (12.2%)	0 (0.0%)
Partially correct	110 (80.3%)	113 (82.5%)	158 (84.0%)	134 (71.3%)
Correct	7 (5.1%)	19 (13.9%)	7 (3.7%)	54 (28.7%)
6. Specific symptoms of hypoglycemia				
Wrong	20 (14.6%)	5 (3.6%)	12 (6.4%)	1 (0.5%)
Partially correct	87 (63.5%)	38 (27.7%)	126 (67.0%)	12 (6.4%)
Correct	30 (21.9%)	94 (68.6%)	50 (26.6%)	175 (93.1%)
7.Management of diabetes				
Wrong	66 (48.2%)	44 (32.1%)	83 (44.1%)	3 (1.6%)
Partially correct	68 (49.6%)	53 (38.7%)	98 (52.1%)	41 (21.8%)
Correct	3 (2.2%)	40 (29.2%)	7 (3.7%)	144 (76.6%)

8.Consequences of diabetes on human life				
Wrong	88 (64.2%)	50 (36.5%)	110 (58.5%)	8 (4.3%)
Partially correct	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Correct	49 (35.8%)	87 (63.5%)	78 (41.5%)	180 (95.7%)
9.Knowledge about insulin				
Wrong	93 (67.9%)	57 (41.6%)	136 (72.3%)	14 (7.4%)
Partially correct	42 (30.7%)	66 (48.2%)	49 (26.1%)	106 (56.4%)
Correct	2 (1.5%)	14 (10.2%)	3 (1.6%)	68 (36.2%)
10.Exercise				
Wrong	9 (6.6%)	5 (3.6%)	5 (2.7%)	0 (0.0%)
Partially correct	123 (89.8%)	131 (95.6%)	173 (92.0%)	187 (99.5%)
Correct	5 (3.6%)	1 (0.7%)	10 (5.3%)	1 (0.5%)

Data presented as number (percentage)

5.12 Frequency distribution of the participants of the study subjects with individual question vise beliefs levels

5.12.1 Frequency distribution of the patients with individual question vise belief levels

Table 18 shows answers given by the patients for each of the twenty-eight belief related question for both SMS and Non-SMS group. Pre and post of correct and wrong individual answers are given in percentage.

Table18: Option selected for belief related questions by **patients**

Option Selected	Non-SMS group (n=139)		SMS group (n=188)	
	Pre	**Post**	**Pre**	**Post**
1-3a. The usual cause of diabetes is lack of effective insulin in the body.				
Correct	93 (66.9%)	111 (79.9%)	115 (61.2%)	183 (97.3%)
Wrong	46 (33.1%)	28 (20.1%)	73 (38.8%)	5 (2.7%)
2-3b.Eating too much sugar and other sweet foods is a cause of diabetes.				
Correct	65 (46.8%)	63 (45.3%)	99 (52.7%)	166 (88.3%)
Wrong	74 (53.2%)	76 (54.7%)	89 (47.3%)	22 (11.7%)
3-3c.High blood pressure is a major cause of diabetes				
Correct	82 (59.0%)	78 (56.1%)	144 (76.6%)	173 (92.0%)
Wrong	57 (41.0%)	61 (43.9%)	44 (23.4%)	15 (8.0%)
4-3d. Diabetes can transfer from husband to Wife or vise versa				
Correct	92 (66.2%)	124 (89.2%)	152 (80.9%)	184 (97.9%)
Wrong	47 (33.8%)	15 (10.8%)	36 (19.2%)	4 (2.1%)
5-4a. The best way to check my diabetes is by testing my urine.				
Correct	76 (54.7%)	109 (78.4%)	123 (65.4%)	183 (97.3%)
Wrong	63 (45.4%)	30 (21.6%)	65 (34.6%)	5 (2.7%)
6-1b. Diabetes can be cured				
Correct	105 (75.5%)	113 (81.3%)	164 (87.2%)	181 (96.3%)
Wrong	34 (24.4%)	26 (18.7%)	24 (12.8%)	7 (3.7%)
7-2ab. Frequent urination and thirst are signs of low blood sugar.				
Correct	63 (45.3%)	110 (79.1%)	100 (53.2%)	178 (94.7%)
Wrong	76 (54.7%)	29 (20.8%)	88 (46.8%)	10 (5.4%)
8-2c. Diabetes causes to reduce hungriness				
Correct	73 (52.5%)	107 (77%)	112 (59.6%)	151 (80.3%)
Wrong	66 (47.4%)	32 (23.0%)	76 (40.4%)	37 (19.7%)

9-7a. Medication is more important than diet and exercise to control diabetes.				
Correct	13 (9.4%)	12 (8.6%)	6 (3.2%)	6 (3.2%)
Wrong	126 (90.6%)	127 (91.4%)	182 (96.8%)	182 (96.8%)
10-4b. Diagnosis diabetes through blood sample is painful and old concept				
Correct	42 (30.2%)	97 (69.8%)	72 (38.3%)	169 (89.9%)
Wrong	97 (69.8%)	42 (30.2%)	116 (61.7%)	19 (10.1%)
11-8a. Those who are diabetic can't enjoy life like normal people				
Correct	84 (60.4%)	96 (69.1%)	128 (68.1%)	179 (95.2%)
Wrong	55 (39.6%)	43 (30.9%)	60 (31.9%)	9 (4.8%)
12-2e. Blurred vision is the symptom of low blood sugar				
Correct	26 (18.7%)	20 (14.4%)	27 (14.4%)	6 (3.2%)
Wrong	113 (81.2%)	119 (85.6%)	161 (85.6%)	182 (96.9%)
13-10a. Regular exercise can manage diabetes better.				
Correct	118 (84.9%)	114 (82%)	176 (93.6%)	171 (91%)
Wrong	21 (15.2%)	25 (18.0%)	12 (6.4%)	17 (9.0%)
14-9a. After taking insulin patient become addicted of insulin				
Correct	46 (33.1%)	82 (59%)	72 (38.3%)	169 (89.9%)
Wrong	93 (66.9%)	57 (41.0%)	116 (61.7%)	19 (10.2%)
15-9b. Insulin syringe cant reuse				
Correct	61 (43.9%)	106 (76.3%)	102 (54.3%)	179 (95.2%)
Wrong	78 (56.1%)	33 (23.7%)	86 (45.8%)	9 (4.8%)
16-8b. Those who are diabetic can't participate in sports				
Correct	96 (69.1%)	104 (74.8%)	140 (74.5%)	179 (95.2%)
Wrong	43 (30.9%)	35 (25.2%)	48 (25.5%)	9 (4.8%)
17-9c. One of the most important impact of insulin it damages kidney and heart				
Correct	32 (23.0%)	14 (10.1%)	50 (26.6%)	4 (2.1%)
Wrong	107 (77.0%)	125 (89.9%)	138 (73.4%)	184 (97.9%)

18-7b. Fruit is a healthy food. Therefore, it is ok to eat as much as				
Correct	79 (56.8%)	107 (77%)	127 (67.6%)	177 (94.1%)
Wrong	60 (43.2%)	32 (23.0%)	61 (32.5%)	11 (5.9%)
19-7e. Diabetes can control trough starvation				
Correct	110 (79.1%)	119 (85.6%)	149 (79.3%)	174 (92.6%)
Wrong	29 (20.9%)	20 (14.4%)	39 (20.8%)	14 (7.5%)
20-8d. Diabetic male patient cant lead a normal marital life				
Correct	89 (64.0%)	118 (84.9%)	132 (70.2%)	181 (96.3%)
Wrong	50 (36.0%)	21 (15.1%)	56 (29.8%)	7 (3.7%)
21-7d. People with diabetes should eat special diabetic foods				
Correct	37 (26.6%)	109 (78.4%)	52 (27.7%)	170 (90.4%)
Wrong	102 (73.4%)	30 (21.5%)	136 (72.3%)	18 (9.5%)
22-8c. People with diabetes are more likely to get colds and other illnesses				
Correct	51 (36.7%)	106 (76.3%)	75 (39.9%)	159 (84.6%)
Wrong	88 (63.4%)	33 (23.8%)	113 (60.1%)	29 (15.4%)
23-8e. Diabetic female can’t conceive				
Correct	101 (72.7%)	126 (90.6%)	155 (82.4%)	185 (98.4%)
Wrong	38 (27.3%)	13 (9.4%)	33 (17.5%)	3 (1.6%)
24-5a. In hyperglycemia patient feels extreme tiredness				
Correct	124 (89.2%)	135 (97.1%)	179 (95.2%)	187 (99.5%)
Wrong	15 (10.8%)	4 (2.9%)	9 (4.8%)	1 (0.5%)
25-5d. Hyperglycemic patient usually suffer from acidity				
Correct	18 (12.9%)	91 (65.5%)	22 (11.7%)	173 (92.0%)
Wrong	121 (87.1%)	48 (34.6%)	166 (88.3%)	15 (8.0%)
26-6c. Blurred vision is in main symptom of hypoglycemia				
Correct	96 (69.1%)	124 (89.2%)	161 (85.6%)	186 (98.9%)
Wrong	43 (30.9%)	15 (10.8%)	27 (14.3%)	2 (1.1%)

27-6b. Morning headaches are also symptoms of night time hypoglycemia				
Correct	64 (46%)	116 (83.5%)	126 (67%)	182 (96.8%)
Wrong	75 (53.9%)	23 (16.5%)	62 (33.0%)	6 (3.2%)
28-10b. Diabetic patient can't participate in games and athletics				
Correct	80 (57.6%)	60 (43.2%)	104 (55.3%)	94 (50.0%)
Wrong	59 (42.4%)	79 (56.8%)	84 (44.7%)	94 (50.0%)

Data presented as number (percentage)

5.12.2 Frequency distribution of the relatives with individual question vise belief levels

Table 19 shows answers given by the relatives for each of the twenty-eight belief related question for both SMS and Non-SMS group. Pre and post of correct and wrong individual answers are given in percentage.

.Table19: Option selected for belief related questions by **relatives**

Option Selected	Non-SMS group (n=137)		SMS group (n=188)	
	Pre	**Post**	**Pre**	**Post**
1-3a. The usual cause of diabetes is lack of effective insulin in the body.				
Correct	88 (64.2%)	111 (81.0%)	119 (63.3%)	184 (97.9%)
Wrong	49 (35.8%)	26 (19.0%)	69 (36.7%)	4 (2.1%)
2-3b.Eating too much sugar and other sweet foods is a cause of diabetes.				
Correct	54 (39.4%)	66 (48.2%)	101 (53.7%)	173 (92%)
Wrong	83 (60.6%)	71 (51.8%)	87 (46.3%)	15 (8.0%)
3-3c.High blood pressure is a major cause of diabetes				
Correct	77 (56.2%)	75 (54.8%)	137 (72.9%)	177 (94.1%)
Wrong	60 (43.8%)	62 (45.2%)	51 (27.1%)	11 (5.9%)
4-3d. Diabetes can transfer from husband to Wife or vise versa				
Correct	97 (70.8%)	112 (81.8%)	142 (75.6%)	184 (97.9%)
Wrong	40 (29.2%)	25 (18.2%)	46 (24.4%)	4 (2.1%)
5-4a. The best way to check my diabetes is by testing my urine.				
Correct	74 (54%)	109 (79.6%)	131 (69.7%)	181 (96.3%)
Wrong	63 (46.0%)	28 (20.4%)	57 (30.3%)	7 (3.7%)
6-1b. Diabetes can be cured				
Correct	106 (77.4%)	107 (78.1%)	157 (83.5%)	176 (93.6%)
Wrong	31 (22.6%)	30 (21.9%)	31 (16.5%)	12 (6.4%)
7-2ab. Frequent urination and thirst are signs of low blood sugar.				
Correct	63 (46%)	107 (78.1%)	103 (54.8%)	171 (91%)
Wrong	74 (54.0%)	30 (21.9%)	85 (45.2%)	17 (9.0%)
8-2c. Diabetes causes to reduce hungriness				
Correct	78 (56.9%)	97 (70.8%)	103 (54.8%)	146 (77.7%)
Wrong	59 (43.0%)	40 (29.2%)	85 (45.2%)	42 (22.3%)

9-7a. Medication is more important than diet and exercise to control diabetes.				
Correct	13 (9.5%)	26 (19%)	10 (5.3%)	6 (3.2%)
Wrong	124 (90.5%)	111 (81.0%)	178 (94.7%)	182 (96.8%)
10-4b. Diagnosis diabetes through blood sample is painful and old concept				
Correct	53 (38.7%)	95 (69.3%)	72 (38.3%)	165 (87.8%)
Wrong	84 (61.3%)	42 (30.7%)	116 (61.7%)	23 (12.2%)
11-8a. Those who are diabetic can't enjoy life like normal people				
Correct	84 (61.3%)	101 (73.7%)	133 (70.7%)	181 (96.3%)
Wrong	53 (38.7%)	36 (26.3%)	55 (29.3%)	7 (3.7%)
12-2e. Blurred vision is the symptom of low blood sugar				
Correct	27 (19.7%)	19 (13.9%)	38 (20.2%)	7 (3.7%)
Wrong	110 (80.3%)	118 (86.1%)	150 (79.8%)	181 (96.3%)
13-10a. Regular exercise can manage diabetes better.				
Correct	109 (79.6%)	116 (84.7%)	172 (91.5%)	177 (94.2%)
Wrong	28 (20.4%)	21 (15.3%)	16 (8.5%)	11 (5.8%)
14-9a. After taking insulin patient become addicted of insulin				
Correct	42 (30.7%)	83 (60.6%)	66 (35.1%)	170 (90.4%)
Wrong	95 (69.3%)	54 (39.4%)	122 (64.9%)	18 (9.6%)
15-9b. Insulin syringe cant reuse				
Correct	60 (43.8%)	106 (77.4%)	99 (52.7%)	179 (95.2%)
Wrong	77 (56.2%)	31 (22.6%)	89 (47.3%)	9 (4.8%)
16-8b. Those who are diabetic can't participate in sports				
Correct	93 (67.9%)	103 (75.2%)	135 (71.8%)	180 (95.7%)
Wrong	34 (32.2%)	34 (24.8%)	53 (28.2%)	8 (4.3%)
17-9c. One of the most important impact of insulin it damages kidney and heart				
Correct	35 (25.5%)	18 (13.1%)	43 (22.9%)	4 (2.1%)
Wrong	102 (74.5%)	119 (86.9%)	145 (77.1%)	184 (97.9%)

18-7b. Fruit is a healthy food. Therefore, it is ok to eat as much as				
Correct	80 (58.4%)	108 (78.8%)	121 (64.4%)	179 (95.2%)
Wrong	57 (41.6%)	29 (21.2%)	67 (35.6%)	9 (4.8%)
19-7e. Diabetes can control trough starvation				
Correct	96 (70.1%)	112 (81.7%)	153 (81.4%)	177 (94.1%)
Wrong	41 (29.9%)	25 (18.3%)	35 (18.6%)	11 (5.9%)
20-8d. Diabetic male patient cant lead a normal marital life				
Correct	81 (59.2%)	112 (81.8%)	131 (69.7%)	180 (95.8%)
Wrong	56 (40.8%)	25 (18.2%)	57 (30.3%)	8 (4.2%)
21-7d. People with diabetes should eat special diabetic foods				
Correct	32 (23.3%)	104 (75.9%)	56 (29.7%)	167 (88.8%)
Wrong	105 (76.7%)	33 (24.1%)	132 (70.3%)	21 (11.2%)
22-8c. People with diabetes are more likely to get colds and other illnesses				
Correct	44 (32.1%)	102 (74.5%)	68 (36.0%)	163 (86.7%)
Wrong	93 (67.9%)	35 (25.5%)	120 (64.0%)	25 (13.3%)
23-8e. Diabetic female can’t conceive				
Correct	98 (71.5%)	115 (83.9%)	159 (84.6%)	186 (98.9%)
Wrong	39 (28.4%)	22 (16.1%)	29 (15.4%)	2 (1.1%)
24-5a. In hyperglycemia patient feels extreme tiredness				
Correct	115 (83.9%)	131 (95.6%)	174 (92.6%)	188 (100%)
Wrong	22 (16.1%)	6 (4.4%)	14 (7.4%)	0 (0.0%)
25-5d. Hyperglycemic patient usually suffer from acidity				
Correct	17 (12.4%)	88 (64.2%)	20 (10.6%)	171 (91%)
Wrong	120 (87.6%)	49 (35.8%)	168 (89.4%)	17 (9.0%)
26-6c. Blurred vision is in main symptom of hypoglycemia				
Correct	80 (58.4%)	115 (83.9%)	141 (75%)	186 (98.9%)
Wrong	57 (41.6%)	22 (16.1%)	47 (25.0%)	2 (1.1%)

27-6b. Morning headaches are also symptoms of night time hypoglycemia				
Correct	55 (40.1%)	101 (73.7%)	105 (55.9%)	184 (97.9%)
Wrong	82 (59.9%)	36 (26.3%)	83 (44.1%)	4 (2.1%)
28-10b. Diabetic patient can't participate in games and athletics				
Correct	76 (55.5%)	58 (42.4%)	99 (52.6%)	96 (51.1%)
Wrong	61 (44.5%)	79 (57.6%)	89 (47.4%)	92 (48.9%)

Data presented as number (percentage)

CHAPTER 6

DISCUSSION

DISCUSSION

Diabetes related knowledge and beliefs were found significantly to be improved in patients and their relatives after SMS-based educational intervention. Pre and post assessment of knowledge on sign & symptoms and as well as management of diabetes were performed. Significantly improved knowledge was observed after the intervention in patients and their relatives ($p<0.001$). We have not found any study related to beliefs related to diabetes. To the best of our knowledge, this study is the first ever on diabetes related beliefs and for measuring the impacts of mobile SMS in patients and their relatives. After the intervention we found that beliefs were increased both among participants who received and did not receive SMS based education. However, diabetes related knowledge was significantly higher in participants who received SMS compared to the participant who did not receive SMS ($p<0.001$). Pre- and post-mean difference of knowledge scores in participants who received and who did not receive SMS were 41.46 and 15.11 respectively ($p<0.001$). Similarly regarding belief related scores for both SMS and Non-SMS group, the mean belief score from pre- to post shows a significant change ($p<0.001$), however change in scores was higher in SMS group compared to the Non-SMS group.

The findings are found in line with a recent study from India, where it has been chosen that mobile SMS is generally well accepted and it is an effective technique for lifestyle modification [29]. The numbers of patients in the Non-SMS group is 139 and that in the SMS group is 188 while relatives in Non-SMS group are 137 and in the SMS group are 188. Similar kind of uneven case and control group found in different studies [62, 63]. Education and living status of the patients in the non-SMS and SMS groups were significantly different ($p=0.04$ & $p=0.039$ respectively). We found that age weight and marital status of the patients relatives were significantly different between the groups ($p<0.008$, $p<0.001$ and $p<0.005$ respectively). Analysis from pre and post assessment of knowledge and belief related responses from patients and relatives reveled significant improvement ($p<0.001$). We found that knowledge and belief of the patients and their relatives in Non-SMS and SMS groups were significantly increased after the intervention. In SMS group knowledge and beliefs were significantly changed; however the change was very small in the non-SMS group compared to the SMS group. We also analyzed the impact of knowledge and

beliefs adjusting the confounding variables in a multivariate model. Education and SMS were found to be most important variables which impact the knowledge and beliefs of the patients and their relatives. To validate the impact of knowledge and beliefs in Non-SMS and SMS group we have not found any strong relation. We observed that young people's beliefs are positively stronger among both patients and relatives.

To validate our findings we compared between total pre and post mean knowledge and belief scores of patients and relatives. Between SMS and Non-SMS groups in relatives, the mean knowledge score from pre to post, shows a significant change ($p=0.001$). However, the change was higher in SMS group compared to the Non-SMS group. The mean difference in Non-SMS group between pre and post is 14.46 while that in the SMS group is 21.48. Between SMS and Non-SMS groups, in relatives the mean belief score from pre to post, shows a significant change ($p=0.001$) however, the change was higher in SMS group compared to the Non-SMS group. The mean difference in Non-SMS group between pre and post is 17.1 while that in the SMS group is 41.86. Similarly in case of beliefs, the mean belief score shows a significant change in both SMS and non-SMS groups ($p<.001$ for both); however, the change was higher in SMS group compared to the Non-SMS group. The mean difference in the Non-SMS group between pre and post is 15.41 while that in the SMS group is 22.53. Similar results related to impact of knowledge education were also found in a study by Hee Yun Lee [64]

This hospital based diabetes education intervention study describes to measure the effects of mobile phone SMS among diabetic subjects and their relatives attending the Baqai Institute of Diabetology and Endocrinology (BIDE), which is a tertiary care hospital in the city of Karachi. One of the most significant barriers to diabetes management is the lack of awareness and education about the disease. Different studies already available, show that primary prevention is needed to control the rising trend in the prevalence of diabetes [65]. Short message service (SMS) is a substitute technique for dissemination of educational guidance and motivation to attain lifestyle modification in primary prevention [22], it is also useful for patient compliance. In recent years there are numerous attempts to integrate mobile phones for health interventions and this study can direct future research in Pakistan for diabetes prevention and management using the innovative mobile technologies. Due to the

time and budget constrain we limit our study to a single diabetic center; however it still provides valuable indications regarding the effectiveness of the strategy.

CHAPTER 7

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

7.1 Conclusions

Data from the present study leads to the following conclusions:

- Whether education traditional or technology based itself has significant impact on improving the knowledge and belief status of diabetic patients and their relatives;
- SMS based continuous education using a mobile phone significantly increases the effectiveness on traditional education to improve knowledge and beliefs regarding diabetes mellitus both among patients and relatives;
- Younger patients and relatives have better health friendly beliefs compared to those among higher age group counterparts, especially after face to face intervention, their belief level increased;
- Relatives who have higher BMI in both Non-SMS and SMS group, their prior knowledge about diabetes was higher;

7.2 Limitations

- The study was conducted only in an urban center which does not represent the overall population;
- The questionnaire was not based on a piloting, so some issues may not have been addressed.
- Duration of pre and post intervention was very limited, which may also impact.

7.3 Recommendations

- SMS based education, with targeted messages, should be recommended to both diabetic patients and their relatives to improve their knowledge and beliefs regarding the disease.
- Larger scale studies, especially at community levels, should be designed to assess a more general effectiveness of the technique as well as to evaluate the determinants and cost-effectiveness of the strategy.

CHAPTER 8

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ANNEXURE 1

WORK PLAN

An Interventional Study On The Use Of Mobile SMS As A Tool For Modification Of Knowledge And Belief Regarding Diabetes Among Patients And Relatives

2014-2015										
	July	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**
Submission of the proposal										
Literature Review										
Protocol										
Design of a final questionnaire/schedules, etc										
Ethical Clearance										
Recruitment of participants										
Intervention										
Final Call to Patients										
Analysis of data										
Report Writing										

Total period: Ten months (from July 2014 to Apr 2015)

ANNEXURE 2

CONSENT FORM

Consent Form Patients

An Interventional Study On The Use Of Mobile SMS As A Tool For Modification Of Knowledge And Belief Regarding Diabetes Among Patients And Relatives
OBJECTIVES

General objective

- To determine the effectiveness of Mobile SMS to improve knowledge and belief regarding diabetes among patients and relatives

Specific objectives

- To determine baseline and endline knowledge on diabetes among patients and relatives;
- To determine baseline and endline beliefs on diabetes among patients and relatives;
- To assess the effectiveness of Mobile SMS in improving knowledge on diabetes among patients and relatives;
- To assess the effectiveness of Mobile SMS to modify the beliefs on diabetes among patients and relatives; and
- To explore the factors that may influence the effectiveness of mobile SMS in improve the knowledge and beliefs among patients and their relatives.

اقرار نامہ برائے ذیابیطس سے متاثرہ افراد

میں اپنی رضامندی سے اس تحقیق میں شرکت کر رہا/رہی ہوں۔ مجھے بتا دیا گیا ہے کہ میں کسی بھی وقت اس تحقیق سے دستبردار ہو سکتا/سکتی ہوں اور یہ فیصلہ میرے ہسپتال سے تعلق پر اثر انداز نہیں ہوگا۔ مجھے بتا دیا گیا ہے کہ میرا میڈیکل ریکارڈ خفیہ رکھا جائے گا جو کہ اس تحقیق اور اس سے مشترکہ دوسری تحقیقوں کے لئے استعمال ہوگا۔ میں اس بات کی بھی تصدیق کرتا/کرتی ہوں کہ مجھے اس تحقیق کے بارے میں تفصیل سے بتا دیا گیا ہے۔۔ مجھے یہ بھی بتا دیا گیا ہے کہ مجھے روزانہ دو سے تین ذیابیطس کی معلومات کے متعلق SMS ملیں گے اور اس پوری تحقیق کا مقصد یہ پتہ کرنا ہے کہ موبائل SMS کے ذریعہ لوگوں کی ذیابیطس کے متعلق معلومات اور یقین کو بدلا جا سکتا ہے کہ نہیں۔

نام: ----------

رجسٹریشن نمبر: ----------

دستخط مریض: ----------

تاریخ: ----------

دستخط کورڈینیٹر: ----------

Consent Form Relatives

An Interventional Study On The Use Of Mobile SMS As A Tool For Modification Of Knowledge And Belief Regarding Diabetes Among Patients And Relatives

OBJECTIVES

General objective

- To determine the effectiveness of Mobile SMS to improve knowledge and belief regarding diabetes among patients and relatives

Specific objectives

- To determine baseline and endline knowledge on diabetes among patients and relatives;
- To determine baseline and endline beliefs on diabetes among patients and relatives;
- To assess the effectiveness of Mobile SMS in improving knowledge on diabetes among patients and relatives;
- To assess the effectiveness of Mobile SMS to modify the beliefs on diabetes among patients and relatives; and
- To explore the factors that may influence the effectiveness of mobile SMS in improve the knowledge and beliefs among patients and their relatives.

اقرار نامہ برائے بالغ نارمل افراد (کنٹرول)

میں اپنی رضامندی سے اس تحقیق میں شرکت کر رہا/رہی ہوں۔ مجھے بتا دیا گیا ہے کہ میں کسی بھی وقت اس تحقیق سے دستبردار ہو سکتا/سکتی ہوں اور یہ فیصلہ میرے ہسپتال سے تعلق پر اثر انداز نہیں ہوگا۔ مجھے بتا دیا گیا ہے کہ میرا میڈیکل ریکارڈ خفیہ رکھا جائے گا جو کہ اس تحقیق اور اس سے مشترکہ دوسری تحقیقوں کے لئے استعمال ہوگا۔ میں اس بات کی بھی تصدیق کرتا/کرتی ہوں کہ مجھے اس تحقیق کے بارے میں تفصیل سے بتا دیا گیا ہے۔ مجھے یہ بھی بتا دیا گیا ہے کہ مجھے روزانہ دو سے تین ذیابیطس کی معلومات کے متعلق SMS ملیں گے اور اس پوری تحقیق کا مقصد یہ پتہ کرنا ہے کہ موبائل SMS کے ذریعہ لوگوں کی ذیابیطس کے متعلق معلومات اور یقین کو بدلا جا سکتا ہے کہ نہیں۔

نام: ----------

دستخط: ----------

گواہ کا نام: ----------

گواہ کے دستخط: ----------

مترجم کا نام: ----------

تاریخ: ----------

QUESTIONNAIRE

Questionnaire Knowledge

معلوماتی سوالات

1. کون سی بیماری قابل علاج ہے؟
   - ☆ دل کی بیماری
   - ☆ ذیابیطس
   - ☆ کینسر
   - ☆ بلڈ پریشر
   - ☆ ہیپاٹائٹس کی بیماری
   - ☆ مجھے نہیں معلوم

2. شوگر کی کمی کی علامات
   - ☆ پیشاب کا زیادہ آنا
   - ☆ زیادہ پیاس لگنا
   - ☆ بھوک کی کمی
   - ☆ پسینہ بہنا
   - ☆ دھندلا دکھائی دینا
   - ☆ مجھے نہیں معلوم

3. شوگر ہونے کی کیا وجوہات ہیں؟
   - ☆ انسولین کی کمی
   - ☆ چینی کا زیادہ کھانا
   - ☆ بلڈ پریشر ہونا
   - ☆ جینیاتی بنیاد
   - ☆ عمر کا تقاضہ
   - ☆ مجھے نہیں معلوم

4. شوگر کی تشخیص کی جا سکتی ہے
   - ☆ پیشاب کی جانچ سے
   - ☆ خون کی جانچ سے
   - ☆ بلڈ پریشر
   - ☆ علامات
   - ☆ حرارت
   - ☆ مجھے نہیں معلوم

5. **بلند فشارِ خون (Hyperglycemia) کی مخصوص علامت**

- ☆ خشک منہ
- ☆ بہت زیادہ قے ہونا
- ☆ بالوں کا گرنا
- ☆ تیزابیت
- ☆ الجھن
- ☆ مجھے نہیں معلوم

6. **(hypoglycemia) خون میں شکر کی کمی کی مخصوص علامت**

- ☆ بھوک کا بڑھنا
- ☆ سر کا درد
- ☆ دھندلا دکھائی دینا
- ☆ نزلہ
- ☆ کھانسی
- ☆ مجھے نہیں معلوم

7. **شوگر کا انتظام**

- ☆ دوائی غذا سے زیادہ اہم ہے
- ☆ پھل کھانے سے شوگر زیادہ نہیں ہوتی
- ☆ جسمانی سرگرمی شوگر کو بہتر کرتی ہے
- ☆ کھانے کی چیزوں میں پرہیزی شوگر کو بہتر کرتی ہے
- ☆ بھوکے رہنے سے شوگر بہتر ہوتی ہے
- ☆ مجھے نہیں معلوم

8. **انسانی زندگی پر شوگر کے نتائج**

- ☆ مریض عام آدمی کی طرح زندگی کے مزے نہیں لے سکتا
- ☆ مریض کوئی کھیل نہیں کھیل سکتا
- ☆ مریض کو اکثر سردی اور دوسری بیماریاں لگ جاتی ہیں
- ☆ مرد حضرات عام شادی شدہ زندگی نہیں گزار سکتے
- ☆ شوگر والی خواتین بچہ پیدا نہیں کر سکتیں
- ☆ مجھے نہیں معلوم

9. انسولین کے متعلق معلومات

☆ یہ عادت ہے
☆ انسولین کا انجیکشن کو دوبارہ استعمال کیا جا سکتا ہے۔
☆ انسولین مگر دے اور دل کو خراب کر سکتی ہے۔
☆ انسولین سے وزن بڑھتا ہے
☆ انسولین شوگر کے ساتھ ساتھ آخری حد تک پہنچ جاتا ہے۔
☆ مجھے نہیں معلوم

10. ورزش

☆ روزانہ کی ورزش شوگر کو بہتر کرتی ہے
☆ جن کو شوگر ہوتی ہے ان کو ایک حد تک ورزش کرنی چاہیئے
☆ ورزش کی وجہ سے انسولین بہتر کام کرتی ہے۔
☆ دل کے مریض جن کو شوگر ہو انہیں زیادہ ورزش کرنی چاہیئے۔
☆ ورزش سے شوگر صحیح ہو جاتی ہے
☆ مجھے نہیں معلوم

Questionnaire Belief

یقین کی بنیاد پر سوالات

K-Q	سوالات	ہاں	معلوم نہیں	نہیں
3a.	شوگر کی مجموعی وجہ جسم میں انسولین کی کمی ہے			
3b.	زیادہ چینی یا میٹھی غذائیں شوگر کا سبب بنتی ہیں			
3c	شوگر کی بنیادی وجہ بلڈ پریشر ہے			
3d.	شوگر شوہر سے بیوی کو اور بیوی سے شوہر کو لگ جاتی ہے			
4a.	میری شوگر جانچنے کا بہترین طریقہ پیشاب میں شوگر چیک کرنا ہے۔			
1b	شوگر کو مکمل طور پر ختم کیا جا سکتا ہے۔			
2ab.	پیشاب کی زیادتی اور پیاس کا زیادہ لگنا بلڈ پریشر کی کمی کی نشانی ہے۔			
2c.	شوگر کی وجہ سے بھوک میں کمی ہوتی ہے			
7a.	دوائی ورزش اور غذا سے بہتر شوگر کو کنٹرول کرتی ہے			
4b	خون۔ کرموننہ۔ کے ذریعہ شوگر کو جانچنے کا طریقہ پرانا اور تکلیف دہ ہے			
8a.	شوگر کے مریض عام آدمی کی طرح نارمل زندگی نہیں گزار سکتے			
2e.	دھندلا نظر آنا کم بلڈ پریشر کی نشانی ہے			
10a	روزانہ ورزش سے شوگر کو بہتر طور پر مینیج کیا جا سکتا ہے			
9a	انسولین کا استعمال سے مریض اس کا عادی ہو جاتا ہے			
9b.	انسولین سرنج کو دوبارہ استعمال نہیں کیا جا سکتا ہے			
8b.	شوگر کے مریض کھیلوں میں حصہ نہیں لے سکتے			
9c.	انسولین کے استعمال کا سے۔ سے زیادہ اثر گردے اور دل پر ہوتا ہے			
7b.	پھل طاقت ور غذا ہے اسلئے اس کو جتنا چاہیں کھایا جا سکتا ہے			
7e.	شوگر کو بھوکا رہنے سے کنٹرول کیا جا سکتا ہے			
8d.	بوڑھے جن کو شوگر ہے نارمل شادی شدہ زندگی نہیں گزار سکتے			
7d	شوگر کے مریضوں کو خاص شوگر کی غذا کھانی چاہیے			
8c.	شوگر کے مریضوں کو سردی اور دوسری بیماری جلدی لگتی ہے			
8e.	بوڑھی خواتین جن کو شوگر ہو حاملہ نہیں ہو سکتی			

5a.	(Hyperglycemia) بلند فشار خون کے مریض زیادہ تھکاوٹ محسوس کرتے ہیں			
5d.	(Hypoglycemic) کے مریض عموماً تیز اہیت کا شکار رہتے ہیں			
6c.	بہت زیادہ نظر آنا (Hypoglycemia) کی ایک بڑی وجہ ہے			
6b.	صبح کے وقت کے سر کا درد Hypoglycemia کی نشانی ہے			
10b.	شوگر کے مریض اتھلیٹکس میں حصہ نہیں لے سکتے			

ANNEXURE 3

MARKS OF KNOWLEDGE QUESTIONNAIRE

Total marks are 100. Which is categorized as:

- Poor = 0 – 44.9%
- Average = 45% - 59.9%
- Good = 60% - 79.9%
- Excellent = equal to or above 80%

Category A = 15 (Marks will be divided as per the correct answers)

Total = (15*3) 45

Question 3
Question 7
Question 10

Category B = 10 (Marks will be divided as per the correct answers)

Total = (10*4) 40

Question 2
Question 4
Question 5
Question 6

Category C = 5 (Marks will be divided as per the correct answers)

Total = (5*3) 15

Question 1
Question 8
Question 9

Grand Total = 45+40+15= 100

MARKS OF BELIEF QUESTIONNAIRE

Total marks are 100. Which is categorized as:

Poor = 0 – 44.9%

Average = 45% - 59.9%

Good = 60% - 79.9%

Excellent = equal to or above 80%

Category A = 4.5 Marks

Total = (4.5*13) 58.5

Question 3a
Question 3b
Question 4a
Question 7a
Question 4b
Question 8a
Question 10a
Question 9a
Question 9c
Question 8d
Question 7d
Question 8e
Question 10b

Category B = 3 Marks

Total = (3*8) 24

Question 3d
Question 1b
Question 2e
Question 9b
Question 7b
Question 7e
Question 5a
Question 6c

Category C = 2.5 Marks

Total = (2.5*7) 17.5

Question 3c

Question 2ab
Question 2c
Question 8b
Question 8c
Question 5d
Question 6b

Grand Total = 58.5+24.0+17.5 = 100