Deanship of Graduate Studies
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Determinants of Glycemic Control among Patients with type 2 Diabetes Attending UNRWA Health Centers: A Comparative Study

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Randa Maso

Declaration

I certify that this thesis submitted for the degree of master is the result of my own research, except where otherwise acknowledged, and that this thesis or any of its parts has not been submitted for higher degree to any other university or institution.

Signed:

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Date: ---23-----/-----3----/----2024-----

Abstract

Introduction and objective

Due to its heavy burden on mortality, morbidity, and health costs, there is a growing attention to non-communicable diseases including diabetes. This study aims to investigate the determinants of glycemic control among patients with type 2 Diabetes mellitus attending United Nations Relief and Works Agency for the Refugees of Palestine health centers in the Gaza Strip.

Methodology

The research employs a comparative mixed methods approach, combining a quantitative survey with semi-structured interviews. The quantitative component assessed the effects of sociodemographic, lifestyle, nutritional, physical activity, healthcare-related, medication-related, and mental health factors on glycemic control. A stratified random sampling technique was applied to select 420 participants, divided equally between those with controlled and uncontrolled glycemic control. Laboratory tests and body measurements were also extracted from medical records. The qualitative component explored the perspectives of patients and healthcare providers regarding factors influencing glycemic control through 4 focus group discussions with patients and 20 in-depth interviews with healthcare providers. Thematic analysis was used to explore enablers and barriers to glycemic control.

Key findings

Slightly more than half (55%) of participants were women, the average age was 60.5 years,78% were married, 72% had secondary education or above and 75% were unemployed. The average family size was 5.48 members, median monthly family income was 450 ILS while the median monthly family expenditure was 750 ILS.

The food consumption analysis revealed that food diversity was poor as scored by 4% of participants, 17% borderline and 79% were acceptable. Findings show that food diversity is a significant factor in controlling diabetes; as food diversity score increases the HbA1c level decreases, and this correlation was statistically significant. The study shows that most participants (73%) reported scores suggesting having depression according to the PHQ-9 screening tool, and 51% perceived their mental health as bad or half/half. Participants with scores suggesting having depression were less likely to show optimal glycemic control and vice versa and this relationships between the score of PHQ-9 and control status were statistically significant. Regarding physical activity, the study shows that 58% of participants had a low level of physical activity according to the IPAC score. Scoring high in physical activity was statistically significant associated with higher level of control. Findings show that only 3% of respondents reported regular self-monitoring of blood glucose at home by glucometers, 43.5% of patients had low to medium adherence to medications. Respondents who reported high adherence to medications had better control status and the differences between patients with high adherence and their counterparts with low adherence in control status were statistically significant. Findings also show that the presence of obesity plays a negative role in control with obese patients with diabetes are less likely to show glycemic control than their counterparts who were not obese. Good self-management practices like monitoring blood glucose level at home were associated with better control status with statistically significant differences. Also, developing complications were more prominent among patients with high glycemic levels than among people with optimal control.

Conclusions and recommendations

Achieving optimal glycemic control requires a multi-faceted approach to address the root reasons behind hyperglycemia, including proactive targeting of categories of diabetic people at risks, improving access to the needed resources, focusing on patient education, and addressing mental health problems. The study recommends interventions to improve control status through promoting healthy lifestyles, investing in mental health support, addressing dietary challenges, promoting physical activity through community-based approaches, better family engagement and promoting adherence to medications.

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List of Abbreviations

ADA	American Diabetic Associations
BMI	Body Mass Index
DM	Diabetes Mellitus
ESRD	End stage renal disease
FAO	Food & Agriculture Organization
FCS	Food Consumption Score
FHT	Family Health Team
FP	Family Physician
FPG	Fasting Plasma Glucose
FGD	Focus Group Discussions
HC	Health Centers
HCP	Healthcare Providers
HF	Heart Failure
HHC	Head of Health Center
HbA1c	Glycosylated Hemoglobin
IMR	Infant Mortality Rate
IPAQ	International Physical Activity Questionnaire Score
IDI	In-depth Interviews
KAP	Knowledge, Attitudes, and Practices
LMIC	Low- & Middle-Income Countries
MCI	Micro-clinic Initiative
MENA	Middle East & North Africa

MO	Medical Officer
MHPSS	Mental Health and Psychosocial Support
MoH	Ministry of Health
MMR	Maternal Mortality Ratio
NCD	Non-Communicable Diseases
NEFA	Non-Esterified Fatty Acids
NGOs	Non-Governmental Organizations
OGTT	Oral Glucose Tolerance Test
PN	Practical Nurse
PCBS	Palestinian Central Bureau of Statistics
PHCs	Primary Healthcare Center
SMBG	Self-monitoring of Blood Glucose
SSN	Senior Staff Nurse
T2DM	Type 2 Diabetes Mellites
UN	United Nations
UKPDS	UK Prospective Diabetes Study
UNRWA	United Nations Relief and Works Agency for the Refugees of Palestine in the Near East
USA	Unit United States of America
WHO	World Health Organization

Chapter One: Introduction

1.1 Background

In year 2019, the top 10 causes of death accounted for 55% of the 55.4 million deaths worldwide (World Health Organization-WHO, 2020). The same source indicates that these can be grouped into three categories: communicable diseases, noncommunicable diseases (NCDs) and injuries. Moreover, at the global level, 7 out of the 10 leading causes of deaths in 2019 were categorized as NCDs. The list of the leading causes of death in Palestine is not that different, where NCDs directly contributed to 75-80% of the top 10 leading causes of death in 2019 and diabetes alone caused 14.6% of deaths. Beyond mortality, NCDs constitute a huge burden as the Ministry of Health (MoH) in Palestine is spending about 80% of its budget on NCDs (MoH, 2020).

Between 2010 and 2030, there will be a 69% upsurge in numbers of patients with diabetes in developing countries and a 20% upsurge in developed countries. It is striking that Arab world will have the second highest rise in percentage of patients with diabetes in year 2030 compared to other parts of the world (Shaw et. al., 2009).

United Nations Relief and Works Agency for the Refugees of Palestine in the Near East (UNRWA) fields prevalence rates of DM and hypertension were higher in 2019 compared to previous years; precisely it has reached 16.5% in 2019 for diabetes among those above 40 years old Palestinian Refugees and keeps rising (UNRWA, 2019). Similarly, the agency-wide prevalence of diabetes among patients 18 years and older was also higher in 2019 (8.2%). The prevalence of diabetes mellitus in the Gaza Strip is 12.3% among Refugees population aged 40 years and above based on the served population. This increase may also be attributed to the rise in cases detected and registered at UNRWA health centers through screening programs (UNRWA, 2020).

Diabetes mellitus - especially Type 2 - has many risk factors that lead to its rising prevalence at earlier ages, and the early development of its complication nowadays. Therefore, optimal control of blood glucose is by far the best way to prevent or delay the development of those complications (American Diabetic Association, 2016).

1.2 Problem statement:

Most interventions targeting people with diabetes had focused on lifestyle modifications and the proper use of medications, but the control of blood sugar remains a challenging issue among people with diabetes, especially in developing countries. Undesirable clinical outcomes occur due to lack of control which might be attributed to many factors. It is important to keep in mind that the control of diabetes differs largely by socioeconomic and cultural factors (Gautam et al., 2015). A wide variety of studies were conducted about diabetes mellitus in the Gaza Strip, studying the prevalence, risk factors and the complications of this highly prevalent disease. Still, little is known about the nutritional, lifestyle modification, and medication compliance knowledge-attitude-practice (KAP) among our patients with diabetes and its relationship to the control status of Type 2 diabetes including to which extent it affects the health and quality of life of those patients. The effects of NCD management programs & determinants of glycemic control on patients glycemic control levels are under searched and remain largely unknown. This study tries to fill such gaps in information by answering the core question what the key determinants of glycemic control among people with type 2 DM are attending UNRWA healthcare centers.

1.3 Study objectives:

1.3.1 Aim of the study:

The aim of this study is to assess the main determinants of glycemic control among patients with diabetes type 2 attending UNRWA health centers in the Gaza-Strip and their correlates which ultimately might contribute to improving the control status of patient with diabetes type 2 and subsequently their health outcomes and wellbeing.

1.3.2 Specific Objectives:

- To assess the impact of socioeconomic and demographic variables on the glycemic control status of patients with diabetes type 2.
- To explore the effects of lifestyle related factors and the glycemic control status of patients with diabetes type 2.

- To assess the relationships between health-related variables (health status and healthcare) and the glycemic control status of patients with diabetes type 2.
- To identify the contribution of medication related factors on the glycemic control status of patients with diabetes type 2.

1.4 Research justification:

At present, combined with the demographic transition, Palestine is going through an epidemiological transition. This refers to the change in disease patterns from mostly communicable diseases to NCDs such as cancer, heart disease, stroke, injuries, diabetes and arthritis. In both the West Bank and the Gaza Strip, NCDs including heart diseases, cancer, hypertension and cardiovascular diseases and diabetes mellitus are replacing the traditional threats of infectious diseases as the leading causes of death (MoH, 2020). This flags the importance of this research topic that affects large number of people.

But, despite all measures and projects supporting UNRWA NCD care for the last ten years, the burden of such conditions and their complications keeps surging. By the end of year 2020, a total of 283,584 Palestinian refugees' patients with diabetes mellitus, or hypertension, or both were benefiting of UNRWA NCD health services across the five fields of UNRWA operations.

Poor glycemic control is significantly associated with clinical complications. But unfortunately, most local studies have revealed a suboptimal level of glycemic control among people with diabetes attending PHC, reaching in one study as low as 20% (Radwan et.al., 2018). This coincides with the official numbers all demonstrating a suboptimal and serious problem in control status of people with diabetes in the Gaza Strip. Among people with diabetes attending UNRWA healthcare centers in the Gaza Strip only one third of patients had optimal glycemic control (HbA1c $\leqslant$ 7%) in 2019, and this level has deteriorated during the COVID pandemic even more (UNRWA, 2019). Hence, this study which will focus on determinants of glycemic control among patients with diabetes attending PHC services can shed the light on the main weakness and potential areas for interventions and improvements in our comprehensive NCD management program and might help improving the control status by gaining better insights on what works well and what doesn't according

to our special sociocultural and economic context and within available PHC resources.

This study is innovative not only because it is the first of its kind to study in-depth the control status, but also due to its comprehensiveness as it studies several determinants of glycemic control including KAP, lifestyle, diet, health status and healthcare, diabetes related factors, mental health, etc. Several people might be interested in this study particularly policymakers, planners and programmers. The national health plan regards controlling NCDs as a strategic issue as strategic objective number 1 (MoH, 2020). This study might give evidence to support decision making to fulfill national plans strategic objectives. Practitioners and researchers also can benefit from this study as it provides evidence about determinants of control in the Palestinian culture which can be valuable for evidence-based practice and also for stimulating further research studies. This study is expected to have an added value as it gives new insights to the researcher who works in a managerial position at UNRWA, so the findings can be used to improve practice at the agency wide.

1.5 Context of study:

1.5.1 Socio- demographic context:

The Gaza Strip, sited on the south-eastern side of the Mediterranean Sea, and housing more than two million Palestinians on an area of land of only 365 km^2. The Gaza Strip is well thought- out to be one of the most densely populated urban areas around the world with approximately 5,479 persons per square meters (PCBS, 2020). Registered refugees constitute a very important segment of the Palestinian population in Gaza, making up two thirds of half of the total population according to PCBS (2020).

Today, it is estimated that 50.3% of served Palestine refugees remain highly dependent on UNRWA services. Reports suggest that more than half of the population still face great economic hardships, particularly those living in conflict areas, high unemployment rates and worsening poverty levels. A combination of national, social, legal, economic and political factors explains the persistence of the refugee camps after more than seven decades (UNRWA, 2020)

The socioeconomic situation has deteriorated dramatically in the past 16 years following a blockade's imposition in 2007 by the Israeli government, with repetitive military

oppressions on Gaza in June 2006, December 2008/ Jan 2008, November 2012, August 2014, May 2021, August 2022, May 2023 and most recently October 2023. The blockade has dramatically affected the health sector in Gaza, as health facilities continue to lack adequate physical infrastructure, drugs, supplies, capacity building activities, infection prevention materials, and access to advanced healthcare services and referral for cancer patients for instance. It is sensible to assume that the unstable power supply, the deteriorating functionality of medical equipment, the periodic shortages of essential drugs and medical consumables have had an adverse impact on the quality of medical care & overall health status.

This ongoing crisis has also weakened the social networks, increased incidence of psychological and emotional liabilities, and aggravated poor housing and sanitation. It has also led to high poverty levels (more than 60% of Gazans are poor or extremely poor) and high unemployment rates (around 70% among youth and women). A total of 36.4% of Palestinians have a monthly income that is below the extreme poverty line, of whom 24.3% are in the West Bank and 55.9% are in the Gaza Strip (PCBS, 2020). The UN has described the situation as a 'protracted human dignity crisis' and considers it as a 'collective punishment' in clear violation of international humanitarian law (Hamad, 2021). The ongoing Palestinian-Israeli conflict continues with no political resolution is on the foreseen horizon.

1.5.2 Health status and health care system

Despite of all challenges, obstacles, and continuation of the Israeli occupation of Palestine, the Palestinian MoH, in cooperation and support of the international community and United Nations organizations particularly UNRWA, has managed to keep the Palestinian health system from collapsing and to achieve good health outcome indicators at the level of the WHO Eastern Mediterranean Region, which Palestine is part of. Vaccination coverage levels are one of the best indicators reflecting the performance of health system, and consequently a great reduction of prevalence of communicable diseases was witnessed in Palestine since 1988 and a reduction of reported crude mortality rate in Palestine to 2.7 cases per 1,000 populations and an infant mortality rate of 13 per 1000 live births in 2023 (Salem, 2023). The maternal mortality rate has increased in 2020 compared to previous

years (28.5 per 100000 live births), possibly attributed to Covid-19, but this is still a major improvement from a decade ago (38 per 100000 live births in 2009) (MoH, 2020). According to UNRWA, though significantly decreased, maternal mortality rates (MMR) and infant mortality rates (IMR) among Palestine refugees remain relatively high. Among Palestine refugees in Gaza, MMR has decreased from 23.4 per 100,000 live births in 2008 to 16.2 per 100,000 live births in 2019. Moreover, the estimated IMR in Gaza has not declined since 2008. IMR had slightly increased from 20.2 per 1,000 live births in 2008 to 22.7 per 1,000 live births in 2015 (UNRWA, 2020). Multi-decade provision of health services to Palestine refugees has primarily enabled the control of communicable diseases, mainly through high vaccination coverage and early detection and management of outbreaks. Communicable diseases related to personal hygiene and poor environmental sanitation are also almost entirely eradicated. Nevertheless, food insecurity and the burden of micronutrient deficiencies remain prominent risk factors for Palestine refugees' diseases (UNRWA, 2020).

On the other hand, a clear increase of incidence and prevalence of NCD has been witnessed, with all types of cancer crude incidence in 2020 reaching a striking 115.8 per 100000 populations (triple the incidence of 2010), and a Diabetes Mellitus incidence rate of 160.4 per 100,000 populations, with NCDs accounting for 80% of major 10 causes of death in 2020 (MOH, 2020).

A reduction in communicable diseases incidence, combined with a longer life expectancy and lifestyle modifications, has led to a change in refugees' morbidity profile. Cardiovascular diseases, chronic respiratory diseases, Diabetes Mellitus, hypertension, and cancer are today's leading NCDs among Palestine refugees, representing the highest financial burdens on UNRWA health services. The growing elderly population will be a major determining force in the coming eras for the demand and supply of health services and, therefore, for the type of resources required to provide those services. Hence, policymakers, planners and programmers focus should be on health promotion and policy formulation to address the major problems of NCDs through primary prevention, screening, detection, and appropriate management. Policies that promote healthy lifestyles, healthy diet, exercise, obesity control and ending smoking are essential.

There are five main providers for health care in Palestine providing primary, secondary and tertiary health care: MoH, UNRWA, Palestinian Non-Governmental Organizations, private sector, and military health services. While UNRWA mainly provides primary HealthCare services, the secondary and tertiary healthcare services are mainly provided by MoH. On the other hand, there is underutilization of NGOs and private healthcare services which is an indicator of poor coordination between the different key providers. Additionally, a large number of our patients are referred abroad with very high healthcare costs which further affects our burdened & fragmented health system (MoH, 2020).

Currently, the MoH manages 475 out of the 749 (63.4%) PHC centers in Palestine, while UNRWA manages 47 PHC centers in Palestine, 22 out of them in the Gaza Strip. Overall, the population to PHC center ratio in Palestine has reached 6387. (MOH, 2020; UNRWA, 2020). Based on the Midterm strategic plan 2016-2021 set by UNRWA, the second outcome to be achieved is: "Refugees' health is protected, and the disease burden is reduced". Accordingly, the activities under all sub-programs by the Department of Health are presented, and these include the introduction of the mental health and psychosocial support (MHPSS), and the Family Health Team (FHT), outpatient care, non-communicable diseases (NCDs), communicable diseases, maternal health services, child health services, school health, oral health, physical rehabilitation and radiology services, disability care and pharmaceutical services. UNRWA has contributed to sizeable health gains for Palestine refugees since the beginning of its operations in 1950. UNRWA continues to provide quality health services to fulfil the health needs of Palestine refugees, and it strongly relies on partnerships with host countries and other stakeholders. The health needs of Palestine refugees have changed over the past decades; however, the Agency continued to evolve and improve its services. Today, it is estimated that 50.3% of served Palestine refugees remain highly dependent on UNRWA services (UNRWA, 2020).

1.6 Operational Definitions

1.6.1 Optimal Glycemic control: Will be operationally defined according to UNRWA NCD technical instruction as having a glycated hemoglobin level HbA1c equals to or below 7% (≤ 7%).

1.6.2 Poor Glycemic control: Will be operationally defined according to UNRWA

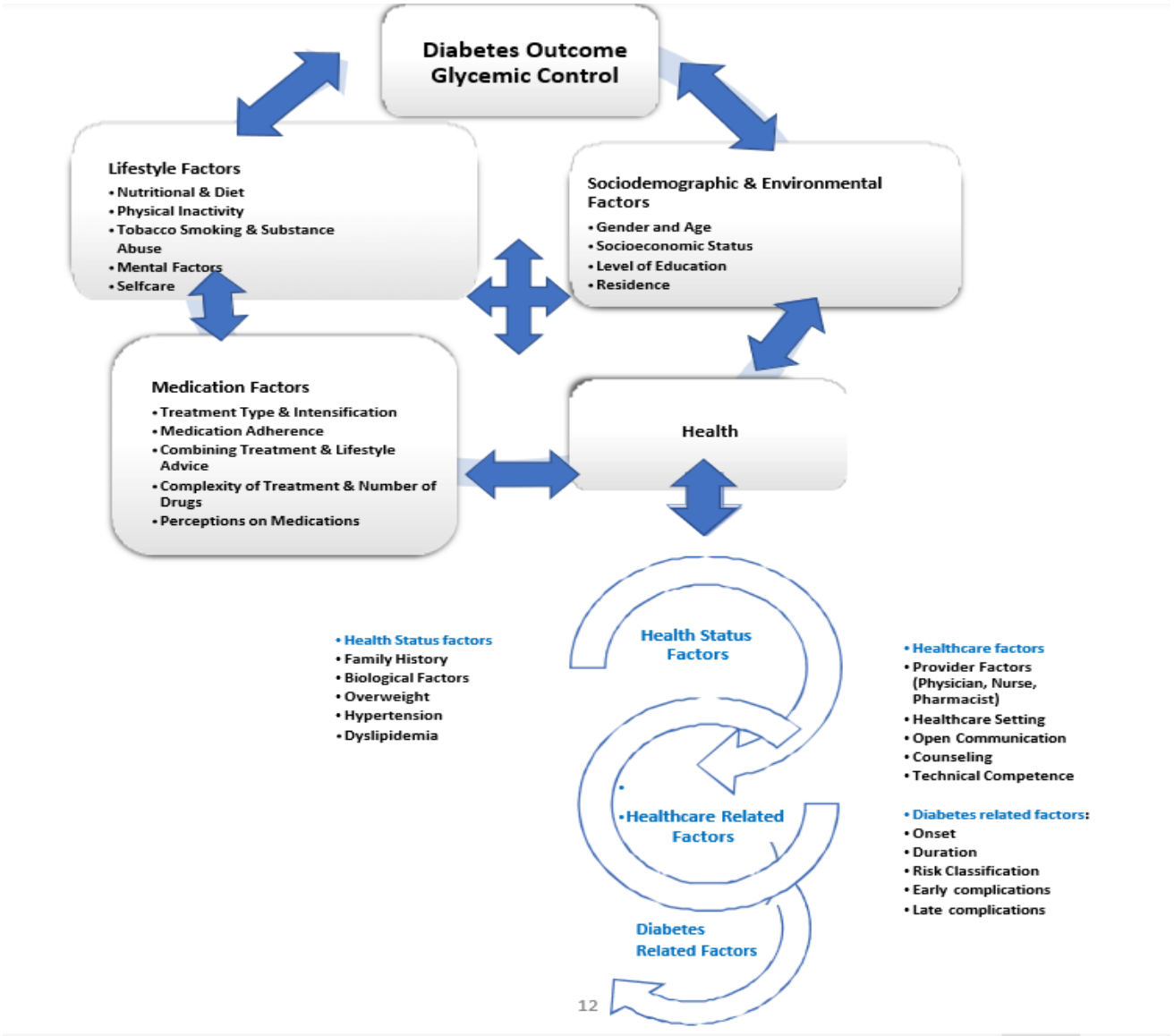
NCD technical instruction as having a glycated hemoglobin level HbA1c higher than 7% (> 7%).

1.6.3 **Diabetes type 2 case:** Will be considered in this research as a patient with Diabetes type 2 who has an active NCD file, had an NCD management visit in the past 3 months, and a glycosylated hemoglobin testing within last 6 months.

1.6.4 **Body Mass Index (BMI):** the body weight in kilograms divided by height in meters squared (wt./ht2) used as a practical marker and proxy to assess obesity among adults. According to WHO definition: A body mass index (BMI) over 25 is considered overweight, and over 30 is obese.

Chapter Two: Literature Review

2.1 Conceptual Framework



Sociodemographic & Environmental Characteristics:

Those include demographic characteristics combined with socioeconomic and other related environmental factors like: Gender, age, marital status, educational level, employment & occupation, socioeconomic status, residence, and housing conditions.

Health Status Factors:

Family history is an important factor to be considered, as Type 2 DM results from an interaction between genetic and environmental factors.

While age, sex and genetic susceptibility are non-modifiable, many of the risks associated with age and sex are modifiable. Such risks include biological factors (e.g., dyslipidemia, hypertension, overweight & obesity); and finally, societal factors, which include a complex mixture of interacting socioeconomic, cultural, and other environmental parameters (WHO & Consultation, 2003).

Medication Factors: Disease knowledge & beliefs about medicines & medication adherence:

This includes factors related to pharmacological treatment of Diabetes such as: complexity and type of medications, combination insulin with oral hypoglycemic agents, number of chronic medications, compliance to medication plan, therapeutic intensification when indicated, medication literacy, combining lifestyle advice with medication, perceptions toward medications etc.

Lifestyle Factors:

Lifestyle factors are important factors in the promotion and preservation of good health throughout the entire life. Their role as determinants of chronic NCDs is well established and they therefore occupy a prominent position in preventive & public health activities. Lifestyle factors include nutritional and dietary habits, sedentary life and physical activity patterns, tobacco smoking, attitudes toward illness and self-care, in addition to coping mechanisms with stress.

Mental Factors, Psychological Stress & Depression:

Those include presence of major life stressors, chronic minor stressors, anxiety disorders,

mood disturbances, clinical depression, dysthymia etc.

Healthcare Related Factors:

This large category of determinants includes all factors related to healthcare provision including technical competence, regular follow up, adherence to appointments, relationship with providers, open communications, facility infrastructure, teamwork, NCD Practical nurse role, Family physician roles, pharmacist engagement, counseling, and patient satisfaction.

Diabetes Related Factors:

Those include factors related to the disease itself and its consequences like onset, duration, severity, risk classification, early and late complications development etc.

2.2 Literature Review

2.2.1 Definition of Diabetes:

Type 2 diabetes -formerly known as non-insulin-dependent diabetes - accounts for most cases of diabetes worldwide. Type 2 diabetes develops when the production of insulin is insufficient to overcome the underlying abnormality of increased resistance to its action. The early stages of type 2 diabetes are characterized by overproduction of insulin, but as the disease progresses insulin levels may fall because of partial failure of the insulin production by beta cells of the pancreas. Complications of type 2 diabetes include blindness, kidney failure, foot ulceration which may lead to gangrene and consequent amputation, and substantially increased risk of infections, coronary heart disease and stroke. The enormous and mounting economic and social costs of type 2 diabetes make a compelling situation for attempts to reduce the risk of developing the condition as well as for active management of the established disease.

2.2.2 Epidemiology:

Diabetes is one of the most common NCDs which is predictable to affect an excess of 439 million adults worldwide by the year 2030, with serious consequences for healthcare expenditure. It has been projected that the global health expenditure on DM was more than $376 billion in 2010 and will reach $490 billion in 2030, which creates a major public health concern. The prevention of DM is thus clearly an important public health priority

internationally. In recent decades, concern has mounted regarding the premature mortality and morbidity associated with DM, especially with the growing interest in altering risk factors and reversing this global epidemic (Li et. al., 2014).

No doubt that Diabetes -particularly Type 2 Diabetes Mellitus- is a major public health concern worldwide. It has dominated the top 10 causes of death, following a significant percentage increase of 70% since 2000. Additionally, Diabetes is responsible for the largest rise in male deaths, with an 80% increase in male mortality since 2000. Moreover, Diabetes mellitus is an important risk factor for Late complications which include cardiovascular diseases (myocardial infarction, or congestive heart failure, or both), cerebrovascular disease (stroke), end-stage renal failure (ESRF), above-ankle amputation and blindness. Diabetes prevalence is still increasing continuously and is predicted to affect more than 353 million people globally in 2030 (Malekzadeh, 2016).

NCDs are far from being restricted to the developed sections of the world. Contrary to widely held beliefs, developing countries are increasingly suffering from high levels of public health problems related to chronic diseases. In five out of the six regions of WHO, deaths caused by chronic diseases rule the mortality statistics (WHO & Consultation, 2003). NCDs have accounted for 44% of all deaths globally or 80% of the top 10 causes of death in 2019 (WHO, 2020). Diabetes has entered the top 10 causes of death, following a significant percentage increase of 70% since 2000. Moreover, diabetes is also responsible for the largest rise in male deaths among the top 10, with an 80% increase since 2000 (WHO, 2020).

NCDs are the major causes of morbidity and mortality in Gaza, resulting in an escalating direct cost of healthcare, and high indirect cost in terms of loss of productivity, and social stress. The urbanization, stressful life events, socioeconomic burden, and continuing nutritional change from a healthy Mediterranean diet to an increasingly western-style diet is associated with reduced physical activity, obesity, and a loss of the protective effect of the traditional diet. Thus, an efficient comprehensive NCD control strategy should be established as soon as possible to prevent/reduce, screen/identify, monitor and manage these diseases (Courbage, Abu Hamad & Zagha, 2016). All this has led to the escalated incidence rate of Reported Diabetes Mellitus of 160.4 (per 100,000 pop) according to (MoH, 2020).

As for Palestinian Refugees population, A reduction in communicable diseases incidence,

combined with a longer life expectancy and lifestyle modifications, have led to a change in refugees' morbidity profile. Cardiovascular diseases, chronic respiratory diseases, diabetes mellitus, hypertension and cancer are today's leading non-communicable diseases (NCDs) among Palestinian refugees, representing the highest burdens on UNRWA health services. For example, in 2020, 123,319 patients were treated for hypertension, another 43,502 patients were treated for diabetes mellitus, and 116,763 Palestine refugees were treated for having both diabetes and hypertension. The significant risk factors for NCDs among the Palestinian refugee's population included sedentary lifestyles, obesity, unhealthy diets, and smoking.

In addition to the heavy mortality & morbidity burden of DM, there is a huge financial burden too. For example: The total UNRWA expenditure on medications in 2020 has peaked to 11,359 million US Dollars. Analysis of this expenditure on different medicines has revealed that 41% of the budget was spent on medications used to treat NCDs. Further analysis of the expenditure on NCD drugs revealed that 49% of the funds were spent on purchasing hypoglycemic medications (UNRWA, 2020). This further stresses on the importance of exploring & adopting other more efficient & yet effective strategies to tackle this burdening disease.

2.2.3 Classification:

New recommendations for the classification, diagnosis and screening of diabetes, were publicized at the American Diabetes Association (ADA) meeting in 1997, have reformed the epidemiology of DM. The new diagnostic criteria recommend that the diagnosis of diabetes mellitus be made based on fasting plasma glucose only - in-contrast to the longstanding criteria - which were based upon an oral glucose tolerance test (OGTT). Besides, it has been suggested that the OGTT should not be used for epidemiological study, as it is an inaccurate test with poor reproducibility. The main purpose of the new criteria is to facilitate better classification of persons and lead to fewer therapeutic misjudgments. The definitions proposed by ADA and adopted by WHO are as follows: a person is said to have a normal blood glucose when fasting plasma glucose (FPG) is <6.1 mmol/L (110 mg/dL), impaired fasting glucose (IFG) is when FPG is between 6.1- 6.9 mmol/L (110 and 125 mg/dL), and diagnosis of DM when FPG is ≥ 7.0 mmol/L (126 mg/dL) or a random value at or above 11.1 mmol/L (200 mg/dL).

Diabetes control is not restricted to taking medications. It comprises practices and a comprehensive management approach to prevent or delay possible complications, and according to the old UKDPS study, a 1% reduction in the HbA1c results in a 35% reduction in the risk of microvascular complications and 25% reduction in diabetes-related mortality (UKDPS study, 1998). Poor glycemic control is significantly associated with clinical complications. But unfortunately, most local studies have revealed a suboptimal level of glycemic control among people with diabetes attending PHC, reaching in one study as low as 20% (Radwan et.al., 2018). This coincides with the official numbers all demonstrating a suboptimal and serious problem in control status of people with diabetes in the Gaza Strip. Among people with Diabetes attending UNRWA healthcare centers in Gaza Strip only one third of patients had optimal glycemic control (HbA1c $\leqslant$ 7%) in 2019, and this level has deteriorated during the COVID pandemic even more (UNRWA, 2019).

Determinants of Glycemic Control

2.2.4 Sociodemographic & Environmental Characteristics:

According to the United States government document Healthy People 2020 highlights the social and environmental factors that affect the individuals and their health. A Healthy People 2020 goal for the diabetes health indicator for example is to "reduce the disease and economic burden of diabetes mellitus and improve the quality of life for all persons who have, or at risk for diabetes" (Healthy People 2020). No doubt, social determinants of health which are social- ecological factors affects people`s health significantly. The persons, their surrounding social network, and cultural and environmental circumstances form the overall framework. Constructs include environmental socio-ecological influences on the individual, for instance, culture, environment, education, working conditions, access to medical care, and community infrastructure which all affect the health of the individual (Clark & Utz, 2014).

According to Kayar et al., (2017) study the Diabetes onset younger was related to poor glycemic control. In another meta-analysis of 10 studies, it was also shown that glycemic control is better among patients who are 60 years or older (Sanal et al., 2011). They explained that the reason of poorer glycemic control in younger populations compared to elders can be associated with the fact that young people do not pay importance to their

disease and treatments as elders. Similar findings were demonstrated by (Fekadu et. al., 2019) where age, exercise, level of education, duration of the treatment, and smoking were significantly associated with poor glycemic control.

Many studies have shown a between health and income, with the poorest sectors of the population being the most vulnerable. Poor people are at an increased social disadvantage in terms of the occurrence of chronic diseases, as well as access to treatment. They also display lower rates of acceptance of health-promoting behaviors compared with other sectors of society. Accordingly, policies need to favor the poor and appropriately target them, as poor people are the most at risk and have the least power to effect change (Benjelloun, 2002).

In the developed countries, low socioeconomic status is associated with higher risk of developing cardiovascular disease and diabetes. It is assumed that the disease will progressively shift to the more disadvantaged sectors of society. There is some evidence that this is already happening, especially among women in low-income groups, for example in Brazil, South Africa, as well as in countries going through economic transition such as Arab countries (WHO, 2003). While according to (Manne-Goehler, 2019) analysis of 28 national surveys: they have identified important variation in health system performance in management of diabetes by region, World Bank income group, and individual-level sociodemographic factors. Explicitly, they found that individuals with diabetes who live in upper-middle-income countries are more likely to be tested, diagnosed, and treated for their diabetes than those in low income and lower-middle-income countries, but that in any given World Bank income group, only 16%–25% of those with diabetes eventually achieve control (Manne-Goehler, 2019).

Greater educational accomplishment has been linked with improved health outcomes, possibly because of a greater probability of socioeconomic stability when compared to those with lower levels of education. Other related reasons may include the stability derived from marriage and a wider range of opportunities for better employment. Furthermore, literature has shown that individuals with higher levels of education are more likely to participate in preventive healthcare measures including eating healthier nutritious foods, being more physically active, and avoiding obesity (Montez & Zajacova, 2013).

According to USA Healthy People 2020 D-5.2 objective (Persons with diagnosed diabetes

whose A1c value is less than 7%), the best group rate for this objective, 51.0% was attained by persons aged 25 years and over with high school education. The worst group rate for this objective, 44.0%, was attained by persons aged 25 years and over with a less than high school education.

Similarly, previous literature on the Saudi population has reported rural-urban differences in the prevalence of diabetes mellitus and glycemic control status. Diabetes mellitus was more prevalent among Saudis living in urban areas compared to rural Saudis, despite the readily available access to healthcare services in Saudi Arabia (Al-Nozha et. al., 2004). Similarly, one study in USA has discussed healthcare providers' perceived barriers in rural healthcare settings, pointing out an apparent lack of culturally appropriate educational materials within healthcare clinic settings (Denham et. al., 2010).

2.2.5 Health Status:

Family history is an important factor to be considered, as Type 2 DM results from an interaction between genetic and environmental factors. The rapidly changing incidence rates though suggest a particularly important role for the latter as well as a potential for halting the tide of the global epidemic of the disease. The most dramatic increases in type 2 diabetes are occurring in societies in which there have been major changes in the type of diet consumed, increase in physical inactivity, and increases in overweight and obesity among other environmental risk factors.

Among the most firmly established relationships between cardiovascular disease or diabetes and factors in the lifetime are the ones between those diseases and the major known ''adult'' risk factors, such as tobacco use, obesity, physical inactivity, cholesterol, high blood pressure and alcohol consumption. In all societies, overweight and obesity are associated with an increased risk of type 2 DM, especially when excess adiposity is centrally distributed. But waist circumference or waist-to-hip ratio (reflecting abdominal or visceral adiposity) are more powerful determinants of subsequent risk of type 2 diabetes than BMI (Elisaf, 2001) & (Bohn et. al., 2015).

According to Al-Nuzha et. al., 2004, national survey study in Saudi Arabia, the central obesity which is defined as waist circumference ≥ 102cm for males and ≥ 88cm for females, is well correlated with higher prevalence of DM as well as impaired fasting glucose. The

prevalence of DM in females was doubled in persons with central obesity (p<0.0001). Similarly, the prevalence of DM was found to be approximately 40% higher for males with bigger waist circumference (≥102 cm), and this correlation was statistically significant (p<0.0001). Besides, the mean BMI was 29.6 Kg/m^2 for people with diabetes, which is significantly different than participants with normal FPG with a mean BMI of 28 Kg/m^2.

In a trial to understand at what step in the diabetes care continuum individuals are lost to care, and how this varies between countries and population groups, a cross-sectional study of nationally representative surveys in 28 low- and middle-income countries (LMICs) was done and examined health system performance for diabetes among adults using a cascade of care approach.

The study revealed poor management of diabetes along the care cascade, indicating large unmet need for diabetes care across 28 LMICs. Performance across the care cascade varied by World Bank income group and individual-level characteristics, particularly age, educational attainment, and BMI of patients. According to this analysis of national surveys: among the population with diabetes, 58.2% were female, 45.7% were > 55 years old, 39.2% had obesity and 32% had overweight (Manne-Goehler, 2019).

Other several reported studies also found a significant connection between the poor glycemic control and the duration of disease such Other several reported studies also found a significant connection between the poor glycemic control and the duration of disease such as (Khatab et al., 2010, El Halabi, 2018, Adham et al., 2010, Mamo et al., 2019, Al-Akour et al., 2011 and Almutairi et al., 2013). They agreed upon the fact that longer duration of diabetes is known to be associated with poor control as for example in Mamo et al., (2019) study which explained that respondents who were diagnosed with diabetes more than seven years ago were 3.08 times more likely to have poorly controlled blood glucose than respondents diagnosed with diabetes less than or equal to seven years ago (AOR = 3.08, 95% CI = 1.33–7.16). this is possibly because of advanced impairment of insulin secretion with time because of pancreatic Beta cell failure, which makes the response to lifestyle modification alone or oral agents unlikely as was revealed long time ago in the UK Prospective Diabetes Study Group (UKPDS, 1997). The worsening of glycemic control over time could also be explained by the reduction in pancreatic beta cell's function associated with an increased fat mass -particularly visceral adiposity- leading to greater insulin

resistance associated with the ageing process (Adham et. al, 2010). It is known that achieving and maintaining optimal HbA1clevels below 7% is problematic in patients with a longer duration of DM even with the addition of a third oral hypoglycemic agent or increasing insulin doses.as (Khatab et al., 2010, El Halabi, 2018, Adham et al., 2010, Mamo et al., 2019, Al-Akour et al., 2011 and Almutairi et al., 2013). They agreed upon the fact that longer duration of diabetes is known to be associated with poor control as for example in Mamo et al., (2019) study which explained that respondents who were diagnosed with diabetes more than seven years ago were 3.08 times more likely to have poorly controlled blood glucose than respondents diagnosed with diabetes less than or equal to seven years ago (AOR = 3.08, 95%CI = 1.33–7.16). this is possibly because of advanced impairment of insulin secretion with time because of pancreatic Beta cell failure, which makes the response to lifestyle modification alone or oral agents unlikely as was revealed long time ago in the UK Prospective Diabetes Study Group (UKPDS, 1997). The worsening of glycemic control over time could also be explained by the reduction in pancreatic beta cell's function associated with an increased fat mass – particularly visceral adiposity – leading to greater insulin resistance associated with the ageing process (Adham et. al, 2010). It is known that achieving and maintaining optimal HbA1c levels below 7% is problematic in patients with a longer duration of DM even with the addition of a third oral hypoglycemic agent or increasing insulin doses.

2.2.6 Medication Factors: Disease knowledge & beliefs about medicines & Medication adherence:

According to Al Qazaz et. al., (2011), patients' knowledge about diabetes is associated with better medication adherence and better glycemic control. In addition to other factors affecting medication adherence and glycemic control, healthcare providers should pay attention to knowledge about diabetes that the patients carry towards medication adherence.

Similarly, Swilieh et. al., (2014) showed that beliefs and knowledge are important factors in understanding variations in medication adherence among diabetic patients & glycemic control among diabetic patients attending PHC in Nablus – Palestine.

Additionally, Number & type of antidiabetic medications has a significant relationship to glycemic control according to (Ahmed et. al., 2014). The study demonstrated that,

compared with the patients who were receiving a combination of insulin and oral antidiabetics, those receiving monotherapy and a combination of oral antidiabetics were more likely to have good glycemic control.

According to Manne-Goehler, 2019, analysis of 28 national surveys, when they disaggregated the forms of treatment that people with diabetes were offered, they found that 10% of those treated were receiving only lifestyle modification advice (e.g., no medication), and, among those, only 18% achieved control. On the contrary, 13% of the sample was treated with medications in the absence of lifestyle modification advice, and, among those, 58% achieved control. They stated that while they would not advocate for a strategy of medicating patients without also counseling them on lifestyle factors that contribute to their disease risk and progression, their evidence suggests that lifestyle advice alone is likely insufficient to achieve higher rates of glycemic control at a population level (Manne-Goehler, 2019).

According to a US cohort study in 2005, a 10% increased frequency of therapeutic intensification (i.e., increasing the dosage or amount of hypoglycemic medication a patient takes) by a physician was associated with a 0.15% lower level of HbA1c ($p<0.0001$) among patients in primary care setting. A single episode of therapeutic intensification was associated with an average 0.7% reduction in HbA1c ($p<0.001$). This study recommended that in order to improve diabetes management and glycemic control nationwide, physicians in PHC and generalists must learn to overcome clinical inertia, to intensify therapy when appropriate, and to use insulin when clinically indicated (Zeimer et. al., 2005).

2.2.7 Lifestyle Factors:

Lifestyle factors are important factors in the promotion and preservation of good health throughout the entire life. Their role as determinants of chronic NCDs is well established and they therefore occupy a prominent position in preventive & public health activities. Lifestyle factors include nutritional and dietary habits, sedentary life and physical activity patterns, tobacco smoking, attitudes toward illness and self-care, in addition to coping mechanisms with stress.

Not to forget that type 2 DM – chronic disease of epidemic prevalence – is one of the major challenges to public health globally. Even though effective interventions aiming to

prevent or halt long-term complications are available, the complex interventions required, and the large size of the diabetic population have made the application of such therapies problematic. For these reasons – and others – early and aggressive treatment modalities aiming for optimal glycemic control are recommended by several international guidelines like American Diabetes Relationship and the European Relationship for the Study of Diabetes in addition to extensive literature (Inzucchi et. al, 2015). Nevertheless, this should always be in the context of a more comprehensive & holistic cardiovascular risk factor reduction program which include smoking cessation and adoption of healthy lifestyle habits, blood pressure control, lipid management and when indicated antiplatelet therapy. Of course, diet and exercise in the treatment of all stages should be in the forefront of any program tackling diabetes and\or metabolic syndrome. Carefully planned and personalized clinical nutrition therapy ought to be applicable though out the life of all patients with all types of Diabetes (Inzucchi et. al, 2015).

2.2.7.1 Nutritional Habits & Dietary Control:

Contemporary dietary patterns and physical inactivity patterns are risk behaviors that travel across countries and are transferable from one population to another like a communicable disease, affecting disease patterns worldwide. Traditional, largely plant-based diets have been rapidly replaced by high-fat, energy-dense diets with a substantial content of animal-based foods. But diet, while critical to prevention, is just one risk factor (WHO & Consultation, 2003).

In observational epidemiological studies, a high saturated fat intake has been associated with an advanced risk of impaired glucose tolerance, higher fasting glucose & insulin levels. Higher proportions of saturated fatty acids in serum have been associated with higher fasting insulin, lower insulin sensitivity and a higher risk of type 2 diabetes. On the contrary, higher unsaturated fatty acids from vegetable sources and polyunsaturated fatty acids have been associated with a reduced risk of type 2 diabetes and lower fasting and 2-hour postprandial glucose levels.

According to a Meta-analysis and systematic review of prospective cohort studies; higher fruit or green leafy vegetables intake is associated with a significantly reduced risk of type 2 diabetes, which highlights the strong relationship between nutritional & dietary habits & the

disease (Li et. al., 2014). Similarly, the WHO has recommended the public to consume more than 400 g or five portions of combined fruit and vegetables per day to prevent type 2 DM (WHO & Consultation, 2003).

The (WHO & Consultation, 2003) report also demonstrated that throughout the world, increasing intakes of highly processed carbohydrate – depleted in NSP (dietary fibers) – had promoted the development of diabetes. Three cohort studies have shown a protective effect of NSP (dietary fiber) which was independent of age, BMI, smoking and physical activity. In many controlled experimental studies, high intakes of NSP (dietary fiber) have constantly been shown to result in reduced blood glucose and insulin levels in people with type 2 diabetes and impaired glucose tolerance. Moreover, an increased intake of wholegrain cereals, vegetables and fruits was a feature of the diets associated with a reduced risk of development of impaired glucose tolerance to type 2 diabetes.

2.2.7.2 Physical Inactivity:

Physical inactivity, now recognized as an increasingly significant determinant of health, is the result of a progressive shift of lifestyle towards more sedentary patterns, in developing countries as much as in industrialized ones (Rezende et. al., 2014). Recent data from Sao Paulo, Brazil, for example, indicate that 70--80% of the population are remarkably inactive (Matsudo et. al., 2010).

The abundant evidence on relationship of diet & physical activity with NCD occurrence & complications has led the WHO in 2002 to adopt a resolution that urged Member States to collaborate with WHO to develop ‘‘a global strategy on diet, physical activity and health for the prevention and control of non-communicable diseases, based on evidence and best practices, with special emphasis on an integrated approach’’ (WHA55, 2002).

Furthermore, longitudinal studies have clearly shown that increased physical activity reduces the risk of developing type 2 DM regardless of the degree of adiposity. Vigorous exercise (i.e., training to an intensity of 80-90% of age-predicted maximum heart rate for at least 20 minutes, at least five times per week) has the potential to substantially enhance insulin sensitivity & improve glycemic control (Bohn et. a., 2015).

2.2.7.3 Tobacco Smoking & Substance Abuse:

According to (Fekadu et. al., 2019) Age, exercise, level of education, duration of the

treatment, and tobacco smoking were significantly associated with poor glycemic control.

2.2.7.4 Attitude Towards Diabetes & Selfcare Behaviors:

According to the Jordanian study (Khattab et. al., 2010), longer duration of diabetes and non-adherent to diabetes self-care management behaviors were associated with poor glycemic control. In the multivariate analysis of the study, increased duration of diabetes (>7 years vs. ≤7years), negative attitude towards diabetes, and increased barriers to adherence scale scores were significantly associated with increased odds of poor glycemic control.

A similar significant relationship was demonstrated by Kayar et, al, (2017), Kirk & Stegner, (2010), Mamo et al., (2019) and Poolsup et al., (2009) meta-analysis which concluded the usefulness of self-measurement of blood glucose (SMBG) in improving glycemic control in non–insulin-treated patients with type 2 DM as demonstrated by the reduction of HbA1c levels. Particularly, SMBG was evidenced to be useful in the subgroup of patients whose baseline HbA1c was ≥ 8% (Poolsup et al., 2009). In Mamo et al., (2019) study it was clearly demonstrated that respondents who were not self-monitoring their blood glucose were 3.44 times more likely to have poor glycemic control as compared to those who were monitoring their blood glucose level regularly (Mamo et la., 2019).

The American Diabetic Association (ADA) at first established guidelines for SMBG in year 1987, and current recommendations suggest regular SMBG in patients with diabetes based on each patient's needs (ADA, 2012). According to ADA latest recommendations, self-monitoring of blood glucose provides information concerning patient`s dynamic blood glucose profile. This information can help with the proper scheduling of food, physical activity, and medications dosing. It is also required for better understanding of the timing of blood glucose variations per individual patients. Additionally, lack of regular SMBG can predict hospitalization for diabetes-related complications (Poolsup et al., 2009). Self-monitoring of blood glucose is an indispensable tool for patients with diabetes who are taking insulin or for those who experience frequent fluctuations in their blood glucose levels, especially fear of hypoglycemia. Records of SMBG can also be used during consultation with healthcare providers to titrate oral normoglycemic agents and insulin doses and to guide physical activity and food intake plans (Kirk & Stegner, 2010).

While ADA recommends increasing the number of adults with any type of diabetes who

perform SMBG at least once daily, while patients with type 1 DM must measure their blood glucose at least three times daily (ADA, 2016), this study showed that unfortunately only 3.2% of study participants with Diabetes measured their blood glucose at home few times weekly. When comparing this for example with data from the Behavioral Risk Factor Surveillance System in the United States which reported daily SMBG to be 63.4% among all patients with diabetes and 86.7% among those treated with insulin between 1997 and 2006 (CDC, 2006).

2.2.8 Mental Factors, Psychological stress & Depression

According to (Liyod et. al., 1999) study, recent severe life stressors are associated with poorer glycemic control among diabetic patients. On the contrary, Positive life events were associated with fair or improved glycemic control. While it is not always possible to avoid stress, learning to recognize and cope with stressors may help people with diabetes sustain good glycemic control and improve general quality of life. The same findings were reported by (Surwit et. al., 2002) who proved that stress management training was associated with a small but significant reduction in HbA1c.

Similarly, concurrent depression is associated with a decrease in metabolic control, poor adherence to medication and diet regimens, a reduction in quality of life, and an increase in health care expenditures among type 2 diabetic patients. In turn, poor metabolic control may exacerbate depression and diminish response to antidepressant regimens (Lustman & Clause, 2005).

2.2.9 Healthcare related Factors:

According to Manne-Goehler, 2019, analysis of 28 LMICs national surveys in multiple geographic regions: Overall, they found that health system performance for diabetes management in these settings can generally be characterized by large losses to care at the stage of diabetes testing and only moderate rates of diabetes control despite using a tolerant definition of glycemic control (HbA1c less than 8). These losses might be attributed to demand-side factors such as lack of patient awareness and engagement, inability to afford care, or sociocultural barriers, or supply-side factors such as lack of services, poor responsiveness of the services provided, or geographic inaccessibility. They discovered that total unmet need for diabetes care (defined as the sum of those not tested, tested but

undiagnosed, diagnosed but untreated, and treated but with diabetes not controlled) was high, at 77%. They also identified important variation in health system performance in management of diabetes by region, World Bank income group, and individual-level sociodemographic factors. Explicitly, they found that individuals with diabetes who live in upper-middle-income countries are more likely to be tested, diagnosed, and treated for their diabetes than those in low income and lower-middle-income countries, but that in any given World Bank income group, only 16% –25% of those with diabetes eventually achieve control. These conclusions suggest that countries with greater wealth and, hence, more health systems resources are effectively reaching and engaging more people with diabetes, but that there are comparable difficulties for health systems across all income groups in translating healthcare services delivered into effective disease control. In a second systematic review of 93 studies that assessed the effects of health systems factors, interventions, policies, or programs on diabetes awareness, treatment, control, and treatment adherence, the researchers concluded that limited access to health services and medication was a leading health systems barrier (Ong et. al., 2018). Similarly, in another recent systematic review there were major gaps in guidelines for the management of diabetes in resource- limited health systems as compared to guidelines used in the health systems of high-income settings. Particularly, this systematic review showed that only about 12% of diabetes guidelines from LMICs satisfied at least 4 of the Institute of Medicine's standards, as opposed to 60% of the guidelines from high-income settings (Owolabi et. al., 2018). In addition to the individual-level predictors (which include sex, age, educational attainment, household wealth quintile, and BMI), several other factors may influence how patients interact with the health system. These comprise, for example, lack of awareness of diabetes, low level of health-seeking behaviors, low risk perception for diabetes, and poor medication adherence. These factors are likely to be context-specific and dynamic; and should be explored in greater depth at the country level (Owolabi et. al., 2018, Ong et. al., 2018).

According to (Rhee et. al., 2005) study, Patients who had difficulty obtaining care had higher HbA1c levels, as did patients who used acute care facilities or who had no usual source of care when compared with those who sought care at doctors' offices or clinics. Accordingly, Policy decisions for improving diabetes outcomes should target barriers to

health care access and focus on developing programs to help risky populations maintain a regular place of chronic healthcare (Rhee et. al., 2005).

A Kuwaiti study using interviews with patients who have diabetes and are on oral hypoglycemic agents managed in general practice or hospitals described unavailability of medications, difficulties accessing physicians and medications, inequalities in care provision and medication supply at different healthcare facilities, and lack of trust in the government healthcare system as barriers to adherence to medications and poorer control status (Jeragh-Alhaddad et. al.,205). A South African study interviewed low-income female patients with diabetes and found that their adherence to medication was affected by structural factors in the health system, including overcrowded clinics and poor access to medicines (Mendenhall & Norris, 2015).

According to Ong et al., 2018 systemic review: 17 quantitative studies explored the impact of pharmacists on diabetes outcomes. All - but one - took place in high-income countries. 11 of them found positive effects of pharmacist care on diabetes control and adherence outcomes. Seven studies from high-income countries reported positive impacts of pharmacists administering patient care. Two trials - both conducted in the United States - obtained positive results, as one of them found a significantly greater absolute percent decrease in HbA1c from baseline among those seeing a pharmacist. The other trial has reported that the intervention group achieved reductions in HbA1c with fewer physician visits compared to patients receiving usual care. Similarly, a cohort study in the US reported a lower mean HbA1c among those in an outpatient program involving face-to- face pharmacist consults ($p = 0.024$), and significantly reduced from baseline (Ong et al., 2018). Another pre-post study from the US proved that involving clinical pharmacists in direct patient care of insulin-dependent patients in primary care led to a significant decrease in mean HbA1c post-intervention. This old study demonstrated that pharmacists working as members of interdisciplinary primary care teams can positively impact glycemic control in patients with type 2 Diabetes requiring insulin treatment (Coast-Senior, 1998). Same result and conclusion were found by a Nigerian pre-post study found reductions in mean HbA1c and fasting blood sugar in those receiving monthly follow up pharmacists over three months at a primary healthcare facility (Bello et. al., 2012).

Ong et. al., 2018 systemic review also reviewed impact of Nurses care on control status

of people with Diabetes. According to this review, eight studies looked at the impact of nurses on diabetes control and adherence outcomes. Three studies found positive impacts on control of service delivery by nurses. A Dutch randomized controlled trial explored the impact of shifting routine aspects of diabetes care in hospital outpatient clinics to diabetes specialist nurses. After a year, significantly more patients receiving care from nurses achieved HbA1c <7% compared to the control group. A Cameroonian pre-post study found a significant reduction in mean fasting blood glucose in non-insulin-dependent patients' following a nurse care empowerment scheme. A Danish cross-sectional study found that the proportion of patients with uncontrolled HbA1c ≥ 8% significantly decreased in general practices with well-implemented nurse led diabetes Likewise, consultations, compared to practices without. Four studies, all trials, reported no significant effects of service delivery by nurses on diabetes control. Two were conducted in the Netherlands and examined the impact of diabetes management by nurses on patients. Two were conducted in the US and explored the effect of nurse-led behavioral management and empowerment of nurse practitioners to provide comprehensive patient care.

Interestingly, A US cross-sectional study has discovered a relationship between patient-physician gender concordance and diabetes control, with female patients of female physicians most likely to have HbA1c < 8%. However, this was not due to differences in medication adherence (Schmitt diel et. al., 2009).

Chapter Three: Methodology

3.1 Study Design

This study is a mixed method comparative study. It incorporates a comparison between patients with DM type 2 who have optimal glycemic control with those with suboptimal glycemic control and utilizes quantitative data collection and analysis methods to determine determinants of glycemic control among patients with diabetes.

Qualitative data collection & analysis of focus group discussion sessions (FGDs) with patients with diabetes attending UNRWA health centers & in-depth interviews (IDIs) with healthcare provides from different categories has been used to explore in-depth the promotors and barriers to glycemic control for people with DM type 2.

3.2 Study Population

3.2.1 For Quantitative Data

The study population were diabetic patients who have their follow up in UNRWA health centers all over Gaza Strip and their medical files. As of January 2022, the total number of Type 2 patients with diabetes registered among UNRWA HCs in Gaza Strip is 14845 according to UNRWA health department data (UNRWA eHealth core team). All of them are receiving NCD healthcare services in 22 clinics distributed all over Gaza Strip.

3.2.2 For Qualitative Data

The study population included participants with DM type 2 who have their follow up in UNRWA health centers all over Gaza Strip both with optimal glycemic control and suboptimal glycemic control for in-depth interviews. In addition, healthcare providers from different categories related to comprehensive NCD management program within UNRWA including NCD practical nurses, Family Health Officers, Pharmacists, Senior Staff Nurses, and Head of Health Centers were included through focus group discussions (FGDs).

3.3 Study Setting

This study was conducted at UNRWA primary healthcare centers which operate 22 health centers distributed over the Gaza strip.

3.4 Study Period

The study took around 13 months. It started in June 2022 and completed in July 2023. Annex (1) describes the activities of the research and duration for each activity.

3.5 Eligibility Criteria

3.5.1 Inclusion

The inclusion criteria for this study are:

- Patients who have an active NCD type 2 diabetes file attending for NCD follow up visits at UNRWA health center at least once in the past 3 months.
- A history of at least one year of diabetes mellitus condition.

3.6 Sample Size & Sampling

3.6.1.1 Sample Size

For the quantitative data: The number of patients with type 2 DM registered in UNRWA health centers in the Gaza Strip field is 14845 by end of year 2021 (UNRWA eHealth core team, 2022). The sample calculation formula yielded 380 using the following parameters: confidence level 95% and margin of errors 5%, estimated percentage level of the dependent variable 50%, and study population of 14845. Hence, the researcher is going to select 380 participants (Annex 2 & 3) as a representative sample. To compensate for failure of completion of participation an extra 40 patients were added to reach a total estimated sample of 420. The comparison between controlled and uncontrolled has been made within the selected sample.

The sample has been divided into two equal parts: 210 patients with DM having controlled blood glucose according to HbA1c equal to or less than 7%, and 210 patients with DM having uncontrolled blood glucose according to HbA1c more than 7%.

For Qualitative data: FGDs with patients with type 2 DM (4 FGDs were done, 2 FGDs with patients with uncontrolled DM and 2 with patients with controlled DM from both genders, each FGD included 8 to 10 patients) were purposively selected. In addition to them, 20 health care providers related to NCD management program (2 HHCs, 4 SSNs, 4 pharmacists, 5 family health officers, and 5 NCD PNs) have been conveniently selected for FGDs.

3.6.1.2 Sampling Technique

Stratified Random Sampling was done first. UNRWA HCs were selected based on the 3

areas classified by UNRWA (North & Gaza, Middle area, and South area). The researcher randomly selected six health centers across Gaza Strip, 2 HCs from each area (three main big health centers and three small or medium size health centers) by random selection process. A proportionate sample has been selected from the centers proportionate to the total number of active NCD files in the selected HC.

Correspondingly in the second stage, the researcher has selected patients with DM receiving their care in these health centers through systematic random sampling from daily appointed patients where every eighth patient will be invited to participate in the study (based on daily target of 8 participants and average HC daily NCD appointments of each family health team). Half of the sample included patients with HbA1c equal to or less than 7, the other half had a HbA1c more than 7 to allow comparison of different variables between controlled and uncontrolled groups.

For qualitative data the sampling was non-probability purposive sampling as we need to understand the barriers and enhancers of glycemic determinants KAPs among both patients and healthcare providers including health center`s administrative team.

3.7 Study Instruments

3.7.1 Quantitative Component

1) **Interviewed questionnaire** has been used to collect quantitative data which was developed by the researcher based on the literature review, the proposed objectives, and the work expertise, and included 6 Domains (Annex 4):
   - Socio-demographic variables: Years of education, socioeconomic status, unemployment, housing, age and sex, etc.
   - Health status and lifestyle variables: Family history of NCDs, smoking, physical activity, nutritional habits & diet control, self-monitoring of blood sugar, self-care, obesity, hypertension, dyslipidemia, and stress coping mechanisms.
   - Medication related variables: Type of medications, number of medications, complexity, duration of treatment, knowledge & attitudes toward medications, medication adherence, medications literacy, companying medication with lifestyle modifications.
   - Mental health related variables: Living alone, social support networks, history of

mental conditions, GHQ questions, etc.

- Healthcare related variables: Regular appointments, compliance to appointments, provider related factors, HC setting factors, relationship & satisfaction, open communication, health education activities & counseling, technical competence.
- History of Glycemic control and development of complications.
- The questionnaire was sent to 10 experts for review & suggested modifications (Annex 5).

2) **Laboratory Tests** were taken from file review and include most recent HbA1c level (within 6 months' period), hypertension control status, lipid profile, and microalbuminuria done through routine annual assessment tests for all NCD patients.

3) **Body Measurements** were taken from file review and include most recent measurements of height, weight, and BMI (taken in current visit) according to UNRWA protocols and technical instructions.

3.7.2 Qualitative Component

3.7.3 The researcher conducted 4 focus group discussion sessions (FGDs) with patients with DM (2 with controlled and 2 uncontrolled glycemic level from both genders) and semi structured interviews with 20 healthcare providers including administrative team from the randomly selected UNRWA health centers. The interview & FGDs protocol was developed by the researcher based on the literature review and the work expertise (Annex 6). The interviews elaborated rich data on enhancers and barriers to better glycemic control among patients with DM and healthcare providers from the comprehensive NCD management team including family physicians, practical nurses, pharmacists as well as the administrative team including HHCs and SSNs.

3.8 Pilot Study: A pilot study was conducted with 40 patients (10% of sample) to test the appropriateness of the study instruments. This allowed for further improvement of the study tools. Participants were excluded as some modifications were introduced on the tools.

3.9 Ethical & Administrative Considerations: move before data collection:

1. An academic and ethical approval was obtained from the School of Public Health at Al- Quds University and Helsinki Ethics Committee.

2. An Ethical approval was obtained from UNRWA HQ Amman and UNRWA Research Ethics committee.
3. An administrative approval was obtained from the Chief Field Health Program (CFHP) at UNRWA and from the head of health center of each clinic in which the researcher collected samples from.
4. To guarantee participants' rights, a covering letter indicating that the participation is voluntary, and confidentiality was assured for all of them. Also, a consent form has been signed for each participant (Annex 7).
5. All other ethical issues such as maintaining confidentiality and avoiding harm were strictly maintained during the study.
6. Participants consented also to record the interview (Annex 8).

3.10 Data Collection

Data were collected by the researcher and 2 other physicians from the internship physicians' program who are well trained and have experience in this issue through interviewed structured questionnaire with patients with type 2 DM visiting the health center for their regular monthly or quarterly NCD appointments. Training was conducted on how to ask the questions, complete the questionnaire was organized to streamline the data collection process and to improve reliability. Records of patients and lab results were extracted from the records. Data collection has consumed around 3 months (see Annex 1 for timeline).

For the qualitative part, dates were scheduled with the participants, and we conducted the interviews & FGDs in Arabic using probing techniques to deeply understand their perspectives about glycemic control determinants. We obtained an informed consent and voluntary agreement to record the interview & FGDs from all of them.

The collection of quantitative & qualitative data was done in a suitable private room in UNRWA clinics to allow privacy & confidentiality of patient's data. While taking the result of tests and body measurements was done in NCD stations from reviewing patients' files on eHealth.

3.11 Scientific Rigor

3.11.1 Reliability

The following steps were done to guarantee instruments reliability:

- Training of data collectors on the patient interviewing steps and the way of asking questions. This assured standardization of questionnaire administration.
- Ongoing checking and verification of completed questionnaires, including review of the questionnaire before leaving the HC to assure that the data is complete.
- The data entry in the same day of data collection allowed possible interventions to check the data quality or to re-fill the questionnaire when required.

For the Qualitative Part

The following were done to assure the trustworthiness of the qualitative part in this study. First, we sent the interview & FGD protocol to ten experts to assure that they cover all the required dimensions. Prolonged engagement was done as the researcher tried to probe for answers and cover all the interview dimensions properly. In addition, recording the interviews & FGDs enhanced tracking up facts and re-checking the accuracy of the transcripts.

3.11.2 Validity of the Study and the Questionnaire

- Face and contents validity: The questionnaire was evaluated by 10 experts to assess its relevance, and their extensive comments were taken into consideration during modification process. The final version of the questionnaire was presented to them.
- Also, a pilot study was conducted before the actual data collection to examine client`s responses to the questionnaire and how they understood it. This enhanced the validity of the questionnaire after modifying it to be better comprehended. The
- Also, checking records has validated the responses provided by patients as much as possible especially regarding their control status, lab test results, presence of complications, and management plans etc.

3.12 Data Entry & Analysis

3.12.1 For Quantitative Data

The researcher has used the Statistical Package of Social Science (SPSS) program for data entry and analysis. Data was entered and analyzed using SPSS, version 25. Descriptive results were presented using mean and standard deviation for continuous variables and

percentages for qualitative variables. Bivariate analyses were also conducted: Chi-square test was used to compare between two or more percentages when fulfillment conditions were satisfied such as gender, health status factors, medication adherence with control status. Odds ratio was used to analyze relationships between comparative groups. An independent t-test was used to compare the averages of two samples that are selected independently of each other like average BMI, average duration of DM or average number of medications between controlled and uncontrolled groups of participants. The One-Way ANOVA was used to compare the mean of 3 or more groups based on one independent variable like comparing the mean HbA1c or mean BMI between different sociodemographic groups. We considered P value of equals or less than 0.05 as statistically significant with confidence interval of 95%.

3.12.2 For Qualitative Data

To achieve the objectives by means of qualitative research methodology, interviews & FGDs were recorded, transcribed, and grouped. The analysis of the data focused on the content of the participants' perspectives, opinions, and experiences. The data was examined in an open-ended manner so that the voices of the respondents appeared clearly. As the text is read, quotations were coded in terms of how they related to the question of respondents' perspectives. The analysis was conducted using the categorizing process in thematic analysis.

3.13 Limitations of the Study:

- The study was conducted in UNRWA health centers only and it was not feasible to conduct other primary health care clinics such as MOH and NGOs because of different protocols and operational definitions of NCD programs, in addition to lack of standardization of collected data and health information systems. Additionally, other PHC centers do not perform HbA1c and other annual assessment lab tests routinely like UNRWA.
- Due to the retrospective nature of comparative studies, they are susceptible to the effects of recall bias.

- The researcher worked at UNRWA health program -which is targeted in the study- so possible bias may be palpable. For that, the researcher tried to maximize the means of objectivity and scientific rigor to get highly accurate and objective data, and she was supervised closely by the supervisor.
- The study may be biased towards healthier older and poorly educated adults with diabetes who access UNRWA care.
- The study may not capture the full impact of socioeconomic factors due to the complex interplay with individual behaviors and healthcare access.
- Individual variations and small sample size might affect some conclusions.
- Study design may not capture the full impact of all factors related to glycemic control.

Chapter four: Results and Discussion

This chapter provides an overview of the characteristics of the quantitative study sample and how control status varies by these characteristics between people whom their diabetes is controlled and those who are not. As this chapter proceeds on, analytical results related to how control status varies by medical treatments, physical exercise and lifestyle Additionally, the results of the qualitative work have been layered into the quantitative findings to allow more in-depth analysis into the promotors and the barriers that affect the control status among people with diabetes.

❖ **Demographic Characteristics:**

The total number of the beneficiaries surveyed, both with controlled and uncontrolled diabetes is 434; participants are deliberately selected to be stratified equally by control status, 48.8% of them their status according to HgA1c readings were controlled and 51.2% uncontrolled. Nearly half (45%) of them were men and 55% were women. The gender distribution of this study was close to the gender distribution reported by UNRWA (UNRWA, 2022). The control status was slightly higher among females (49.2%) than males (48.5%), but the differences among the two groups were not statistically significant (see Table 4.1). Findings in this study were like El Halabi (2018), but contrary to other regional studies showing statistically significant differences with males were having significantly lower mean HbA1c levels than females (P = 0.02) (Adham et al., 2010). It seems other mediating factors play a role in the relationships between gender and control status. The average age of study participants was 60.5 years (Median 61 years), the minimum age was 22 years, and the maximum age was 95 years. Of the total participants, 30.2% aged below 55 years old, 35.7% aged from 55 to 65, 34.1% aged above 65 years (see Table 1). The proportion of control among participants aged less than 55 years was 47.3%, 34.8% among participants aged 55 to 65 years, while it was 64.9% among participants aged more than 65 years. Findings revealed in this study around age & gender distribution are like what is being reported about the patients with NCDs by UNRWA for the year 2021 (UNRWA, 2021). As shown in Table 1, elderly patients aged 65 years and more had a higher percentage of controlled DM (64.9%) compared to uncontrolled DM (35.1%), while patients aged 55 to 64 years old had a higher percentage of uncontrolled DM (65.2%). These differences in control status among the

different age categories were found to be highly statistically significant (p value 0.001). The findings of this study are consistent with the literature which shows that advancement of age is associated with better control status El Halabi, (2018) & Manne-Goehler et al., (2019). According to Manne-Goehler et al., (2019) a cross-sectional study of 28 nationally representative surveys revealed that age more than 55 years was associated with an odd of control 4.77 (95% CI: 2.82–8.06) times higher than younger age groups mainly 15–35 years. Qualitative findings showed controversial opinion as a NCD SSN said *"Elderly patients especially 65 years and more are difficult to achieve control and difficult to be counselled, sometimes I spend long time encouraging an elderly patient and explaining to him/her, he/she ends the conversation saying phrases like there is not enough time left for me to live and change things around. He added of course the other important influence in acceptance and compliance is the socioeconomic status of patients".* This somewhat is different from the opinion of a head of health center who said, *"The most difficult patients to achieve control are children with type 1 DM and elderly patients, but the age groups of middle age are always the easiest to obtain control as they are flexible, highly aware, and can adopt lifestyle changes especially diet and exercise more easily".*

The same controversary was reported by patients with DM, participants of FGDs who agreed that *"Young patients must have better glycemic control than elderly who can't follow medical advice strictly and are usually more stubborn and have a worse overall health and multiple chronic diseases",* while another elderly male participant in a FGD of uncontrolled patients said, *"The older you become, the more sick and less hopeful in life you become".*

Table 4.1: Differences in the Control Status by Demographic Characteristic

Correlates	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222,51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Gender								
Male	94	48.8	100	51.5	194	44.7	0.022	0.883
Female	118	49.2	122	50.8	240	55.3		
Age								
Less than 55 yrs.	62	47.3	69	52.7	131	30.2	27.49	0.001*
55 to 65 yrs.	54	34.8	101	65.2	155	35.7		
More than 65 yrs.	96	64.9	52	35.1	148	34.1		
Mean age	62.33 years		58.88 years		60.56 years			
Median age	61 years							
Locality								
Inside camp	120	49.2	124	50.8	244	56.2	.025	0.875
Outside camp	92	48.4	98	51.6	190	43.8		
Governorate								

North Gaza	53	47.7	58	52.3	111	25.6	0.235	0.994
Gaza	49	48.0	53	52.0	102	23.5		
Deir Al Balah	31	50.8	30	49.2	61	14.1		
Khan Younis	50	50.0	50	50.0	100	23.0		
Rafah	29	48.3	31	51.7	60	13.8		
Family size								
1-2 members	47	58.0	34	42.0	81	18.8	7.092	.069
3-5	68	48.9	71	51.1	139	32.3		
6-9	80	48.2	86	51.8	166	38.5		
=> 10	15	33.3	30	66.7	45	10.4		
Mean of family size	5.48 members		6.04 members		5.76 members			
Marital status								
Married	157	58.5	183	41.5	340	78.3	4.484	0.034*
Not married	55	46.2	39	53.8	94	21.7		
Level of education								
Illiterate	32	65.3	17	34.7	49	11.3	16.886	0.002*
Preparatory education or less	43	59.7	29	40.3	72	16.6		
Secondary	90	41.9	125	58.1	215	49.5		
Bachelor or diploma degree	22	39.3	34	60.7	56	12.9		
Postgraduate education	25	59.5	17	40.5	42	9.7		

Variations in control status regarding age and gender might be due to individual variation in lifestyle, especially diet control and exercising which are also underpinned by cultural and gender norms related factors. Regarding place of residency, 56% of study participants were residing inside camps, while the other 44% of participants were residing outside camps and are served by the clinics serving these catchment areas in the five governates of the Gaza Strip (see Table 4.1). The mean family size of study participants was 5.8 members (SD= 3.4). People with diabetes who belonged to smaller size families showed higher level of control (58% among families with 2 members) than their counterparts from larger size families (33.3% among those with 10 members and more). However, differences in control related to family size didn't reach statistically significant despite being very close to it (see Table 4.1).

Moreover, married patients with DM had a lower percentage of controlled DM (46.2%) compared to unmarried (58.5%), and the differences were statistically significant (p value 0.034). Findings around the relationships between control status and marital status reported in study are congruent with the literature as reported by Kayar et al., (2019) study which reached to the same conclusion around marital status. This finding around marital status and control status of DM can be attributed to different social eating habits and more sedentary life experienced by married people compared to not married. When participants of FGDs commented on the relationship between marital status and glycemic control one

male healthcare provider said *“Married patients might be more emotionally stable than single people, however, single people can adopt their lifestyle like diet l and exercise more than married ones. Single people have more time and energy to practice physical exercise. I think we need research to clarify the relationships between marital status and control”.* On the other hand, another female patient said, *"I think it doesn’t matter the marital status itself, it depends on the mental wellbeing and being happy & relaxed regardless of the marital status"*.

Regarding educational level, 11.3% of participants were illiterate which was similar to findings of El El Khatib, (2018) study among patients with DM attending UNRWA HCs, nearly half of the participants are educated at secondary school level. According to Table 1; participants who were illiterate or educated at preparatory education or less patients had higher percentage of controlled DM (65.3% & 59.7% respectively) in comparison to their peer who are educated at a higher level (41.9% among participants who were educated at secondary school level). Differences in the control status by educational level were statistically significant. Evidence shows controversial findings around the relationships between education and control among people with diabetes, for instance Kayar et. al, (2017) indicated that control is more among low educated beneficiaries, while Manne-Goehler et al., (2019) suggest that control is much better among people with better education status. This might be related to other factors associated with higher education like employment, being busy and overloaded with responsibilities, and the tendency of educated people who work in offices to live more sedentary life than less educated who are engaged in work that require physical efforts. A male participant in a FGD with patients having controlled DM said, *“I think that educated patients will have better control status as they can read information and gain knowledge from different sources and benefit more from educational materials provided at the health center".*

In the qualitative part of the study when different healthcare providers were asked about their opinions on relationship of sociodemographic factors and optimal control; a physician stated *“You can never put assumptions, from my experience with patients with DM you can’t assume that young people will be more compliant that elderly, or educated will be more aware than poorly educated, or assume that a financially able patient would buy medication needed for his condition more and have better control status than poor patient, it seems to*

be more complex than that always. It's more of an integrated factors and behaviors with degree of awareness". Another practical nurse who works in NCD services stated that *"I feel that there are more psychological, emotional and social stressors on women with DM than men and especially married women with their excessive gender-based roles and responsibilities".* On the other hand, another PN working in an NCD station said, *"From my observation and long experience as a practical nurse working in NCD stations for more than 10 years now, patients with poor socioeconomic status, elderly and socially neglected people, and married patients tend to have a worse control status than their opposite peers".*

These results have several important policy implications for health system strengthening in the context of a growing diabetes epidemic. First, we found that those individuals who were older and those who were not married and have very low or very high level of education, had better performance and greater rates of disease control, as compared to younger, married, and medium level of education. This may also partially reflect a survivor bias in that we are only capturing healthier older & poorly educated adults with diabetes who have access to care at UNRWA. These findings also indicate that certain subsets of the refugee's population appear to be "Left behind" in terms of effective coverage to diabetes services, namely younger and more educated individuals who have diabetes, and there is a need to strengthen linkage to care for these refugees.

❖ **Socioeconomic Related Factors:**

Table 4.2: Differences in the Control Status by Socioeconomic Characteristics

Correlates	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222, 51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Employment status								
Employed full time or part time	18	41.9	25	58.1	43	9.9	1.971	0.373
Not employed	158	48.5	168	51.5	326	75.1		
Retired	36	55.4	29	44.6	65	15.0		
Monthly income in ILS								
less than or equal 500	131	50.8	127	49.2	258	59.4	0.964	0.618
501-1500	65	45.8	77	54.2	142	32.7		
More than 1500	16	47.1	18	52.9	34	7.8		
Mean	561.32		644.82		604 ILS			
Median for all the sample	450 ILS							
Average monthly expenditure in ILS								
Less than or equal 500	22	42.3	30	57.7	52	12.0	6.395	0.094
501-1000	133	50.6	130	49.4	263	60.6		

More than 1000	57	47.9	62	52.1	119	27.4		
Mean	985.6		1119.4		1054 ILS			
Median for all the sample	750 ILS							
Receiving social assistance								
Yes	173	48.5	184	51.5	357	82.3	0.122	0.727
No	39	50.6	38	49.4	77	17.7		
Having a functioning refrigerator								
Yes	186	48.8	195	51.2	381	87.8	.350	0.839
No	26	49.1	27	50.9	53	12.2		
Overall living conditions of the family								
Very good	16	59.3	11	40.7	27	6.2	3.449	0.327
Good	86	44.3	108	55.7	194	44.7		
Poor- very poor	110	51.6	103	48.4	213	49.1		
Availability of glucometer and strips								
Yes, most of the times	22	44.9	27	55.1	49	11.3	.350	0.839
Yes, sometimes	21	48.8	22	51.2	43	9.9		
No	169	49.4	173	50.6	342	78.8		

According to the above table (4.2) which compares control status by socioeconomic factors; there wasn't any statistically significant relationship between average monthly income, average monthly expenditure, social assistance, and overall living conditions with the control status of DM. This finding goes in line with local study El-Halabi, (2018) and international Manne-Goehler et al., (2019) study of population-based surveys conducted in 28 low- and middle-income countries between 2008 and 2016, which revealed that there were no statistically significant relationships between household wealth quintile and any of the 3 outcomes namely DM diagnosis, treatment, and control status. It also explained that persons with diabetes who live in upper-middle-income countries are more likely to be tested, diagnosed, and treated for their disease than those in low and lower-middle-income countries, but that in any given World Bank income set, only 16% to 25% of patients eventually achieve optimal control. They suggested that countries with greater wealth have more health systems resources for reaching and engaging more people with diabetes but are facing similar difficulties across all income groups in translating high quality services delivered into effective disease control (Manne-Goehler et al., 2019). A total of 75% of study participants were unemployed, only 10% were employed. This could be explained by the relatively older age of the population and the concurrent high unemployment rates in Gaza (PCBS, 2022). Similar alarming results were presented by El Halabi, (2018) & El Khatib, (2010) studies within UNRWA, as both researchers demonstrated that 75% & 80% of their study participants reported currently being unemployed respectively. While the control status was higher among retired (55.4%), currently working showed lower control status

(41.9%). Nevertheless, variations among these groups didn't reach statistical significance. The evidence suggests contradictory findings, as Kayar et al (2017) research indicates that unemployment is associated with poor control outcomes. It's not clear if the significance is affected by the fact that most of employed people in the Gaza Strip don't have sufficient financial stability due to low income of study participants including the employed ones. Also, unemployment in Gaza is attributed to the political context, affecting too many people so it is taken as a contextual rather than personal issue.

Additionally, 92.2% of participants have a monthly household income less than 1500 ILS, only 7.8% have a monthly income higher than that. It is worth mentioning that the minimum wage is 1880 ILS, but despite that the monthly minimum wage in the Gaza Strip was 676 ILS compared with 1382 ILS in the West Bank in PCBS labor force survey in fourth quarter of year 2022 (PCBS, 2022). Findings of this study suggest that lower income is associated with higher control status (50.8% among people with income up to 500 ILS, 43.5% among people with monthly income 1001-1500); nevertheless, variations among the groups in reference to monthly income were not statistically significant.

Furthermore, the mean average monthly household income of study participants was 604 ILS (SD= 751 ILS) and the mean monthly household expenditure was 1054 ILS (SD= 830 ILS), and 82% of study participants were receiving social assistance. Out of the 357 receiving social assistance: 355 (77%) stated receiving food in kind rations, 15 (3.5 %) received cash assistance and 6 participants (1.5%) received both food rations & cash assistance. This is even worse than what was revealed in the Crisis Monitoring Report issued by UNRWA in December 2022, stating an average monthly household expenditure of Palestinian refugees in the Gaza Strip of 1770 ILS, and a percentage of 81% of refugees living below the national poverty line, while a total of 64% of families reported having taken debts within the last 3 months (UNRWA Crisis Monitoring Report, Dec. 2022). In this study and as seen in Table 2 also, 41.2% of participants with DM perceived and described their overall living conditions as poor and additional 7.8% as very poor making a total of half of the patients (49%). This is even worse than what was described by El Halabi, (2018) study among UNRWA HCs in which only 33.7% of participants with DM attending UNRWA HCs described their living conditions as poor (El Halabi, 2018). This reflects how badly the socioeconomic condition of people has deteriorated in the past few years in the Gaza Strip. Both studies showed a lack of

statistically significant relationship between perception of living conditions and the control status of patients with DM.

The socioeconomic status and its impact on glycemic status and diabetes outcomes was one of the most mentioned and discussed factors in the interviews with HCPs and FGDs with both controlled and poorly controlled patients with DM from different health centers and geographical areas. There was a debate and variation in opinions of healthcare providers. On one side most, providers explained that socioeconomic factors are less important factors than awareness, attitudes, and behaviors regardless of the socioeconomic status of the patients. For example, a pharmacist said *"you can never put assumptions, from my experience with patients with DM you can't assume that a financially better off e patient would buy medications needed for his/her condition more and have better control status than poor patients, it seems to be more complex than that always. It's more of an integrated factors and behaviors with degree of awareness",* which confirms with the opinion of a medical officer who also said *"Poor people are more prone for complications and poor control status as I see it, but not necessarily that is the case in majority of patients. I have seen so many rich patients not motivated or keen to spend money for the sake of their health or have unhealthy lifestyle or non-adherent to their medications*" and a NCD PN who said *"the most uncontrolled patients are usually type 1 DM, emotionally or mentally distressed, and old age. On the other hand, I see that both poor and rich are not that different when it comes to their control status".*

On the other side, few providers acknowledged the negative impact of poor socioeconomic status on the glycemic control outcomes. For example, a head of health center explained *"the socioeconomic status deterioration in our community has hugely and adversely affected our people`s physical and mental health. It making it more and more difficult for us to achieve optimal glycemic control",* another NCD PN confirmed *"People who are financially better off can purchase healthier foods, do exercise, and have less stress levels than poor patients",* similarly a medical officer agreed too that *"the poor socioeconomical status of our people has led to the high dependance on bread, rice and other simple carbohydrates on favor of other more nutritious and less caloric intake foods. It's not only our feeding culture but also our socioeconomic status is what drives our food choices".*

It seems that patients with poor glycemic control have more consistent views around the impact of socioeconomic status on glycemic control as all of them in the FGDs agreed that poor socioeconomic status plays an important role in their uncontrolled status. To quote from their words a male participant with uncontrolled status said *"Of course my socioeconomic status affects my diabetes control status. How can I purchase healthy food even if I want to? How can I avoid being sad and angry when my children ask for their pocket money for school, and I can offer them nothing?? Don't deceive yourself, we will always eat what is available at the house, not what is healthy for us. When I can't purchase vegetables for my family, I will feed them bread. Unemployment has ruined everything in Gaza".* Another female participant from the same FGD said *"Of course poor people will have a worse control status. Poor people can't purchase anything, while rich people can buy anything they need or even bring the moon down if they wish. Most patients with DM that I know live on social subsidies and need financial support. It's the government`s responsibility to take care of them, they should provide more social subsidies and job opportunities for them".*

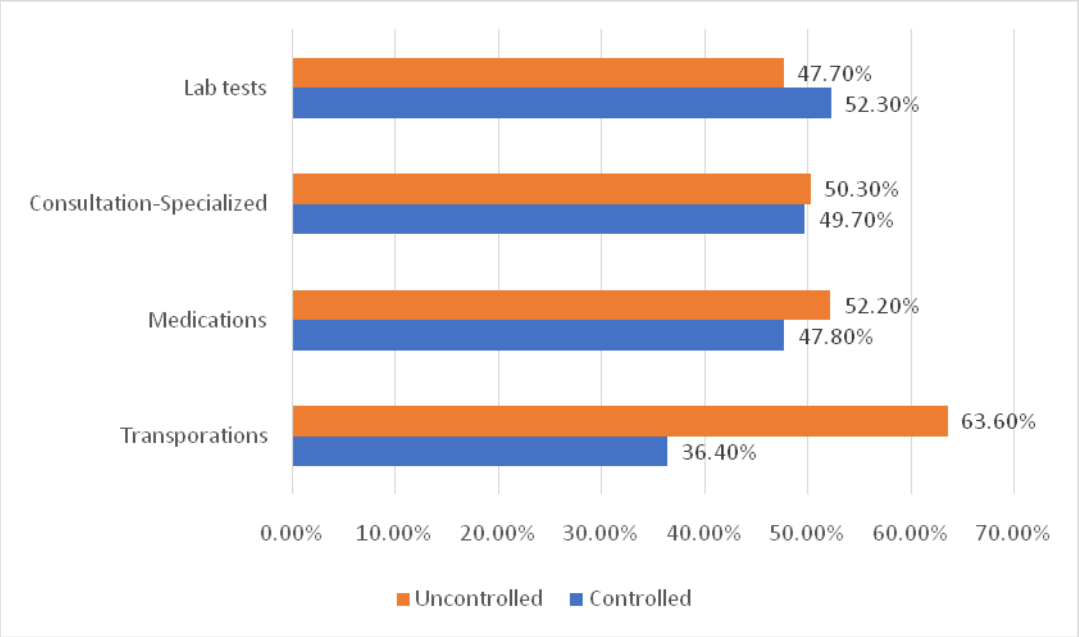
On the other hand, a patient with optimal glycemic control in another FGD summarized his opinion saying *"I don't think financially comfortable patients have a better or a worse glycemic status than poor patients. I think it's the attitude and behaviors that matter more regardless of the economic status. Take me as a living example, I do not have much income and I can barely make it through the month, but I have determination and I pay much attention to what I eat and what I do to my body".*

Another important finding from Table 4.2, only 11.3% of study participants had glucometers & strips available for home measurement of blood sugar for most of the time. This has an important policy implication to be considered in future programs tackling Diabetes within primary healthcare context in the Gaza Strip, especially with the poor socioeconomic conditions and the high importance of home blood sugar monitoring as part of management plans, insulin dose calculations, and self-care. However, having a glucometer and strips for testing at home or not didn't make a difference in control status, even the control status was higher among those who don't have in comparison to those who have these items. Possibly people who are not controlled and have complications are the ones who own these devices. The differences in control status in reference to having a

glucometer and strips or not were not statistically significant which might indicate the importance of regular use of those glucometers and strips in measuring and monitoring blood glucose and not only having them around that makes the difference. A male patient with uncontrolled DM in the FDG said *"there are very effective medications for diabetes out there that I think UNRWA should provide for our people. Glucometers and strips are important tools, and we can't purchase them on our own. We depend on UNRWA for everything in our life especially education and health and they are responsible to help us. I can't pay the private pharmacy 1 ILS every day to measure my blood sugar by glucometer",* While another male patient with controlled DM in another FGD also explained "*I have a glucometer for home monitoring of my blood sugar, but buying sticks costs me every month. When I don't have sufficient income, I stop purchasing them and I stop measuring my blood sugar. My family`s needs are a priority for me over my diabetes condition".*

When asked about the need to pay to seek services or to obtain extra services that are not available at UNRWA including payment for transportation, medications, and specialized consultations and the findings are demonstrated in below segregated by control status (see Figure 4.1). El Khatib, (2018) study on DM and HTN patients attending UNRWA HCs, (23.5%) of his study participants stated paying extra money for purchasing medications not available at UNRWA which is much lower than this study. This increase might be due to advancement in pharmaceuticals used to manage diabetes and expansion of the local market with those new medications, combination oral normoglycemic drugs, and new insulin analogues pens, while UNRWA essential drug list remained unchanged in past years providing same older generations of mediations and no combination drugs. It's worth mentioning that one of the most mentioned points for improvement in provided services through UNRWA in the IDIs with HCPs and FGDs with patients with DM were related to medications, lab tests, and specialist care. Some comments of patients of the uncontrolled group were *"we hear about very good medications for diabetes that some patients use and help them control their condition that are not available within UNRWA. If it's not available in the health center I won't take them, I won't be able to pay for them. I wish they can provide them in the health center".* Another male patient said "*I think the medical services in the HC are excellent. I receive a lot of care in the health center, I even lost a lot of weight with their help and follow up from 95 Kgs to 75 kgs. But my only remark for improvement would be to reduce my*

waiting time and to provide more of the chronic medications that I need and sometimes I can obtain them from an outside institution for free but most times I can't. I wish UNRWA can arrange to provide these chronic medications for me continuously. I would feel so relieved". On the same context a female patient with uncontrolled DM and other comorbidities said " *I think the health center needs the presence of specialists like cardiologist available for all patients and endocrinologist for the difficult uncontrolled cases. I also wish they can provide glucometers and strips for all patients with DM".*



Graph 4.1: Need to Pay for Any Extra Service that are not Provided at UNRWA Health Centers

❖ Family History and Factors Related to Diabetes:

Table 4.3: Differences in Controlling Status by Family History.

Correlates	Controlled (n=212, 48.8%)		Uncontrolled (n=222, 51.2%)		Total (N=434)		P value	Sig
	No	%	No	%	No	%		
Hypertension								
Yes	99	50.0	99	50.0	198	45.6	0.193	0.660
No	113	47.9	123	52.1	236	54.4		
Diabetes								
Yes	106	50.2	105	49.8	211	48.6	0.317	0.573
No	106	47.5	117	52.5	223	51.4		
Chronic heart diseases								
Yes	31	49.2	32	50.8	63	14.5	0.004	0.951
No	181	48.8	190	51.2	371	85.5		
Thromboembolic events								
Yes	22	64.7	12	35.3	34	7.8	3.713	0.054
No	190	47.5	210	52.5	400	92.2		

Chronic lung diseases								
Yes	9	60.0	6	40.0	15	3.5	.773	0.379
No	203	48.4	216	51.6	419	96.5		
Chronic kidney diseases								
Yes	10	35.7	18	64.3	28	6.5	2.066	0.151
No	202	49.8	204	50.2	406	93.5		

Around 46% of study participants reported having a family history of hypertension, 49% reported having a family history of diabetes (the most prevalent), and 14.5% reported history of chronic heart disease. Family history of other chronic diseases was less prevalent and shown in detail in Table 3 above. Other studies demonstrate family history of chronic disease such as Kayar et al., (2017) & Almutairi et al., (2013) with a family history in 78% and 77.9% of study participants respectively. Similarly in local study among UNRWA HCs in 2018, family history of DM was confirmed in 56.5% of patients (El Halabi, 2018).

Table 3 shows in general that control was higher among participants who reported having family history, but the differences were not statistically significant except in having a family history of thromboembolic diseases. Possibly having a family history affects health seeking behaviors in the family with positive spell over effects. Patients with family history of thromboembolic events had a better control rate (64.7%) than those who don't (47%) and the differences among the two groups were nearly statistically significant. The literature suggests a contradictory finding with people having positive family history of chronic diseases tend to report poor control status (Kayar et al., 2017; Almutairi et al., 2013). This has a clinical significance showing that patients with family history of acute thromboembolic events which is one of the top ranked causes of death nationally might be associated with better attitudes and healthier practices and maybe better medications adherence leading to better glycemic control fueled by their fear of having the same health outcome and premature death. This information of patient's family history can be used by healthcare providers to motivate patients to adopt healthier lifestyle and selfcare and be part of their effective counseling messages. This possible explanation was demonstrated by a female patient with controlled DM in one of the FGDs as she said *"I want to talk about my brother who had Diabetes and was very uncontrolled. He used to drink soft drinks with big quantities on daily basis despite his family`s advice and his HCP`s*

advice, but unfortunately, he suddenly developed renal failure, blindness in one eye and then he had heart attack and passed away. I lost him to Diabetes, and I don't want to have his fate, hence I take very good care of what I eat, and I try to be active inside the house and outside as much as I can. I never stop taking my medications even if I am outside my home or at a social gathering and I never drink soft drinks or eat heavy sweets".

Table 4.4: Differences in Control Status by Variables Related to Diabetes

Correlates	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222, 51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Period since diagnosis with DM								
Up to 3 years	72	69.2	32	30.8	104	24.0	27.560	0.000 *
4 - 9 years	59	48.4	63	51.6	122	28.1		
10 years and more	81	39	127	61	208	47.9		
Mean	8.446		11.115		9.8 years			
Current management plan - lifestyle modification								
Yes	97	64.2	54	35.8	151	34.8	21.952	0.000 *
No	115	40.6	168	59.4	283	65.2		
Current management plan - Oral hypoglycemic agents								
Yes	186	46.0	218	54.0	404	93.1	18.44	0.000 *
No	23	86.7	4	13.3	30	6.9		
Current management plan - Insulin only								
Yes	4	30.8	9	69.2	13	3.0	1.753	0.186
No	208	49.4	213	50.6	421	97.0		
Current management plan - Insulin + OHA								
Yes	21	18.8	91	81.3	112	25.8	54.729	0.000 *
No	191	59.3	131	40.7	322	74.2		
Period since starting OHA								
Up to 3 years	92	68.1	43	31.9	135	31.1	31.804	0.000 *
4 - 6 years	29	45.3	35	54.7	64	14.7		
7- 9 years	21	38.2	34	61.8	55	12.7		
10 - 15 years	43	38.7	68	61.3	111	25.6		
16 years and more	27	39.1	42	60.9	69	15.9		
Mean	8.5 years							
Period since starting Insulin								
Up to 3 years	190	53.5	165	46.5	355	81.8	24.768	0.000 *
4 - 6 years	5	18.5	22	81.5	27	6.2		
7- 9 years	3	21.4	11	78.6	14	3.2		
10 - 12 years	9	60.0	6	40.0	15	3.5		
13 years and more	5	21.7	18	78.3	23	5.3		
Mean	2.2 years							

Last modification of OHA such as adding new drug / increasing dose								
Up to 1 month	8	21.6	29	78.4	37	11.4	13.184	0.022 *
1-3 months ago,	14	38.9	22	61.1	36	11.1		
4- 6 months ago	15	51.7	14	48.3	29	9.0		
7-9 months ago,	4	44.4	5	55.6	9	2.8		
9-12 months ago,	13	68.4	6	31.6	19	5.9		
12 months and more	86	44.3	108	55.7	194	59.9		
In case on Insulin: Last modification of insulin regimen or dose								
Up to 1 month	1	3.6	27	96.4	28	23.7	9.493	0.091
1-3 months ago,	3	15.0	17	85.0	20	16.9		
4- 6 months ago	2	15.4	11	84.6	13	11.0		
7-9 months ago,	2	50.0	2	50.0	4	3.4		
9-12 months ago,	2	15.4	11	84.6	13	11.0		
12 months and more	11	27.5	29	72.5	40	33.9		
Self-monitoring of blood glucose SMBG at home (By glucometer)								
No home measurement	89	43.6	115	56.4	204	47.0	18.881	0.001 *
Several times annually	107	59.4	73	40.6	180	41.5		
One to several times monthly	14	38.8	22	61.2	36	8.2		
Once or more weekly	2	14.3	12	85.7	14	3.2		

When taking a deeper look into association between control status & the duration since onset of diabetes and diagnosis, it is obvious that a short duration of illness of less than 3 years is associated with better control status than longer durations of illness more than 10 years. For example, among patients with a duration of illness of more than 10 years only 39% had optimal control compared to 61% with poor glycemic control. On the contrary, among patients with a duration of illness of less than 3 years, 69.2% had an optimal control compared to 30.8% with poor control status, and this association between duration of diabetes and control status was statistically highly significant with a p value of 0.00.

Subsequently, the same significant association was demonstrated between control status & the duration since starting management of DM either with OHA or insulin with a P value of 0.000% for both. Once again, it is obvious that a short duration of starting management plans with OHA or insulin of less than 3 years is associated with better control status than longer durations on management plans of more than 10 years. For example, among patients with a duration of starting OHA of 13 to 15 years only 29.4% had optimal controlled compared to 70.6% with poor glycemic control. On the contrary, among patients with a duration of starting OHA of less than 3 years, 68.1% had an optimal control compared to 31.9% with poor control status. Additionally, according to above Table 4 which compares control status by factors related to management plan, 34.8% of study participants were on

lifestyle modification plans, 90.6% were on oral hypoglycemic agents, 3% on insulin only, and 25.8% were on combination therapy of both oral hypoglycemic agents OHA & insulin. This is somewhat similar to Kayar et al., 2017 which reported that 61% of patients were only on OHA therapy alone, while only 8% were on insulin and 31% were both on OHA + insulin Kayar et al., (2017). As seen in Table 4 patients on lifestyle modification only have shown more control (64.2%). Patients on OHA, insulin, or combination therapy reported less control (46.0%, 30.8% and 18.8% respectively) compared to being uncontrolled (54.0%, 69.2% and 81.3% respectively) with worst control status seen among patient on combination therapy of OHA and insulin. This association between type of management plan and control status was statistically significant (p value less than 0.05). This finding aligns with El Halabi, (2018) and Kayar et al., (2017) which showed a statistically significant association between type of management plan and the control status of study participants. Similarly, Kayar et al., (2017) and Adham et al., (2010) reported that poor glycemic control was found to be significantly higher in patients taking insulin therapy and in patients taking insulin + OHA medications than in patients taking only OHA medications. This demonstration may be related to the fact that patients treated by insulin or combination therapy have more progressively severe chronic disease that requires more aggressive treatment plans to achieve control, while patients with milder disease are more easily controlled by lifestyle modification alone and\or oral hypoglycemic agents.

In the qualitative part of data collection many patients with uncontrolled DM and healthcare providers who were interviewed showed negative attitudes toward insulin therapy and several concerns. Practical nurse said, "*I had several occasions that my patients refused to take insulin because they live alone, or their caregivers are neglecting them, and they are afraid no one would help them take insulin or they will have hypoglycemia and lose consciousness when they are alone and no one will save them".* While another medical officer added *"I remember an old female patient that I had last year who was severely uncontrolled with HgbA1c 15 on maximum OHAs and refusing to take insulin therapy at all saying that she feels nothing and feels well. She wasn't even aware that she was a mile away from developing multiple late complications of DM. I remember that the PN and I had so many sessions trying to raise her awareness and motivate her and convince her to start inulin and diet program till she was convinced. A few months later she was much better with*

HgbA1c less than 8, and she was saying I got so used to taking my insulin and eating low carb diet that it became a lifestyle for me, and I can't imagine going back to what I used to do".

On the contrary to the duration of illness, the longer the duration of more than 12 months from last modification of management plan especially OHA was associated with better glycemic control (44.3%), in comparison to short durations of less than 1 month from last medications adjustments (21.6%) and this association was statistically significant (p value equals 0.022). On the other hand, this significant association wasn't clear when studied for duration since last adjustment of insulin therapy. This effect seen with OHA might be due to better understanding and hence adherence of the new OHA regimen over time or might be explained by the fact that patients with more recent and more frequent dose adjustments are usually the poorly controlled ones compared to controlled patients with less frequent medication regimen adjustments and more dependance on lifestyle modifications.

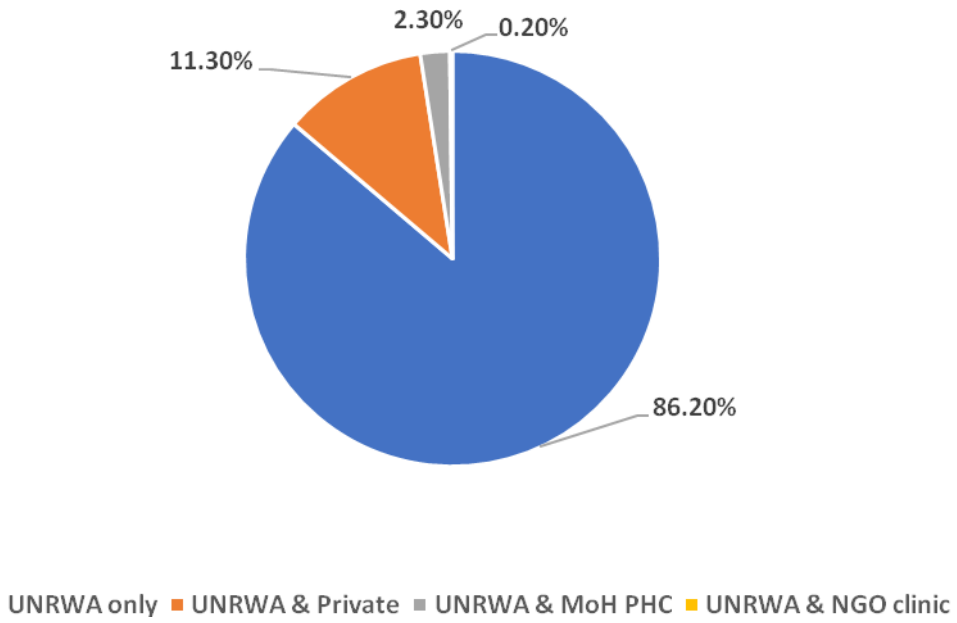
It's worth noting that among study participants on OHA therapy, 194 patients (two thirds of participants on OHA) and 40 patients (one third of participants on insulin) did not have their therapeutic regimen adjusted at all for more than a year. This needs further investigation to understand reasons for this non optimal management of therapeutic protocols and weather it`s more related to patient factors like good control or resistance to change of management plans, or to healthcare provider factors like PHC physicians' hesitancy to change management plans, needs for better knowledge or more empowerment of clinical decisions. This might have significant service implications and might help gain better understanding of reasons of poor glycemic control related to service provision.

Table 4.4 shows that 47% of all participants don't do any measurement for blood glucose level, and only 3.2% of participants had home measurement of their blood glucose level once or more weekly. The remaining (50%) ranged from just a few times annually to few times monthly as part of self-care. As for the optimal self-monitoring of blood glucose (SMBG) and self-care protocols for patients with diabetes it is advised by the American Diabetes Association (ADA) and makes optimal glycemic control harder to achieve (ADA, 2016). This observation was demonstrated also by El Halabi, (2018) study among UNRWA

HCs in which 58.5% of participants with DM confirmed lacking self-monitoring for blood sugar at home (El Halabi, 2018). This is explained by a patient with uncontrolled DM in the FGD who explained *"I have a glucometer for home monitoring of my blood sugar, but buying sticks costs me every month. When I don't have sufficient income, I stop purchasing them and I stop measuring my blood sugar. My family`s needs are a priority for me over my diabetes condition".* Similarly, a female NCD practical nurse in an IDI explained *"HgbA1c testing twice a year instead of once annually is much better and improved patients control status and their satisfaction. I wish we can increase this to 4 times a year each quarter and provide our patients with glucometers and strips for home monitoring of blood sugar and calculation of short acting insulin doses based on meals content. This will make our patients more aware about their condition and progress and motivate them to adopt a healthier lifestyle and informed self-care".*

This issue has a significant policy & economic implication as the cost-effectiveness of SMBG has also been questioned, and affordability of glucose test strips by individuals & health agencies like UNRWA must be considered. Some research has already shown that providing SMBG devices free of charge can improve the rate of testing (Soumerai et al., 2004). The researchers proved that providing free glucose monitors improved rates of self-monitoring possibly by offering an initial incentive for patients to engage in more desirable patterns of self-care. Thereafter, initiating SMBG was associated with increased regularity of medication use and a reduction in high blood glucose levels. They proceeded to conclude that self-monitoring of blood glucose can serve an important role in improving patient`s knowledge of their glucose levels (Soumerai et al., 2004). This has to be considered by UNRWA as in Table (2) previously it was shown that **78.8%** of study participants stated that they didn't have a functioning glucometer and strips available for SMBG, and in Graph 4.2 below which shows that 86% of study participants with DM have accessibility and receive healthcare services at UNRWA only, while another 11.5% receive healthcare services related to their chronic illness at UNRWA and other organizations (private & NGOs), while only 2.3% having accessibility to MoH primary healthcare centers. This is even higher percentage than described by El Khatib, 2018 twelve years ago when he demonstrated that 76.5% of his study`s partocrats with DM received NCD healthcare services and depended fully on UNRWA HCs alone to supply them with their chronic medications. This reflects even more

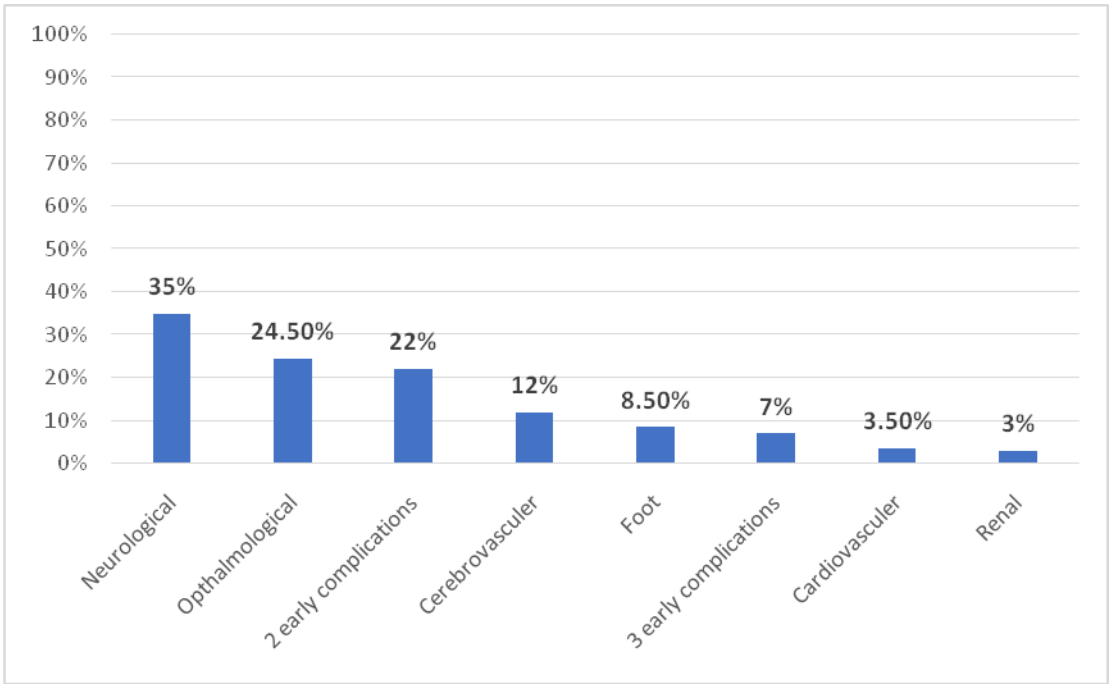
and more the huge burden and responsibility that UNRWA has toward the refuge's community suffering from one of the most challenging to control chronic diseases, and considered one of the highest health expenditures.

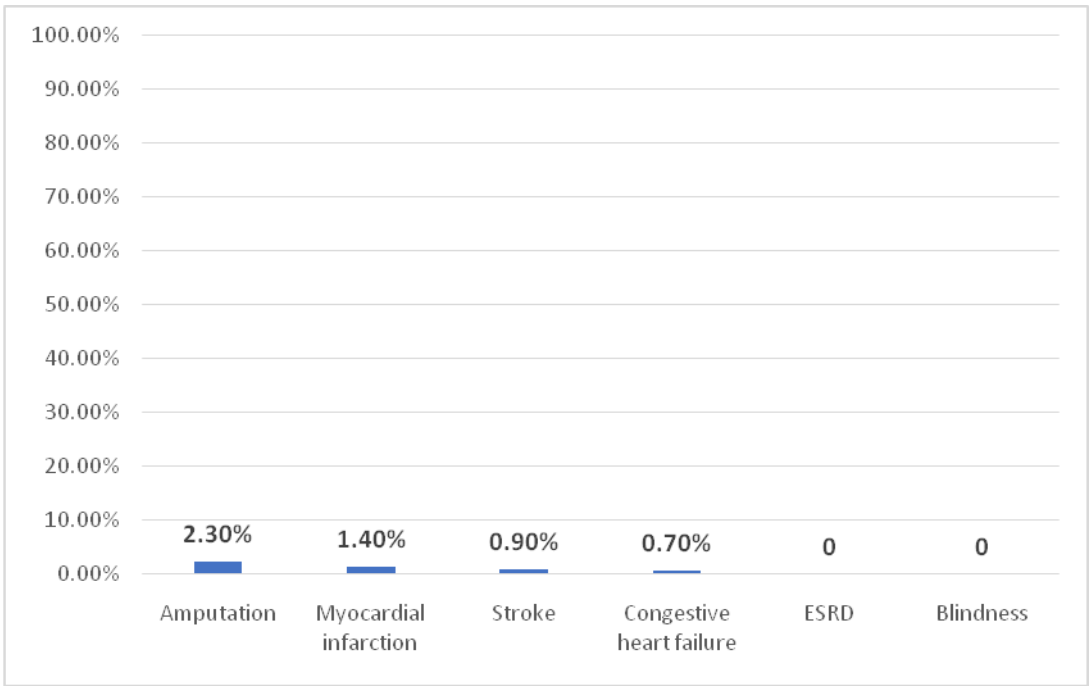


Graph 4.2: Accessibility to Organizations Providing NCD Health Services to Patients with Diabetes

Table 4.5: Differences in Control Status by Developing Complications Related to Diabetes Condition.

Correlates	Controlled (n=212, 48.8%)		Uncontrolled (n=222, 51.2%)		Total (N=434)		P value	Sig
	No	%	No	%	No	%		
Developing early complications of diabetes according to file review								
Yes	103	44.2	130	55.8	233	53.7	4.338	0.037 *
No	109	54.2	92	45.8	201	46.3		
Developing late complications of diabetes according to file review								
Yes	12	57.1	9	42.9	21	4.8	0.608	0.436
No	200	48.4	213	51.6	413	95.2		
Risk stratification from file review								
Low risk	173	50.6	169	49.4	342	78.8	3.210	0.201
Intermediate risk	35	44.9	43	55.1	78	18.0		
High risk	4	28.6	10	71.4	14	3.2		





Graph 4.3 and Graph 4.4 Shows the Distribution of Early and Late Complications Related to Diabetes Condition Among Study Participants

Table 4.5 clearly demonstrates; 53.7% of study participants have developed early complications of DM, while fortunately less than 5% (only 21 participants) has developed late complications of DM. This is much higher than what was revealed by El Khatib, 2018

when studying satisfaction among patients with DM and HTN attending UNRWA HCs as he described a lower percentage of developing complications of only 32%. It's not clear if the rate of developing complications has dramatically increased in past 12 years, or more logically the detection and registration of those complication has improved especially with discarding work on hard copy patient files and registers and fragmented primary healthcare practice and the use of continuous comprehensive family practice with electronic patients' medical files (eHealth system).

Moreover, a total of 44.2% of patients with early complications had an optimal glycemic control compared to a higher percentage 55.8% of patients who developed early complications with uncontrolled DM. This association was clearly revealed to be statistically significant (p value .037%), while on the contrary the association of control status with developing late complications and risk stratification was not statistically significant (p value more than 0.05). This both has a clinical significance in focusing efforts on prevention or halting of complication development through optimization of glycemic control among patients with DM, and can be explained and backed up by solid clinical and scientific facts and knowledge linking poorly controlled DM to development of all types of early & late diabetic complications. The lack of association between glycemic control and late complications might be due to the small sample size of people who developed late complications among this random study simply of less than 5% of all partocrats which might have affected the statistical significance but can't exclude the clinical significance.

This positive association was concurrent with what was found by Kayar et al., (2017) who stated that there is a significant association between poor glycemic control and nephropathy, retinopathy, neuropathy, and cardiovascular diseases, and it was not significant for the later complications like cerebrovascular diseases, arthropathy and amputation. Furthermore, they explained that the worse glycemic control rates were detected, the greater number of complications were seen, and poor glycemic control was significantly higher in patients with 2,3 or more complications than in patients with one or no complication developed.

In Graph 4; the types of early complications developed Vs. types of late complications developed (from history taking & file review) were demonstrated in detail and sorted from the most prevalent to least prevalent. The most common early complication was

neurological (35%) and ophthalmological (24.5%), while the most common developed late complication was amputation (2.3%). This is also different from demonstrated by El Khatib, 2018 in his study 12 years ago where it came as follows: cardiovascular complications represented 36.2% of the reported complications, 23.8% were neurologic related complication, cerebrovascular related complications represented 20 %, whereas the remaining 20% represented all other types of complications (renal, foot, ophthalmologic, etc.). Currently as shown in this study, neurological and ophthalmological were the most common and earliest to develop. This difference again might be attributed to the difference in availability of screening programs for complications with more accuracy of earlier detection and better documentation on eHealth.

It's worth mentioning that 22% of participants has developed 2 early complications, and 7% has developed 3 or more early complications despite not developing late complications, which has a high clinical and economic significance with policy implications to be taken in consideration and paying more attention to prevention of occurrence & delay of progression of early complications.

Despite some late complications like ESRD are not common among the sample, we can't measure their occurrence by only neglecting their devastating impact on patients with DM and their caregivers, not to mention their large health costs. A patient in the FGD was describing the impact of late complications on his diabetic neighbor's life and said *"I have a neighbor who had Diabetes for long time and developed renal failure. He goes for dialysis 3 times a week and his life has become very difficult and he lost his joy in life. He needs renal transplantation, but the doctors told him that his overall health wouldn't allow it. When I go to visit him, he seems always sad, depressed and speaks very few words as if he has lost all hope in life".*

When meeting with patients with uncontrolled DM during FGDs and asking them what they knew about early and late complications of DM, it was clear there was a huge gap between what they knew and the whole picture of DM complications. What they knew was like a drop in an ocean of knowledge, that if we really invested in enlightening them enough about the prognosis of poorly controlled DM it would make a big difference. Some of their answers included: " *I don't know the complications of DM yet as I am newly diagnosed, but my sister who had diabetes once lost consciousness at home when she had her insulin and*

didn't eat, I know also from her that DM affects the brain and limbs and can lead to amputation", another patient said *"when my blood sauger is high I feel that it affects my entire body. I don't feel that any part of my body is healthy. also, I become tired and exhausted all the time and suffer from headache".* Another patient continued by saying *"I remember few years ago during Haj, I sat down on floor cross-legged and after a while people told me my feet were blue, but I didn't feel anything no pain or numbness. That event was shocking for me, and I took a decision now I will start a major lifestyle change to control my blood sugar once I return home, and I did".* A similar conclusion was stated by a senior staff nurse responsible for NCD healthcare services within an UNRWA HC as he said *"Most of our HCPs are highly aware about DM complications and how to prevent them and avoid such devastating complications. I remember we had a patient with poorly controlled DM and very high HgbA1c and due to our team`s awareness of her possible fate if we didn't interfere, we started an intensive program of follow up despite her hesitancy at first. I remember her HgbA1c dropped from 11% to 6.8% in a few months".*

Table 4.6: Comparing Development of Early & Late Complications by Risk Stratification

Correlates	**Developed complications** (n=233, 53.7%)		**Didn't develop complications** (n=201, 46.3%)		**Total** (N=434)	**P value**	**Sig**
	No	**%**	**No**	**%**	**No**		
Early Complications							
Risk stratification							
Low risk	188	55.0	154	45.0	342	6.912	0.032*
Intermediate risk	34	43.6	44	56.4	78		
High risk	11	78.6	3	21.4	14		
Late Complications							
Correlates	**Developed complications** (n=21, 4.8)		**Didn't develop complications** (n=413, 95.2%)		**Total** (N=434)	**P value**	**Sig**
	No	**%**	**No**	**%**	**No**		
Risk stratification							
Low risk	9	2.6	333	97.4	342	66.04	0.000*
Intermediate risk	5	6.4	73	93.6	78		
High risk	7	50.0	7	50.0	14		

Interestingly - as Table 6 demonstrates - not only there is an association between control status & development of early complications of DM, but there is also a statistically significant association between risk stratification of study participants with DM (low, intermediate, and high) and the development of both early complications (p value 0.032%) and late complication (p value 0.000%). It's clear that the worse the risk stratification of the

patient, the higher the chance of developing both early & late complications. This is consistent with what Dewi et al., (2020) study on development of foot ulcers and foot complication recognize, they also recommended that recognition of the patient at risk may prevent the development of foot complications, but if they do happen urgent treatment is required to avoid limb loss (Dewi et al., 2020). The same findings for the relationship between type 2 DM and heart failure (HF) have been extensively reviewed, previous works focused frequently on epidemiology, pathophysiology, and treatment of HF in type 2 DM in addition to risk stratification. Lately, risk stratification tools and calculators to estimate HF incidence have been established to guide treatment with a view to bringing correctness in management plans into diabetes care (Cannistraci et al., 2020).

Having considered the negative effects of poor risk stratification on development of diabetic complications, patients with intermediate to high-risk stratification may now need to be seriously considered in programs for prevention and delay of development of diabetic complications. This will significantly improve patients' outcomes, decrease morbidity & disability related to DM, and hence decrees health expenditure on patients with Diabetes & other chronic diseases in low to middle income settings.

Table 4.7: Comparing Control Status by Comorbidities & their Control Status

Correlates	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222, 51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Prescence of hypertension								
Yes	155	51.5	146	48.5	301	69.4	2.754	0.097
No	57	42.9	76	57.1	133	30.6		
Control status of hypertension if present								
Controlled hypertension	124	56.6	95	43.4	219	72.8	8.457	0.004 *
Uncontrolled hypertension	31	37.8	51	62.2	82	27.2		
Sequence of developing HTN & DM								
HTN developed first	84	57.5	62	42.5	146	47.9	8.462	0.015*
DM developed first	51	41.1	73	58.9	124	40.7		
Both discovered simultaneously	21	60.0	14	40.0	35	11.5		
Prescence of hyperlipemia\dyslipidemia								
Yes	101	48.3	108	51.7	209	48.2	0.044	0.834
No	111	49.3	114	50.7	225	51.8		
BMI								
Underweight – normal body weight	34	51.5	32	48.5	66	15.2	11.74	0.008*
Overweight	87	54.7	72	45.3	159	36.6		
Obese	91	43.5	118	56.5	209	48.2		

According to Table 4.7 regarding relationship between the presence of hypertension and control status of DM there were no statistically significant difference (p value 0.097%), but on the contrary, the control status of hypertension was statistically significantly associated with control status of DM among study participants (p value 0.004%). A total of 56.6% of participants with controlled HTN had an optimal controlled status of their DM, compared to only 43.4% of patients with controlled HTN having poorly controlled DM. Additionally, as explained in the above table, 69.4% of participants reported having hypertension, which was double checked & confirmed from file review. Control status among people with hypertension was higher (51.4%) than those who are not hypertensive (42.9%). This was even higher than what was found by Kayar et al., (2017) which declared that 59% of the patients had hypertension, but still less than a percentage of 80% described by El Halabi, (2018) among patients with DM attending UNRWA HCs in 2018.

Furthermore, the control status was better among people who developed HTN and DM simultaneously (60%) in comparison to their counterparts who HTN or DM developed sequentially, the differences between these categories were statistically significant (P value .015).

Table 4.7 shows that only 15.2% of study participants had a normal body weight or underweight according to their BMI measurements, 36.6% were overweight, and 48.2% were obese (meaning a total of 85% of participants with DM were having elevated body weight). This is almost identical to Kayar et al., (2017) and Adham et al., (2010) studies where the researchers stated that 10.9% of the patients were normal weight, while 89.1% and 91.3% of patients were overweight or obese respectively. Similarly local research at UNRWA HCs in 2018 revealed the same extremely high percentage of overweight and obese of 89.2% of patients with DM (El Halabi, 2018).

The least reported control status was among obese (43.5%), and diabetics who are normal and or overweight showed better control status (see table 4.7), and the differences among groups were statistically significant (p value 0.008). This relationship was similarly revealed by many studies locally, regionally, and internationally such as (Kayar et al., 2017), (Adham et al., 2010), (Sanal et al., 2011), (Mamo et al., 2019) (Manjoo et al., 2012) and (Al-Zurfi et al.,2012). Some research has explained that obesity increases the secretion of Non-Esterified Fatty Acids (NEFAs) from adipose tissue, which in turn is associated with insulin

resistance (Khen et al., 2006; Jelic et al., 2007; Mitrou, 2013; Najjar et al., 2022).

When it comes to hyperlipidemia\hypercholesteremia, 48.2% of study participants with DM have reported having lipid profile abnormality, which was confirmed and double checked from file review by the researcher. Again, this like Kayar et al., (2017) who reported that total cholesterol was elevated in 53% of patients, and triglyceride was elevated in 54% of patients with DM in their study. According to Dyslipidemia is one of the key risk factors for cardiovascular disease in diabetes mellitus. The prevalence of hypercholesterolemia is not increased in patients with DM, however mortality from coronary heart disease increases exponentially as a function of serum cholesterol levels, and lowering of cholesterol with statins reduces diabetic patient`s relative cardiovascular risk (Yuan et al., 2021). In addition, hyperlipidemia is a well-known risk factor for cerebrovascular diseases such as atherosclerosis and stroke (Yuan et al., 2021).

But on the contrast to our study, both Khatab et al., (2010), Parhofer, (2015) and Mamo et al., (2019) had stated in their study presence of a significant relationships between glycemic control and dyslipidemia, total cholesterol levels, triglyceride and low-density lipoprotein LDL as compared to our study which didn't reveal a statistical significance of glycemic control with hyperlipidemia\ hypercholesteremia. In our study individual variations of the sample especially the advanced age of most of participants (above 60 years) and long duration of illness may have cancelled the impact of this chronic inflammation caused by hypercholesteremia on glycemic control. In addition to that, all patients with DM attending UNRWA clinics for NCD follow up and having hypercholesteremia with cholesterol level above 200 receive statins as part of their management plans according to UNRWA technical instruction (UNRWA, 2020).

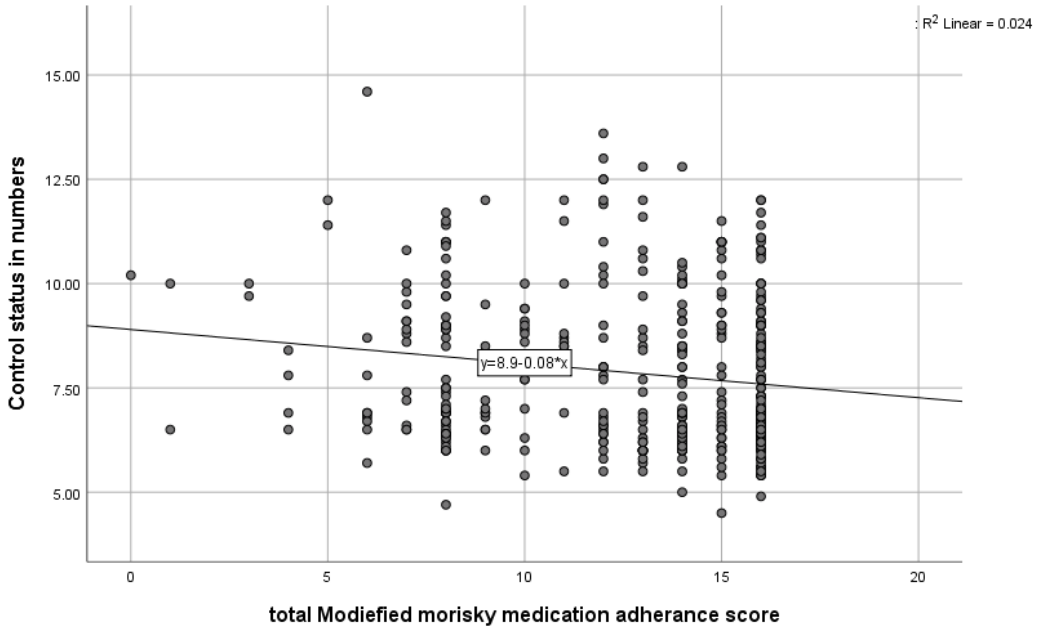
❖ **Medications Related Factors:**

Adherence to medications was evaluated by self-reporting with the use of the international eight-item Morisky scale (Morisky, 1986). The scale contains questions inquiring the patient to respond by "yes" or "no" to a group of eight questions. In this study, a positive response was granted zero or one point, and a negative response was granted two points. A positive response therefore indicates a problem with adherence. Consequently, lower overall scores indicate that a patient with chronic disease -per say DM-

is least adherent to his/her medications. Patients were then classified as highly adherent (score of 14-16 points), moderately adherent (9-13 points) and least or not adherent (score of equal or less than 8 points).

Table 4.8: Differences in controlling status by adherence to medications related variables.

Correlates	Controlled (n=212, 48.8%)		Uncontrolled (n=222, 51.2%)		Total (N=434)		P value	Sig
	No	%	No	%	No	%		
Medication adherence according to Morisky score								
Low adherence	32	35.6	58	64.4	90	21.7	8.432	0.015*
Medium adherence	40	44.9	49	55.1	89	21.5		
High adherence	125	53.2	110	46.8	235	56.8		
Degree of respondent`s awareness about medications regimen from file review								
Well-informed (correct types & doses)	110	54.7	91	45.3	201	46.4	4.990	0.025 *
Not well-informed (wrong types and\or doses)	102	44	130	56	232	53.6		
Degree of patient engagement in decisions related to the management plan taken by HCP								
Not fully engaged & informed	118	44	150	56	268	61.8	6.510	0.011 *
Fully engaged & informed	94	56.6	72	43.4	166	38.2		
Taking mediations during social visits or gatherings								
Yes, most of the times	37	36.3	65	63.7	102	23.5	8.560	0.014*
Yes, few times	35	54.7	29	45.3	64	14.7		
No	140	52.2	128	47.8	268	61.8		
Number of all chronic medication's types taken regularly								
Less than or equal 3	119	54.6	99	45.4	218	50.2	11.134	0.004*
4 - 6	87	46.0	102	54.0	189	43.5		
= > 7	6	22.2	21	77.8	27	6.2		
Mean was (3.5 types) and SD was (1.9) for all sample								
Number of all chronic medication's items (tablets & injections) taken regularly								
Less than or equal 3	71	68.9	32	31.1	103	23.7	41.624	0.000 *
4 - 6	77	55.0	63	45.0	140	32.3		
7 -9	39	39.0	61	61.0	100	23.0		
More than 10	25	27.5	66	72.5	91	21		
Mean was (6.2 items) and SD was (3.7) for all sample								



Graph 4.4: Correlation of Medication Compliance Morisky Score to HgA1C Level

NB: *Pearson Correlation factor is -.154 and Sig .002**

As shown in above Table 8, 21.7% of participants had low adherence to their chronic medications, 21.5% had medium adherence, and a higher percentage (**56.8%)** had a high adherence which is considered very good. The control status was better among participants with higher Morisky score and hence better adherence; 53.2% of study participants with high adherence to medication score had optimal glycemic control, compared to 46.8% having poor glycemic control, while participants with low adherence who had optimal control were only 35.6% compared to 64.4% having poor control status, and these differences were statistically significant. Similarly, significant relationships were demonstrated by Kayar et al., (2017) study on determinants of glycemic control, and again in their study **64.1%** of the patients had adherence to medical treatment with a Morisky score of high adherences, while the other 35.9% of the patients did not take their drugs regularly with a Morisky score of low or intermediate adherence (same as our study). Further studying the relationship between medication adherence according to Morisky scale & glycemic control status of study participants: it was highly statistically significant with a p value of .015% and when correlated medication adherence Morisky score to HbA1c level, a negative correlation appeared with a Pearson Correlation factor of -.154 and Sig .002, indicating that as the Morsiky adherence score goes higher (more medication adherence),

the HbA1c gets lower (better control status). But at the same time, we as healthcare providers must be aware of the difficulties chronic patients face in adhering to their chronic medications and lifestyle modifications. We as healthcare providers should have empathy with them and help them understand these difficulties, accept them, and cope with their reference. As a medical officer explained in one of the interviews *"Part of patients with DM denial to their illness and resistance is related to difficulty of adopting major lifestyle changes and behavioral changes. They are usually inactive and eating whatever they want whenever they want and suddenly, they are requested to start exercising, eating healthy according to preset diet plans and taking many chronic medications with different side effects. It's overwhelming and frightening for them. Their lives are not easy at all, and they need all the help and support they can get".* This was confirmed by the story told by a female patient with DM who used to be severely uncontrolled but fortunately currently optimally controlled as she said *"in 2014 I was first diagnosed with DM, but I refused to admit or believe that, as I didn't feel the symptoms of DM that we always hear about. I didn't have numbness or weight loss. I refused to take any medications and ate whatever I wanted whenever I desired. Afterwards, I had a JCP working opportunity at Rantissi hospital as a cleaner where I worked for 45 days till I suddenly developed weakness in the left side of my body and was diagnosed with CVA which I had a very long journey of treatment and rehabilitation. Since then, I never neglected my medications or my diet".*

A head of health center further explained that it is both awareness raising and motivation that we need to enhance patent`s adherence to their medications and lifestyle modifications as she explained *"Most important step to improve control status of chronic patients is to raise their overall awareness toward their disease, its nature, complications, adherence to medications and healthy diet & exercise. Many patients are aware but still have no positive attitude or have insufficient motivation to control their blood sugar".* This was confirmed by HC pharmacist who added *"I think we need a lot of work to be done to enhance people's awareness on their disease and its management especially and mostly issues related to diet, nutrition, and medication adherence. Adherence to medication is vital & crucial for optimal control of DM. God has created illness and, also, gave us the ability to create medicine to alleviate peoples suffering ".*

In addition to the degree of adherence to medications, Table 4.8 demonstrates a

relationship with other factors related to medications & therapeutic plans, namely degree of patients' awareness about his\her medication regimen, commitment to medication regimen during social visits & gatherings, and the degree of patient engagement in decisions related to his\her management plan. The control status was better & higher among patients with better awareness, more engagement in management plan decisions, and more prone to take their medications during social visits and gatherings. All three differences were statistically significant with a p value less than 0.05% (0.025%, 0.014%, and 0.011% respectively).

Another remark related to social factors affecting adherence to therapeutic & diet plans for glycemic control among patients with DM; 414 (95%) of study participants preferred that their relatives, friends, and neighbors knew about their chronic DM condition, while only 20 (5%) participants preferred, they do not know about their condition. Similar remarks were mentioned in the FGDs with patients with uncontrolled DM as one of them said *"Sometimes I ask others not to offer me sweets and sugary drinks and I tell them I am on diet for losing weight. I don't want to tell others I have diabetes. but then they don't listen to me, and I wonder if it`s better to tell them to help take care of my health and not destroy my efforts".*

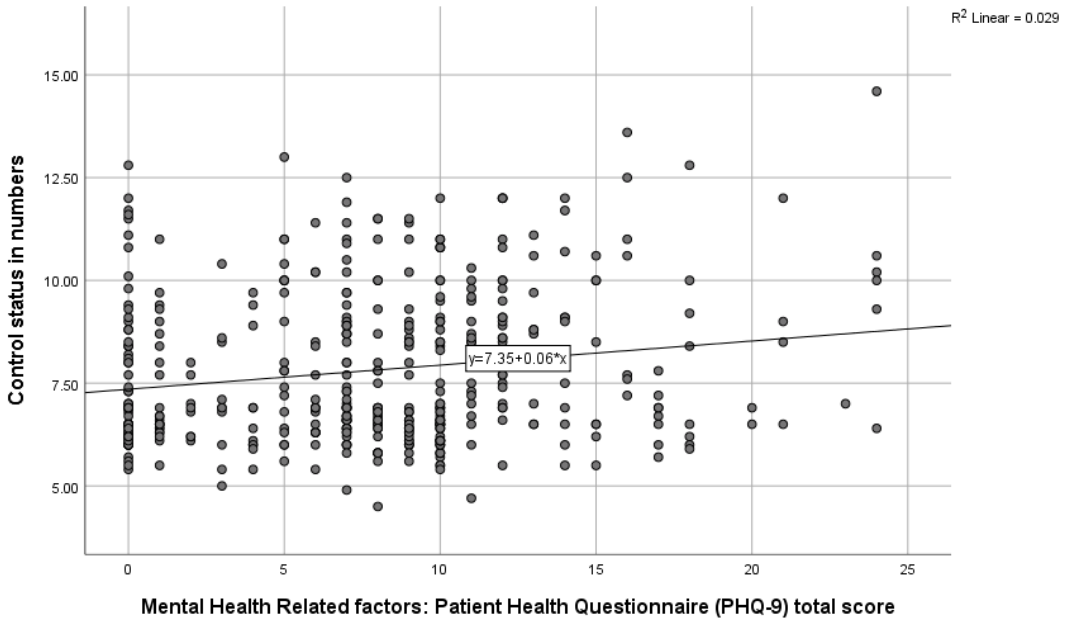
Despite the positive effects related to adherence & patient engagement in management plans outlined above, negative issues also need to be considered such as the relationship between number of medication types & items (tablets & injections) used to treat DM and the control status of the condition. As Table 8 demonstrates, a better control status with a fewer number of chronic medications items is used to treat all chronic conditions including DM (tablets & injections). The control status was better among patients with DM who have lesser number of medication types and items; to explain this more, a 68.9% of patients being on a regimen of 3 or less medications had an optimal control status, compared to 31.1% with poor glycemic control, and conversely 27.5% of patients being on a regimen of more than 10 medications items had optimal glycemic control, compared to 72.5% with poor glycemic control. This difference has turned out to be highly statistically significant in our study with a p value of (0.010) for number of medication types and (0.000%) for number of chronic medication items (tablets & injections). Noting that in this study the Mean number of chronic medication items was (6.2 items) and standard deviation was (3.7). This issue of relationship between high number of drugs and adherence was mentioned by

several HCPs in the IDIs and patients with DM in the FGDs, for instance a female pharmacist at UNRWA HC said *"Adherence to medication is vital & crucial for optimal control of DM, God has created illness and gave us the ability to create medicine to alleviate peoples suffering. I feel sorry & pitiful for chronic patients when I dispense their medication and see the large amounts of medications they need to deal with and take regularly, if I was them, I would be so frustrated I would drop out taking all the medicines".* Agreeing with his colleague pharmacist a male NCD PN said in another interview *"I am a nurse and if you give me a 7-day course of antibiotic, I will find it hard to adhere to it and finish the course. I can't imagine being on the same medications for 15 years and increasing number of medications each year".*

❖ **Mental & Phycological Related Factors:**

Table 4.9: Differences in Controlling Status by Mental Health Related Factors

Correlates	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222, 51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Patient health Questionnaire PHQ-9 for depression								
Minimal depression score 0-4	69	59.5	47	40.5	116	26.7	11.83	0.008*
Mild depression 5-9	77	51.3	73	48.7	150	34.6		
Moderate depression 10-14	48	38.7	76	61.3	124	28.6		
severe depression =>15	18	40.9	26	59.1	44	10.1		
Perception of current mental health								
Good to very good	117	55.2	95	44.8	212	48.8	6.682	0.035*
half\half	68	43.0	90	57.0	158	36.4		
not good	27	42.2	37	57.8	64	14.7		



NB: *Pearson Correlation factor is .171 and Sig .000**

The Above Table 4.9 shows that 38.7% of study participants with DM had a moderate to severe depression according to PHQ-9 screening tool for depression regardless of control status, and a total of 51% of participants perceived their mental health to be not good to half\half. On the other hand, only half of the study participants (49%) perceived their mental health to be good\very good. This shows a deterioration of mental health of patients with DM attending UNRWA HCs in past few years when compared to El Halabi, 2018 study among patients with DM attending UNRWA in which she explained; about 77% of participants had mild psychological distress; however, about 16.2% had moderate distress and 6.8% had severe distress and needed intervention according to use of GHQ questionnaire for screening for psychological stress level. This deterioration might be related to worsening of both political & socioeconomic conditions or might be more related to use of a different international screening tool (GHQ Vs. PHQ) or a combination of both.

Additionally, the presence of higher degree of depression was associated with worse control status, for example 59.5% of patients who had minimal depression had an optimal glycemic control compared to 40.5% of them having poor control, and on the other extreme 40.9% of patients who had moderate to severe depression had optimal glycemic control and 59.1% having poor control. Both PHQ-9 and patient`s perception of mental health had a

statistically significant relationship with the glycemic control of study participants (p values 0.008 & 0.035 respectively). This is also demonstrated by the correlation between HbA1c and PHQ-9 in Graph 5 below which revealed a statistically significant weak positive correlation between both variables with a Pearson correlation factor being 0.171 and Sig .000 and a similar positive correlation was described by El Halabi, 2018 study among UNRWA patients with DM which explained that increasing the level of psychological stress increase the level of HBA1c or vice versa, increasing the level of HBA1c increase the level of stress among patients (El Halabi, 2018). This is consistent with updates from American Diabetic Association, which explains that both physical and psychological stress causes higher blood glucose levels in people with both type of diabetes (ADA, 2013). In addition, it`s also concurrent with Whichester, (2016) study which used a correlation analysis to test the relationship between diabetes distress and HbA1c and concluded that distress could significantly affect the control status among diabetic patients (Whichester et al., 2016).

Similarly, the worse the patient`s perception of his\her mental health was associated with worse control status, for example 55.2% of patients who had a good\very good perception of own mental health had optimal control status compared to 44.8% having poor control, and on the other extreme 43.0% of patients who don't have good perception of own mental health had optimal control compared to 57.0% of them having poor control.

"Once a patient with DM is diagnosed, it has huge impact & burden that affects his entire life. They become very anxious and in bad need of psychological support. When I have the chance & time, I try to talk to them convincing them to consider DM their friend and co-live with it. Stress management and anger control are key factors in glycemic control of patients with Diabetes. But, whenever I try to tell our patients not to be stressed out and to take care of their mental & psychological wellbeing, they always say it's impossible to do that while living in our community facing all these stressors and hardships and not being able to provide for their families. If a chronic patient doesn't love himself\herself and love their own lives, they will never be able to take care of their health properly, let's start their first", that's what a female healthcare provider said when she was asked about her opinion regarding mental health and its relationship to control status in an interview. But to which degree do mental and psychological factors affect outcomes of patients with DM and their overall physical health? We will explore that.

If we could list the factors mentioned by patients with DM to affect their control status in the focus group discussions, the mental and psychological related factors would be top ranked. It was mentioned over and over by healthcare providers from all categories too, as one medical officer said *"When patients are diagnosed with DM, I see them get deeply shocked, they seem to take long time and a lot of support to accept that and start dealing with it. Afterwards, I see them divide after years of battling the illness to either close friends or harsh enemy. Most of the patients with poor glycemic control I deal with - when I do a general health questionnaire (GHQ12) for them- they show high scores of more than 9 indicating poor mental health status and high stress levels. Many of my patients I refer to psychosocial counselors on daily basis.".*

The top ranking of mental health related factors was also mentioned by a HHC in an interview who said *"Life for patients with DM is full of suffering and agony. When they are initially diagnosed, they always manifest different degrees of denial before accepting their illness. I think if we put together a list for ranking factors affecting the control status of our patients and need for action, I would list the mental & psychological factors at the top of the list".*

The same phenomenon was explained by another MO in another UNRWA HC as he said *"I face many patients with diabetes suffering from depression maybe even on daily basis. I especially find depression among patients who live alone, neglected, refuse insulin, non-adherent to medications, not compliant with lifestyle modifications, refuse exercise, not compliant with their appointments, etc.".*

Dealing with patient's mental health issues is not always easy task for healthcare providers who lack sufficient experience and knowledge of such a complex issue as mental health and a relatively newly introduced service which is MHPSS (integrated with UNRWA PHC in 2016). This was put together by an NCD PN who explained *"When we as NCD PNs try to provide mental & psychological care to our NCD patients we are blocked by their bad economic & social situation that we can't fix. I remember an old man with uncontrolled DM once told me my son finished high school with a score of 98%. Unfortunately, I couldn't send him to the college he desires, and could only send him to a free of charge education that neither he nor I desired. This event has given him a broken heart, CVA and severely uncontrolled glycemic status. I tried to help him as much as I could through providing MHPSS*

support and referred him also to the psychosocial counselor, but neither of us could give his son the education he dreamed of and fix his broken heart". His colleague PN from another HC also agreed that *"The mental and psychological suffering of patients with DM is a huge barrier to their improved control status in the way I see it".*

The patients with both uncontrolled and controlled DM in all FGDs agreed with HCPs on the great impact and relationship of poor mental & psychological wellbeing on control status. A patient with uncontrolled DM emotionally stated *"My family has diabetes and it's almost hereditary for us, but still when I was diagnosed with diabetes, I felt very sad and angry. I am still young, why should I suffer? It took me a long time to accept my illness and my blood sugar remained high for a long time. My provider in my last visit told me if you keep taking everything to your heart, Diabetes will kill you".*

On the other hand, patients with controlled DM showed a more positive attitude toward their illness and stronger coping mechanisms. One of the patients with controlled DM explained this saying *"I consider the mental & psychological factors are the most threating because those are the factors that are external and beyond our ability to control, which is unlike diet, exercise and medications which are within our control, and we are totally responsible for them. Our mental health comes first. I know many of our stressors are external and we can't control them. But as patients with DM, we must teach and train ourselves not to be affected by every minor stressor or issue we face and not to overreact to things. We must keep ourselves calm and relaxed as much as we can. When we feel dawn or stressed out, we should go out for a walk, visit a friend we like, go to the mosque, or asks for help from others around us or even tell our healthcare providers that we are mentally suffering".*

Another well-educated patient with controlled DM explained the same message saying *"Patients must cope with diabetes like any other chronic illness, of course I have noticed that most of patients with DM have some degree of sadness or anxiety, but still, they need to understand the nature of their illness and adapt and co-live with it as a companion. If they dealt with it positively, their illness will be kind to them. But if they deal with it negatively and with no acceptance, it will treat them adversely".* This was also confirmed by a middle-aged female patient with controlled DM who said *"I keep good control over my blood sugar through diet, I take my medications regularly, and I try not to be sad and nervous. I am the*

biggest supporter of myself, and my daughters and sons are supportive to me too".

❖ **Nutrition & Diet Control Related Factors:**

What is our patient's food habits, food diversity scores, and to what degree does it affect their control status? We explore that in the sections below.

To understand nutritional profile more for study participants, the "Food Consumption Score FCS", a score calculated using the frequency of consumption of different food groups consumed by a person during the past seven days, has been calculated using the approach recommended by the world food bank "WFP" vulnerability analysis and mapping (WFP, 2015).

Table 4.10: Consumption Pattern Over the last 7 Days of Study Participants.

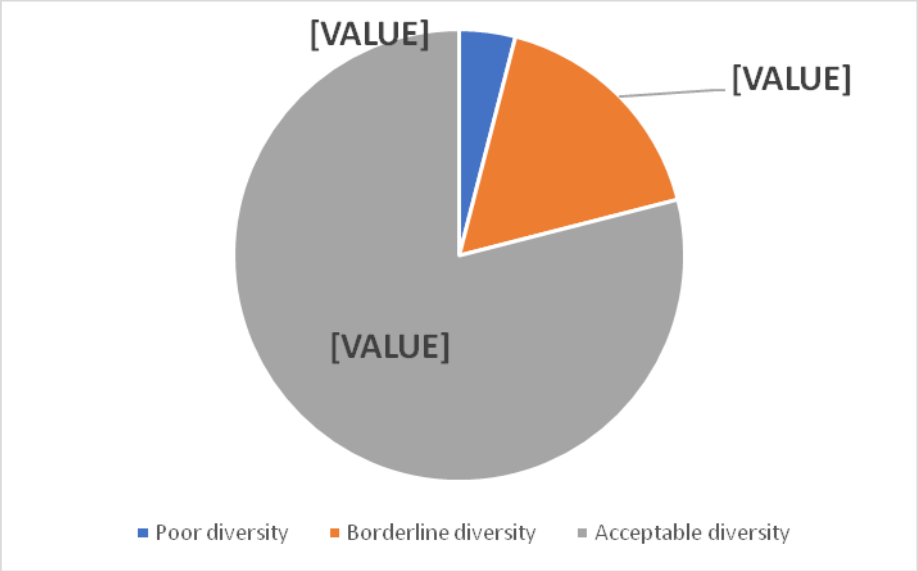
Frequency of consumption in days	0	1	2	3	4	5	6	7
Cereals (bread, pasta, wheat flour, bulghur)	0	0.7%	6.5%	0	2.3%	16%	0.5%	74%
White tubers and roots (potato, sweet potato)	6.5%	35%	36%	.9%	7.4%	5%	0	9.2%
Vegetables, leaves	0	0	20%	7.4%	17%	10%	4.4%	41.5%
Fruits	0	5.3%	32%	13%	3%	9.4%	1%	36.6%
Meat (organ & flesh meat)	4.6	41.9	16.4	29.7	7.4	0	0	0
Eggs	10%	57.6%	9%	8.3%	2.3%	1.2%	.2%	11.3%
Fish and other seafood	40.3%	49.5%	1.2%	2%	0	0	0	7%
Legumes, nuts and seeds (beans, chickpeas,)	55%	18.7%	18%	8%	0	.2%	0	0
Milk and dairy products	37.6	0	6.5	25.1	4.1	24.4%	0	2.3%
Oil and fats	10.8%	16.6%	53.7%	2.5%	12.4	0	2.3%	1.6%
Sweets (sugar, honey, jam, cakes, candy,)	48.4%	33.6%	9.4%	3.2%	4.1%	0	1.2%	0

As the above Table 4.10 illustrates the most frequently consumed food items in the past week were cereals (74%), vegetables (41.5%), fruits (36.6%) which were consumed by study participants with relatively high percentages, 7 days a week. Of the total respondents, 90% reported not consuming fish & seafood -at all or only once-in the past week, and similarly 74% indicated not consuming legumes & nuts, 67.6% indicated not consuming eggs and 46.5% reported not consuming meat. Additionally, 82% reported not consuming any sweets -at all or only once- in the past week, which shows that sweets are a less prevalent in patients with diabetes than other sources of simple carbohydrates like cereals and white

flour products which was consumed every day or at least 5 days a week by 90.5% of study participants. Overall, it could be understood from the table that study participants focus on consuming cheap less nutritious foods than more expensive nutritious ones. Similar effect of socioeconomic status on food choices was described by local study El Halabi, (2018) as she described that; only 24% of participants ate oily fish every week and only 25% consumed nuts and seeds regularly, and she proceeded to explain that this may be due to the high cost of such foods (El Halabi, 2018). Similar food patterns and habits were shown among other age groups in Gaza strip like in study which demonstrated that adolescents from the West Bank consumed fruits, sweets, meat, and chicken more often and drank soft drinks more often than adolescents of Gaza ($P < 0.001$), while adolescents from Gaza ate vegetables more (Al Sabbah et al., 2007). The researchers explained that the Gaza Strip is a highly populated area and thus poverty may result in lack of accessibility and availability of some kinds of foods that are not locally grown or produced, or cants be purchased or afforded. In addition, people in the West Bank to some extents are wealthier and many have adopted a more westernized lifestyle (Al Sabbah et al., 2007). Another recent local nutritional study El Belbeisi et al., (2022) studying the food frequency and diversity among under five years old children and their parents in Gaza strip has revealed a similar pattern of consumption. According to El Belbeisi et al., (2022), 92% and 78% of under-five children in food-insecure and food-secure households do not consume group 4: flesh foods, respectively ($P < 0.05$). Furthermore, 38.4% and 20.0% of under-five children in food-insecure and food-secure households do not consume up to 7: other fruits and vegetables, respectively. In their study, families consumed less flesh food, eggs, vitamin A rich fruits & vegetables, nuts, legumes and more Grain based foods and dairy products (El Belbeisi et al., 2022).

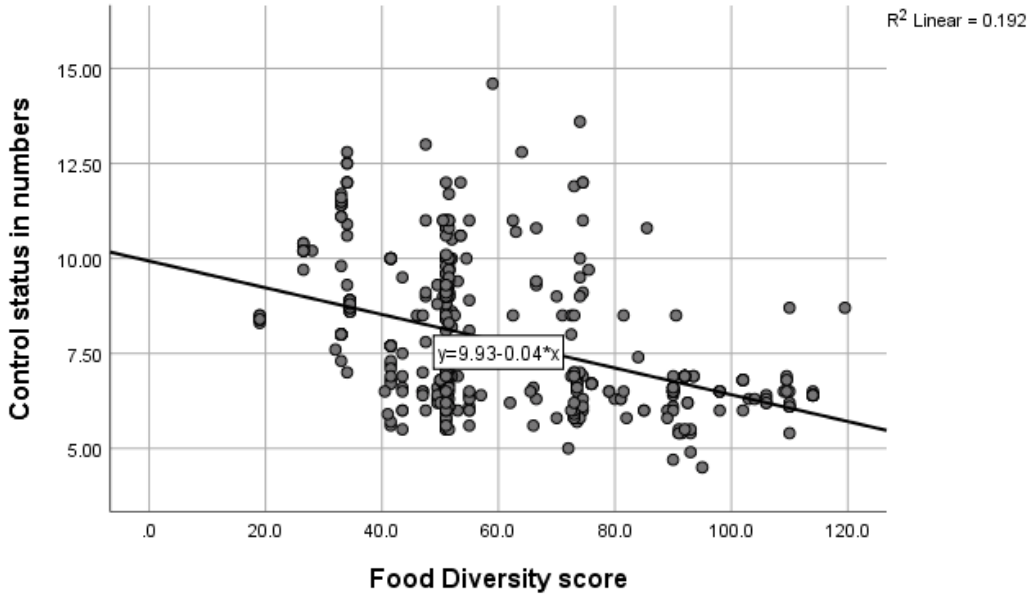
"Diet, diet, diet. In my opinion and experience diet control is the main factor in controlling blood sugar levels, followed by stress & sadness. The soft drinks and artificial juices have the worst effect on my body", that's what a female patient with uncontrolled DM expressed when was asked about most important factor affecting her overall physical health and control status of Diabetes. On the same page, a male NCD PN explained *"Nutrition and diet control is pivotal for optimal glycemic control in my opinion. It works interactively with the other parts of care (the Amer عامر Acronym which stands for medications – diet control –*

follow up & self-care - regular exercise which we use for counseling purpose) to help patients control their blood sugar levels. Each one of the 4 aspects depends on the other and dynamically interacts with the other aspects to reach the result of optimal control. As PNs we need to teach our patients how to differentiate and choose between foods with high glycemic index and foods with low glycemic index. Most of our patients and their relatives do not have this knowledge and can't design their daily meal plans wisely on a scientific basis and within the available resources they have".



Graph 4.6: Consumption Pattern Over the Last 7 Days According to FCS-Food Diversity Score

The food consumption score analysis shows that around 4% are regarded as poor, 17% are borderline and the remaining 79% are acceptable as presented in Graph 4.6.



Graph 4.7: Correlation of Food Diversity Score FDS to HgA1C Level

***NB**: Pearson Correlation factor is -.438 and Sig .000**

As above Graph 4.7 shows: there is a moderate strength negative correlation between food diversity score of past week and glycated hemoglobin HbA1c level among study participants, as the food diversity score increases the HbA1c level decreases. This correlation was highly statistically significant with a p value of 0.000%. To put this in other words, people with higher diversity score tend to have better control manifested in lower hemoglobin A1c.

The quantitative findings were also consistent with qualitative interviews and FGDs findings describing unhealthy food habits based on cheap carbohydrates (mainly bread) and poor in meats, fish, eggs, nuts, and fruits which are more expensive. This was described repeatedly by both HCPs and patients of both control status. A pharmacist working in an UNRWA health center explained *"Unlike other foreign countries -like some Western and Asian countries- who don't each much bread, we as Arab people rely mostly on bread in our diet and can't exclude it or even rationalize it in our diet including patients with Diabetes".* Another colleague medical officer further explained "*We must be aware as HCPs that nutrition is a big challenge for our people. Many patients have the desire to eat healthy food and optimize their diet to improve their control status. But they lack the financial abilities to purchase healthy foods and it's not convenient for them to eat separately from their families, especially with family's limited resources. At the end of the day, they will just eat with their*

families from what's available at their homes regardless of if it suits their health needs and control status or not".

A senior staff nurse responsible for NCD healthcare services among an UNRWA HC described this challenge by saying *"During Summer chronic patients in our community consume large amounts of sugary fruits like grapes, mangos, figs, dates, and watermelon. We advise them to eat rationally as much as they can limiting their portions and consuming more portions from fruits with low glycemic index. We are in need more scientifically based nutritional counseling through well trained HCPs on clinical nutrition counseling principles for patients with DM. Furthermore, I believe we need to have visited clinical nutritionists among our health centers for difficult or complex cases".*

In terms of several patients with uncontrolled DM described their attitudes and behaviors regarding nutrition and diet during FGDs. Some of their statements included *" I can't follow a diet program, my blood sugar drops if I try to minimize food intake, I feel sweaty and drowsy and must eat something sweet immediately".* Another patient said *" I developed Diabetes during pregnancy and continued with me till this day, I try to follow diet regimen to improve my control status especially that I am very uncontrolled -my HgbA1c is 12- and my husband is a nurse who tells me I must follow a diet plan like my HCP at the HC does. It's not that easy to do. It's very hard when I feel down or frustrated, I must eat something sweet or go visit my parents who will give me delicious food too".* Another female patient with poorly controlled DM explained *" soft drinks and laziness are my worst enemies, I guess. Every visit my nurse and my doctor tell me about the importance of diet control, and I honestly try to commit to their advice. But then my daughters make basbousa "oriental sweet dish" and I can't resist it, then I feel guilty. I wish I could have more determination to follow diet plan strictly. I also try to reduce my bread intake but it's very hard too. I don't feel satiety unless I eat enough bread."*

On the other hand, other patients with optimal controlled DM showed a more positive attitude toward dieting and more balanced food habits. One of them said *"I can keep my blood sauger within normal levels through following diet control. I don't eat randomly, and I eat only healthy food and avoid eating bread as much as I can. I consume all drinks like tea and coffee without sugar. When we invite our daughters for Friday`s lunch I try to eat small portions only of sweets and go for a long walk on that evening. I don't feel deprived or sad.*

On the contrary I feel like I am having control over my body and my illness not the opposite".

Table 4.11: Differences in Controlling Status by Food Consumption Score "FCS" & Other Diet Related Factors.

Correlates	Controlled (n=212, 48.8%)		Uncontrolled (n=222, 51.2%)		Total (N=434)		P value	Sig
	No	%	No	%	No	%		
Food consumption score								
Poor diversity	0	0	17	100	17	3.9	78.55	0.000 *
Borderline diversity	7	9.5	67	90.5	74	17.1		
Acceptable diversity	205	59.8	138	40.2	343	79.0		
Following advice on meal plan prescribed by a physician or a nutritionist								
Yes	155	54.8	128	45.2	283	65.2	11.418	0.001 *
No	57	37.7	94	62.3	151	34.8		
Following any herbal or traditional remedy to control blood sugar								
Yes	36	38.3	58	61.7	94	21.7	5.345	0.021 *
No	176	51.8	164	48.2	340	78.3		

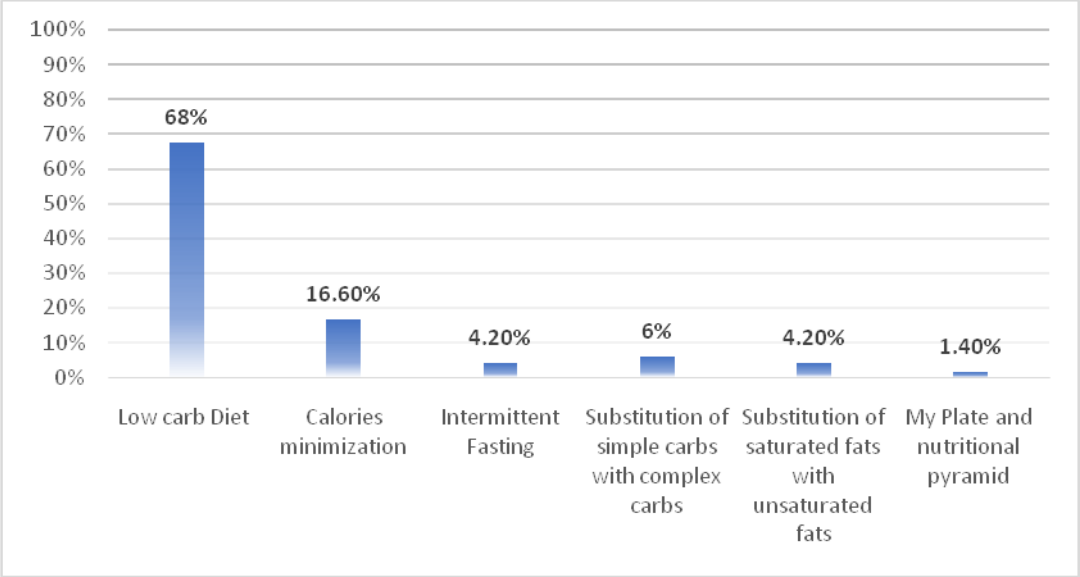
In the above Table 4.11 we take a deeper look at some nutritional & diet related factors and their comparison among both control status groups. First came the comparison of control status based on the food consumption score explained above, which revealed a statistically significant relationship to control status with p value of 0.001. As seen in below table the better food diversity and FCS was associated with better control status, as 59.8% of patients with acceptable diversity having an optimal glycemic control compared to only 40.2% with poor control, and on the contrary 100% of patients with poor diversity had a poor control status compared to none having controlled DM.

Similarly, as shown in the above table, following advice on meal plan prescribed by a family\PHC physician or a nutritionist was associated with an optimal control status in 54.8% of participants compared to 45.2% of poorly controlled group. Failure to follow advice or meal plan on the other hand was associated with a worse control status, as 62.3% of patients not following any plan of diet control had a poor control status. This relationship was also statistically significant with a p value of 0.001. To take a deeper look into types of diet plans followed by study participants and their ranking from most common to least common please check below Graph 8.

On the contrary to the positive relationship between control status and both FCS and following diet plan; the table shows a negative relationship between following any herbal or

traditional remedy to control blood sugar and the control status. Study participants following herbal & traditional remedies for glycemic control had a worse control status than participants who didn't, and this comparison was statistically significant with a p value of 0.021. It's not clear if those remedies had a direct biological effect on glycemic control or rather a more behavioral effect by reducing patient`s compliance to their pharmacological therapies, lifestyle modifications, and diet plans while depending on those remedies. Further local research to explore this negative relationship is needed in the future.

Like our findings and according to El Belbeisi et al., (2017) when studying food patterns among 1200 patients with T2DM in the Gaza Strip and its relationship with control status and development of complications he found out that patients adopted one of 2 patterns either Asian- like or sweet-soft drinks-snacks pattern. Asian-like pattern was characterized by a high intake of whole grains, potatoes, beans, legumes, vegetables, tomatoes, and fruit as well as a low intake of refined grains, sugar, sweets and desserts, while Sweet-soft drinks-snacks pattern characterized by a high intake of refined grains, sugar, sweets, desserts, snacks and soft drinks. The main findings of this study showed that the Asian-like pattern may be associated with a better control status and lower prevalence of diabetes complications (High BP, kidney problems, heart problems, extremities problems and neurological problems) among T2DM patients in Gaza Strip, Palestine. But the researcher also recommended that the relationship between dietary patterns with diabetes complications needs more local studies in the future, which I agree with.

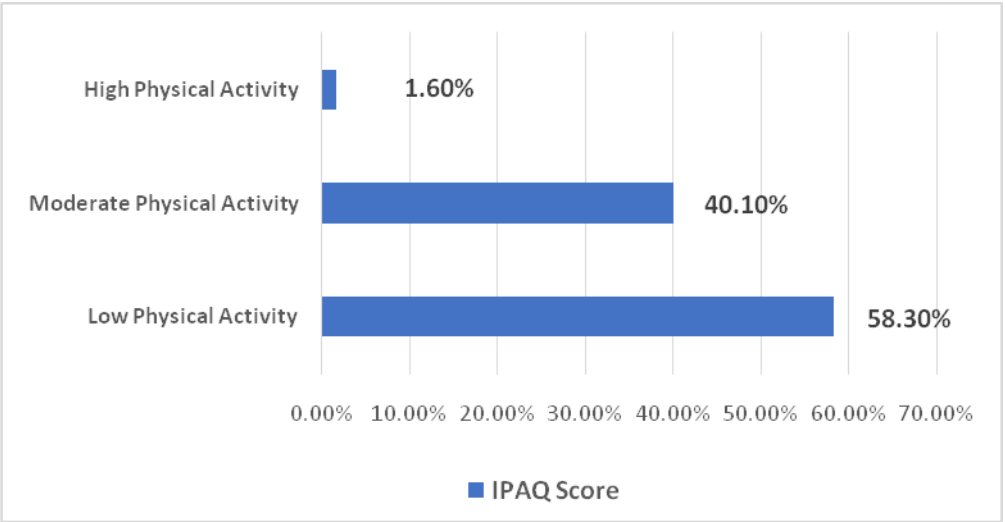


Graph 4.8: Type of Diet Plan Followed

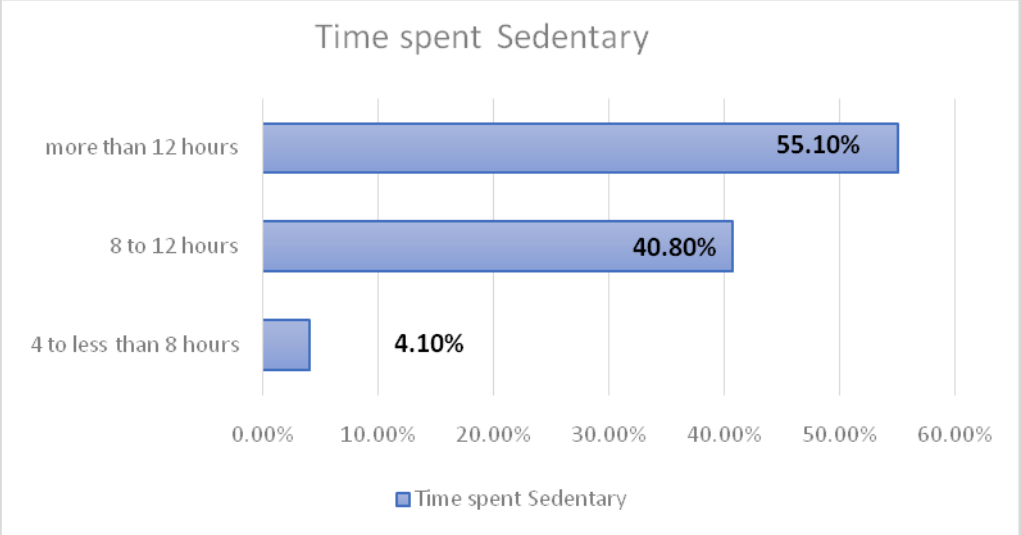
To summarize this and for the purpose of prevention & halting of early and late complications of DM, the effective treatment depends on a careful balance between lifestyle changes, diet, exercise, and personalized pharmacological treatment.

❖ **Physical Activity & Sedentary Time Related Factors:**

The below section explores the findings related to the international physical activity score (IPAQ score) of study participants, in addition to time spent sedentary and their relationship with the glycemic control of participants**.**



Graph 4.9: International Physical Activity Questionnaire Score IPAQ



Graph 4.10: Times Spent Sedentary

In above Graphs 4.9 and 4.10, there is an illustration of the findings related to the international physical activity score (IPAQ score) of study participants, in addition to time spent sedentary. We can see that 58.3% of study participants had a low physical activity classification, compared to 40.1% having a moderate activity and only a rare 1.6% having a high physical activity profile. This is like low levels of physical activity described by El Halabi,

(2018) for majority of patients with DM at UNRWA HCs, as she described that only 23.8% of them had a 30-minute walking three times a week, while the remaining 76.2% walked 30 minutes barely once or twice weekly (El Halabi, 2018).

This is compatible with a meta-analysis which included 125 prevalence measures from 20 Middle East and North African countries in the MENA region done in 2020 (Chaabane et al., 2020) which revealed that after 2000, 50.8% of adults (ranging from 13.2% in Sudan to 94.9% in Jordan) and 25.6% of youth (ranging from 8.3% in Egypt to 51.0% in Lebanon) were sufficiently active. However, there is still limited data on physical activity behaviors is available for MENA countries, apart from Gulf Cooperation Council countries (Chaabane et al., 2020).

Only 4.1% of study participants had a sedentary time spent less than 4 hours during awakening hours, while 40.8% acknowledged being sedentary for 8 10 12 hours every day, and more than half (55.1%) being sedentary for more than 12 hours during awakening hours on daily basis. This means that 96% of our patients with DM spend more than half of their awakening hours on complete sedentary style, and this is very alarming knowing how much sedentary lifestyle is harmful to cardiovascular health and linked to metabolic syndrome in addition to insulin resistance & poor glycemic control and other chronic diseases as well established in medical textbooks, clinical guidelines, and the literature.

According to Chaabane, (2020) meta-analysis in the MENA region; the region reported the second highest prevalence of diabetes in the world (10.8%) and is recording a rapid increase in obesity. Insufficient physical activity and sedentary behavior are key risk factors for obesity and other several NCDs leading to premature mortality. It has been suggested that physical activity has the potential to excellently control and reduce the burden of obesity during the various phases of human development. Lately, sedentary behaviors have received global attention as prolonged sedentary time is associated with an increased risk of chronic disease and an increase in all-cause mortality, even though if individuals are meeting the recommended levels of physical activity (Chaabane et al., 2020).

On the same page, local researchers Sirdah et al., (2011) has demonstrated long time ago that age, sex, and physical activity are risk factors independently associated with metabolic syndrome in the Palestinian population at the Gaza Strip. They strongly recommended that

a national health awareness and preventive programs should be established aiming at decreasing of metabolic syndrome trends in the Palestinian population at Gaza focusing on enhancing physical activity, decreasing sedentary time, and focusing adults aged 20 to 65 years old (Sirdah et al., 2011).

Qualitative findings didn't fall far from the tree of quantitative findings exploring physical activity and sedentary life related factors and their relationship with control status among patients with DM. Both healthcare providers and patients with DM interviewed or discussed shared the same ideas about high levels of sedentary life and low levels of physical activity among our patients with diabetes and the challenges behind that. A pharmacist said, *"Not all patients have sufficient awareness, abilities, facilitations, or sometimes enough passion to adopt a regular exercise routine",* while her colleague medical officer further explained *"Follow up & continuity is essential in helping people adopt an active lifestyle. As a health care provider, it's not enough to tell my chronic patient in single visit to do regular exercise and expect him\her to hurry up and do it immediately and keep doing it. Changing people's culture and behaviors needs time, consistency, and reptation. the nature of people is to forget or get easily bored".*

A head of health center explained that the issue with lack of physical activity culture is not healthcare related issue but rather a public health & health behavior problem facing the entire community and needs to be addressed on a larger scale *"Not only patients with DM need to enhance their culture of physical activity but rather the entire community. If children and adolescents are raised on the importance & culture of physical activity, they will not face such difficulty in adopting an active lifestyle when they get older or sicker. Nowadays, I see more and more people walking along the beach in Gaza. I didn't use to see this scene a lot a few years ago. I think this is excellent and should be encouraged by all HCPs and government as much as we can".*

Regarding patients with uncontrolled DM in FGDs, most of them confirmed having a sedentary lifestyle and not doing any kind of physical activity. They demonstrated different reasons and explanations for that, some of them were related to their health and physical well-being while others included lack of motivation, facilities, or support. Some of their answers included *"I can't do exercise especially when my blood sugar is high. I can't even stand on my feet; I feel that my legs can't hold me. I don't imagine myself able to perform*

any type of exercise". while another female patient said *"when I go for a walk, I feel sweety and my blood sugar drops, and I stop and eat something sweet or drink a juice rapidly. To be honest I avoid exercise because I am afraid my blood sugar will drop".*

On the other hand, patients with optimal glycemic control in FGDs showed a higher level of physical activity according to feasibility and a positive attitude toward inclusion of physical activity into their lifestyle and less barriers. Some of their testimonies included *"When I feel dawn I go for a long walk or go visit my parents' house walking. It's not only beneficial for my blood sugar level control but it gives me a good feeling and releases all my tension and stress, I feel stress free when I go back home, and my mind is empty".* Another male patient said *"One of the positive impacts is that I learned to be physically active. I never performed any exercise and was sedentary. But when I started developing complications, I started walking regularly for more than an hour on daily basis and I go swimming in the sea whenever I can with a group of my friends".* Another optimally controlled male patient said, *"I do regular exercise as I go for at least 2 hours walking every day on two trips each lasting for an hour from my home to the sea".*

While patients in the uncontrolled group didn't do any sort of physical activity due to their musculoskeletal problems like osteoporosis or osteoarthritis or cardiac health issues, an optimally controlled old male patient explained how he adopts an active lifestyle despite all barriers. He said, *"I can't walk for a continuous hour because I have heart disease and osteoarthritis, but I try to keep as active as I can by walking to mosque and back in each prayer and I walk around my house as much as I can".* These stories might indicate that physical health and ability is not the main determinant for active lifestyle but rather a more complex factors like desire, attitude, awareness, determination, motivation, and support from others.

❖ **Lifestyle Modification Attitudes & Practices:**

The below sections explore different lifestyle modification factors in terms of study participants' attitudes and practices and their relationship with their glycemic control if any.

Table 4.12: Differences in Controlling Status by Physical Activity, Lifestyle Modifications Attitudes & Practices.

Correlates	Controlled (N=212, 48.8%)	Uncontrolled (N=222, 51.2%)	Total (N=434)	P value	Sig

	No	%	No	%	No	%		
International Physical Activity Questionnaire score IPAQ								
Low physical activity	70	27.7	183	72.3	253	58.3	110.2	0.000*
Moderate physical activity	138	79.3	36	20.7	174	40.1		
High physical activity	4	57.1	3	42.9	7	1.6		
Currently smoking cigarettes or Argilas								
Yes	17	43.6	22	56.4	39	**9.0**	0.474	0.491
No	195	49.4	200	50.6	395	91.0		
Quit using Tobacco (N= 46)								
Yes	13	35.1	24	64.9	37	**80.4**	1.267	0.260
No	5	55.6	4	44.4	9	19.6		
Trying to reduce salt in diet								
Yes	185	49.6	188	50.4	373	**85.9**	0.597	0.440
No	27	44.3	34	55.7	61	14.1		
Trying to reduce daily consumption of sugar in diet								
Yes	191	48.7	201	51.3	392	**90.3**	0.025	0.875
No	21	50.0	21	50.0	42	9.7		
Trying to eat at least two servings of fruits each day								
Yes	175	49.7	177	50.3	352	**81.1**	0.562	0.454
No	37	45.1	45	54.9	82	18.9		
Trying to eat at least three servings of vegetables each day								
Yes	105	50.2	104	49.8	209	**48.2**	0.312	0.576
No	107	47.6	118	52.4	225	51.8		
Trying to Reduce saturated & trans-fat/ fried food in diet								
Yes	110	47.8	120	52.2	230	**53.0**	0.204	0.651
No	102	50.0	102	50.0	204	47.0		
Starting or do more physical activity								
Yes	106	49.1	110	50.9	216	**49.8**	0.009	0.925
No	106	48.6	112	51.4	218	50.2		
Trying to reduce body weight or maintain healthy weight								
Yes	106	48.0	115	52.0	221	**50.9**	0.141	0.707
No	106	49.8	107	50.2	213	49.1		

As seen in the above table, control status appears to be better among patients with higher physical activity. To explain more, 82.4% of participants with low physical activity score had a poor control status compared to only 33% of participants with optimal control status. On the contrary, 65% of participants with moderate physical activity score had an optimal glycemic control compared to only 16% of participants with poor control status. According to Mamo et al., 2019 study, physical activity is another predictor of poor glycemic control, and a patient involved in physical activity only for less than three days were more likely to have poor glycemic control compared to those doing the regular physical activity for more than three days (Mamo et al.,2019). This is also in line with other studies performed in Jordan and Thailand (Khatab et al., 2010 & Howteerakul et al., 2007). This might be attributed to increasing glucose uptake by the exercising muscle groups than muscles at

rest, because physical activity increases the blood flow to exercising muscles and will eventually increase the number of insulin receptors, which in turn will result in increasing insulin sensitivity (Nayak et al., 2005).

In Table 4.12 we also dig into factors related to most common and general lifestyle modification attitudes and practices of the study participants and their relation to the glycemic control status. It shows that the most adopted lifestyle modifications adopted by study participants recently included reduction of daily consumption of sugar in diet (90.3% of participants), reduction of salt in diet (86% of participants), trying to consume at least two servings of fruits each day (81% of participants), and quitting smoking (80% of 46 smokers).

On the contrary, less commonly adopted lifestyle modification practice among study participants included trying to consume 3 servings of vegetables per day, reduction of saturated & trans-fat/ fried food in diet, starting or doing more physical activity, and trying to reduce body weight or maintain healthy weight (48.2%, 53%, 49.8%, and 50.9% respectively). All those four lifestyle modifications were adopted in only half of the participants, while it's not clear if they are not adopted due to lack of patient`s knowledge of their importance, lack of proper counseling & education by healthcare providers, difficulty of change or maintaining change, or a combination of all those causes and others. Some of these lifestyle modification factors were revealed to be defective in previous local study among UNRWA patients with DM such as consumption of 3 servings of vegetables on daily basis which was adopted by only 15% and adopted some of the times in 47% of participants and consumption of health unsaturated fats over unhealthy saturated and trans fats adopted in 54.2% of them (El Halabi, 2018).

Again, this reflects how much of bread and carbohydrate eaters our patients with DM are as part of a local food culture forced by the very poor socioeconomic status and poor nutritional culture which favors carb and fat rich cheap foods over health balanced diet containing consuming proteins, healthy fats, vegetables, and fruits on daily basis.

It`s worth mentioning that only 9% of participants with DM were currently smokers, which is also close to local study among UNRWA HCs in 2018 with current smoking rate of 12.3% (El Halabi, 2018). In both studies, no statistically significant relationship was revealed

between smoking and control status of diabetes among study participants.

According to the above table, none of those factors individually had a statistically significant relationship with the control status (p value above 0.05).

❖ **Healthcare System & Service Provision Related Factors:**

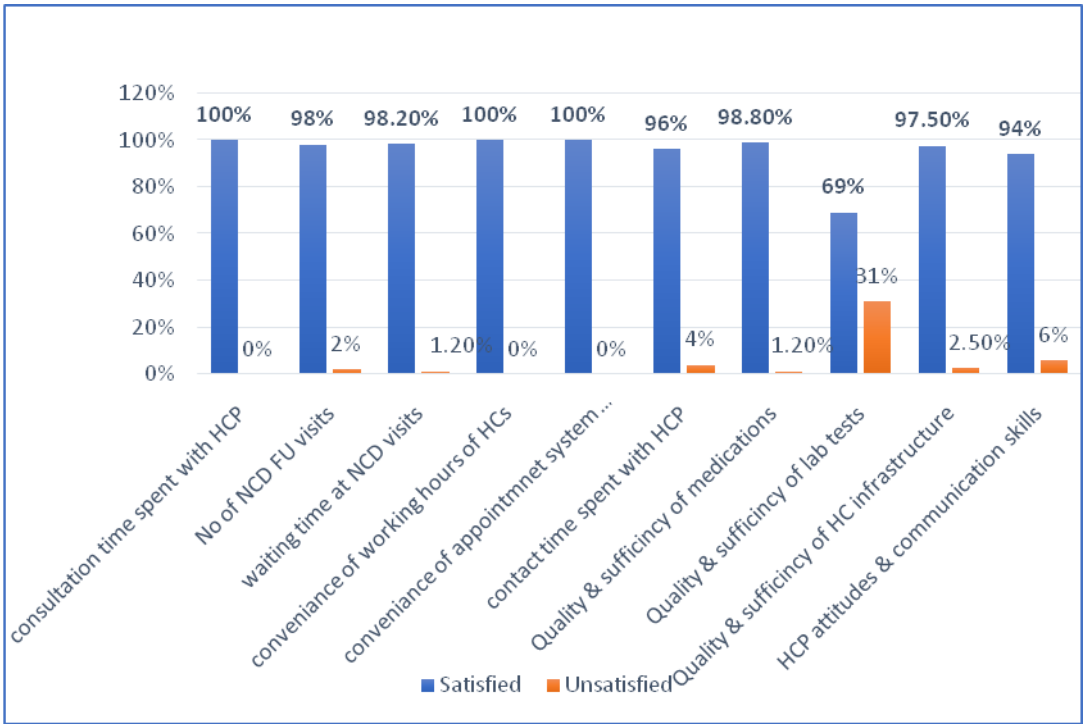
The below parts deeply explore the impact of healthcare system, healthcare services provision, and healthcare provider- patients interaction related factors on the outcomes of diabetes including patients' satisfactions and glycemic control.

Table 4.13: Differences in Controlling Status According to Healthcare Provision Related Factors

Items	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222, 51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Compliance to NCD follow up appointments at UNRWA HC								
Regularly, every appointment	210	49.0	219	51.0	429	98.8	0.556	0.434
Partially regular, skipped 1-2 appointments this year	2	40.0	3	60.0	5	1.2		
Ever been turned away home without receiving NCD healthcare services he/she came to receive this year								
Yes	75	54.7	63	45.3	138	**32**	4.799	0.187
No	137	46.1	159	53.9	297	68		
Ever received information and awareness on selfcare from healthcare provider in past 6 mo.								
Yes	102	49.0	106	51.0	208	47.9	0.006	0.939
No	110	48.7	116	51.3	226	52.1		
Receiving printed educational materials related to DM from healthcare provider in past 6 mo.								
Yes	113	50.7	110	49.3	223	51.4	0.611	0.434
No	99	46.9	112	53.1	211	48.6		
Types of health education & counseling modalities received in past 6 mo. (not mutually exclusive)								
Extensive individual face to face counseling	123	50.6	121	49.4	244	**56.2**	1.788	0.618
Educational material	113	50.6	110	49.4	223	**51.4**		
Group counseling, MCI sessions	1	33.3	2	66.7	3	0.7		
Ever consulted a nutritionist for nutritional planning or counseling in past 6 mo.								
Yes	74	54.4	62	45.6	136	31.3	2.454	0.117
No	138	46.3	160	53.7	298	68.7		
Patient`s opinion on counseling skills of healthcare providers (FP & PN)								
Very good	115	49.4	118	50.6	233	53.7	0.443	0.801

Good	85	47.5	94	52.5	179	41.2		
Poor	12	54.5	10	45.5	22	5.1		
Ever facing any kind of difficulty accessing or barriers to reaching the health services when needed								
Yes, (financial, social, or cultural barriers)	102	49.2	105	50.8	207	47.8	0.030	0.999
No	110	48.5	117	51.5	227	52.3		
Patient fully participating in setting NCD follow up appointments								
Yes	210	49.1	218	50.9	428	98.6	.586	0.444
No	2	33.3	4	66.7	6	1.4		
Patients having any difficulty dealing with healthcare providers during NCD follow up visits in past 6 mo.								
Yes	3	30.0	7	70.0	10	2.3	1.455	0.228
No	209	49.3	215	50.7	424	97.7		
Patients facing discriminative behaviors from healthcare providers during NCD follow up visits in past 6 mo.								
Yes	14	41.2	20	58.8	34	7.8	0.869	0.351
No	198	49.5	202	50.5	400	92.2		
Patients facing problem in acceptability of their healthcare provider`s age or gender								
Yes, gender	29	42.0	40	58.0	69	15.9	2.85	0.240
Yes, age	2	28.6	5	71.4	7	1.6		
No	181	50.6	177	49.4	358	82.5		
Patient`s level of confidence and trust in their family physician in past 6 months								
Very confidant	129	48.0	140	52.0	269	62.0	0.226	0.635
Partially confidant	83	50.3	82	49.7	165	38.0		
Patient`s level of confidence and trust in their NCD practical nurse in past 6 months								
Very confidant	128	48.3	137	51.7	265	61.1	0.081	0.776
Partially confidant	84	49.7	85	50.3	169	38.9		

Table 4.13: Differences in Controlling Status According to Healthcare Provision Related Factors



Graph 4.11: Participants Satisfaction About Health Care Services

In the preceding Table 4.13 and Graph 4.11, we thoroughly discuss healthcare service-related factors including patient`s compliance, health education & counselling, satisfaction, mutual confidence, convenience, barriers, and difficulties. None of the below items has shown a statistically significant relationship with control status individually but in general reflected a high compliance and satisfaction of patients with DM on NCD services provided to them in UNRWA health centers (details in above table). As shown above (99%) of participants were compliant with their appointments for NCD healthcare services and follow up visits which is much better than demonstrated by El Khatib, (2010) on patients with DM attending UNRWA HCs with a compliance rate of only 79% and in El Halabi study in 2018 the percentage of compliance to appointments has reached 86% (El Khatib, 2018 & El Halabi, 2018). A satisfied 95% of participants also described the counselling skills of their healthcare providers as being good to very good.

Additionally, more than 93% and up to 100% of participants were satisfied with most of the factors related to service provided to them in UNRWA health centers namely (waiting time, consultation time, frequency of NCD visits, engagement in appointments, convenience

of appointments and working hours, quality & sufficiency of medications and infrastructure, and healthcare providers attitudes and communication skills). Again, this is much better than what used to be and described by El Khatib, (2010) study 12 years ago. In which he stated that 84.4% and 71.9% of patients with DM attending UNRWA HC in his sample were satisfied with the communication and counselling skills of healthcare providers and overall NCD services they received during NCD follow up visits and only 56.62% of patients were stratified with the waiting time for the services (El Khatib, 2018). This can be logic and understood comparing the huge advancement of UNRWA healthcare services and the adoption of family practice, eHealth, beautiful state of the art facilities, improvement in manpower profile, continuous training and capacity building programs which all reflected on patient`s satisfaction and a better doctor-patient relationship and longer contact times.

None of the study participants stated that they lacked confidence in their healthcare providers including both family physicians and practical nurses, and ranged from partially confidant (38%) to very confidant (62%), and less than (8%) of participants stated facing discriminative behaviors from healthcare providers during NCD follow up visits in past 6 months; which all reflects high levels of confidence & mutual trust that might be attributed to the adoption of family practice & family health team letting NCD patients to deal every time with the same healthcare provider and allows for building long term relationship of mutual trust and rapport. The only item they didn't show a good level of satisfaction with was the quality & sufficiency of laboratory investigations for NCD patients as 30% of participants stated being unsatisfied with it. This can be partially understood as lab tests for chronic patients provided by UNRWA under done based on UNRWA NCD technical instructions (last updated 2020) and can be /considered insufficient when compared to international guidelines, for example a HbA1c testing was done once annually till year 2021-2022 started to be performed biannually which is still less than recommendations and fasting blood sugar is performed once monthly for uncontrolled patients with HbA1c more than 9 and once every 3 months for patients with controlled DM with HbA1c below 7 and uncontrolled patients with HbA1c between 7 and 9 (UNRWA NCD TI, 2020).

Furthermore, during years of COVID pandemic and as part of UNRWA health program response to the pandemic they adopted different phases in service provision and for long periods of time during phase 1 and 2 of their response the lab tests for NCD patients were

withheld and substituted with medication provision only and/or use of glucometers by practical nurses for a fasting blood sugar testing. Those factors may have affected their level of satisfaction on lab tests quality & sufficiency which was much less other service-related factors including the providers, medications, and infrastructure.

Overall, the high level of satisfaction on quality of services provided within UNRW HCs for chronic patients was highly demonstrated and reflected upon in the focus group discussions with patients with DM and interviews with healthcare providers. A Medical officer in an IDI explained NCD services at UNRWA HCs saying *"We adopt a very comprehensive approach to our patients with DM, we never deal with them in a fragmented or isolated manner. We see them human beings controlled by both physical, mental, social, and spiritual factors. I believe that family medicine practice has benefited our patients a lot and improved the doctor patient relationship with our chronic patients. I wouldn't want to work in another way".* His colleague female medical officer added *"All our physicians and nurses working in NCD stations have excellent relationship with our chronic patients, we see them regularly and know their names, medical conditions, social circumstances, concerns and even their day-to-day major life events they like to tell us all those things".* A female pharmacist also explained her point of view by saying *"When patients feel they are cared for by healthcare providers and that they are being followed attentively and with true care, they will even feel ashamed to let their providers dawn by self-neglect. We -as HCPs- need to be more patient with our patients suffering from Diabetes. Even if they are not patient and annoying, we need to be more patient than them, because at the end we are more aware of their condition and their health needs than them. We should never feel bored from them or their repeated questions".*

A male medical officer stated important points on importance of trustful relationship with chronic patients specifically, as he said *"If the physician is not scientifically competent, alert, and can build trustful relationship with his\her patient, he\she can't and shouldn't work with NCD patients. Chronic patients need to be dealt with carefully and attentively. If you copy & paste their medications one time and send them to pharmacy directly without tailored counseling and management plan, they will never trust you or respect you ever again".*

Another colleague NCD practical nurse explained with passion *"We adopt a*

comprehensive approach to NCD care, we take care of our patients with all possible means and consider the different aspects of their health. I sometimes like to use the term "management" as I like to say to my patients you have to "manage" your disease from all aspects and not allow your disease to manage your life". Another NCD PN stated *"The appointment system at UNRWA HCs has improved the healthcare provided to our chronic patients and their compliance a lot. A few years ago, the patient would wait at their nurse`s door for an hour sometimes then move to their family physician`s room and wait for a long time. Eventually they will become nervous and irritable and leave unsatisfied, and sometimes not coming back for their next appointment."*

This perception of chronic patients' high satisfaction was confirmed by patients with DM in the discussion groups repeatedly. One of them said *"I feel support mostly from my HCPs in the HC especially the physicians and nurses, in addition to my family members especially my daughters and wife. I feel happy and satisfied when my healthcare providers ask me to choose a suitable appointment for my follow up, it's great". Other patients said "I have been chronic patient for 12 years now, but I only receive HC services at UNRWA health centers. The service is excellent; they even took care of my mental health and opened a mental health support file for me. I have no concerns whatsoever about the healthcare service I receive in this health center. Maybe only I wish they can provide more chronic medications and topical analgesics". "The healthcare providers attitude is excellent, and I like all my healthcare providers here. The health center is always clean and looks nice and tidy. I only wish if the specialists, especially the ophthalmologist, were available all the time at the health center as I suffer from eye complications of DM and need continuous care"* another patient explained.

Contrary to the high level of patient satisfaction on services provided as part of NCD prevention & control program by UNRWA, there is **suboptimal health education** component of the services. It can be seen in above Table 1 that half of the participants (52%) confirmed not receiving any information or awareness on selfcare from healthcare provider in past 6 months, and similarly half of them (49%) confirmed not receiving any printed educational materials related to DM from healthcare providers in past 6 months and only 3 participants (0.7%) participated in group counseling sessions or MCI groups. This is very similar to the findings of El Khatib, (2018) study on patients with DM attending UNRWA HCs who reported that 42% of participants didn't receive any educational material related to DM in the past 6

months (El Khatib, 2018). This is confirmed by opinions of different HCPs in the IDIs, for example an NCD PN said, *"The high workload at nursing stations in UNRWA clinics is adversely affecting our ability to help our patients in a more optimal way, and to provide all needed counseling and sharing information with them. I wish I had more time to spend with my patients. I believe I would provide better & more diverse counseling to them if I had the time & energy".* Another medical officer said *"In general we might consider ourselves satisfied because today we stand in a better place than yesterday, but we are still far from target and have a long path to go. Most of the patients I encounter are aware about their illness nature and complications, but they are not aware that theses complications could happen to them if they had poor glycemic control for long time, they are in a denial state of mind or lacking insight about this".* These opinions were confirmed by a pharmacist who said *"We need to give more educational materials to help our patients get better control status like pamphlets, brochures, posters, booklets, photos, support groups, lectures etc. I truly believe this would improve their awareness & knowledge or even at least give some motivation to take care of their health. I believe all patients think their health is a crown on their heads and they don't mean to neglect it, they are just not aware enough or not motivated enough",* while an NCD PN said *"As a practical nurse I wish we had more educational materials available for us to use during individual counseling sessions and during support groups especially when we are facing limited time and energy and high workload. The time is always tight for us, and we need educational aids till we have less workload and can provide sufficient counseling based on face to face interaction alone"*

A head of Health center reinforced the importance of standardized systemized health education activities & aids within UNRWA HCs rather a more fragmented intermittent one, as she said, *"when we notice that our patients needs more educational materials and enthusiastic to read more on his\her illness we try to provide him\her with some pamphlets or enroll them in a support group, but still we need to adopt more systemized and sustainable educational materials ready for use anytime needed".*

Regarding barriers and difficulties related to NCD services; as demonstrated in below table half of the participants (47.8%) stated having a kind of barrier to NCD services in general which was financial in almost all of them (203 out of 207 had financial barrier) due to scarcity of money needed to spend on transportation to healthcare facilities, additional

specialist consultations, additional unavailable medications and lab tests etc. which is a considerable barrier taking in consideration the poor to very poor socioeconomic & unemployment status described in the first part of this chapter of the study participants (see table 4.2). The high level of accessibility to UNRWA HC especially the lack of geographical and sociocultural - and excluding the financial- barriers was also described by El Khatib, (2010) study on patients attending UNRWA HCs as he explained that *"It reflects that UNRWA is focusing on delivering accessible health care to the Palestine refugees. In this study the finding showed that accessibility domain reported a mean 3.8522 (77.04%) of satisfaction level which means that patients also have a moderate positive satisfaction about accessibility of care, as the health centers are located right in the heart of the refugee camps"* (El Khatib, 2018).

Another challenge was the acceptability of gender of healthcare provider as 69 participants (15.9%) stated having a difficulty in acceptance of the opposite gender of the healthcare providers mostly family physician and practical nurse, which is mostly related to the socio-cultural background of them. On the other hand, less than 2% of participants stated having any difficulty or problem in acceptance of healthcare providers age (neither young nor old age).

In the qualitative part of this study, the most mentioned challenges and areas of improvement stated by both HCPs and patients with DM were high workload, stability of healthcare providers & manpower, limited availability of lab tests for chronic patients, and need for newer generations of chronic medications. The head of health center explained *"We have enough quantities of medications for DM, but the problem is that most of our chronic medications are old generations. There are more effective novel medications with less side effects and easier regimen -like combination drugs- are available and I hope to see them among our essential drug lists. Limited time and high workload are also of the biggest challenges we face",* a pharmacist said *"There is a wide range of medications for DM out there, but our patients can't afford them. I wish we could add them to our lists".* A patient with poorly controlled DM in a FGD similarly said *"We hear about very good medications for diabetes that some patients use and helped them control their condition better which are not available in UNRWA HCs. If it's not available in the health center I won't take them, I won't be able to pay for them. I wish they could provide them in the health center. I think the*

medical services in the HC are excellent. I receive a lot of care in the health center, I even lost a lot of weight with their help and follow up from 95 Kgs to 75 kgs. But my only remark for improvement would be to reduce my waiting time and to provide more medications that I need. Sometimes I can fix them from an outside institution for free but other times I can't. I wish UNRWA could arrange to provide these chronic medications for me continuously, I would feel so much relieved".

❖ **Knowledge on Diabetes Related Factors:**

The below Tables dig deeper into factors related to patient`s knowledge and information on DM and its comparison between both controlled and uncontrolled groups.

Table 4.14: Differences in Controlling Status According to Patient`s Knowledge Related to Diabetes Including Nature of the Disease, Management and Selfcare

Items	**Controlled** (n=212, 48.8%)		**Uncontrolled** (n=222, 51.2%)		**Total** (N=434)		**P value**	**Sig**
	No	**%**	**No**	**%**	**No**	**%**		
Main source of knowledge about DM including nature of the disease, management and selfcare								
PHC Physician\Family Physician	102	46.8	116	53.2	218	**50.2**	12.61	0.082
Specialist\Endocrinologist\ Interest	76	56.3	59	43.7	135	**31.1**		
Relatives, friends, and other chronic patients	26	51	26	49	53	12.2		
Internet browsing	6	40	17	100	23	5.3		
NCD nurse	2	40.0	3	60.0	5	1.2		
The main person to seek help for questions or concerns related to DM or its management								
PHC Physician\Family Physician	184	50.1	183	49.9	367	**84.6**	12.25	0.057
Relatives, friends, and other patients	18	48.6	19	51.4	37	8.5		
Internet browsing	6	46.2	16	53.8	22	5.1		
Specialist\Endocrinologist\ Interest	3	100	0	0	3	0.7		
NCD Nurse	1	20.0	4	80.0	5	0.9		
The main source\person to seek help for questions or concerns related to medications & side effects								
PHC physician\Family Physician	104	51.2	99	48.8	203	**46.8**	11.79	0.108
NCD Nurse	75	47.8	82	52.2	157	**36.2**		

Relatives, friends, other chronic patients	20	55.5	16	44.5	36	8.3		
Internet browsing	9	27.3	24	72.7	33	7.6		
Pharmacist	2	66.7	1	33.3	**5**	**1.2**		
The main source\person to seek help for questions or concerns related to nutrition & diet								
PHC Physician\Family Physician	171	50.1	170	49.9	341	78.6	11.88	0.065
NCD Nurse	10	45.5	12	54.5	22	5.1		
Internet browsing	3	16.7	15	83.3	18	4.1		
Relatives, friends, and other patients	17	36	15	64	32	7.4		
Specialist\Endocrinologist\ Interest	11	52.4	10	47.6	21	4.9		
Patient`s perception of his knowledge related to Diabetes & its management including selfcare								
Very good	37	39.4	57	60.6	94	21.7	6.07	0.194
Good	160	51.1	153	48.9	313	72.1		
Poor or can't determine	15	55.5	12	44.5	27	6.2		
Having questions or concerns related to DM couldn't be shared with healthcare provider								
Yes	9	50.0	9	50.0	18	4.1	0.010	0.920
No	203	48.8	213	51.2	416	**95.9**		
Having questions or concerns related to DM shared with healthcare provider without receiving satisfactory answer								
Yes	12	63.2	7	36.8	19*	4.4	1.628	0.202
No	200	48.2	215	51.8	415	95.6		
knowledge items that patients said is deficient and need more focus during consultations (answers not mutually exclusive)								
Selfcare	100	49.3	103	50.7	203	**46.8**	.026	.872
Stress management	97	55.4	78	44.6	175	**40.3**	5.082	.024*
Screening for complications	82	50.9	79	49.1	161	**37.1**	.445	.505
DM complications	47	50.5	46	49.5	93	**21.4**	.135	.713
Nature of disease	24	42.1	33	57.9	57	13.1	1.194	.275
Nutrition	30	53.6	26	46.4	56	12.9	.574	.449
Risk factors	26	55.3	21	44.7	47	10.8	.883	.347
Lifestyle	23	53.5	20	46.5	43	5.1	.411	.521
Physical activity	13	56.5	10	43.5	23	5.3	.572	.449
Medication	11	50.0	11	50.0	22	5.1	.012	.912
Lab tests	13	65.0	7	35.0	20	4.6	2.189	.139

*The reason for this according to them were: 10 said due to crowdedness, 8 said due to insufficient contact time, and 1 for personal reasons.

As Table 15 explains the different sources of patient's knowledge on DM including nature of disease, management, and selfcare and ranks them from highest source to least source we can see the following: the highest source for knowledge and information was PHC\

family physicians (50%), followed by specialists\interests (31%), while all other sources were limited and ranged from 1% to 10%. This reflects the high level of confidence & trust chronic patients have in their family physicians when it comes to their need for solid knowledge and reliable clinical and scientific information and reflects the good doctor-patient relationship and rapport benefited from adoption of family practice and it`s holistic and continuous approach.

On the contrast and unfortunately the ranking in below table shows a much less than expected role and feasibility of NCD nurse as a source of solid and reliable source of knowledge despite the very good knowledge and experience of NCD PNs regarding Diabetes it seems that patients attending UNRWA health centers still don't consider them as a reliable or a top ranked source of information which needs to be tackled by the agency to benefit more from the high competence and dedication of NCD practical nurses working in UNRWA health centers.

Again, the top ranked source\person to seek help for questions or concerns related to DM or its management chosen by (84.6%) of study participants was their family physicians in UNRWA HCs, while all other sources were chosen by less than 10% of participants, while when asked for first source to seek answers for questions related to DM medications or their possible side effects the ranking came as follows; family physicians (46.8%), NCD practical nurses (36.2%). For questions related to nutrition and diet the ranking came as follows; family physicians (78.6%), NCD practical nurses (5.1%).

Shockingly, the pharmacists were the least chosen source to seek answers (only chosen by 1.2% of the participants) which is totally opposite to expectation since they are the most oriented and experienced when it comes to chronic medications, their optimal use, and their side effects. The reasons for this might be partially explained by the very limited contact time between pharmacists and clients in UNRWA HCs obligated by their high workload and need to pay high level of their attention and concentration to proper dispensing of large number of chronic and other medications with large quantities to each client without any dispensing errors, This limits both their contact time and attention span with NCD patients and mostly leaves no time for exploring question and concerns and provide satisfactory answers. Of course, other reasons and explanations must be explored to tackle this issue by the agency and enhance pharmacist's role in NCD management as

part of the highly recommended comprehensive approach and teamwork with chronic patients and to improve patient`s compliance with their medication, minimize side effects and drug-drug interactions, and eventually contribute to improving control status.

Despite all these findings, patient`s perception of their knowledge regarding DM was very high as 94% of study participants described their knowledge level as good to very good, while only 3.7% perceived it as poor and 2.5% couldn't determine. This is considered a very optimistic level of perception of good knowledge regarding a very complex chronic degenerative disease like Diabetes and contradicts with the not very good self-care and lifestyle modifications practice revealed by this study. This can demonstrate who far and deceiving can the perceptions be from facts and that patients' perceptions are largely affected by their expectations and background.

This high perception of good knowledge also contradicts with the findings of the last part of below table were the study participants confirmed presence of defect in their knowledge regarding important aspects of DM and their need for more focus and health education from different provider during NCD follow up visits. As can be seen in last part of below table the most chosen aspects of DM that have poor knowledge and need enhancement according to patients' opinion were selfcare (46.8%), stress management (40.3%), screening for complications (37.1%) and DM complications (21%).

On the other hand, less than 10% of participants declared having incompetent knowledge regarding lifestyle modification and physical activity needed for control of DM, which is not reflected by optimal practice related to those aspects by them as seen in this study (see Graph 4.9 and Table 4.13 above).

❖ **Social Network & Support Related Factors:**

Below Table 4.15 and Graph 11 explores the social network of patients with DM attending UNRWA, their level of support and the degree of engagement in disease management and patient`s home care and self-care. As seen below unfortunately family members and caregivers are not properly engaged in decisions related to patient`s chronic condition and its management as 18.7% of patients stated that their family members were not engaged at all, 38% only partially engaged, and 35% couldn't even determine, leaving only 8.3% admitted their family members being fully engaged and well informed.

When all study participants were asked to reflect on their family members, healthcare providers and other people in their social network as being socially supportive or not for them in issues related to their chronic illness and its management including social acceptance, lifestyle modifications, stress management, diet change, and medication compliance the results came as follows:

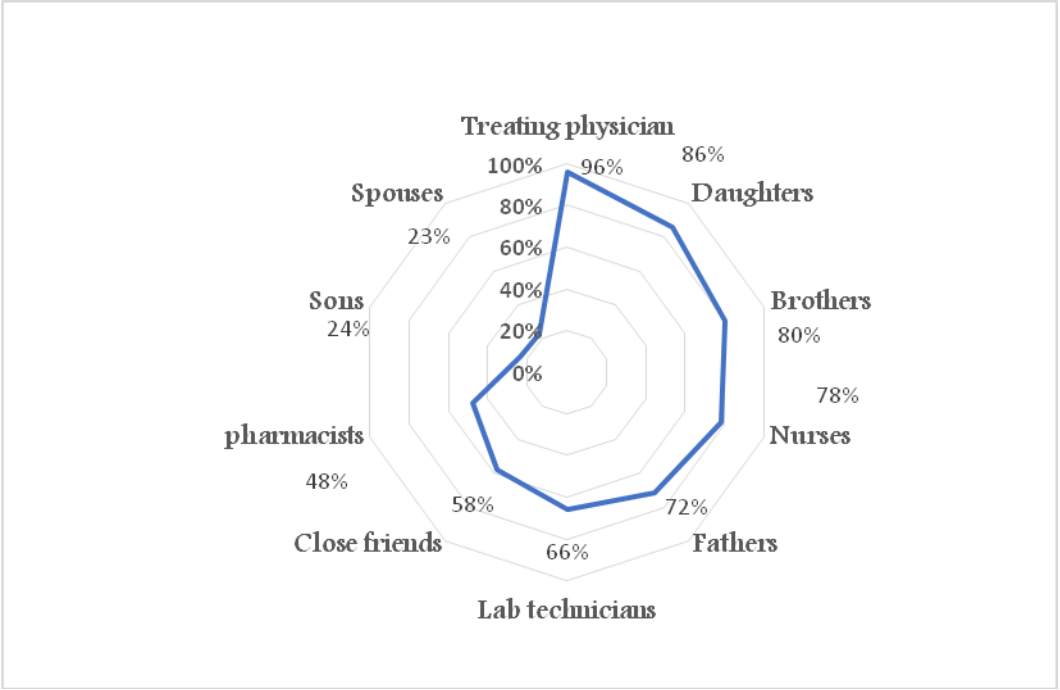
The top ranked supportive people from the social network of chronic patients with DM were treating physicians (96%), daughters (86%), brothers (80.4%), NCD nurses (77.6%), and fathers (71.8%). On the contrary, the least socially supportive social network members as chosen by patients in this study to be not supportive were pharmacists (45.0%), sons (66.8%) and spouses (68.1%). This result reflects a clear difference in social support and care between sons and daughters with daughters being highly supportive in 86% of patients and sons being not supportive in 66.8% despite Arab sociocultural favors of sons over daughters but clearly daughters have higher levels of emotional intelligence, support, and affections to their parents.

Spouses also has been chosen to be not supportive by 68% of patients in this study, and it`s not clear if we can link it to the negative relationship between marital status and control status revealed earlier in table (see Table 4.1) were single, divorced, and widowed patients had better control status than married patients in this study. In this sample the spouses were not supportive according to participants and this might explain their negative effect on control status which contradicted with other regional and international studies, but this needs further exploration by another future local research.

Table 4.15: Social Network Related Factors (N not equal to 434 in all questions)

Items	No	%	
Degree of engagement of family members in decisions related to patient`s chronic condition and its management			
No engaged at all	81	18.7%	
Partially engaged & informed	165	38.0%	
Fully engaged & informed	36	8.3%	
I can't determine	152	35.0%	
Degree of social support provided by others according to patient`s opinion "N doesn't equal 434 as non-applicable excluded"			
Social network	**Supportive**	**Not supportive**	**Not certain**

person	No	%	No	%	No	%
Treating physician	405	96.2	0	0.0	16	3.8%
Daughters	255	86.0	13	3.1%	45	10.9%
Brothers	336	80.4	31	7.4%	51	12.2%
Nurses	204	77.6	13	4.9%	46	17.5%
Fathers	176	71.8	13	5.3%	56	22.9%
Lab technicians	171	66.0	21	8.1%	67	25.9%
Close friends	166	57.8	32	11.1%	89	31.0%
Pharmacists	202	48.3	28	6.7%	188	45.0%
Sons	68	24.3	25	8.9%	187	66.8%
Spouses	62	22.5	26	9.4%	188	68.1%



Graph 4.12: Degree of Social Support Provided by Others According to Patient`s Opinion- Being Supportive.

Chapter Five: Conclusion & Recommendations

5.1 Conclusion

The study built its conclusion and suggestions to be presented in this chapter on the findings and results of assessing the determinants of glycemic control among study population. The self-designed and verified questionnaire tool used to obtain quantitative results, which then have been validated and explained with people in FGDs and IDIs. Special focus was drawn towards assessing different determinants related to glycemic control including sociodemographic, environmental, lifestyle related, medication related, mental health, health status and healthcare system related factors. The used tools assessed patients glycemic control determinants in six domains (see conceptual framework in literature review chapter) to reflect the range of physical and mental aspects thought to constitute or indicate the overall control status.

The main findings related to socioeconomic & demographic factors of this study have shown that, almost equal representation of men and women, with slightly higher control rates among females. Elderly (over 65 years old) had significantly higher control rates compared to younger age groups. There was a trend towards better control rates in smaller families, but it was not statistically significant. Unmarried patients with DM had significantly better control status than married individuals.

Education had a more of a U shape relationship with glycemic control; as illiterate or lower educated individuals had significantly better control status compared to those with secondary education, but patients with higher education had a better control status than both. Generally, studies cited show conflicting results regarding the relationship between education and control status, possibly due to the interplay of many other confounding factors.

Regarding economic factors, no statistically significant relationship was found between average income, expenditure, social assistance, living conditions, and control status. Lower income was associated with higher control rates (but not statistically significant). Unemployment was high, but control status did not differ significantly between employed, unemployed, and retired groups. Additionally, over half of the participants perceived their

living conditions as poor or very poor. Despite widespread poverty, there was no statistically significant link between living conditions and control status.

When it comes to factors related to medical & family history, no significant association with glycemic control was found, except for history of thromboembolic events (had better control status). Similarly, Shorter duration of illness (less than 3 years since diagnosis with DM) is associated with better control status**.** While regarding management plans and its relationship to glycemic control; the best control was seen among patients on lifestyle modification only, followed by patients on OHA, and lowest control was seen among patients on combination therapy (Insulin + OHA). Longer duration since the last medication adjustment (OHA) was also associated with better control status.

Self-monitoring of blood glucose (SMBG) has shown low prevalence among patients with DM attending UNRW HCs, as it was found out to be very infrequent (most don't do it or do it rarely). The lack of glucometers and strips due to their cost was stated as the main reason for that.

Regarding development of DM complications, poor glycemic control was associated with a higher risk of early complications. Similarly, higher risk scores among study participants were associated with a higher chance of developing complications.

Despite the higher prevalence of hypertension among participants, no significant association between presence of hypertension and DM control was found. But controlled hypertension was associated with better DM control. Obesity was associated with worse DM control. On the contrary, no significant association between hyperlipidemia and DM control in this study was found.

Another strong association was found in this study between medication adherence and glycemic control. Higher Morisky scores (indicating better adherence) correlated with lower HbA1c levels (better control status). But some challenges with adhering to medications and lifestyle changes were acknowledged by both healthcare providers (HCPs) and patients. Additionally, awareness about medication regimen has shown to be important: Better awareness correlated with better control. Likewise, increased engagement in decision-making and maintaining medication regimen during social gatherings led to better control. On the other hand, a negative correlation was found

between the number of medications and glycemic control.

The study found a high prevalence of moderate to severe depression among participants with DM, based on the PHQ-9 screening tool.

Nutritional and food consumption patterns of study participants had shown a high intake of: Cereals, vegetables, and fruits, and a low intake of: Fish & seafood, legumes & nuts, eggs, meat, and sweets. A moderate negative correlation was found between food diversity score and HbA1c levels. This indicates that higher dietary diversity is associated with better glycemic control.

The study has also shown low physical activity levels among study participants. Similarly, there was a high occurrence of sedentary life among participants. Overall, the study highlights a strong association between physical inactivity and poor glycemic control.

Most common practice of lifestyle Modifications adopted by study participants were reducing sugar intake, reducing salt intake, consuming at least 2 fruits daily, and quitting smoking. Less common practices included consuming 3 servings of vegetables daily, reducing saturated/trans fats, increasing physical activity, and reducing body weight.

Regarding healthcare system related factors, patients showed a high satisfaction with most aspects of service delivery, including appointment compliance, counseling skills, waiting time, consultation time, frequency of visits, engagement in appointments, convenience of appointments and working hours, quality and sufficiency of medications and infrastructure, and healthcare provider attitudes and communication skills. On the other hand, there was a low satisfaction level with quality and sufficiency of lab tests provided at UNRWA HCs. Some patients stated preferring same-gender healthcare providers. Additionally, high workload for healthcare providers may limit time for individual counseling and education.

Regarding the sources of patient knowledge on DM management, the highest scores were obtained by family physicians, followed by specialists. While the least sources included pharmacists and nurses.

Regarding person consulted for patients' questions: the top choice was family physicians for most questions, nurses working at NCD stations for medications/side effects. Study

Participants perceived high knowledge, but self-reported gaps existed. Gaps in knowledge included most significantly **(**Self-care, stress management, screening for complications, DM complications). The limited interaction with pharmacists and nurses might also be attributed to the high workload which limits opportunities for education from these professionals.

Studying the social network of study participants and is relationship to glycemic control has revealed Low family engagement in patient care. Regarding the most supportive from social network as stated by study participants -ranked from top to bottom- treating physicians, daughters**,** brothers**,** and nurses working at NCD stations. While the least supportive were Pharmacists, sons, and spouses.

5.2 Recommendations:

- The study revealed certain categories of people with diabetes who are more likely to be uncontrolled. There is a need for proactive targeted interventions to reach these categories and including them in specific programs to promote glycemic control among them. Special attention should be given to younger, married, living in large families, poorly educated, people living with diabetes for long period, people who developed complications and receiving multiple drugs as these categories are less likely to show good control status.

- Self-management at home played factor in control, therefore there is an urgent need to address the lack of glucometers and strips for home blood sugar monitoring for patients with DM by providing these especially for poor households and possibly establish links with social protection programs.

- Overall, the study emphasizes the importance of adherence to medications and patient engagement in managing diabetes effectively. Addressing the challenges associated with adherence and optimizing medication regimens are crucial aspects of improving glycemic control among patients with DM attending UNRW HCs.

- The study highlights the importance of addressing mental health issues as a key factor in control status. Providing psychosocial and resources are crucial for improving overall well-being and glycemic control. Integrating mental health and psychosocial support into the management of DM is essential.

- The study clearly highlights the crucial role of food security, dietary diversity and nutritional intake in managing diabetes. Addressing the challenges of affordability, cultural preferences, and access to specialized nutritional guidance is essential for improving glycemic control and preventing complications among patients with DM attending UNRW HCs. This also calls for better coordination with programs that distribute food aid to promote food diversity and ensure that healthy food is provided.
- Most patients lack the motivation to adopt an active lifestyle or the support system to help them overcome challenges. Hence, addressing the issue requires a broader approach by public health workers and experts targeting the entire community, not just patients. Health care providers need to incorporate lifestyle modifications and exercising as an essential part of the treatment program.
- Financial barriers stated by study participants included transportation costs, specialist consultations, additional medications, etc. A possible solution might be better linkages with social protection programs that need to consider the financial burden of DM on poor families and to give subsidies to patients with DM who are economically disadvantaged.
- Service providers need to address the commonly reported knowledge gaps by patients, particularly in self-care and complications which can improve glycemic control. Targeted education focusing on areas with identified knowledge gaps (self-care, complications, lifestyle modification, stress management etc.) is essential. It is vital to promote counselling services by dedicated and trained staff. UNRWA needs to recruit additional staff to provide awareness and counselling sessions.
- It is important to strengthen patient and family engagement in care especially around nutrition, adherence to medications and lifestyle. Exploring alternative approaches like group education sessions, counseling, or printed materials and peer-to-peer education to overcome limitations to optimal counseling by HCPs.
- There is a need to promote access to essential medications and specialist care, especially the new generation drugs that are not currently provided by UNRWA. UNRWA needs to update the drugs list for DM management based on updated evidence. Also, it is crucial to support laboratory services designated for diabetes mellitus.

Recommendations for future research studies

- A national study that incorporates MoH, NGOs and other actors is needed to study determinants of glycemic control at national level and guide health planning for national NCD management programs.
- Further research is needed to understand the complex interplay of individual and social factors influencing diabetes control.
- A study is needed to deeply assess the nutritional habits, food intake practice and diet plans of patients and guide effective & culturally sensitive nutritional interventions and counseling programs at the local level.
- The negative perception of spouses as unsupportive needs further investigation.
- A study is needed to further address enhancers & barriers to physical activity and lifestyle modification among patients with DM at the local level.

Chapter Six: References

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Annexes

Annex (1): Study Activities Timetable

Activity	Duration	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
Proposal writing	1 month	■																		
Proposal approval & tool designing	1 month		■																	
Expert check	1 month			■																
Pilot study	2 weeks				■															
Data collection	3 months						■	■	■											
Data entry	3 months									■	■	■								
Data analysis	2 months												■	■						
Qualitative part	2 months														■	■				
Writing the final thesis	4 months																■	■	■	■

Annex (2): Sampling Criteria

UNRWA Clinic	North & Gaza Area	Middle Area	South Area	Total
Big centers	1	1	1	3
Small or Medium size centers	1	1	1	3
Total	2	2	2	6

Annex (3): Sample Size

Table 8.4 Sample sizes based on the 95% confidence level and 5% level of precision for populations of 10 to 1 000 000

N	n	N	n	N	n	N	n
10	10	110	86	300	169	1 000	278
15	14	120	92	320	175	1 500	306
20	19	130	97	340	181	2 000	322
25	24	140	103	360	186	3 000	341
30	28	150	108	380	191	3 500	346
35	32	160	113	400	196	4 000	351
40	36	170	118	420	201	4 500	354
45	40	180	123	440	205	5 000	357
50	44	190	127	460	210	6 000	361
55	48	200	132	480	214	7 000	364
60	52	210	136	500	217	8 000	366
65	56	220	140	550	226	9 000	368
70	59	230	144	600	234	10 000	370
75	63	240	148	650	242	50 000	381
80	66	250	152	700	248	75 000	382
85	70	260	155	750	254	100 000	384

Annex (4): Quantitative Questionnaire

Interviewed Questionnaire

Determinants of Glycemic Control among Patients with Type 2 Diabetes

Attending UNRWA Health Centers

Module 1- Identification		**Serial number …….**	
Date	Date (day/month/year)	dd mm year	
ID01	Locality	01	Inside Camp
		02	Outside Camp
ID02	Governorate	01	North Gaza
		02	Gaza
		03	Deir Al Balah
		04	Khan Yunis
		05	Rafah
ID03	Name of UNRWA Health Center you are registered at currently.	----------	
ID04	Participant`s RCN Individual Number	… … … … … … …	**ID05 Participant`s** NCD file Number … … … … ….
Note: Data collector reads the consent form and asks respondent if he/she is interested to participate in the study. If yes, data collector should sign the provided consent form.			

Module 2- Socio-Demographics					
DEM01	How many people live in your household (all)?	Number of people ⌊_⌋⌊_⌋			
DEM02	What is the sex of the participant?	01	Male		
		02	Female		
DEM03	How old are you in years?	……			
DEM04	What is your current marital status?	01	Never married	02	Currently married
		03	Divorced	04	Widowed

		05	Others, specify_____		
DEM05	What is the highest educational level you have attained?	01	Illiterate	05	Secondary
		02	Can read & write	06	Associate diploma
		03	Elementary	07	Bachelor's degree
		04	Preparatory	08	Higher Education (Higher diploma-master-PHD)
DEM06	Did you work during the past 30 days?	01	Yes, all the days except weekends	02	No Partially, some days
		03	Not at all		
DEM07	What is the number of **rooms** occupied by your household? (Excluding kitchen, dining rooms bathrooms, garage, balcony, corridors)	Number of rooms ⌊_⌋⌊_⌋			
DEM08	Taking **the past year**, can you tell me what is the average **monthly income** of the household from all sources have been in ILS?	01	Per month ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋		
		88	Don't know		
		99	Refuse to answer		
DEM09	Taking **the past year**, can you tell me what the average monthly expenditure of the household is have been in ILS?	01	Per month ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋		
		88	Don't know		
		99	Refuse to answer		
DEM10	Taking **the past year**, have you been receiving any kind of **social assistance money**?	01	Yes		
		02	No		
DEM10-2	If the answer to above question is yes, please specified source of social assistance?	01	Food-in-kind		
		02	Cash		
		03	Food voucher		
		04	Work		
		05	Voucher		
		06	Health insurance		
		07	Scholarship for education		

		08	Clothes
		09	Others, specify ……..
DEM11	Do you have any person with disability (PWD) among your family members living within the same household?	01 02 03	Yes, You Yes, others in family. No Specify number of PWD ……
DEM12	In your current residence, do you have a functional **Refrigerator**?	01	Yes
		02	No
DEM13	In your current residence, do you have **facilitations to test blood glucose (Glucometer and strips)** to help you measure your blood sugar levels as part of self-care?	01	Yes
		02	No
DEM14	Which is true about the status of the family overall living conditions according to your opinion?	01	Very Good
		02	Good
		03	Poor
		04	Very Poor
DEM15	Do you have enough resources to pay for health services for yourself "other than services provided free of charge at UNRWA HCs"? (Tick all applicable)	01	For Transportation
		02	For Medications
		03	For Lab services
		04	For medical Consultations
		05	For Advanced services
		06	Special food related to your DM-therapeutic food

Module 3- Family History Factors:			
Family01	Do you have a **family history** of any of the following chronic diseases including your parents & siblings? **Tick all applicable**	01	Hypertension
		02	Diabetes
		03	Chronic Heart Disease
		04	Chronic Kidney Disease
		05	Chronic Lung disease- COPD
		06	thromboembolic events (MI, CVA, TIA,

			DVT, PE)
		07	Hyperlidemia-hypercholestermia
		08	None of the above

Module 4- Diabetes Related Factors: (Can be double checked from file review)			
DIAB01	How many years have been passed since you were diagnosed with Diabetes?	Number of years …….	
DIAB02	How many years have been passed since you have registered at NCD service at UNRWA health center?	Number of years …….	
DIAB03	Where are you following for your diabetes condition healthcare?	01	UNRWA only
		02	UNRWA and private
		03	UNRWA and Government PHC
		04	UNRWA and NGO clinic
		05	UNRWA and Hospital
DIAB04	What kind of treatment do you receive now for controlling your glycemic status?	01	Lifestyle modifications only
		02	Oral Hypoglycemic agents
		03	Insulin Therapy injections- Mixtard
		04	Insulin Therapy injections- NPH
		05	Insulin therapy analogues-pens
		06	Combination therapy OHA+ NPH Insulin
		07	Combination therapy OHA+ Mixtard Insulin
		08	Others, please specify? …….
DIAB05	How many years have been passed since you have started receiving oral hypoglycemic agents or insulin therapy for control of your glycemic status?	Number of years …….	
DIAB06	When was your last modification of your treatment plan to improve your glycemic control done by your healthcare provider or treating	01	0-4 weeks ago,
		0	1-3 months ago,

	physician such as adding new drug/ increasing dose of OHA/ adding insulin/ increasing dose of insulin or using non-pharmaceutical modalities? (File review check)	2	
		03	4- 6 months ago
		04	7-9 months ago,
		05	9-12 months ago,
		06	More than 1 year
DIAB07	Currently, how many chronic medications are you taking to control all your chronic conditions including your glycemic control medications for Diabetes and including drugs prescribed & dispensed from all sources\providers? (Double check from file review)	Number of medications\items ……. Number of tablets & injections ……..	
DIAB8	Can you please mention all medications you are currently receiving to control your Diabetes condition with the prescribed regimen by your treating physician?		
DIAB9	How you describe …To which degree is the respondent well informed about his/her medications and regimen? **(Check degree of knowledge from file review)**	01	Well informed (correct types & doses)
		02	Partially informed (only correct types, wrong doses)
		03	Poorly informed (wrong types & doses)
DIAB10	In case the participant t is on any type of insulin: when was the last type your healthcare provider\treating physician adjusted your insulin regimen or dose? (File review check)	01	0-4 weeks ago,
		02	1-3 months ago,
		03	4- 6 months ago
		04	7-9 months ago,
		05	9-12 months ago,
		06	More than 1 year
DIAB11	Are you currently following advice on meal plan prescribed by a physician or nutritionist or another health care provider?	01	Yes
		02	No
DIAB12	If the answer to above question is yes, please specify type of diet prescribed and followed? (Tick all applicable)	01	Low carb Diet (low carb high fat LCHF diet, ketogenic, Atkins etc.)
		02	Intermittent Fasting
		03	Calories minimization & calculation
		04	Substitution of simple carbs with complex carbs

		05	My Plate and nutritional pyramid meal planning
		06	Substitution of saturated fats with unsaturated fats
		07	Other, specify ……..
DIAB13	Are you currently taking any herbal or traditional remedy for your raised blood sugar? *(Example: ginseng, cinnamon, aloe vera)*	01 02	Yes No
DIAB14	In the past year, how do you describe the frequency of your measuring of your blood sugar? *(By blood sugar we do not mean HbA1c)*	……. times daily ……. times weekly …… times monthly …….. . times quarterly ……. times annually	
DIAB15	Did the participant develop any of the early complications of Diabetes according to UNRWA classification of early complications?	01 02	Yes No
DIAB16	If the answer to **DIAB05** is yes, please specify type of early complications developed? Multiple answers allowed. **(File Review)**	01 02 03 04 05 06 07	Cardiovascular Cerebrovascular Renal Ophthalmological Neurological Feet Others; specify
DIAB17	Did the participant develop any of the Late complications of Diabetes according to UNRWA classification of late complications?	01 02	Yes No
DIAB18	If the answer to **DIAB07** is yes, please specify type of late complications developed? Multiple answers allowed. **(File Review)**	01 02 03 04 05 06	MI CHF Stroke ESRD Blindness Amputations
DIAB19	What is the current risk status for cardiovascular	0	Low Risk

	disease according to last risk status assessment according to UNRWA TI?	1	
		02	Intermediate Risk
		03	High Risk
DIAB20	What is the current **control status** of Diabetes condition of the participant according to cutoff points of last Hgba1c done within past 6 months?	01	controlled
		02	uncontrolled
DIAB21	What is the current and most recent **Hgba1c** level of the participant?	Hgba1c ……	
DIAB22	In case the participant has HTN: What is the current **control status** of Hypertension condition of the participant according to cutoff points of BP and according to UNRWA TI?	01	controlled
		02	uncontrolled
DIAB23	Does the participant have Hyperlipemia\dyslipidemia according to UNRWA TI cutoff points?	01	Yes
		02	No
DIAB24	Does the participant have Hypertension according to UNRWA TI cutoff points?	01	Yes
		02	No
DIAB25	In case the participant has hyperlipidemia: What are the current **values of lipid profile**?	Cholesterol ……	
		LDL ……	
		HDL ……	
		TG ……	

Module 5- Adherence to Medications: The 8-item Morisky Medication Adherence Scale (MMAS-8)			
MEDS01	Did you forget to take your NCD pills in the past 2 weeks?	01	Yes, many times
		02	Yes, sometimes
		03	No
MEDS02	People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past 2 weeks, were there any days when you did not take your chronic medicine?	01	Yes, many times
		02	Yes, sometimes

		03	No
MEDS03	Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it especially in past 6 months?	01	Yes, many times
		02	Yes, sometimes
		03	No
MEDS04	When you travel or leave home, do you sometimes forget to bring along your chronic medication?	01	Yes, many times
		02	Yes, sometimes
		03	No
MEDS05	Did you take your chronic medicine yesterday?	01	Yes
		02	No
MEDS06	When you feel like your antihypertensive is under control, do you sometimes stop taking your medicine?	01	Yes, many times
		02	Yes, sometimes
		03	No
MEDS07	Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	01	Yes, many times
		02	Yes, sometimes
		03	No
MEDS07	Item 8. How often do you have difficulty remembering to take all your medications?	01	Never
		02	Rarely
		03	Sometimes
		04	Usually,
		05	All the Time

Module 6- Mental Health Related factors: Patient Health Questionnaire (PHQ-9)

Source: Questions 1-9 are the PHQ-8 (Kroenke, Strine, Spitzer, Williams, Berry, & Mokdad, 2008)			
I now would like to ask you some questions about your current general well-being. **Over the last two weeks, how often have you been bothered by?** **Codes for Q1-8** 0= Not at all (0 days out of the last 2 weeks) 1 = Several Days (1-6 days out of the last 2 weeks) 2 = More than half of the days (7-11 days out of the last 2 weeks) 3 =-Nearly every day (12-14 days out of the last 2 weeks)			
1	Having little interest or pleasure in doing things that you used to enjoy?		-----
2	Feeling sad, down, depressed, or hopeless?		-----
3	Trouble sleeping including staying asleep or sleeping much more or much less than you normally do?		-----
4	Feeling tired or like you are carrying a heavy burden or like you have little strength in your body?		-----
5	Your appetite including eating much less or much more than you normally do?		-----
6	Feeling bad about yourself, feeling that you are a failure, feeling that you are worthless, or feeling guilt that that you have let yourself or your family down		-----
7	Having trouble concentrating on things such as your work, the care of your children or other activities?		-----
8	Moving or speaking so slowly that other people have noticed? or have you experienced the opposite - meaning that others noticed that you had so much movement, or restlessness that caused you to move around a lot more than usual?		-----
9	***[if CR answered 1+ to Q1-8]*** How difficult have the problems you mentioned, made it for you to do your work, to take care of things at home or to get along with other people in your life?	Not difficult at all	0
		Somewhat difficult	1
		Very difficult	2
		Extremely difficult	3

Self-Rated Health SRH:

SRH	In the past 30 days; how do you perceive your current health?	01.	Very good
		02.	Good
		03.	Half/half

	04.	Not good
	05.	Not good at all
	88.	Don't know

Module 7- Physical Activity:	
Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.	
PA01	During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling? (Maximum 7)
	_____ **days per week** 00. No vigorous physical activities **(Skip to question PA3)**
PA02	How much time did you usually spend doing **vigorous** physical activities on one of those days?
	_____ **hours per day** _____ **minutes per day** 888 Don't know/Not sure
Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.	
PA03	During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or tennis doubles? Do not include walking. (Maximum 7)
	_____ **days per week** 00. No moderate physical activities **(Skip to question PA5)**
PA04	How much time did you usually spend doing **moderate** physical activities on one of those days?
	_____ **hours per day** _____ **minutes per day** 888 Don't know/Not sure
Think about the time you spent **walking in the last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.	
PA05	During the last 7 days, on how many days did you walk for at least 10 minutes at a time? (Maximum 7)
	_____ **days per week** 00. No walking **(Skip to question PA7)**
PA06	How much time did you usually spend **walking** on one of those days?
	_____ **hours per day** _____ **minutes per day** 888 Don't know/Not sure
The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.	

Module 8- Tobacco Use[1]

PA07	During the **last 7 days**, how much time did you spend **sitting** on a **weekday**? _____ **hours per day** _____ **minutes per day** 888 Don't know/Not sure

1

TOBAC01	Have you ever smoked 100 cigarettes (5 packs) in your entire life?	01	Yes
		02	No
If TOBAC01=02, skip			
TOBAC02	Do you now smoke cigarettes?	01	Every day
		02	Some days
		03	Not at all
TOBAC03	**If TOBAC02=03** When did you stop smoking?	……. years	
		……. months	
		…… weeks	
TOBAC04	**If TOBAC02=03** The reason (s) for smoking cessation? *(Multiple answers are possible)*		Yes 01 No 02
		Medical reason	
		Physician's advice	
		Relative's advice	
		Family reason	
		Economic reason	
		Policies at public places	
		Personal preference - antismoking attitudes	
		Anti-smoking campaigns in media, social media	
		Others, specify	…….
TOBAC05	What was your age when you started smoking?	……. years	
		88	Don't know/Not sure

Sibai, A., Tohme, R. A., Mahfoud, Z., Chaaya, M., & Hwalla, N. (2009). Non-communicable diseases and behavioral risk factor survey: comparison of estimates based on cell phone interviews with face to face interviews. WHO Lebanon office. Beirut, Lebanon: Final report submitted to World Health Organization-Lebanon office.
WHO STEPS, Palestine

Module 9- Lifestyle Change [2]			
During the past year did you:			
LSTL01	If **TOBAC01=02 No skip** Quit using tobacco?	01	Yes
		02	No
LSTL02	Reduce salt in your diet?	01	Yes
		02	No
LSTL03	Reduce daily consumption of sugar	01	Yes

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	in your diet (including sugary drinks)?	02	No
LSTL04	Eat at least two servings of fruits each day?	01	Yes
		02	No
LSTL05	Eat at least three servings of vegetables each day?	01	Yes
		02	No
LSTL06	Reduce fat/ oil in your diet?	01	Yes
		02	No
LSTL07	Start or do more physical activity?	01	Yes
		02	No
LSTL08	Maintain a healthy body weight or lose weight?	01	Yes
		02	No

Sibai, A., Tohme, R. A., Mahfoud, Z., Chaaya, M., & Hwalla, N. (2009). Non-communicable diseases and behavioral risk factor survey: comparison of estimates based on cell phone interviews with face to face interviews. WHO Lebanon office. Beirut, Lebanon: Final report submitted to World Health Organization-Lebanon office.

WHO STEPS, Palestine.

Module 10- Nutrition & Diet:		
NUTR01	**I would like to ask you about your food consumption pattern in the past week,**	
consider only meals consumed at home or in public kitchen but not in private restaurants or street food. do not count food consumed in very small amounts, i.e., less than a teaspoon per person or consumed by only one member of case.		consumption pattern **over the last 7 days**, how many days did your family consume the following foods? 0 = Not eaten, 1 = 1 day, 2 = 2 days, 3 = 3 days, 4 = 4 days, 5 = 5 days, 6 = 6 days, 7 = everyday
	1-Cereals (bread, pasta, wheat flour, bulghur)	
	2-White tubers and roots (potato, sweet potato)	
	3-Vegetables, leaves	
	4-Fruits	
	5-Meat (organ and flesh meat)	
	6-Eggs	
	7-Fish and other seafood	
	8-Pulses, nuts and seeds (beans, chickpeas, etc.)	
	9-Milk and dairy products	
	10-Oil and fats	
	11-Sweets (sugar, honey, jam, cakes, candy, etc.)	
	12-Spices and condiments	

Module 11- Healthcare Related factors, Patient Engagement, and Selfcare:
Communication & Information

SYSTEM01	Do you attend UNRWA HC for your NCD management visits regularly according to given appointments (monthly for uncontrolled cases and quarterly for controlled cases)?	01	Regularly, every appointment
		02	Partially regular, skip 1-2 appointments this year
		03	Irregular, skips more than 2 appointments this year
SYSTEM02	In the past year, have you ever been turn away home without receiving healthcare services related to your chronic condition that you came to receive at the HC?	01	No
		02	Yes, happened 1-2 times this year
		03	Yes, happened more than twice this year
SYSTEM03	Have you received any information and instructions of selfcare related to your chronic condition from your healthcare provider in past 6 months?	01	Yes
		02	No
SYSTEM04	Have you been given any printed educational materials and instructions related to your chronic condition from your healthcare provider in past 6 months?	01	Yes
		02	No
SYSTEM05	Have you been given any electronic educational materials and instructions related to your chronic condition from your healthcare provider in past 6 months?	01	Yes
		02	No
SYSTEM06	Can you specify -if applicable- types of educational & counseling activities you have received from your healthcare providers in past 6 months? Choose all applicable answers	01	Individual face to face counseling
		02	Group counseling, MCI sessions
		03	Mental health support groups
		04	Lectures by providers
		05	Learning by doing, modules, interactive, participatory etc.
		06	Social media pages or groups by providers
		07	Educational material (printed, electronic)
SYSTEM07	Have you ever consulted a nutritionist for nutritional planning or counseling for your chronic condition?	01	Yes
		02	No
SYSTEM08	Regarding your information & knowledge related to Diabetes including nature of the disease, it`s management and selfcare, can you choose the sources you generally get your disease related health information from?	01	Specialist\Endocrinologist\ Interest
		02	PHC Physician\Family Physician
		03	NCD Nurse
		04	Pharmacist
		05	Other patients
		06	Relatives & Friends
		07	Newspapers\ Journals

		08	Television or Radio
		09	Internet browsing
		10	Social media pages
		11	Others. Specify ……
		12	None
SYSTEM09	If you have a question or concern related to your Diabetes condition or its management in general, who would be the first source\person you would seek their help?	01	Specialist\Endocrinologist\ Interest
		02	PHC Physician\Family Physician
		03	NCD Nurse
		04	Pharmacist
		05	Other patients
		06	Relatives & Friends
		07	Newspapers\ Journals
		08	Television or Radio
		09	Internet browsing
		10	Social media pages
		11	Others. Specify ……
		12	None
SYSTEM10	If you have a question or concern related to your medications and their side effects, who would be the first source\person you would seek their help?	01	Specialist\Endocrinologist\ Interest
		02	PHC Physician\Family Physician
		03	NCD Nurse
		04	Pharmacist
		05	Other patients
		06	Relatives & Friends
		07	Newspapers\ Journals
		08	Television or Radio
		09	Internet browsing
		10	Social media pages
		11	Others. Specify ……
		12	None
SYSTEM11	If you have a question or concern related to your nutrition, diet control and lifestyle, who would be the first source\person you would seek their help?	01	Specialist\Endocrinologist\ Interest
		02	PHC Physician\Family Physician
		03	NCD Nurse
		04	Pharmacist
		05	Other patients
		06	Relatives & Friends
		07	Newspapers\ Journals
		08	Television or Radio
		09	Internet browsing
		10	Social media pages
		11	Others. Specify ……
		12	None
SYSTEM12	According to your opinion: how good you think your knowledge related to Diabetes & its management including	01	Very poor
		02	Poor
		03	Good

	selfcare is?	04	Very Good
		05	I can't determine
SYSTEM13	Did you ever have questions and concerns related to your chronic health condition that you couldn't share with your healthcare provider (family physician-practical nurse), or that you shared with them but didn't receive sufficient answers or advices?	01	Yes
		02	No
SYSTEM14	If the answer to above question is Yes: what is\are the reasons for that from your point of view?	01	Lack of access to healthcare provider when needed
		02	Insufficient contact time with the provider
		03	Crowdness
		04	Lack of responsiveness of the provider
		05	Lack of trust
		06	Poor technical skills or knowledge of the provider
		07	Poor communication & active listening
		08	Lack of understanding of provided information\ difficult medical language
		09	Lack of privacy
		10	Lack of patient engagement
		11	Personal Reasons
		12	Others, specify ……..
SYSTEM15	What is the knowledge\information that you feel deficient, and you think your healthcare provider should focus more upon during consultations? You can select all applicable answers	01	Nature of Illness, clinical course etc.
		02	Risk factors
		03	Complications of DM
		04	Medications plans, interactions and side effects
		05	Lifestyle modifications
		06	Nutrition & Diet control
		07	Physical activity
		08	Lab tests & self-monitoring
		09	Stress management & coping strategies
		10	Screening for complications
		11	All aspects of Selfcare
		12	Others, specify ……
Perceptions About Services:			
SYSTEM16	In your perception, how would you describe the counseling skills of your	01	Very poor
		02	Poor

	healthcare providers (family physician & practical nurse) that you receive during your NCD management visits?	03	Good
		04	Very Good
SYSTEM17	In your perception, how would you describe the consultation time you spend with your healthcare providers (family physician & practical nurse) during your NCD management visits in comparison to your needs?	01	Satisfactory\ sufficient
		02	Not satisfactory\ insufficient
SYSTEM18	In your perception, how would you describe the number of NCD management (follow up) visits you receive annually in comparison to your needs?	01	Satisfactory\ sufficient
		02	Not satisfactory\ insufficient
SYSTEM19	In your perception, how would you describe the waiting time you spent for NCD management (follow up) visits you receive in comparison to your needs?	01	Satisfactory, short waiting time
		02	Partially satisfactory, moderate waiting time
		03	Not satisfactory, long waiting time
SYSTEM20	If you perceive the waiting time as not satisfactory, do you think it`s affecting the quality of services you are receiving or might affect your commitment to your NCD follow up visits?	01	Yes
		02	No
SYSTEM21	In past 6 months, did you ever face any kind of difficulty accessing or barriers to reaching the health services you needed when needed?	01	Yes, financial barriers
		02	Yes, geographical barriers
		03	Yes, social or cultural barriers
		04	Yes, organizational barriers (lack of information from UNRWA or Health center)
		05	No
SYSTEM22	Do you generally consider working hours of the health center convenient & suitable to you?	01	Yes
		02	No
SYSTEM23	Do you generally consider the appointments you receive from your healthcare provider for NCD visits convenient & suitable to you?	01	Yes
		02	No
SYSTEM24	Do you generally consider the contact time you spend with the healthcare provider during your NCD follow up visits acceptable?	01	Yes
		02	No
SYSTEM25	In your perception, to which degree are you satisfied with sufficiency & quality of NCD services you receive regarding lab investigations?	01	Very satisfied
		02	Partially satisfied
		03	Not satisfied
SYSTEM26	In your perception, to which degree are you satisfied with sufficiency & quality of NCD services you receive regarding chronic medications?	01	Very satisfied
		02	Partially satisfied
		03	Not satisfied

SYSTEM27	In your perception, to which degree are you satisfied with sufficiency & quality of NCD services you receive regarding health center infrastructure & physical environment?	01	Very satisfied
		02	Partially satisfied
		03	Not satisfied
SYSTEM28	In your perception, to which degree are you satisfied with sufficiency & quality of NCD services you receive regarding healthcare provider`s **attitudes and communication** skills?	01	Very satisfied
		02	Partially satisfied
		03	Not satisfied
SYSTEM29	During past 6 months, have you had any difficulty or problems dealing with any of your healthcare providers during NCD follow up visits?	01	Yes
		02	No
SYSTEM30	If the answer to any of the above question is Yes, did this affect your compliance to your appointments or healthcare seeking behavior?	01	Yes
		02	No
SYSTEM31	During past 6 months, have you faced any kind of discriminative behaviors from any of your healthcare providers during NCD follow up visits?	01	Yes
		02	No
SYSTEM32	During past 6 months, have you faced any problem in acceptability of your healthcare provider`s age or gender?	01	Yes, age
			Yes, gender
		02	No
SYSTEM33	How would describe the level of confidence and trust that you have in your healthcare provider in past 6 months?	01	Very confidant
		02	Partially confidant
		03	Not confidant
SYSTEM34	In your perception, to which degree do you consider yourself/caregiver engaged in decisions related to your medical condition and its management taken by your healthcare providers?	01	No engaged at all\ I am only a receiver
		02	Partially engaged & informed
		03	Fully engaged & informed
		04	I can't determine
SYSTEM35	Is there anything that you would like to change in the current NCD services provided to you?	01	Yes
		02	No
SYSTEM36	If the answer to above question is yes, please explain your answer?		
SYSTEM37	In your perception, to which degree do you consider your close family members & caregivers are engaged in decisions related to your medical condition and its management taken by your healthcare providers?	01	No engaged at all\ they are only receivers
		02	Partially engaged & informed
		03	Fully engaged & informed
		04	I can't determine
SYSTEM38	How you judge the following people with regard to your diabetes?	1- Supportive 2- Not Certain 3- Not Supportive 4- Not Applicable	

	Treating doctor	Nurses
	Lab technician	Pharmacis t
	Other service providers	Partner
	Sons	Daughters
	Father	Mother
	Brothers	Sisters
	Close Friends	Peer at work

Thank you for your valuable participation.

Annex (5): Qualitative Questions

Questions for Patients with DM:

1) How do you describe your illness?
2) How do you think your illness affects your life?
3) What are the complications and health hazards related to your illness that you know?
4) What do you think are the most important risk factors affecting your DM control status?
5) According to your knowledge & opinion: what can improve your control status and optimize your health?
6) According to your knowledge & opinion: what can worsen your control status and jeopardize your DM condition?
7) What can your healthcare provider do to help you improve your control status?
8) What can you do to improve your control status?
9) What can your social network, family, and friends do to help you improve your control status?
10) What do you know about self-care?
11) What is preventing you from adopting a healthy lifestyle, diet control and regular exercise?
12) What can improve your compliance to your medications?
13) What do you think can happen if you gained control on your DM condition?
14) If you were a decision maker in the health system, what decisions would you take to improve healthcare provided to chronic patients and optimize their control status.

Questions for Healthcare Providers:

1) How do you describe diabetes?
2) How do you think this illness affects people`s lives?
3) What are the complications and health hazards related to this illness that you know?
4) What do you think are the most important risk factors affecting DM control status?
5) According to your knowledge & opinion: what can improve control status and optimize patients with Diabetes health?
6) According to your knowledge & opinion: what can worsen control status and jeopardize DM condition among patients?
7) What do you think healthcare providers can do to help improve patient`s control status?
8) What can you do to improve patients control status?
9) What do you think patient`s social network, family, and friends can do to help them improve their control status?
10) What do you think can improve your nutritional and diabetes care counseling sessions and skills?
11) What do you think is preventing you from providing most optimal healthcare to patients with DM?
12) What can improve patients' compliance to their medications?
13) What can improve patients' compliance to lifestyle modifications especially diet, weight reduction, healthy eating and exercise?
14) What can improve patients' compliance to their own self-care activities?
15) What do you think can happen if majority of patients gained control on their DM condition?
16) If you were a decision maker in the health system, what decisions would you take to improve healthcare provided to chronic patients and optimize their control status?

Annex (6): Review Experts

- Dr Khitam Hamad
- Dr Yehia Abed
- Dr Zoheir El Khatib

- Dr Khalil Hamad
- Dr Sireen Attar
- Dr Neisseria Halabi
- Hala Maghari
- Dr Mohamed Obeid
- Dr Imad Afana
- Dr Khalid Abu Saman
- Dr Ahmed Ghazali
- Dr Ola Najjar

Annex (7): Informed Consent for the Qualitative Part

Dear participant,

I am Dr. Randa Masoud, a master student from Al Quds University- Faculty of Public Health, and I would like to invite you to participate in a research project entitled "**Determinants of Glycemic Control among Patients with Diabetes Attending UNRWA Health Centers: A Comparative Study**."

Please take some time to read the information presented here, which will explain the details of this study and contact us if you require further explanation or clarification of any aspect of the study. Also, your participation is entirely voluntary, and you are free to decline to participate. If you say no, this will not affect you negatively in any way. You are also free to withdraw from the study at any point, even if you do agree to take part.

The study aims at evaluating the determinants of glycemic control among patients with Diabetes attending UNRWA health centers in Gaza Strip to provide the policy makers with systematic data that can be used as a base to enhance the control status of Patients with Diabetes and hence their health outcomes and quality of life.

We offer you to share us your expertise as a beneficiary/ healthcare provider/ manager and your role is to provide the investigator with information related to the study aims by answering questions as a part of semi-structured interview.

You will not get personal benefits from the research, but it will provide policy makers

with systematic data to develop a future plan, also there is no risk involved in taking part of this research.

The information collected from you will be audio recorded/ saved in a closed cabinet and will be treated as confidential. If it is used in a publication or thesis, your identity as a participant will remain anonymous.

You will not be paid to take part in the research, and will be no costs involved for you, if you do take part.

If you have any questions or concerns about the research, please feel free to contact Dr. Randa Masoud at mobile **0567886679**.

You will receive a copy of this information and consent form for your own records.

If you are willing to participate in this study, please sign the attached Declaration of Consent and hand it the investigator.

DECLARATION BY PARTICIPANT

By signing below, I agree to take part in a research study entitled **"Determinants of Glycemic Control among Patients with Diabetes Attending UNRWA Health Centers: A Comparative Study"** and conducted by Dr. Randa Masoud.

I declare that:

- I have read the attached information leaflet, and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

Signed on	Signature of participant
___/___/20-___	----------

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to ---*Name of the participant*--- He/she was encouraged and given ample time to ask me any questions. This conversation was conducted in Arabic and no translator was used.

Annex (8): Informed Consent for the Quantitative Part

Dear participant,

I am Dr. Randa Masoud, a master student from Al Quds University- Faculty of Public Health, and I would like to invite you to participate in a research project entitled **"Determinants of Glycemic Control among Patients with Diabetes Attending UNRWA Health Centers: A Comparative Study".**

Please take some time to read the information presented here, which will explain the details of this study and contact us if you require further explanation or clarification of any aspect of the study. Also, your participation is **entirely voluntary,** and you are free to decline to participate. If you say no, this will not affect you negatively in any way. You are also free to withdraw from the study at any point, even if you do agree to take part.

The study aims at evaluating the determinants of glycemic control among patients with Diabetes attending UNRWA health centers in Gaza Strip in order to provide the policy makers with systematic data that can be used as a base to enhance the control status of Patients with Diabetes and hence their health outcomes and quality of life.

We offer you to share us your expertise as a patient with Diabetes and your role is to provide the investigator with information related to the study aims by filling a questionnaire.

You will not get personal benefits from the research, but it will provide policy makers with systematic data to develop a future, also there is no risk involved in taking part of this research.

The information collected from you will be saved in a closed cabinet and will be treated as confidential. If it is used in a publication or thesis, your identity as a participant will remain anonymous.

You will not be paid to take part in the research, and will be no costs involved for you, if you do take part.

If you have any questions or concerns about the research, please feel free to contact Dr. Randa Masoud at mobile **0567886679**.

You will receive a copy of this information and consent form for your own records.

If you are willing to participate in this study, please sign the attached Declaration of Consent and hand it the investigator.

DECLARATION BY PARTICIPANT

By signing below, I agree to take part in a research study entitled **"Determinants of Glycemic Control among Patients with Diabetes Attending UNRWA Health Centers: A Comparative Study".** and conducted by Dr. Randa Masoud.

I declare that:

- I have read the attached information leaflet, and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

Signed on	Signature of participant
___/___/20-___	----------

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to ---*Name of the participant*--- He/she was encouraged and given ample time to ask me any questions. This conversation was conducted in Arabic and no translator was used.

دراسة حول حالة العافية والرفاهية في قطاع غزة: العوامل والتداعيات

إعداد: رنده مسعود

إشراف: د. بسام أبو حمد

ملخص الدراسة

تهدف هذه الدراسة إلى التحقيق في العوامل المؤثرة على السيطرة على مستوى السكر في الدم لدى مرضى السكري من النوع الثاني الذين يتلقون الرعاية الصحية في مراكز صحة الأونروا في قطاع غزة. كما يسلط الضوء على سياق الدراسة، بما في ذلك الارتفاع المتزايد للأمراض غير المعدية، وخاصة مرض السكري، والتحديات التي يواجهها النظام الصحي الفلسطيني بسبب الصراع المستمر والحصار.

تمتلك هذه الدراسة القدرة على تقديم رؤى قيمة لتحسين حالة السيطرة على مرض السكري من النوع الثاني لدى المرضى الذين يتلقون الرعاية الصحية في مراكز صحة الأونروا، والمساهمة في تطوير برامج أكثر فعالية لإدارة الأمراض غير المعدية في سياق قطاع غزة.

تستخدم الدراسة نهجًا منهجيًا مختلطًا مقارنًا يجمع بين استطلاع كمي ومقابلات شبه منظمة. سيقيّم المكون الكمي تأثير العوامل الاجتماعية والديموغرافية ونمط الحياة والتغذية والنشاط البدني والمرتبطة بالرعاية الصحية والمرتبطة بالأدوية والصحة العقلية على السيطرة على مستوى السكر في الدم. يستخدم المكون الكمي أسلوب أخذ العينات العشوائية الطبقية لاختيار 420 مشاركًا، يتم تقسيمهم بالتساوي بين أولئك الذين لديهم سيطرة محكمة على مستوى السكر في الدم وغير المحكمة (هيموجلوبين A1c٪ ≤ 7 و >7٪على التوالي). كما يتم استخراج تحاليل المختبر وقياسات الجسم من السجلات الطبية. سيبحث المكون النوعي في وجهات نظر المرضى ومقدمي الرعاية الصحية فيما يتعلق بالعوامل التي تؤثر على السيطرة على مستوى السكر في الدم. يتم استخدام التحليل الموضوعي لاستكشاف العوامل التي تمكن وتعيق السيطرة على مستوى السكر في الدم من وجهة نظر كل من المريض والمقدم.

السيطرة على مستوى السكر في الدم هي عنصر حاسم في إدارة مرض السكري، حيث تؤثر بشكل كبير على صحة المرضى ونوعية حياتهم. تؤثر العديد من العوامل على السيطرة، وتصنف إلى عوامل اجتماعية وديموغرافية وحالة صحية ودواء ونمط حياة وصحة عقلية وإمكانية الوصول إلى الرعاية الصحية وعوامل مرتبطة بالسكري. وتجدر الإشارة إلى أن العمر والتعليم والوضع الاجتماعي والاقتصادي والسمنة والالتزام بالدواء والعادات الغذائية والنشاط البدني والصحة العقلية تلعب جميعها أدوارًا أساسية.

وُجد أن العديد من العوامل تؤثر على السيطرة على مستوى السكر في الدم، وتصنف إلى عوامل اجتماعية وديموغرافية (العمر والتعليم والحالة الاجتماعية)، وحالة صحية (الوراثة والسمنة ومدة الإصابة بالسكري)، والأدوية (الالتزام ونوع الدواء)، ونمط الحياة (النظام الغذائي والنشاط البدني)، والصحة العقلية (الاكتئاب)، والنظام الصحي (إمكانية الوصول وجودة الرعاية)، والشبكة الاجتماعية (المشاركة العائلية). ولاحظ الباحثون أن العمر الأصغر وانخفاض مستوى التعليم والحالة الاجتماعية غير المتزوجة وانخفاض الدخل والوراثة ومدة الإصابة بالسكري الأطول وعدم الالتزام بالدواء والنظام الغذائي غير الصحي وعدم ممارسة الرياضة والاكتئاب وقلة الدعم الأسري ترتبط جميعها بسوء السيطرة على مستوى السكر في الدم.

يتطلب تحقيق السيطرة المثلى على مستوى السكر في الدم نهجًا متعدد الأوجه يعالج عوامل مختلفة، بما في ذلك التدخلات المستهدفة وتحسين الوصول إلى الموارد وتثقيف المرضى ومعالجة مشاكل الصحة العقلية.

توصي الدراسة بتدخلات لتحسين ربط فئات سكانية معينة بالرعاية الصحية، مثل الشباب والمتعلمين والمبتعدين عن مراكز الرعاية. كما توصي الدراسة ببرامج لمعالجة نقص أجهزة قياس السكر في الدم، واستكشاف سبل تحسين الوصول إلى الأدوية والمتخصصين.

تشمل التوصيات الأخرى تعليم المرضى حول المضاعفات المحتملة لمرض السكري وأهمية اتباع أنماط حياة صحية، بالإضافة إلى استثمار في دعم الصحة العقلية، ومعالجة التحديات الغذائية التي يواجهها مرضى السكري .كذلك، يوصى الدراسة بتعزيز النشاط البدني من خلال نهج مجتمعية، واستكشاف تقديم مساعدة مالية للمرضى لضمان قدرتهم على توفير مستلزمات العلاج.

وأخيرا، توصي الدراسة بمعالجة فجوات المعرفة لدى المرضى حول مرض السكري وطرق إدارته، وتعزيز دور أفراد العائلة في تقديم الدعم للمرضى.