

KAIRUKI UNIVERSITY

SCHOOL OF MEDICINE

DEPARTMENT OF PAEDIATRICS AND CHILD HEALTH



**SELF-CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL, AND
ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES**

MELLITUS IN

DAR ES SALAAM, TANZANIA

By

LEONARD JAMES MALASA, MD

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN

PAEDIATRICS AND CHILD HEALTH

YEAR 2025

SUPERVISOR: PROF. FLORENCE SALVATORY KALABAMU, MD, MMED

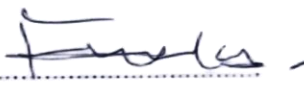
CO-SUPERVISOR: DR. MAULIDI R. FATAKI, MD, MMED, MPH

CERTIFICATION

The undersigned certify that they have read and recommend for acceptance by Kairuki University a dissertation entitled "SELF-CARE MANAGEMENT PRACTICES, GLYCAEMIC CONTROL AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA" in partial fulfillment of the requirements for the degree of Master of Medicine in Paediatrics and Child Health.

SUPERVISOR

Prof. Florence S. Kalabamu

Signature: 

Date: 01/12/2025

CO-SUPERVISOR

Dr. M. R. Fataki

Signature: 

Date: December 1, 2025

DECLARATION AND COPYRIGHT

DECLARATION

I, Dr. Leonard James Malasa, hereby declare that this dissertation is my own effort and original work, and that it has not been presented and will not be presented to any other University for a similar degree or any other academic award.

Being a Student Researcher, enrolled at Kairuki University, I understand that plagiarism is a serious offence, and therefore confirm that the contents of this research are purely my own production.

Signature: 

Date: 01/12/2025

COPYRIGHT

This dissertation is copyright material protected under the Berne Convention Act of 1979 and other international and national enactments on that behalf, on intellectual property. It may not be reproduced by any means, in whole or in part, except for short extract in fair dealing for research or private study. Furthermore, it may not be transmitted in any form, electronic or mechanical, without prior written consent from the author or Kairuki University on behalf.

ACKNOWLEDGEMENT AND DEDICATION

First and foremost, I thank the Almighty God for blessing me with good health and the ability to successfully complete this research project.

Appreciation to the Ministry of Education, Science and Technology for the scholarship to undertake a Master of Medicine in Paediatrics and Child Health under the Higher Education for the Economic Transformation (HEET) project through my employer, Kairuki University. I will always be grateful for this opportunity. I extend my sincere gratitude to my supervisor, Prof. Florence Salvatory Kalabamu, and co-supervisor, Dr. Maulidi Fataki, my mentor Prof. Esther Mwaikambo and all members of Department of Paediatrics and Child Health for their invaluable guidance, constructive criticism, and unwavering support throughout the study. I am deeply grateful to the authorities and healthcare professionals at Temeke, Amana, and Mwananyamala Regional Referral Hospitals, as well as the diabetes educators, especially Mr. Jacob and Mr. Kambona, for their cooperation and support throughout the data collection process. I would like to extend my sincere gratitude to Dr. Emily Godfrey and Mr. Abraham Banduka for their invaluable assistance as research assistants throughout this study. Their dedication, expertise, and tireless efforts were instrumental in ensuring the successful completion of this research. I am also deeply grateful to all study participants who generously volunteered their time and shared their experiences, making this meaningful research possible. Their

willingness to contribute to the advancement of knowledge in this field is truly appreciated.

DEDICATION

A very special appreciation goes to my family, particularly my beloved wife Joyce and my dearest children Petra and Giancarlo, whose endless support, understanding, and encouragement have been instrumental throughout my academic journey. Their patience and moral support have made this work possible. This dissertation is as much yours as it is mine.

ABSTRACT

Introduction: Type 1 diabetes mellitus is among the leading non communicable diseases of public health importance worldwide. According to the International Federation of Diabetes atlas report, there were 8.75 million people living with T1DM worldwide in the year 2022, and out of these individuals, 1.52 million were those under 20 years of age. In Tanzania, approximately 6,915 youth under the age of 20 have T1DM. Despite improvement in diabetes care, maintaining optimal glucose levels in adolescents with T1DM remains challenging, with many exhibiting poor glycemic controls. Therefore, this study aimed at assessing self-care management practices, glycemic control, and associated challenges among adolescents with T1DM.

Rationale: This study stems from the critical need to understand and address the challenges faced by adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania. Given the complexities of managing Type 1 diabetes mellitus during adolescence, especially in developing countries, this research is crucial to identify areas where support is most needed.

Objective: The broad objective of this study was to assess self-care management practices, glycemic control, and associated challenges among adolescents with type 1 diabetes mellitus in Dar es Salaam, Tanzania.

Methods: This was a cross-sectional study employing mixed-methods, sequential explanatory design comprising both quantitative and qualitative data collection methods. The standard questionnaire and Self Care Inventory-Revised

Version of 2009 were used to gather quantitative data from 155 study participants. Qualitative data were gathered through focus group discussions to investigate challenges to self-care management. Data were analyzed using SPSS version 27, with continuous variables presented as mean $\pm$ standard deviation. Categorical responses were expressed in frequencies and percentages, with glycaemic control categorized as good ($\leq 7.5\%$ HbA1c) or poor ($> 7.5\%$ HbA1c), and participants in each category reported proportionally. The thematic analysis method was used to analyze the qualitative data.

Results: Among the 155 adolescents with Type 1 Diabetes recruited into the study, 51.6% were females. The majority of participants (62.6%) were aged 15-19 years, and 37.4% were in the 11-14 years age group. Regarding self-care management practices, the overall weighted average was 3.6 out of 5 equivalent to 72%. High adherence was reported for insulin use and clinic attendance, with over 80%, while recording blood glucose results, keeping food records, carrying quick-acting sugar to treat low blood glucose, exercise, and adjusting insulin dosage were among the most challenging practices. The majority of participants, 122 (78.7%), had poor glycaemic control, while only 33 (21.3%) had good glycemic control.

Conclusion: This study showed the self-care management practices among the 155 study participants with varying levels of adherence. The overall weighted average score for self-care management practices was 3.6 out of 5, indicating moderate adherence to recommended self-care behaviours. However, only a

third of study participants had good glycaemic outcomes despite moderate overall adherence to self-care practices. The qualitative analysis revealed multiple interconnected challenges that adolescents with Type 1 Diabetes mellitus face in managing their condition. Seven areas stood out: Insulin management challenges; Blood glucose monitoring difficulties; Dietary management barriers; Exercise-related concerns; Healthcare system challenges and the perceptions of Type 1 Diabetes mellitus. These findings reveal a complex interplay between technical, psychosocial and systemic barriers that require comprehensive, multifaceted interventions addressing not only clinical education but also healthcare system improvements, social stigma reduction, and age-appropriate developmental support.

Recommendations: To improve glycaemic control among adolescents with Type 1 Diabetes mellitus:

- i. There is an urgent need for targeted interventions designed specifically for this population. These interventions should address the multifactorial nature of poor glycaemic control by incorporating age-appropriate education, family-centered care approaches, peer support programs, and enhanced healthcare system capacity for adolescent diabetes management.
- ii. To conduct further studies, especially involving study participants in rural areas to ensure generalizability countrywide, as well as including family and healthcare providers to explore their perspectives.

TABLE OF CONTENTS

CERTIFICATION	i
DECLARATION AND COPYRIGHT	ii
ACKNOWLEDGEMENT AND DEDICATION.....	iii
ABSTRACT	v
LIST OF TABLES.....	xi
LIST OF FIGURES	xii
ABBREVIATIONS AND ACRONYMS	xiii
DEFINITION OF TERMS	xiv
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background	1
1.2 Problem Statement	4
1.3 Rationale.....	6
1.4 Research Questions.....	6
1.5 Objectives	7
1.5.1 Broad objective.....	7
1.5.2 Specific objectives:.....	7
CHAPTER TWO: LITERATURE REVIEW	8
2.1 The burden of type 1 diabetes mellitus	8
2.2 Self-care management practices among adolescents with type 1 diabetes mellitus	11
2.3 Glycaemic control status among adolescents with Type 1 diabetes mellitus.....	14
2.4 Challenges to self-care management practices among adolescents with type 1 diabetes mellitus	17
2.5 Conceptual Framework.....	27

CHAPTER THREE: METHODOLOGY.....	29
3.1 Study area and population	29
3.2 Study design	30
3.3 Sampling methods	31
3.3.1 Sample size estimation	31
3.4 Procedures for data collection	33
3.4.1 Data collection tools	33
3.4.2 Data collection methods.....	35
3.4.3 Eligibility criteria.....	36
3.4.4 Study variables	37
3.4.5 Ethical considerations	37
3.4.6 Ethical clearance	39
3.5 Data management	39
3.5.1 Data collection in the field.....	39
3.5.2 Data coding and cleaning.....	40
3.5.3Data analysis	41
3.6 Dissemination of the study findings	42
CHAPTER FOUR: RESULTS	43
4.1 Enrollment.....	43
4.2 Baseline socio-demographic characteristics of study participants	44
4.2.1 Baseline characteristics of the study participants.....	45
4.3 Level of self-care management practices among adolescents with Type 1 Diabetes	47
4.4 Glycaemic control status	50

4.5 challenges affecting self-care management practices among adolescents with type 1 diabetes mellitus	51
CHAPTER FIVE: DISCUSSION	59
5.1 Overview of discussion	59
5.2 Strengths and limitations	64
5.3 Conclusion.....	65
5.4 Recommendations.....	65
CHAPTER SIX: REFERENCES.....	67
LIST OF APPENDICES	82

LIST OF TABLES

Table 4. 1: Socio-demographic characteristics of study participants (n=155) ...	46
Table 4. 2 : Level of self-care management practices among adolescents with Type 1 Diabetes (n=155)	49

LIST OF FIGURES

Figure 2. 1: The conceptual framework of the study.....	28
Figure 4. 1 : Enrollment flow chart of study participants.....	44
Figure 4. 2: Glycaemic control status among adolescents with Type 1 Diabetes (n=155)	50

ABBREVIATIONS AND ACRONYMS

CDiC	Changing Diabetes in Children
CGM	Continuous Glucose Monitoring
DM	Diabetes Mellitus
FGDs	Focused Group Discussions
HbA1C	Glycosylated Hemoglobin
HEET	Higher Education for Economic Transformation
ISPAD	International Society for Paediatric and Adolescent Diabetes
KU	Kairuki University
LFAC	Life for a Child
NCDs	Non-Communicable Diseases
RBG	Random Blood Glucose
RRH	Regional Referral Hospital
SCI-R	Self Care Inventory-Revised Version
SMBG	Self-Monitoring of Blood Glucose
SSA	Sub-Saharan Africa
STG	Standard Treatment Guideline
T1DM	Type 1 Diabetes Mellitus
TDA	Tanzania Diabetes Association
WDF	World Diabetes Foundation
WHO	World Health Organization

DEFINITION OF TERMS

Diabetes Mellitus: A complex metabolic disorder characterized by persistently high blood sugar levels (hyperglycemia) resulting from impairments in either insulin production, the body's response to insulin, or both (1).

Type 1 diabetes mellitus: A form of diabetes that occurs when there is destruction of beta cells in the pancreas, typically due to an autoimmune reaction. This results in the body's inability to produce insulin, leading to abnormalities in carbohydrate, fat, and protein metabolism (1).

Glycosylated haemoglobin (HbA1c): A crucial biomarker for long-term glycemic control that reflects average blood glucose levels over the past 3 months. The recommended HbA1c level for good glycemic control is less than 7.5% for all age groups (2,3)

Continuous glucose monitoring: A method of tracking blood glucose levels continuously throughout the day and night using a device. It estimates glucose level every few minutes and keeps track of it over time. It typically involves a small sensor inserted under the skin that measures glucose levels in the interstitial fluid, providing real-time data to help manage diabetes more effectively (4).

Self-care practices: These are a set of behavioral practices used by individuals suffering from diabetes in order to manage and control the disease on their own. They include monitoring blood glucose, eating a healthy diet, remaining

physically active, remaining adherent to the treatment regimen, taking medications on time, and reducing risk behaviors (5).

Adolescence: Is the transitional phase of growth and development between childhood and adulthood which encompasses the physical, cognitive, and psychosocial changes that occur during this time. It is the period of life between 10 and 19 years of age (6)

CHAPTER ONE: INTRODUCTION

1.1 Background

Diabetes mellitus refers to a complex metabolic disorder characterized by persistently high blood sugar levels (1). This chronic state of hyperglycemia arises from impairments in either the production of insulin, the body's response to insulin, or a combination of both factors. Although diabetes has various causes, most cases fall into two main categories based on their origin and development, Type 1 diabetes mellitus and type 2 diabetes (1).

Type 1 diabetes mellitus (T1DM) occurs when there is destruction of beta cells in the pancreas which produce insulin, a hormone responsible for regulating blood glucose in the body, typically due to an autoimmune reaction in which the body's immune system attacks and destroys these insulin-producing beta cells (1). This process leads to the body's inability to produce its own insulin leading to abnormalities of carbohydrate, fat, and protein metabolism. In contrast to adults, Type 1 diabetes mellitus (T1DM) is the most prevalent form of diabetes among children and adolescents, accounting for more than 90% of all diabetes patients in this age group (7).

The burden of diabetes in general is on the rise at global scale. In 2022, according to the International Federation of Diabetes atlas report, there were 8.75 million people living with T1DM worldwide, and out of these individuals, 1.52 million were those under 20 years old (8). It is also important to note that the number of childhood patients is set to increase by more than 100, 000 by 2050 (9). This

trend is attributed to various factors, including lifestyle changes, obesity, environmental and genetic predispositions (10–13)

In sub-Saharan Africa, where data is scarce, it has been reported that the occurrence of Type 1 diabetes mellitus ranges between 1.5 and 10.1 patients per 100,000 individuals (14). This variation depends on the specific country and the age group under consideration.

Tanzania, mirroring the trend in many sub-Saharan African nations, is witnessing an upward trajectory in T1DM cases among its young population. Recent estimates from 2022 reports indicate that roughly 6,915 Tanzanian youth under the age of 20 are grappling with T1DM (8). These figures underscore the growing health challenge of this disorder among youths present globally and, in the country, highlighting the need for improved management strategies tailored to the unique needs of adolescents living with this chronic condition.

An individual with diabetes presents with increased thirst, increased frequency of urination which can lead to enuresis in a previously continent child, polyphagia which is an increased desire to eat frequently and in large quantities, loss of weight, blurred vision and body weakness (1). In young children, especially infants and toddlers, failure to thrive and wasting may be the first symptoms to be noticed (1)

The diagnosis of diabetes is confirmed by an increase in plasma glucose concentration which can be evidenced by either a random plasma glucose measurement of 11.1 mmol/L (200 mg/dL) or higher, or a fasting plasma glucose

level of 7.0 mmol/L (126 mg/dL) or higher (1–3). These diagnostic criteria are applicable when accompanied by overt symptoms of diabetes. The presence of these elevated glucose levels, in conjunction with characteristic symptoms, provides a definitive basis for diagnosing diabetes mellitus.

Although not routinely done especially in low resource settings, confirming the specific type of diabetes may involve testing for diabetes-associated autoantibodies which characterize T1DM. These include glutamic acid decarboxylase 65 autoantibodies (GAD), tyrosine phosphatase-like insulinoma antigen 2 (IA2), insulin autoantibodies (IAA), and β -cell specific zinc transporter 8 autoantibodies (ZnT8) and in children, the presence of one or more of these antibodies is indicative of T1DM (1).

While autoantibodies confirm the autoimmune nature of the disease, C-peptide test can be performed to assess the functional status of pancreatic beta cells. C-peptide is a byproduct of insulin production and serves as a marker of endogenous insulin secretion and therefore, low or undetectable C-peptide levels indicate little to no insulin production which is a characteristic of T1DM (15). Together, autoantibodies and C-peptide provide a robust approach to diagnosing T1DM but unfortunately, these advanced diagnostic tests are costly and often inaccessible in many African countries with limited healthcare resources (16,17).

People with T1DM depend on daily insulin injections for survival and to ensure their glucose is within the normal range (18). Apart from insulin prescribed, self-care management such as appropriate use of medication, glucose monitoring,

dietary control, physical activity, and use of health care services is crucial for glycaemic control, improving outcome and reducing complications associated with the disease among adolescents (2).

Despite the significant improvement in diabetes care, maintaining optimal glucose levels especially in adolescents with Type 1 diabetes mellitus is a big challenge. Glycosylated hemoglobin (HbA1c), a crucial biomarker for long-term glycemic control reflecting average blood glucose levels over the preceding 3 months, has been shown to be abnormal among many adolescents. According to the Tanzanian treatment guideline for T1DM and the guideline for management of diabetes in childhood and adolescence in under-resourced countries, the recommended HbA1c level should be less than 7.5% (2,3). However, numerous studies conducted in several African countries, including Tanzania, indicate that a substantial proportion of adolescents with Type 1 diabetes mellitus have poor glycemic control, as evidenced by high HbA1c percentages (19–25). This poor control can lead to a rapid onset of complications, hence poor quality of life.

Therefore, this study assessed self-care management practices, glycemic control, and associated challenges among adolescents with type 1 diabetes mellitus.

1.2 Problem Statement

Type 1 diabetes mellitus is an increasing non-communicable disease in sub-Saharan Africa including Tanzania (8,26). Achieving and maintaining optimal blood glucose levels in the management of diabetes poses a significant challenge, particularly for adolescents with T1DM due to due to a combination of

physiological changes occurring in adolescence, psychological issues such as illness perception, anxiety and depression as well as social factors including peer pressure and lack of family support (27–29). Moreover, insulin storage is also a challenge whereby storing it in unfavorable conditions can lead to decreased potency hence impacting glycaemic control (30). Multiple research studies have revealed that, a substantial proportion of individuals in this population with T1DM particularly adolescents, have poor glycemic control with glycosylated haemoglobin above 10% (23–25). This poor glycemic control often results in the development of various complications leading to impairing the individual's quality of life. Self-care management practices which involve medication taking, glucose monitoring, eating behavior, physical activity and use of health care in individuals with diabetes are crucial components of management DM for improving outcome and reducing complications (5). In Tanzania, little is known on self-care management practices among adolescents with T1DM and the challenges they face. Hence, understanding the self-care management practices, glycaemic control status and the challenges adolescents encounter is paramount in this age group for the proper management strategies. To address this issue comprehensively, we propose a study to assess self-care management practices, glycemic control status, and associated challenges among adolescents with type 1 diabetes mellitus.

1.3 Rationale

The rationale for this study stems from the critical need to understand and address the challenges faced by adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania. By focusing on self-care management practices, glycaemic control status, and the obstacles to effective self-management, this research aims to fill a significant gap in our understanding of diabetes care in this specific population and context. The study's importance lies in its potential to inform targeted interventions, improve clinical practices, and ultimately enhance the quality of life for these young individuals. Given the complexities of managing Type 1 diabetes mellitus during adolescence, especially in developing countries, this research is crucial to identify areas where support is most needed. The findings could lead to the development of more effective, culturally appropriate strategies for diabetes education, care, and support systems.

1.4 Research Questions

The research questions of this study were:

1. What is the level self-care management practices among adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania?
2. What is the glycemic control status among adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania?
3. What are the challenges affecting self-care management practices among adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania?

1.5 Objectives

1.5.1 Broad objective

The broad objective of this study was to assess self-care management practices, glycemic control, and associated challenges among adolescents with type 1 diabetes mellitus in Dar es Salaam, Tanzania.

1.5.2 Specific objectives:

The specific objectives of the study were:

1.5.2.1 To assess the level of self-care management practices among adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania.

1.5.2.2 To assess glycaemic control status among adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania.

1.5.2.3 To explore the challenges affecting self-care management practices among adolescents with Type 1 diabetes mellitus in Dar es Salaam, Tanzania.

CHAPTER TWO: LITERATURE REVIEW

2.1 The burden of type 1 diabetes mellitus

In recent decades, the world is experiencing a rapid increase in the burden of non-communicable diseases (NCDs) including diabetes mellitus. Currently there are about 540 million people estimated to be living with diabetes mellitus (31). While the numbers of individuals with other types of diabetes is scaling up, Type 1 diabetes mellitus incidence and prevalence are also unexpectedly accelerating in many parts of the world including African countries and Tanzania is not an exception (31).

The incidence of childhood Type 1 diabetes mellitus (T1DM) varies greatly across regions. While China and Japan report low rates of 1.9 and 2.2 cases per 100,000 person-years respectively, Finland has a much higher incidence at 52.2 cases per 100,000 person-years (1). A systematic review and meta-analysis conducted in 2020 examined the global prevalence and incidence of Type 1 diabetes mellitus indicated that the incidence of Type 1 diabetes mellitus was 15 per 100,000 people and the prevalence of 9.5% (32).

The IDF Atlas reports that, in 2022 the number of children and adolescents aged <20 years with Type 1 diabetes mellitus in Africa was ranging from 4,227 in Ethiopia to 46,642 in Algeria (8). However, experts believe this figure may underrepresent the actual burden of Type 1 diabetes mellitus in sub-Saharan Africa. This potential underestimation is due to insufficient data from numerous countries in the region. Moreover, due to challenges in diagnosis, it's suspected

that many individuals with Type 1 diabetes mellitus succumb to the condition before receiving a proper diagnosis (8)

A 2020 cross-sectional study at Muhimbili National Hospital estimated the incidence of Type 1 diabetes mellitus among children and adolescents in Tanzania to be 1.5 cases per 100,000 people (33) but this rate is believed to be increasing due to improved awareness and resources for diagnosis and treatment (34). With this rise in diabetes burden, in May 2022, the 75th World Health Assembly took a significant step in the global fight against diabetes mellitus (DM) by adopting five ambitious targets to be achieved by 2030 (35). These targets aim to improve diagnosis, treatment, and management of diabetes worldwide. Specifically, the goals are: to diagnose 80% of people living with DM; to achieve glycemic control in 80% of those diagnosed; to attain blood pressure control in 80% of diagnosed individuals; to ensure that 60% of people with DM aged 40 years or older receive statin therapy; and to provide 100% of people with T1DM access to affordable insulin and blood glucose self-monitoring tools (35). These comprehensive targets address key aspects of diabetes care, from early detection to ongoing management, and emphasize the importance of accessibility to essential medications and monitoring devices for effective diabetes control.

Focusing on the targets set, countries are making commendable steps both individually and in collaboration to fight against this chronic condition. Over the years, Sub-Saharan Africa has witnessed the emergence of internationally funded insulin donation initiatives. Prominent examples include the Life For A Child (LFAC)

and Changing Diabetes in Children (CDiC) programs. These initiatives primarily focus on supporting individuals under 25 years of age who are living with Type 1 diabetes mellitus (T1DM). In addition to providing essential insulin, these programs offer comprehensive support by conducting training sessions and enhancing the capacity of healthcare professionals in the diagnosis and management of T1DM (17). This dual approach aims to address both immediate treatment needs and long-term healthcare system capabilities in managing this chronic condition.

Tanzania, recognizing the importance of human capital investment for sustainable socio-economic development, developed the National Strategic Plan for Prevention and Control of Non-Communicable Diseases 2021-2026 (36). This five-year development plan aims to create a healthy and prosperous society free from non-communicable diseases (NCDs), enabling individuals to contribute fully to their personal growth and national development. In addressing the burden of diabetes, the government under the ministry of health in collaboration with other organizations such as the Tanzanian Diabetes Association (TDA), Life for a Child (LFAC), Changing Diabetes in Children (CDiC) and World Diabetes Foundation (WDF) has made a significant step in establishing about 38 diabetic clinics so far in several regions of Tanzania mainland and Zanzibar in which children and adolescents with T1DM are managed with noted improved survival (34). These clinics are equipped with medication, supplies and trained staff. On a regular basis the clinics are supplied with insulin and other commodities such as glucometers,

glucose test strips, lancets, as well as educational materials and are made available for free. Moreover, more than 350 healthcare professionals working in these clinics have been trained in diabetes management (34).

Although there are advancements in healthcare resources, diagnostic capabilities, glucose monitoring tools, and availability of insulin, still there has been a notable lack of progress in improving overall glycemic control among individuals, especially adolescents with T1DM diabetes over time (37). This persistent challenge underscores the complex nature of diabetes management, suggesting that technological and pharmaceutical improvements alone may not be sufficient to achieve optimal blood glucose regulation in this population and therefore, a critical need for improved diabetes care strategies in T1DM adolescents.

2.2 Self-care management practices among adolescents with type 1 diabetes mellitus

Self-care practices are crucial for managing diabetes effectively. They play a vital role in maintaining optimal glycemic control, preventing complications, and improving overall health outcomes for individuals with diabetes. These practices have shown good results in maintaining blood glucose levels for individuals suffering from diabetes and have shown good outcomes (5). However, it has been observed in different studies that self-care practices among adolescents with Type 1 diabetes mellitus are unsatisfactory and therefore impact their glycaemic outcomes and overall well-being (38–41)

Self-care practices among adolescents with T1DM varies across the globe. It is satisfactory in some countries, especially high-income countries, and unsatisfactory in other countries especially middle- and low-income countries. For example, a cross-sectional observational study conducted in Italy, using Self-Care of Diabetes Inventory (SCODI) where researchers assessed various aspects of diabetes self-care, including maintenance, monitoring, and management behaviors among the adolescent subjects. In this study, generally adolescents demonstrated adequate self-care, with significant contributions from their caregivers (42) which is contrary to many low-resource countries where self-care practices have been reported to be poor (39–41).

Researchers in Serbia conducted a study to assess adherence to self-care activities among pediatric patients with Type 1 diabetes mellitus and found that a significant portion of the study participants, specifically 71%, demonstrated non-adherence to recommended self-care tasks (38). A study conducted in Iraq involving secondary school students with T1DM regarding their self-care practices indicated that, the highest percentage of students had either moderate or low self-care practices across all aspects such as insulin administration, blood glucose monitoring, diet, exercise and follow-up (39). A cross-sectional study conducted in public hospitals in Addis Ababa, Ethiopia, examined adherence to diabetes self-management among adolescents living with Type 1 diabetes mellitus. The research revealed that 52.7% of the study participants exhibited poor adherence to diabetes self-management practices. The study identified several factors

associated with this poor adherence, including self-efficacy, social support, age, knowledge about diabetes, and the time since diagnosis (40). In East Africa, a study conducted in Kenya on self-management practices revealed that a significant portion of children and adolescents with Type 1 diabetes mellitus (T1DM) in the study area struggled with effective self-management. Although 95.9% were aware of T1DM self-management practices in general, only 41.6% of participants achieved a satisfactory self-management score, indicating that the majority faced considerable difficulties in managing their condition (41).

These findings in different studies underline the significant challenges faced by adolescents with Type 1 diabetes mellitus in effectively managing their condition and point to key areas that may require intervention to improve adherence rates among this vulnerable population. The global landscape of diabetes mellitus self-care among adolescents reveals profound regional disparities deeply rooted in economic and healthcare infrastructural differences. High-income countries like Italy demonstrate more comprehensive diabetes mellitus management, characterized by robust caregiver involvement and systematic self-care practices. Conversely, low and middle-income countries exhibit significant challenges in adolescent diabetes mellitus self-management.

Studies across different regions provide a picture of these variations. In Ethiopia, 52.7% of adolescents showed poor adherence to diabetes mellitus self-management practices. Iraq revealed predominantly moderate to low self-care practices across critical domains like insulin administration and blood glucose

monitoring. Serbia reported an alarming 71% non-adherence rate among pediatric patients, while Kenya found that despite 95.9% awareness of self-management practices, only 41.6% achieved satisfactory management.

The global disparities in diabetes mellitus self-care highlight a significant public health challenge emphasizing the importance of nuanced, region-specific approaches to adolescent diabetes mellitus management that address underlying social, economic, and educational barriers. These differences arise from multiple interconnected factors, including economic constraints, healthcare education accessibility, social support systems, and community knowledge about diabetes mellitus management (38–41).

While specific Tanzanian data are lacking, self-care management is a critical area requiring further investigation to develop culturally sensitive intervention strategies, enhancing self-efficacy, creating sustainable support mechanisms, hence preventing the long-term implications of suboptimal self-management. The research highlighted the urgent need for targeted educational programs, improved healthcare accessibility, and comprehensive support systems tailored to adolescents' unique needs in different socioeconomic contexts.

2.3 Glycaemic control status among adolescents with Type 1 diabetes mellitus

Despite great efforts made in diabetes mellitus care, a large proportion of adolescents have poor glycaemic control especially in low resource settings (20–24). Adherence to blood glucose monitoring, treatment regimen and primary

caregiver have been reported to be the factors associated with the poor glycaemic control (43)

Poor glycaemic control on one hand can be accompanied by a high incidence of acute diabetes-related complications, including frequent episodes of hyperglycemia with increased risk of diabetic ketoacidosis (DKA), and recurrent bouts of hypoglycemia which can lead to death, and on the other hand it can cause development of microvascular complications such as retinopathy, neuropathy and nephropathy which can seriously compromise the quality of life.

A study that looked at the state of T1DM management and outcome from The T1DM Exchange Clinic Registry in 2016 to 2018 involving 81 U.S.-based pediatric and adult endocrinology practices in 35 states, indicated a little improvement of mean HbA1c levels when compared to the previous data between 2010 to 2012. However, despite the improvement observed in this study, while adults reached the target HbA1c by 21%, adolescents fared worse, with only 17% achieving the target HbA1c (19). In 2022, a study conducted in Egypt showed that most of children and teenagers, about 83.2% had uncontrolled T1DM and only 16.8% of participants had controlled T1DM (20), it was found that, poor knowledge about diabetes was the main risk factor for uncontrolled glycemic control. Another study conducted in Ethiopia, reported huge magnitude of poor glycemic control among children and adolescents with Type 1 diabetes mellitus accounting for 71.9%. The mean HbA1c in this study was 10.4% and factors significantly associated with

poor glycemic control were; age of the child, education level of caregiver, meal frequency and consumption of forbidden foods (21).

Like other African countries, the challenge of poor glycaemic control among adolescents is similar in East African countries. A study examining glycemic control among Kenyan children and adolescents with Type 1 diabetes mellitus (T1DM) found that only 28% of the participants achieved reasonable glycemic control (22). In Tanzania, several studies have reported poor glycaemic control among adolescents. A study conducted across three healthcare facilities highlighted a concerning trend among adolescents with Type 1 diabetes mellitus (T1DM). This investigation revealed significantly poor glycemic control within this population, as evidenced by an average HbA1c level of 12.3% (23). Another study involving five hospitals conducted in Tanzania in 2021 showed that majority of patients had poor metabolic control with HbA1c of more than 12.5% and had highest prevalence of complications, especially retinopathy and neuropathy (24).

Based on the literature findings, while there is substantial documentation of poor glycemic control among adolescents with Type 1 diabetes mellitus (T1DM), particularly in low-resource settings like Tanzania where HbA1c levels exceed 10%, there is a notable research gap in understanding the specific self-care management challenges these adolescents face. The current literature predominantly focuses on quantitative outcomes such as HbA1c levels and broad risk factors like poor knowledge, meal frequency, and caregiver education, but lacks detailed exploration of the day-to-day self-care management difficulties from

the adolescents' perspective. This gap is particularly significant given the serious complications associated with poor glycemic control, including diabetic ketoacidosis, hypoglycemia, retinopathy, and neuropathy. Understanding these self-care management challenges is crucial, especially in the Tanzanian context where glycemic control is notably poorer compared to global statistics (US: 17% achieving target HbA1c, Egypt: 83.2% uncontrolled, Ethiopia: 71.9% poor control, Kenya: 28% reasonable control). The proposed study on assessment of self-care management challenges would address this knowledge gap by providing insights into specific barriers adolescents face, helping develop targeted interventions, informing healthcare providers about areas needing additional support, and potentially improving glycemic control outcomes. This understanding is particularly vital in Tanzania's resource-limited setting, where unique challenges may impact self-care practices and where there's a high prevalence of diabetes-related complications (23,24,44)

2.4 Challenges to self-care management practices among adolescents with type 1 diabetes mellitus

Adolescents with Type 1 diabetes mellitus face specific challenges affecting their self-care management which impact glycemic control, and overall well-being. Research indicates that, there are several factors that can hinder adherence to diabetes care routines and diminish quality of life. These factors include insulin availability and accessibility, insulin adherence, glucose monitoring, eating behavior, physical activity and use of health care, physiological and psychological

challenges as well as lack of knowledge on diabetes and self-care management (45–69). Davis V, et al, also reported in their study the hurdles for self-care management being a child feeling different, distraction in everyday activities, school staff's lack of education and inattention, expenses of healthy foods, parents' job insecurity and lack of safe places for recreation (70).

All these challenges negatively affect self-care management practices among adolescents and needs to be addressed. While these challenges affect adolescents with diabetes worldwide, they are particularly pronounced in SSA due to the region's unique combination of economic constraints, healthcare system limitations, and infrastructure deficits exacerbate the difficulties (45,46).

Limited insulin availability and accessibility: Sub-Saharan Africa (SSA) faces critical challenges in insulin availability and accessibility for type 1 diabetic patients. Key issues include limited supply chains, high costs, inadequate healthcare infrastructure, and geographical barriers. Many countries struggle with procuring and distributing insulin consistently, while patients often cannot afford the medication due to various economic factors. The region also lacks sufficient medical facilities, trained healthcare providers, and patient education programs. These problems are particularly acute in rural areas. As a result, many diabetic patients in sub-Saharan Africa cannot access the insulin they need, leading to poor health outcomes. There is evidence that availability and affordability of essential medicines and diagnostic tests for diabetes in SSA are sub-optimal and the cost of essential medicines and diagnostic tests for diabetes varies widely ranging from 0-

100% (45–47). While there are ongoing efforts to address these challenges, significant work remains to improve insulin access across the region. Although several countries including Tanzania receive support from different organizations ensuring availability of medication and essential supplies. Logistical issues, including supply chain disruptions and pharmacy stock shortages, can complicate access to necessary medications (48).

Poor insulin adherence: Poor insulin adherence among diabetic patients leads to inadequate glycaemic control, increasing the risk of serious short-term and long-term complications. When patients fail to take insulin as prescribed, whether due to missed doses, incorrect timing, or improper administration, blood glucose levels can become dangerously unstable. This instability not only affects day-to-day health and well-being but also contributes to the development of severe complications such as cardiovascular disease, kidney damage, nerve damage, and vision problems. A study in India reported on poor adherence leading to worse glycaemic control and complications (49). Research indicates that adolescents with Type 1 diabetes mellitus (T1DM) often struggle to adhere properly to their treatment regimens. This inadequate adherence can lead to poor glycaemic control and increased health risks. Factors contributing to this issue include the desire for independence, peer pressure, and hormonal changes during puberty. The complex nature of T1DM management further compounds these challenges. Poor adherence during adolescence can have long-term health consequences, highlighting the need for targeted interventions and support systems specifically

designed for this age group (50). To address this critical issue, there is a pressing need for comprehensive educational programs and targeted interventions aimed at improving insulin adherence. These initiatives should focus on educating patients about the importance of proper insulin use, addressing barriers to adherence, and providing practical strategies for integrating insulin therapy into daily life. By enhancing adherence, such programs can significantly improve glycaemic control, reduce the risk of complications, and ultimately lead to better health outcomes for individuals living with diabetes mellitus.

Insulin storage: Insulin is a peptide hormone drug, and temperature variations can significantly impact its stability (71). Therefore, insulin storage is critical for maintaining its potency and effectiveness. Manufacturers are recommending insulin to be stored in a refrigerator at temperatures between 2–8°C (72,73). Since insulin is sensitive to temperature its storage poses a challenge globally and improper storage can lead to loss of potency (71) In Sub-Saharan Africa, storage of insulin can be challenging due to the fact that insulin potency diminishes when stored at elevated temperatures, which are common in Sub-Saharan Africa (30) and as a result of loss of its potency its use can lead to poor glycaemic control.

Poor adherence to Self-Monitoring of Blood Glucose (SMBG): According to International Society for Paediatric and Adolescent Diabetes (ISPAD), for individuals with diabetes who are on insulin therapy, it is recommended to perform SMBG a minimum of six (6) times daily and according to the Standard Treatment Guidelines and National Essential Medicines List for Tanzania Mainland,

SMBG should be performed at home at least 3-4times per day (74). This frequency of glucose checks helps to ensure proper diabetes management and insulin dosing throughout the day. The recommended standardized target range for fingerstick capillary glucose (SMBG) measurements of 4-10 mmol/L (70-180 mg/dL). This range aligns with the target time in range (TIR) for continuous glucose monitoring (CGM) users. For fasting glucose levels, a narrower target range of 4-8 mmol/L (70-144 mg/dL) is advised. Additionally, ISPAD suggests that young people with diabetes should aim for an HbA1c level below 53 mmol/mol (7.0%) (51).

Adolescents with Type 1 diabetes mellitus face significant challenges in glucose monitoring and glycaemic control. According to Noorani, M. et al, adolescents with Type 1 diabetes mellitus in Tanzania face challenges in glucose monitoring due to poor adherence, emphasizing the need for increased monitoring frequency and caregiver involvement. While factors associated with better glycaemic control were younger age, better adherence to blood glucose monitoring regimen, and the mother as the primary caregiver but underlying factors contributing to poor glycaemic control not identified (37) emphasizing the need for finding out the need for targeted interventions.

Poor adherence to dietary recommendations: Dietary recommendations for young people with diabetes and their families emphasize healthy eating principles aimed at improving diabetes mellitus outcomes and reducing complications. These guidelines are designed to support optimal growth, maintain ideal body weight,

and ensure adequate nutrient intake. While the optimal macronutrient distribution varies based on individual needs, a general guide suggests carbohydrates should comprise 40-50% of total energy, fat less than 35% (with saturated fat under 10%), and protein 15-25% (52). For those on intensive insulin regimens, matching insulin doses to carbohydrate intake allows for greater flexibility in meal timing and composition, potentially improving blood glucose control and quality of life. Consistent meal routines and emphasis on dietary quality are crucial for achieving optimal glycaemic targets. By adhering to these principles, young people with diabetes can work towards better overall health outcomes and reduce the risk of both immediate and long-term complications. Fixed insulin regimens require consistency in carbohydrate amount and timing for optimal glycaemic targets and to reduce the risk of hypoglycemia.

Adolescents with Type 1 diabetes mellitus often face significant dietary challenges (37,53,54). A common issue is difficulty in reducing their carbohydrate intake to the recommended levels. This is largely due to limited access to diverse and affordable food options, making it challenging for them to adhere to the dietary recommendations for managing their condition (37). The limited resources available in their communities pose barriers to follow the necessary dietary changes required for effectively managing their type 1 diabetes mellitus.

Failure to meet physical activity recommendations: Regular physical activity (PA) is a cornerstone of diabetes management. There are numerous physical and mental health benefits of regular PA for youth with Type 1 diabetes mellitus

(T1DM). PA can improve insulin sensitivity, lowering HbA1c by approximately 0.3%-0.5%. It also enhances cardiovascular and cardiorespiratory fitness, increases muscle mass and strength, reduces adiposity, and improves bone mineral density. Additionally, PA can enhance overall well-being and may extend the remission period in children with newly diagnosed diabetes. The current recommendations state that children and adolescents should engage in at least 60 minutes per day of moderate-to-vigorous intensity, primarily aerobic PA, throughout the week. Moderate-intensity aerobic activities, such as walking and cycling for 15-45 minutes between meals, can safely lower glucose levels above 10.5 mmol/L (190 mg/dL). However, the type and amount of carbohydrates consumed in relation to exercise should be tailored to the specific activity. This individualized approach helps maximize the benefits and minimize the risks associated with PA for youth with T1DM (55).

Adolescents with Type 1 diabetes mellitus often fail to meet the recommendation physical activity achieving this guideline regardless of weight status (56–59). Hence, there is a need to empower them to adopt healthier, more active lifestyles that will positively impact their short- and long-term health outcomes.

Low clinic appointments adherence: Appointment among adolescents with T1DM is crucial for effective disease management and glycemic control. Effective collaboration between patients and their diabetes care teams is essential for enhancing health outcomes. Studies have shown that integrated care approaches, which systematically address concerns and involve patients in treatment planning,

are well-received by both adolescents and their caregivers (60). These models promote self-directed discussions, increasing adolescents' active participation in their care management. However, challenges remain, as many adolescents struggle to consistently engage with their diabetes care teams (61–63). Adolescents with Type 1 diabetes mellitus in Africa face low appointment adherence, with forgetfulness being a significant factor (64). To overcome these barriers, it's crucial to empower young patients by encouraging them to voice their needs and contribute to the formulation of their care plans. This approach can foster a stronger sense of responsibility for their health. To address these challenges, it is important to empower adolescents by allowing them to express their needs and contribute to the development of care strategies, fostering a greater sense of ownership over their health. Strengthening the partnership between adolescents and their diabetes care teams is fundamental to improving diabetes mellitus management and outcomes during this pivotal period of development. By focusing on collaborative care and patient empowerment, healthcare providers can better support adolescents in managing their diabetes effectively.

Other challenges to self-care management in adolescents include transitional phase of growth, poor knowledge of diabetes and self-care practices and psychosocial challenges.

Transitional phase of growth: Adolescence, a transitional phase of growth and development between childhood and adulthood has unique challenges due to

several physiological, hormonal and psychological changes that occur. Individuals with T1DM in this age group face double challenges in the management of this chronic condition. First, the adolescence stage on its own, due to the rapid development occurring, various physiological, hormonal and psychological changes happen which can affect disease management and glycaemic control. Second, the transition of an individual from depending on the caregiver into self-management is complex, involving a delicate balance between dependence and autonomy, which can be difficult for adolescents, their families, and healthcare providers to navigate. Adolescents' perceived readiness to manage their diabetes independently may not correlate with optimal blood sugar control, underscoring the importance of ongoing support during the shift from pediatric to adult diabetes care. A U.S. study involving adolescents and young adults with type 1 diabetes mellitus, participants reported high comfort levels with diabetes mellitus self-management. However, the higher comfort levels were paradoxically associated with higher HbA1c levels (65) which is an unexpected relationship between comfort levels in self-management tasks and glycaemic control. This finding contradicts the common expectation that individuals more comfortable with diabetes mellitus management tasks would achieve better glycaemic control. This study highlighted the complexity and challenges existing among adolescents when it comes to self-care practices. A 2023 systematic review revealed that, adolescents with Type 1 diabetes mellitus face challenges in self-care due to interdependence on support networks. Transitioning between independence and

dependence impacts effective self-management practices. The transition process was found to be intricate, influenced by multiple factors associated with developmental life changes. The study highlighted three key areas: the tendency of individuals to seek normalcy by making their condition less visible, the critical role of practice and preparation in the transition, and the complex interplay of dependencies as one moves towards self-management (66).

Poor knowledge of diabetes mellitus and self-care practices: Knowledge on diabetes mellitus is primarily important to self-care practices. Studies have shown an existing knowledge gap in diabetes mellitus and self-care practices among adolescents which need to be addressed. A study in Burkina Faso revealed that 68.23% of adolescents with Type 1 diabetes mellitus demonstrated inadequate diabetes knowledge. This deficiency was particularly evident in critical areas such as the management of hypoglycemia and hyperglycemia (67). Research conducted by Najem and colleagues revealed gaps in adolescents' understanding of diabetes mellitus care, especially regarding insulin treatment and nutritional guidelines (24). Addressing knowledge gap is important for improving self-care practices.

Psychosocial challenges: Type 1 diabetes mellitus poses substantial emotional and psychological hurdles for adolescents, often affecting their overall well-being. Studies show these young individuals frequently struggle with elevated anxiety and depression. This is largely attributed to the ongoing nature of their condition and the rigorous self-care routines required, including regular blood sugar checks

and insulin doses (68). Social dynamics, particularly peer interactions and concerns about stigma, further intensify these emotional challenges, often resulting in feelings of isolation among affected adolescents (69). Therefore, addressing the emotional and psychological aspects of living with diabetes can include support groups, counseling, and resources for coping can improve self-care management in this population because poor mental health can lead to worse health outcome.

While information on the challenges affecting adolescents' self-care management is limited, this study will help to identify those challenges for proper planning on strategies to alleviate the challenges.

2.5 Conceptual Framework

The framework in fig.1 below illustrates the relationships between the core condition (Type 1 diabetes mellitus) and required self-care practices, key components of self-care management, facilitators and barriers affecting self-care quality and the resultant outcomes based on self-care adequacy.

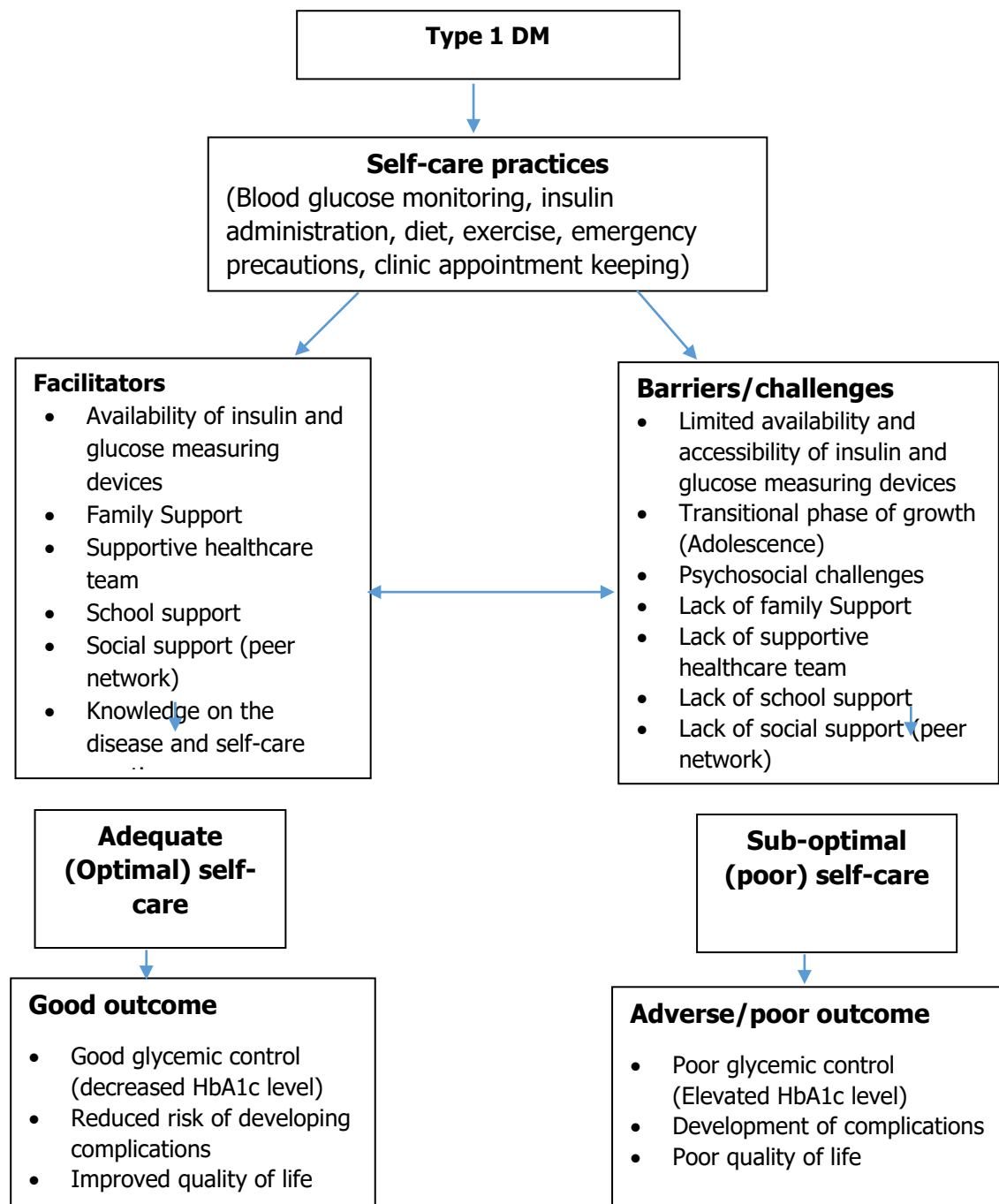


Figure 2. 1: The conceptual framework of the study

CHAPTER THREE: METHODOLOGY

3.1 Study area and population

This study was conducted in three public hospitals, Temeke, Amana and Mwananyamala Regional Referral Hospitals (RRHs) in three different districts among the five districts in Dar es Salaam, Tanzania. These three hospitals are under the Ministry of Health and supervised by Medical Officers-in-Charge, were suitable for the study because they have dedicated diabetic clinics providing services to children and adolescents with Type 1 diabetes mellitus, and they serve as referral hospitals in the respective districts.

Temeke RRH is located in Temeke Municipality which has a population of 1,346,674 people according to the 2022 census (73). This is a 304-bed hospital providing both inpatient and outpatient services with different specialties including paediatrics and serves as a referral hospital for 110 facilities (2010) attending between 1,000 to 1,500 patients per day (74). The hospital has dedicated diabetes mellitus clinic for children, adolescents and young adults running every Tuesday with an estimate of about 100 adolescents with T1DM attending the clinic based on hospital records accessed in November 2024 (Unpublished data; Review of monthly clinic attendance).

Amana RRH is located in Ilala Municipality, and the 2022 National Tanzania Census states the population for Ilala as 1,649,912 (73). Amana serves as a referral hospital receiving patients from private and government health facilities from Ilala Municipal Council and neighboring Municipal Councils. It is a 341-bed

hospital providing both inpatient and outpatient services attending between 800 and 1,200 patients per day (75), providing services in different specialties including paediatrics. The hospital has dedicated diabetes mellitus clinics for children, adolescents and young adults running every Thursday with an estimate of about 60 adolescents with T1DM attending the clinic based on hospital records accessed in November 2024 (Unpublished data; Review of monthly clinic attendance).

Mwananyamala RRH is located in Kinondoni district. The population of Kinondoni District in Dar es Salaam, Tanzania in 2022 was 982,328 (73). The hospital provides regional level referral services to more than 200 public and privately owned health facilities and currently the hospital bed capacity is 254 and attending about 1,500 up to 1,800 patients per day (76). This hospital has dedicated diabetes mellitus clinics providing services to children, adolescents and young adults every Thursday with an estimate of about 100 adolescents with T1DM attending the clinic based on hospital records accessed in November 2024 (Unpublished data; Review of monthly clinic attendance).

3.2 Study design

This was a cross-sectional study employing a mixed-methods, sequential explanatory design in which both quantitative and qualitative methods were used to collect data from study participants. The design was particularly suitable for uncovering self-care management challenges in adolescents with Type 1 diabetes mellitus by combining objective clinical assessment through measurement of

glycated haemoglobin to identify participants with poor glycemic control followed by rich, contextual participant narratives through focus group discussions allowing exploration of underlying reasons for poor glycemic management.

3.3 Sampling methods

The three Regional Referral Hospitals (RRHs) in Dar es Salaam were purposely selected because they provide Diabetes mellitus services for individuals from different municipalities in the city. These patients have different socio-economic backgrounds which provides a suitable representation of adolescents with T1DM in Dar es Salaam. In each site, purposive sampling was used by deliberately selecting study participants based on inclusion criteria, and participants were consecutively recruited until the sample size was reached.

3.3.1 Sample size estimation

a) Quantitative component of the study

The sample size was calculated using OpenEpi software Version 3.01 (Atlanta, GA, USA) (75). OpenEpi (www.OpenEpi.com) is a free, open-source software package for epidemiologic statistics. It provides a user-friendly web interface for various epidemiological and statistical calculations, including sample size and power calculations commonly used in public health and medical research.

Using a population size of the estimated number of about 260 T1DM adolescents currently actively attending clinics at Temeke, Amana and Mwananyamala Regional Referral Hospitals (unpublished data) and anticipated percentage frequency (p) of 50%, confidence limit of 5%, and design effect of 1.0, the

minimum sample size calculated was 156 study participants at a confidence level of 95%. The table below shows the distribution of study participants to be recruited in each hospital.

Table 3. 1 : The distribution of study participants in each hospital

Name of hospital	Calculation	Number of study participants
Temeke RRH	$100/260 \times 156$	60
Amana RRH	$60/260 \times 156$	36
Mwananyamala RRH	$100/260 \times 156$	60
Total		156

b) Qualitative component of the study

For this component of the study, participants were recruited for a focus group discussion (FGD) whereby each FGD comprised of 5-8 participants. A total of 4 FGDs were conducted, after data saturation was achieved. The number of FGDs was selected to balance breadth and depth, ensuring data adequacy for thematic analysis while remaining feasible within the study timeline.

From the quantitative data collected, study participants with glycosylated haemoglobin above 7.5% were purposively sampled to allow selection of participants who were most relevant and informative to address the research question. Selected participants were invited to a scheduled focus group discussion

(FGD) while maintaining sufficient homogeneity within groups to facilitate comfortable and productive discussion.

3.4 Procedures for data collection

3.4.1 Data collection tools

a) Quantitative component of the study

A standardized questionnaire translated in Swahili was used to collect socio-demographic characteristics and preliminary information on the study participants. Self-Care Inventory-Revised Version (SCI-R) of 2009 questionnaire translated in Swahili, was used to assess self-care practices. The SCI-R was designed to measure adherence to diabetes mellitus self-care recommendations and has been shown to be valid and reliable for use in adolescents (76). This tool evaluates diabetes self-care behaviors by asking participants to rate how frequently they perform various diabetes management tasks over the past 1-2 months, considering five (5) key self-care domains i.e blood glucose monitoring, medication management, dietary management, hypoglycaemia management and general health management. It is particularly valuable because it helps healthcare providers identify specific areas where patients might need additional support or education in managing their diabetes.

The tool has a 15-item self-report measure:

1. Checking blood glucose
2. Recording blood glucose results
3. Checking ketones when glucose level is high

4. Taking the correct dose of medication
5. Taking medication at the right time
6. Eating the correct food portions
7. Eating meals/snacks on time
8. Keeping food records
9. Reading food labels
10. Treating low blood glucose with recommended carbohydrate amounts
11. Carrying quick-acting sugar for low blood glucose treatment
12. Attending clinic appointments
13. Wearing a Medic Alert ID
14. Exercising
15. Adjusting insulin dosages based on glucose values, food, and exercise.

However, to reflect the reality, items numbers 3, 9 and 13 were not assessed because they are not routinely practiced, and therefore, a total of 12 items were assessed. Each item was rated on a 5-point Likert scale: 1 = Never 2 = Rarely 3 = Sometimes 4 = Usually 5 = Always.

Before actual data collection, the tool was piloted at Temeke Regional Referral Hospital by the principal investigator, and its reliability was checked.

Glycosylated hemoglobin (HbA1c) was measured for using fluorescence immunoassay analyzer (LYOFIA-I), Hunan Kangxin Biotechnology Co. Ltd, China, and qualitative data was gathered using a voice recorder.

a) Qualitative component of the study

A Swahili-translated discussion guide featuring open-ended questions was used to facilitate the focus group discussions. Each FGD session was captured using audio recording equipment, while supplementary observations and information were documented in a notebook.

3.4.2 Data collection methods

Recruitment and training of research Assistants

Three qualified medical officers were recruited as research assistants. A call for applications to participate as a research assistant was released on social media platforms, and applicants were called for an online interview to screen suitable candidates, in which the main criteria was a previous experience of participating in data collection at least once.

Selected candidates were invited to be trained by the principal investigator on the study protocol, to familiarize themselves with the data collection tools and how to collect data. After training and before the actual start of data collection, a pilot study was conducted at Temeke Regional Referral Hospital for the purpose of gathering preliminary data, testing feasibility and identifying potential challenges for refining data collection tools.

a) Quantitative data collection

During data collection, following screening for eligibility and upon consent and assent, participants were enrolled into the study. Sociodemographic characteristics and other preliminary information were collected using a standardized

questionnaire then self-care practices were assessed using the self-care inventory reported by study participants.

Blood samples from the anterior cubital fossa (about 2.5 mls) was drawn from all participants while observing aseptic technique. Immediately after drawing blood, random blood glucose was tested by following standard operating procedures and the remaining sample was placed into purple vacutainers containing EDTA (Ethylenediaminetetraacetic acid) as an anticoagulant. The vacutainers were kept in a cold box and transported to Kairuki Hospital for HbA1c measurement within 24 hours. Using fluorescence immunoassay analyzer LYOFIA-I, (Hunan Kangxin Biotechnology Co. Ltd, China) HbA1c was measured by following assay procedures as per manufacturer's standard operating procedures (77).

b) Qualitative data collection

The focused group discussions (FGDs) was conducted by two (2) interviewers, the principal investigator and one trained research assistant. The principal investigator was moderating the discussion while the research assistant was responsible for recording and note-taking. Using the Swahili version guide used during FGD, for every question posed, each participant was given time to respond. Each FGD lasted for about 60 minutes and all FGDs were voice-recorded.

3.4.3 Eligibility criteria

Inclusion criteria: Adolescents with type 1 diabetes mellitus, aged 11-19 years, have been on treatment for at least one year, who take care of themselves in diabetes management e.g. insulin injection, blood glucose monitoring etc., whose

caretaker has granted written informed consent to participate in the study, and those who assented to participate in the study. For the qualitative component of the study, participants with HbA1c above 7.5% were invited to the focus group discussions.

Exclusion criteria: Unable to read and write to avoid caregivers' influence on responses, having emergency conditions such as diabetic ketoacidosis, hypoglycaemia or any other serious conditions such as severe malaria, severe pneumonia etc, unable to communicate verbally, and those who did not consent/assent were also excluded.

3.4.4 Study variables

Dependent/Outcome Variable: The dependent variable for this study was glycaemic control status.

Independent Variables: The independent variables were socio-demographic characteristics, self-care management practices, and challenges to self-care management practices.

3.4.5 Ethical considerations

Research ethics were considered during the whole process of conducting the study. Participants were treated with respect and privacy, whereby their identity were kept anonymous during both quantitative and qualitative data collection. Instead of names, only ID numbers were used.

There was a written consent form explaining about the study, its purpose and risk and benefit in participating, the rights to whether to participate or not, and

withdrawal from the study without any consequences on healthcare services. This consent form was signed by caregivers of adolescents below 18 years of age or by adolescents themselves if they were 18 years of age and above who were willing to participate. For adolescents below 18 years there was an additional assent form for the adolescents themselves to sign if they were willing to participate.

To ensure that the study was not interfering with healthcare provision, the researcher informed the clinical team about study and coordinated with them to ensure that participation did not impede patients flow. The study participants were also offered a flexible participation window, whether before clinical service or after.

While no harm was anticipated during the study, participants were reassured that they might experience pain during the process of drawing blood samples for glycosylated haemoglobin measurement. To avoid excessive blood loss and risk of infection, standard operating procedures were strictly adhered to, such as applying compression at the punctured site for 3 minutes and following aseptic techniques.

Participants with poor glycaemic control were educated on proper self-care practices.

There were separate consent and assent forms specifically designed for the qualitative method, with explicit provisions for participants' consent to audio recording. This form comprehensively outlined the purpose of audio recording, its intended use in data analysis, and participants' rights regarding the recorded

material. Participants were clearly informed about their ability to pause, stop, or withdraw consent for audio recording at any point during the Focus Group Discussions (FGDs), without compromising their overall participation in the study and/or healthcare services. All audio recordings were securely stored, anonymized, and were accessible only to authorized research team members. Recordings were deleted after the research analysis was complete.

During FGDs the researcher ensured a safe and non-judgmental environment, protected participant identities, allowed participants to skip sensitive questions, moderated discussion to prevent conflicts, considered cultural and social sensitivities, and respected diverse perspectives. Participants were allowed to withdraw from the study at any time they wished.

3.4.6 Ethical clearance

In adherence to ethical standards the protocol was submitted to the Institutional Research Ethics Committee (IREC) of Kairuki University and ethical clearance was granted. Permission to conduct the study was granted by the Temeke, Amana and Mwananyamala Regional Referral Hospital authorities.

3.5 Data management

3.5.1 Data collection in the field

The PI verified the presence of all materials necessary for data collection, including the letter of introduction, before conducting the study. The healthcare facilities were visited beforehand to arrange for the study implementation.

During data collection, the Research Assistants checked each filled questionnaire for accuracy and consistency at the end of each working day before submitting the questionnaires. The PI also checked for the accuracy of responses and data was entered into a Google Form each working day.

3.5.2 Data coding and cleaning

The dataset from Google Form was extracted in MS Excel format, coded by assigning numerical values to categorical variables to ensure compatibility with SPSS. Data cleaning was then conducted to check for completeness, identify and correct inconsistencies, and remove duplicate entries. Outliers and invalid responses were examined and addressed appropriately, while missing data were assessed to determine whether they should be excluded. Once all variables were properly coded and the dataset was verified for accuracy, the cleaned file was imported into SPSS for further statistical analysis.

3.5.3 Data analysis

a) Quantitative data analysis

The cleaned data was entered, processed, and analyzed using Statistical Package for Social Sciences (SPSS) version 27. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical responses were expressed in frequency and percentages. Self-care management scores were computed by first calculating the mean for each individual item, then obtaining the weighted average by summing the item means and dividing by the total number of items. Items with mean scores below the weighted average were classified as indicating low self-care levels, while items with mean scores above the weighted average were classified as indicating high self-care levels.

To assess the magnitude of participants with poor glycaemic control, glycated hemoglobin of less or equal to 7.5% was categorized as good, while those with above 7.5% were classified as poor glycaemic control. Participants in each category were expressed in frequency and percentages.

a) Qualitative data analysis

The qualitative data analysis was conducted using NVivo software version 14. The audio-recorded discussions were transcribed in Swahili and then translated to English. All interview transcripts were imported into NVivo for systematic organization and analysis. Thematic analysis was employed following Braun and Clarke's six-step approach (78), familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and

producing the report. NVivo facilitated the coding process through its node system, allowing for the systematic organization of codes into broader themes and subthemes. The software was also used to maintain an audit trail of the analytical process and to generate coding reports that demonstrate the development of themes from the raw data. This was followed by the final analysis and report writing, which included the selection of compelling extract examples from participants' responses to illustrate the identified themes. These extracts were used to support the analysis and demonstrate the relationship between the findings, research questions, and existing literature.

3.6 Dissemination of the study findings

Upon completion of the study, a report with research findings was submitted to Kairuki University, Department of Paediatrics and Child Health, the University Library as well as to Temeke, Amana and Mwananyamala hospital administrations. The findings of the study will also be presented at scientific conferences locally at The Tanzania Child Health and Welfare Congress, as well as in international conferences in future. Moreover, a manuscript will be prepared for publication in a peer-reviewed journal.

CHAPTER FOUR: RESULTS

4.1 Enrollment

During the study period, there were a total of 274 adolescents attending diabetic clinics in three (3) Hospitals i.e 79 participants at Temeke Regional Referral Hospital (TRRH), 76 participants at Amana, Regional Referral Hospital and 119 participants at Mwananyamala Regional Referral Hospital (MRRH) who were screened for eligibility criteria. Total number of study participants who were eligible were 156, one study participant did not consent, making the total number of 155 participants involved in the study and included in the final data analysis.

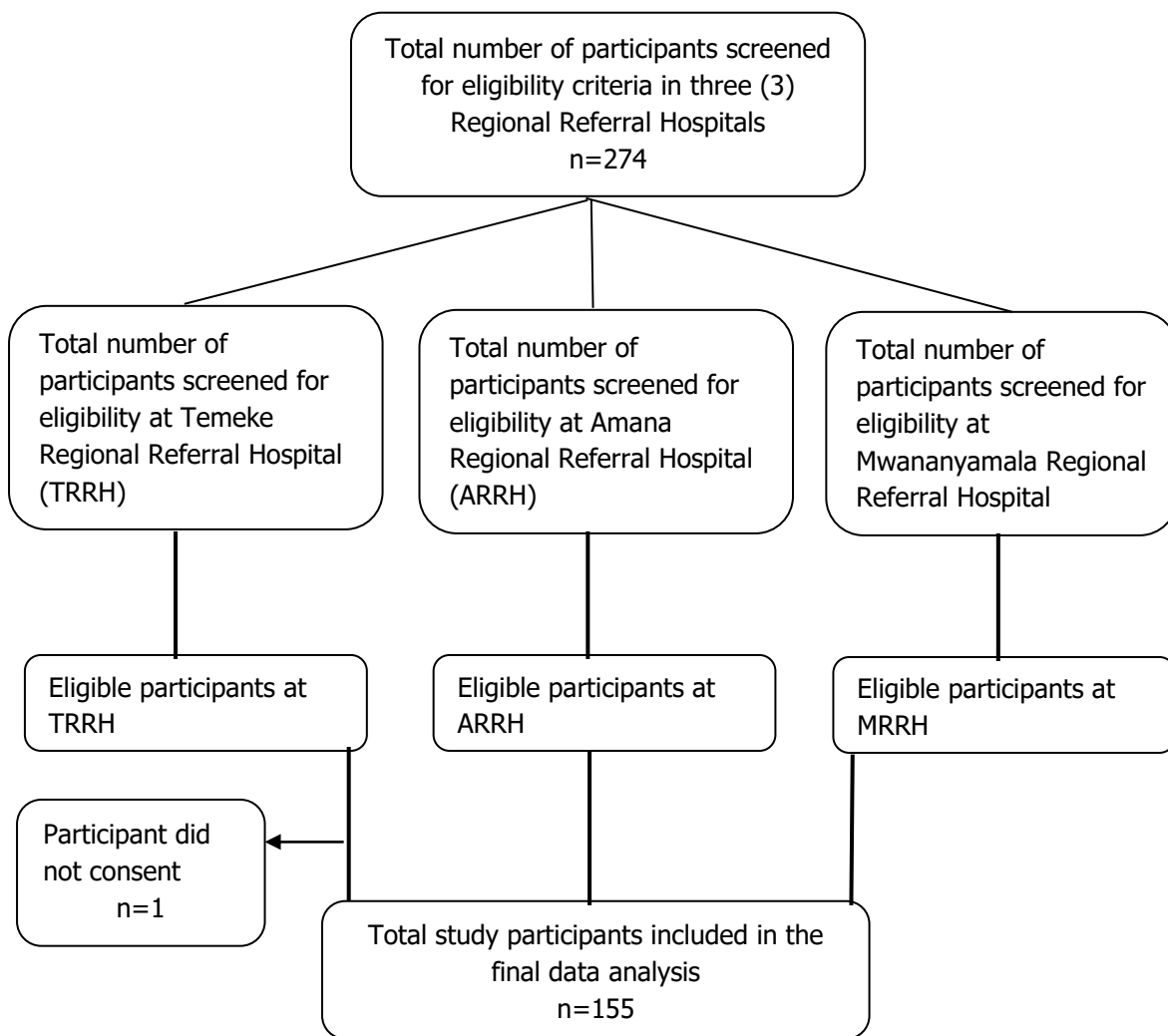


Figure 4. 1 : Enrollment flow chart of study participants

4.2 Baseline socio-demographic characteristics of study participants

4.2.1 Baseline characteristics of the study participants

Table 2 shows the baseline characteristics of study participants. Of the 155 participants enrolled in the study, the mean age was 15.6 years. The study population demonstrated a nearly balanced gender distribution, with 80 females and 75 males. Regarding healthcare payment methods, majority of study participants (n=102) were not insured. Most of the participants were students (n=128), and just over half (n=80) were studying or had completed secondary school (Ordinary Level).

The mean age at diagnosis was 12.79 (SD=3.21), and only 32 participants had family members with Type 1 Diabetes. Living arrangements varied among participants, with the largest group (n=80) residing with both biological parents. The basal bolus insulin regimen, consisting of short-acting insulin with main meals plus intermediate-acting insulin administered once or twice daily, was used by 81 participants, and 74 were on the twice-daily regimen with both short-acting and intermediate insulin.

Table 4. 1: Socio-demographic characteristics of study participants

Variable		Frequency	Percent
Age (Years)	11-14	58	37.4
	15-19	97	62.6
Sex	Male	75	48.4
	Female	80	51.6
Mode of payment when visiting health facilities	Cash	102	65.8
	Health Insurance	14	9.0
	CHF	3	1.9
	Exemption	36	23.2
Occupation	Students	128	82.6
	Working	27	17.4
	Primary level	62	40.0
	Secondary School (O-Level)	80	51.6
Level of education	Secondary School (A-Level)	2	1.3
	College	8	5.2
	University	3	1.9
	Yes	32	20.6
Family member with T1D	No	123	79.4
	Both biological parents	80	51.6
Stay with who	Only one biological parent	39	25.2
	Other caregiver(s)	34	21.9
	Alone	2	1.3
	Twice-daily insulin (both short and intermediate)	74	47.7
Insulin Regimen	Basal bolus regimen (Short acting insulin with main meal + intermediate once or twice daily)	81	52.3
Total		155	100.0

(n=155)

4.3 Level of self-care management practices among adolescents with

Type 1 Diabetes

Table 3 shows the level of self-care management practices among adolescents with Type 1 Diabetes. Among the 155 study participants, there were varying levels of adherence of self-care management practices. The overall weighted average score for self-care management practices was 3.6 out of 5, indicating moderate adherence to recommended self-care behaviors.

Out of 12 items assessed regarding self-care management practices, participants demonstrated high level of self-care management practices in seven items whereby 75 reported that they always check blood glucose with a monitor (mean = 3.74, SD = 1.47), 130 always take the correct dose of insulin (mean = 4.67, SD = 0.83), 130 always take insulin at the right time (mean = 4.74, SD = 0.66), 58 always eat the correct food portions recommended (mean = 3.72, SD = 1.35), 67 always eat meals/snacks on time (mean = 3.76, SD = 1.34). Among participants who experienced low blood glucose, 48 always treat low blood glucose with just the recommended amount of carbohydrate (mean = 3.74, SD = 1.43), and 127 always come in for clinic appointments (mean = 4.72, SD = 0.72).

However, participants demonstrated a low level of self-care management practices in five items, whereby only 66 always record blood glucose results (mean = 3.21, SD = 1.70), 89 never keep food records (mean = 2.14, SD = 1.59), only 61 always carry quick-acting sugar to treat low blood glucose (mean = 3.14, SD = 1.73), only 62 always engaged in exercise (mean = 3.43, SD = 1.55), and only 62

always adjust insulin dosage based on glucose values, food, and exercise (mean = 3.37, SD = 1.58).

Table 4. 2 : Level of self-care management practices among adolescents with Type 1 Diabetes (n=155)

Item	N (%)	R (%)	S (%)	U (%)	A (%)	Mean	SD	Self-care level
Check blood glucose with a monitor	14 (9.0)	34 (21.9)	6 (3.9)	26 (16.8)	75 (48.4)	3.74	1.47	High
Record blood glucose results	38 (24.5)	29 (18.7)	16 (10.3)	6 (3.9)	66 (42.6)	3.21	1.70	Low
Take the correct dose of insulin	0 (0.0)	10 (6.5)	6 (3.9)	9 (5.8)	130 (83.9)	4.67	0.83	High
Take insulin at the right time	0 (0.0)	4 (2.6)	7 (4.5)	14 (9.0)	130 (83.9)	4.74	0.66	High
Eat the correct food portions	15 (9.7)	22 (14.2)	12 (7.7)	48 (31.0)	58 (37.4)	3.72	1.35	High
Eat meals/snacks on time	9 (5.8)	30 (19.4)	17 (11.0)	32 (20.6)	67 (43.2)	3.76	1.34	High
Keep food records	89 (57.4)	22 (14.2)	8 (5.2)	6 (3.9)	30 (19.4)	2.14	1.59	Low
Treat low blood glucose with just the recommended amount of carbohydrate	8 (5.2) 12 (7.7) <i>Never had low blood glucose</i>	34 (21.9)	20 (12.9)	33 (21.3)	48 (31.0)	3.74	1.43	High
Carry quick-acting sugar to treat low blood glucose	45 (29.0)	24 (15.5)	12 (7.7)	13 (8.4)	61 (39.4)	3.14	1.73	Low
Come in for clinic appointments	1 (0.6)	5 (3.2)	3 (1.9)	19 (12.3)	127 (81.9)	4.72	0.72	High
Exercise	23 (14.8)	36 (23.2)	10 (6.5)	24 (15.5)	62 (40.0%)	3.43	1.55	Low
Adjust insulin dosage based on glucose values, food, and exercise	26 (16.8)	34 (21.9)	13 (8.4)	20 (12.9)	62 (40.0)	3.37	1.58	Low

Note: N=Never, R=Rarely, S=Sometimes, U=Usually, A=Always

Weighted average: $44.38/12 = 3.6$

4.4 Glycaemic control status

Among the 155 study participants, glycaemic control was suboptimal in the majority of participants, whereby 122 had poor glycaemic control compared to only 33 participants who achieved good glycaemic control. The mean glycated haemoglobin (HbA1C) was 10.11% (SD=2.77).

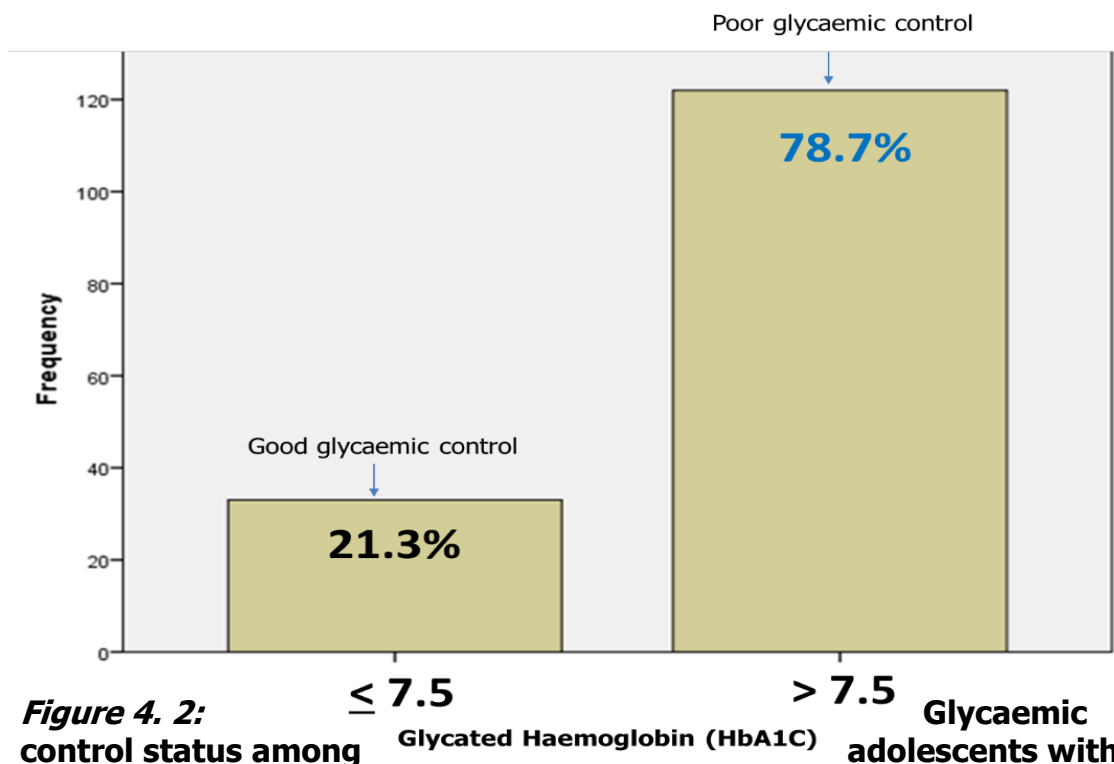


Figure 4. 2: Glycaemic control status among adolescents with Type 1 Diabetes (n=155)

4.5 challenges affecting self-care management practices among adolescents with type 1 diabetes mellitus

The qualitative analysis revealed multiple interconnected challenges that adolescents with Type 1 diabetes face in managing their condition. Through thematic analysis, seven distinct themes emerged, highlighting the complex nature of diabetes self-care management during adolescence. These themes are: (1) Insulin management challenges (2) Blood glucose monitoring difficulties (3) Dietary management barriers (4) Exercise-related concerns (5) Healthcare System Challenges (6) Perceptions of Type 1 Diabetes (7) Other barriers to effective self-management practices among adolescents with Type 1 Diabetes.

(1) *Insulin Management Challenges*

Participants identified several significant barriers related to insulin treatment and administration. Storage of insulin emerged as a predominant concern, with multiple participants expressing difficulties in maintaining proper storage conditions.

"My challenge is with medicine, we don't have a fridge, so I have to look for ice and sometimes I don't get....(P2).

Dose adjustment represented another major challenge, as adolescents struggled with determining appropriate insulin dosages based on varying circumstances.

"The challenge I face with insulin is in adjusting the dose, it's still confusing, especially when my blood sugar goes up, and then I take short acting insulin, the dose is confusing, I can't figure out how much to take." (P1).

Injection techniques posed additional difficulties, with some participants reporting uncertainty about proper administration methods.

"I have a challenge with injection technique. Sometimes when I inject, it bleeds and sometimes when I inject, I see the medicine coming out." (P5).

(2) Blood Glucose Monitoring Difficulties

Blood glucose monitoring presented substantial challenges for participants. The most frequently cited issue was defective glucometers, which significantly impacted participants' ability to monitor their blood glucose levels effectively.

"My measuring machine is bothering me. I haven't checked blood glucose for about a month. When I put the measuring strips in, it keeps bothering me. It doesn't turn on. I was told that it was a battery problem. I bought it less than a week later and bought another one. But it still kept bothering me....(P1).

Fear of pain associated with finger pricking emerged as a psychological barrier that deterred regular monitoring.

".....another problem with self-pricking is that it causes pain, leading to a lack of regular checking of blood glucose" (P4).

Additionally, the availability of glucose testing strips was identified as a practical constraint that limited participants' monitoring capabilities.

"First of all, I have to say that the availability of strips for measuring blood sugar is very expensive... my machine is different from the machines they give out in hospitals...." (P2)

(3) Dietary Management Barriers

Maintaining proper dietary control proved challenging for participants across multiple dimensions. Carbohydrate counting was the most prominent difficulty, with participants expressing confusion and uncertainty about accurately counting carbohydrate content in their meals.

"When it comes to food, I can't estimate the amount of carbohydrate." (P5).

The availability of recommended foods presented socioeconomic and practical barriers, as participants reported difficulties accessing diabetes-appropriate foods consistently.

"For me, when it comes to food, the first challenge depends on is the location, getting the right diet that we were taught, for example, when you are at school..." (P4).

(4) Exercise-Related Concerns

Incorporating exercise into diabetes management routines was hindered by specific diabetes-related fears. Fear of hypoglycemia during physical activity was the predominant concern, with participants expressing anxiety about experiencing low blood glucose episodes during exercise.

"Sometimes when I exercise, I run out of energy" (P5).

Additionally, fear of injury in sports activities created reluctance to engage in physical activities especially sports, further complicating diabetes management efforts.

"The problem we have is that when you're playing football, because someone doesn't know, you can get hit and get injuries..." (P4).

(5) Healthcare System Challenges

Participants encountered multiple barriers within the healthcare system that impacted their diabetes management. Long waiting times at healthcare facilities were frequently mentioned as a significant deterrent to regular clinic attendance.

"The challenge that bothers me is that you may have been to the clinic and found a queue, maybe you left home without eating, your blood sugar drops, and when you go to test, you are asked why your blood sugar dropped." (P4).

"You can come early, when you arrive you are told to wait a little, there is hospital network issue, so you wait and your blood sugar is four, and the blood sugar is dropping, so it is a challenge..." (P3).

Many participants expressed discomfort about being questioned or confronted by healthcare providers regarding elevated blood glucose levels, creating a negative association with healthcare encounters.

"When I leave home to go to the clinic, I get hungry and eat maybe two cassavas on the way. After that, I test and find that blood sugar is high. They ask me why my sugar is twenty? I tell them, it was normal this morning. They tell me why it is so high? You are a liar." (P1).

Insulin stock-outs at healthcare facilities created treatment disruptions, while general discouragement and disappointment about insulin treatment reflected broader systemic challenges in diabetes care delivery.

".... Regarding medicine, when you come, you are told that there is short-acting insulin but no long-acting insulin, or there is long-acting but no short-acting." (P3).

"... another challenge at home is that people tell you that the hospital medicines are not good, use traditional medicines....." (P3).

(6) Perceptions of Type 1 Diabetes

Participants held diverse perceptions about their condition, reflecting varying levels of understanding and acceptance. Some viewed diabetes as an inherited disorder, while others considered it "just like any other disease." More nuanced perspectives emerged, with some participants describing diabetes as "not a disease, but a life challenge" or "an internal disability." Some participants demonstrated medical understanding, recognizing that "the pancreas does not produce insulin," while others normalized their condition by viewing it as "a normal thing" or "a normal challenge."

"For me, I consider diabetes as a hereditary disease in our family" (P1).

"It is a disease like any other disease, except that diabetes is not transmitted by viruses or bacteria." (P2).

"....I can say it's not a disease because it's a challenge, it's an internal disability." (P3).

".....I see it as just a normal challenge" (P5).

(7) Other barriers to effective self-management practices

(Transitional phase of adolescence, stigma and discrimination, Support System Challenges, Psychosocial and Environmental Stressors).

The transitional phase of adolescent growth presented specific challenges, with peer influence emerging as a significant factor affecting diabetes management decisions. This theme highlighted the unique developmental considerations that adolescents with diabetes must navigate while managing their condition.

"There are challenges in adolescence, you can say it's a problem, you find yourself with your friends and they don't know about your condition and you don't want to tell them" (P3).

"You'll find that maybe we'll go to a certain place. You get there when you don't have a plan for consuming certain sugary things. Your friends have bought things like soda or juice, and you don't want to look inferior; if they bought for you, you can't refuse it.the problem comes back to me. My sugar levels go up." (P1).

Participants also reported to experience stigma and discrimination across multiple settings, including schools and within their own families. These experiences created additional psychological burdens that complicated diabetes management efforts and affected participants' willingness to engage in self-care behaviors openly.

".....for example in a school environment there are things you used to be able to do when you weren't sick, but after you get sick, you can't do, so they say you

can't do this, it's like they're stigmatizing you, you see yourself as if you have a disability, it makes you not accept yourself" (P2).

"But also, if you go to visit your brother, the way they treat you, for example, they have cooked spaghetti and they say, 'Put this spaghetti away from your brother.' You find that they are segregating you, and you feel bad." (P4).

The level of support from family and peers varied significantly among participants. Some reported experiencing breach of confidentiality by friends, which created trust issues and reluctance to disclose diabetes-related needs or seek assistance when necessary.

"For me, it's about secrecy, for example, among many of my friends only one knows my condition, and one day someone you haven't told comes to you and tells you that you are like this, so it becomes a challenge." (P4).

Participants faced numerous psychosocial challenges that impacted their diabetes management. Disappointing words from people in their social environment created emotional distress, while elevated blood glucose levels was associated with emotions like anger, reflecting the psychological burden of disease management. Community myths about diabetes contributed to misunderstanding and social isolation, while worry about disease complications created ongoing anxiety that affected participants' quality of life and management behaviors.

".....you'll find yourself sitting in a group like this, talking about normal topics, someone says people with diabetes can't have children, but then you're right there thinking, man, I really can't have a child, there's a challenge like that." (P3).

"When my sugar level goes up, I get angry" (P2).

"There is a challenge, for example, our society believes that if you have diabetes, you should not drink soda, eat bananas, anything related to sugar, they believe that you should not eat, but they are wrong, because fruits also contain nutrients, so that is the challenge" (P2).

"For me, at first I could see, but now I can't see well, so I am worried that I can't see" (P1).

CHAPTER FIVE: DISCUSSION

5.1 Overview of discussion

Adolescents with Type 1 diabetes showed moderate adherence to self-care practices, scoring 3.6 out of 5 overall. While participants demonstrated competence in some areas of diabetes management, this is concerning given the critical importance of comprehensive self-care during adolescence for preventing complications and maintaining optimal blood sugar control.

The study participants showed exceptional adherence to core medical management practices, especially insulin administration and healthcare engagement. High rates of correct insulin dosing (83.9%) and timely administration (83.9%) suggest adolescents understand and prioritize the life-sustaining nature of insulin therapy. The high clinic attendance rate (81.9%) indicates participants recognize the importance of regular medical supervision and maintain engagement with healthcare providers despite potential barriers. These findings are contrary to several studies conducted elsewhere (61–64) and this could be due to comprehensive education provided by trained healthcare professionals and diabetes educators to T1D patients in the hospitals where the study was conducted.

Despite adequate blood glucose checking practices, with nearly half (48.4%) of participants always monitoring their glucose levels, the significantly lower rate of recording results (42.6%) represents a critical gap in self-monitoring behavior. This suggests that while adolescents recognize the importance of checking blood

glucose, they may not fully appreciate the value of systematic record-keeping for pattern recognition and treatment adjustment. The poor adherence to blood glucose recording may reflect factors including the perceived burden of documentation, lack of understanding about record-keeping importance, or inadequate tracking tools and systems. This highlights the need for enhanced education about the clinical significance of glucose monitoring records and implementation of user-friendly technologies that facilitate data collection and analysis.

The moderate adherence to dietary management practices reveals the complexity of nutritional self-care in adolescents with Type 1 diabetes, with reasonable adherence to meal timing (43.2%) and portion control (37.4%), but particularly poor food record-keeping (19.4%). This mirrors the pattern observed with glucose monitoring records, suggesting a broader challenge with documentation and self-monitoring behaviors among adolescents. The dietary management challenges likely reflect normal adolescent developmental patterns where food choices become influenced by peer relationships and independence, while the complexity of carbohydrate counting may overwhelm those with limited nutritional education or family support.

It was found that, only 39.4% of participants always carry quick-acting sugar for hypoglycemia treatment, representing a significant safety concern, with the low rate of appropriate hypoglycemia treatment (31.0%) suggesting inadequate preparation for managing acute diabetes complications. Inadequate emergency

preparedness may reflect overconfidence in glycemic control, inconvenience of carrying supplies, or insufficient education about hypoglycemia recognition and treatment. The findings emphasize the need for reinforced education about hypoglycemia prevention, recognition, and management, as well as the importance of consistent emergency preparedness. The low adherence to exercise (40.0%) and insulin dose adjustment (40.0%) represents significant challenges in advanced diabetes self-management, as both behaviors are essential for optimizing glycemic control and preventing long-term complications. Similar findings were observed in other studies (40,41)

Difficulty with insulin adjustment may reflect inadequate education about flexible dosing, fear of making errors, or lack of confidence in independent treatment decisions. Poor exercise adherence may stem from fear of hypoglycemia during activity, lack of knowledge about exercise management in diabetes, time constraints, or typical adolescent lifestyle patterns.

These findings suggest healthcare providers need targeted interventions that build upon adolescents' existing strengths in basic medical adherence while addressing specific deficits in self-monitoring and advanced management skills. The results highlight the importance of age-appropriate education that addresses unique developmental needs of adolescents, including desire for independence, peer influence, and psychosocial challenges of managing chronic conditions during this critical life stage.

The finding that 78.7% of adolescents with Type 1 diabetes demonstrated poor glycemic control is concerning and reflects a significant public health challenge, consistent with other studies (23,37) where achieving target glucose levels remains particularly difficult during adolescence due to physiological changes, hormonal fluctuations, and competing life priorities (79) This predominance of poor glycemic control likely reflects multiple interconnected factors including puberty-related hormonal changes that increase insulin requirements, psychosocial challenges such as peer influence, and the moderate adherence to self-care practices observed in this population. The high prevalence of poor glycemic control has significant immediate and long-term health implications, increasing the risk of acute complications like diabetic ketoacidosis while more critically raising the risk of developing microvascular and macrovascular complications in adulthood. The finding that only 21.3% of participants achieved good glycemic control suggests significant gaps in current diabetes care delivery, potentially reflecting limitations in healthcare infrastructure, insufficient clinical monitoring frequency, or inadequate access to diabetes education and support services.

The qualitative findings illuminate the multifaceted challenges adolescents with Type 1 diabetes face in self-management, revealing a complex interplay of practical, psychological, and social barriers that extend far beyond clinical parameters. The predominant insulin management challenges, including storage difficulties and dose adjustment confusion, directly correspond with the quantitative finding of moderate adherence scores, suggesting that technical

barriers significantly impact self-care practices. Blood glucose monitoring difficulties, particularly defective equipment and fear of pain, help explain the gap between glucose checking (48.4%) and recording behaviors (42.6%) observed in the quantitative data. These were similar challenges observed in other studies (80,81) Healthcare system challenges, including long waiting times and medication stock-outs, as observed in a study conducted in Ethiopia (40), create structural barriers that undermine consistent diabetes management and may contribute to the high prevalence of poor glycemic control (78.7%) found in this population. The psychosocial challenges identified, particularly peer influence, stigma, and community myths about diabetes, reveal how social factors profoundly impact adolescents' willingness to engage in self-care behaviors, especially in social settings where disclosure concerns override health priorities. The diverse perceptions of diabetes among participants, ranging from viewing it as a hereditary condition to an internal disability, suggest varying levels of disease understanding that may influence self-care motivation and adherence. Exercise-related fears, particularly hypoglycemia during physical activity, align with the low exercise adherence (40.0%) documented quantitatively, highlighting the need for targeted education about safe exercise practices. The reported difficulties with carbohydrate counting and food availability correspond with moderate dietary management scores and emphasize the complexity of nutritional self-care in resource-limited settings. These findings underscore that achieving optimal diabetes outcomes in adolescents requires addressing not only clinical and

educational needs but also systemic healthcare barriers, social stigma, and the unique developmental challenges of adolescence.

5.2 Strengths and limitations

The strengths of this study are; (1) the study employed a robust mixed-methods design that provided comprehensive insights by combining quantitative adherence measurements with in-depth qualitative exploration of challenges to self-care management. (2) The qualitative component effectively explained quantitative findings, revealing underlying reasons for adherence patterns and poor glycemic control observed in the quantitative data. (3) The research addressed domains of diabetes self-management comprehensively, including insulin administration, blood glucose monitoring, dietary management, exercise, and adherence to clinic appointments and identified specific, actionable barriers.

The limitations of the study include: (1) The self-reported quantitative data, may be subject to social desirability or recall bias (2) The research lacks comparison groups or longitudinal follow-up data, which would strengthen understanding of adherence patterns and outcomes over time. (3) The research lacks integration of family and healthcare provider perspectives, which are crucial stakeholders in adolescent diabetes management and could provide additional insights into the challenges identified (4) The study was conducted in regional referral hospitals of Dar es salaam, hence the results can't be generalized.

5.3 Conclusion

This study showed the self-care management practices among the 155 study participants with varying levels of adherence. The overall weighted average score for self-care management practices was 3.6 out of 5, indicating moderate adherence to recommended self-care behaviours. However, only a third of study participants had good glycaemic outcomes despite moderate overall adherence to self-care practices.

The qualitative analysis revealed multiple interconnected challenges that adolescents with Type 1 Diabetes mellitus face in managing their condition. Seven areas stood out: Insulin management challenges; Blood glucose monitoring difficulties; Dietary management barriers; Exercise-related concerns; Healthcare system challenges; perceptions of Type 1 Diabetes mellitus and other barriers.

These findings reveal a complex interplay between technical, psychosocial and systemic barriers that require comprehensive, multifaceted interventions addressing not only clinical education but also healthcare system improvements, social stigma reduction, and age-appropriate developmental support.

5.4 Recommendations

To improve glycaemic control among adolescents with Type 1 Diabetes mellitus we recommend the following:

- i. There is urgent need for targeted interventions designed specifically for this population. These interventions should address the multifactorial nature of poor glycaemic control by incorporating age-appropriate education, family-centered

care approaches, peer support programs, and enhanced healthcare system capacity for adolescent diabetes management.

- ii. To conduct further studies, especially involving study participants in rural areas to ensure generalizability countrywide, as well as including family and healthcare providers to explore their perspectives.

CHAPTER SIX: REFERENCES

1. Libman I, Haynes A, Lyons S, Pradeep P, Rwagasor E, Tung JY ling, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Definition, epidemiology, and classification of diabetes in children and adolescents. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1160–74.
2. The United Republic of Tanzania (URT) M of HTNNCDP and CP. Treatment Guideline for Type 1 Diabetes.
3. Ogle G, Middlehurst A, Silink M, Hanas R. Pocket book for management of diabetes in childhood and adolescence [Internet]. Brussels; 2017. Available from: www.idf.org/lifeforachild
4. Bantle JP, Thomas W. Glucose measurement in patients with diabetes mellitus with dermal interstitial fluid. *Journal of Laboratory and Clinical Medicine*. 1997;130(4):436–41.
5. Ahmad F, Joshi SH. Self-Care Practices and Their Role in the Control of Diabetes: A Narrative Review. *Cureus*. 2023 Jul 5;
6. WHO. World Health Organization. 2024 [cited 2024 Nov 5]. Adolescent health. Available from: https://www.who.int/health-topics/adolescent-health#tab=tab_1

7. Rami-Merhar B, Fröhlich-Reiterer E, Hofer SE, Fritsch M. Diabetes mellitus in childhood and adolescence (Update 2023). *Wien Klin Wochenschr*. 2023 Jan 1;135:106–14.
8. Ogle GD, Wang F, Gregory GA, Maniam J. Type 1 diabetes estimates in children and adults [Internet]. 2022. Available from: www.diabetesatlas.org
9. Ward ZJ et al. Estimating the total incidence of type 1 diabetes in children and adolescents aged 0–19 years from 1990 to 2050: a global simulation-based analysis. *Lancet Diabetes Endocrinol*. 2022;10(12):848–58.
10. Ogrotis I, Koufakis T, Kotsa K. Changes in the Global Epidemiology of Type 1 Diabetes in an Evolving Landscape of Environmental Factors: Causes, Challenges, and Opportunities. *Medicina (Lithuania)*. 2023 Apr 1;59(4).
11. Buzzetti R, Zampetti S, Pozzilli P. Impact of obesity on the increasing incidence of type 1 diabetes. Vol. 22, *Diabetes, Obesity and Metabolism*. Blackwell Publishing Ltd; 2020. p. 1009–13.
12. Saare L, Peet A, Tillmann V. Growth in Children with HLA-Conferred Susceptibility to Type 1 Diabetes. *Endocrinology and Metabolism*. 2022 Feb 1;37(1):175–9.

13. Besser REJ, Bell KJ, Couper JJ, Ziegler AG, Wherrett DK, Knip M, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Stages of type 1 diabetes in children and adolescents. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1175–87.
14. Padoa CJ P. The epidemiology and pathogenesis of type 1 diabetes mellitus in Africa. 2011.
15. Greeley SAW, Polak M, Njølstad PR, Barbetti F, Williams R, Castano L, et al. ISPAD Clinical Practice Consensus Guidelines 2022: The diagnosis and management of monogenic diabetes in children and adolescents. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1188–211.
16. Kanner L, Tracy Bekx M. Targeting IA-2 and GAD65 as a Cost-Saving Approach for Antibody Testing in Children With New-Onset Diabetes. Available from: <http://clinical.diabetesjournals.org/lookup/suppl/doi:10.2337/cd18-0021/-/DC1https://doi.org/10.2337/cd18-0021>
17. Katte JC, McDonald TJ, Sobngwi E, Jones AG. The phenotype of type 1 diabetes in sub-Saharan Africa. 2023.
18. Cengiz E, Danne T, Ahmad T, Ayyavoo A, Beran D, Ehtisham S, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Insulin treatment in children and adolescents with diabetes. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1277–96.

19. Foster NC, Beck RW, Miller KM, Clements MA, Rickels MR, Dimeglio LA, et al. State of Type 1 Diabetes Management and Outcomes from the T1D Exchange in 2016-2018. Vol. 21, Diabetes Technology and Therapeutics. Mary Ann Liebert Inc.; 2019. p. 66–72.
20. Abdelaty MA, Rabei FM, Abdelhakem MM. Proportion And Determinants of Glycemic Control in Type 1 Diabetes Mellitus among Children and Adolescents Attending Assiut Health Insurance Clinic [Internet]. Vol. 89, The Egyptian Journal of Hospital Medicine. 2022. Available from: <https://ejhm.journals.ekb.eg/>
21. Habteyohans BD, Hailu BS, Meseret F, Mohammed A, Berhanu Y, Alemu A, et al. Poor glycemic control and its associated factors among children with type 1 diabetes mellitus in Harar, eastern Ethiopia: A cross-sectional study. BMC Endocr Disord. 2023 Dec 1;23(1).
22. Ngwiri T, Were F, Predieri B, Ngugi P, Iughetti L. Glycemic Control in Kenyan Children and Adolescents with Type 1 Diabetes Mellitus. Int J Endocrinol. 2015;2015.
23. McLarty RP, Alloyce JP, Chitema GG, Msuya LJ. Glycemic control, associated factors, acute complications of Type 1 Diabetes Mellitus in children, adolescents and young adults in Tanzania. Endocrinol Diabetes Metab. 2021 Apr 1;4(2).

24. Najem S, Majaliwa ES, Ramaiya K, Swai ABM, Jasem D, Ludvigsson J. Glycemic control and complications of type 1 diabetes among children in Tanzania. *J Clin Transl Endocrinol*. 2021 Mar 1;23.
25. Majaliwa ES, Muze KC, Ndayongeje J, Mfinanga SG, Mmbaga BT, Ramaiya K. Correlation of C-Peptide With Complications Observed in Children and Adolescents With Type 1 Diabetes in Tanzania: A Cross-Sectional Survey. *Glob Pediatr Health*. 2023 Jan 1;10.
26. Chilunga FP, Mtintsilana A, Aovare P, Msengi G, Mkoma GF, Nakanga W. Tackling the diabetes surge in sub-Saharan Africa through novel youth-centric strategies. *Lancet Diabetes Endocrinol*. 2023 Dec;11(12):886–9.
27. Wilson V. Managing type 1 diabetes in children and young people: challenges and solutions. *Nurs Child Young People*. 2023 Sep 7;35(5):35–42.
28. Khadilkar A, Oza C. Glycaemic Control in Youth and Young Adults: Challenges and Solutions. Vol. 15, Diabetes, Metabolic Syndrome and Obesity. Dove Medical Press Ltd; 2022. p. 121–9.
29. Williams L, Deacon E, Rensburg E Van, Segal D. Continuous glucose monitoring empowers adolescents to take responsibility of diabetes management. *Afr J Prim Health Care Fam Med*. 2023;15(1).

30. Ogle GD, Abdullah M, Mason D, Januszewski AS, Besançon S. Insulin storage in hot climates without refrigeration: temperature reduction efficacy of clay pots and other techniques. *Diabetic Medicine*. 2016 Nov 28;33(11):1544–53.
31. IDF. International Diabetes Federation Annual Report 2023 [Internet]. 2023 [cited 2024 Aug 12]. Available from: <https://idf.org/media/uploads/2024/06/IDF-Annual-Report-2023.pdf>
32. Mobasser M, Shirmohammadi M, Amiri T, Vahed N, Fard HH, Ghojaziadeh M. Prevalence and incidence of type 1 diabetes in the world: A systematic review and meta-analysis. Vol. 10, *Health Promotion Perspectives*. Tabriz University of Medical Sciences; 2020. p. 98–115.
33. Honesta K, Edna M, Benjamin K, Lucy M. Clinical Presentation and Factors Associated with Diabetic Ketoacidosis at the Onset of Type-1 Diabetes Mellitus in Children and Adolescent at Muhimbili National Hospital, Tanzania: A Cross Section Study. *Int J Diabetes Clin Res*. 2020 Jul 4;7(3).
34. Ludvigsson J, Edna M, Ramaiya K. Type 1 diabetes in low and middle-income countries - Tanzania a streak of hope. *Front Endocrinol (Lausanne)*. 2023;14.
35. Schwartz JI, Ramaiya K, Warren M, Yadav P, Castillo G, George R, et al. Carpe DM: The First Global Diabetes Targets. Vol. 11, *Global Health Science and Practice*. Johns Hopkins University Press; 2023.

36. The United Republic of Tanzania (URT) Ministry of Health and Social Welfare. National strategic plan for prevention and control of non-communicable diseases 2021-2026. Dodoma; 2021.
37. Noorani M, Ramaiya K, Manji K. Glycaemic control in type 1 diabetes mellitus among children and adolescents in a resource limited setting in Dar es Salaam- Tanzania. *BMC Endocr Disord*. 2016;16(1).
38. Smudja M, Milenković T, Minaković I, Zdravković V, Javorac J, Milutinović D. Self-care activities in pediatric patients with type 1 diabetes mellitus. *PLoS One*. 2024 Mar 1;19(3 March).
39. Al-nasrawi MMA, Aljebory MKA. Relationship between Self-Care Practices of Secondary School Students with Type 1 Diabetes Mellitus and Their Socio-Demographic Data. *Journal Port Science Research*. 2023 Oct 14;6(1):42–6.
40. Geneti Y, Wondwossen K, Adimasu M, Deressa D, Lami FAM, Abdisa L, et al. Adherence to Diabetes Self-Management and Its Associated Factors Among Adolescents Living with Type 1 Diabetes at Public Hospitals in Addis Ababa, Ethiopia: A Cross-Sectional Study. *Diabetes, Metabolic Syndrome and Obesity*. 2022;15:659–70.
41. W. Mugo A, S. Orago AS, Gachau AG. Self-management practices among children and adolescents presenting with type 1 diabetes attending

- selected health facilities in Nairobi city county. *Int J Community Med Public Health*. 2024 May 30;11(6):2152–9.
42. Fabrizi D, Natta I, Luciani M, Di Mauro S, Rebora P, Ausili D. Self-care and caregiver contribution to self-care in adolescents with type 1 diabetes mellitus: a pilot cross-sectional study. *International Diabetes Nursing*. 2022 Nov 14;15.
43. Abraham AM, Tilahun T, Gelana B. Glycemic Control and Associated Factors Among Children and Adolescents with Type 1 Diabetes Mellitus, Southwest Ethiopia. *Diabetes, Metabolic Syndrome and Obesity*. 2023;16:2025–37.
44. Majaliwa ES, Munubhi E, Ramaiya K, Mpembeni R, Sanyiwa A, Mohn A, et al. Survey on acute and chronic complications in children and adolescents with type 1 diabetes at Muhimbili National Hospital in Dar es Salaam, Tanzania. *Diabetes Care*. 2007 Sep;30(9):2187–92.
45. Kibirige D, Sanya RE, Katende D, Atuhe D, Milln J, Schwartz JI. Availability and affordability of essential medicines and diagnostic tests for diabetes mellitus in sub-Saharan Africa: A systematic review. 2020; Available from: <https://doi.org/10.21203/rs.3.rs-16103/v1>
46. Kiconco R, Lumumba SA, Bagenda CN, Atwine R, Ndarubweine J, Rugera SP. Insulin therapy among diabetic patients in rural communities of Sub-

Saharan Africa: a perspective review. Vol. 15, Therapeutic Advances in Endocrinology and Metabolism. SAGE Publications Ltd; 2024.

- 47.Boiro D, Mbaye A, Sow A, Ndongo AA, Ewagnignon AS, Seck N, et al. Acta Scientific PAEDIATRICS (ISSN: 2581-883X) Type 1 Diabetes in Adolescents: About 207 Cases Monitored at the Abass Ndao Hospital Center in Dakar (Senegal). 2023.
- 48.Kanbour S, Everett E. Addressing disparities in technology use among patients with type 1 diabetes: a review. Curr Opin Endocrinol Diabetes Obes. 2024 Feb;31(1):14–21.
- 49.Dabas H, Sarin J, Madhu S V. Insulin Adherence in Adolescents with Type 1 Diabetes Mellitus. Vol. 27, Indian Journal of Endocrinology and Metabolism. Wolters Kluwer Medknow Publications; 2023. p. 394–7.
- 50.Westen SC, Warnick J, Entessari M, Albanese-O’neill A, Sachatz D, Haller MJ, et al. Poor Adherence in Adolescents with Type 1 Diabetes Associated with Distress, Fear of Hypoglycemia, and Executive Functioning. Diabetes. 2018 Jul 1;67(Supplement_1).
- 51.de Bock M, Codner E, Craig ME, Huynh T, Maahs DM, Mahmud FH, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Glycemic targets and glucose monitoring for children, adolescents, and young people with diabetes. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1270–6.

52. Annan SF, Higgins LA, Jelleryd E, Hannon T, Rose S, Salis S, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Nutritional management in children and adolescents with diabetes. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1297–321.
53. Muze KC, Majaliwa ES. Type 1 diabetes care updates: Tanzania. Indian J Endocrinol Metab. 2015;19(7):S12–3.
54. Dłużniak-Gońska K, Panczyk M, Szostak-Węgierek D, Szypowska A, Sińska B. Analysis of the diet quality and dietary habits of children and adolescents with type 1 diabetes. Diabetes, Metabolic Syndrome and Obesity. 2019;12:161–70.
55. Adolfsson P, Taplin CE, Zaharieva DP, Pemberton J, Davis EA, Riddell MC, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Exercise in children and adolescents with diabetes. Vol. 23, Pediatric Diabetes. John Wiley and Sons Inc; 2022. p. 1341–72.
56. Marlow AL, King BR, Trost SG, Weaver N, Smart CE. Healthy weight and overweight adolescents with type 1 diabetes mellitus do not meet recommendations for daily physical activity and sleep. Diabetes Res Clin Pract. 2023 Sep 1;203.
57. Giblin S, Scully P, Evers J, Dalton N, Hayes G, Donnelly A, et al. Physical Activity Surveillance in Adolescents with Type 1 Diabetes: A Pilot Mixed-Methods Investigation. J Diabetes Res. 2022;2022.

58. Ergin BD, Ergin I, Gökşen D. Fear of Hypoglycemia and Longer Disease Duration Associated with Physical Activity Avoidance in Children and Adolescents with Type 1 Diabetes Mellitus. *JCRPE Journal of Clinical Research in Pediatric Endocrinology*. 2023;15(3):238–47.
59. Neyman A, Woerner S, Russ M, Yarbrough A, DiMeglio LA. Strategies that adolescents with type 1 diabetes use in relation to exercise. *Clinical Diabetes*. 2020 Jul 1;38(3):266–72.
60. Versloot J, Ali A, Minotti SC, Ma J, Sandercock J, Marcinow M, et al. All together: Integrated care for youth with type 1 diabetes. *Pediatr Diabetes*. 2021 Sep 1;22(6):889–99.
61. Coyne I, Pembroke S, Sleath B, Brenner M, Roche EF, Hilliard C, et al. Adolescents, parents, and providers' experiences of triadic encounters in paediatric diabetes clinics: A qualitative study. *Health Expectations*. 2024 Feb 1;27(1).
62. Montali L, Zulato E, Cornara M, Ausili D, Luciani M. Barriers and facilitators of type 1 diabetes self-care in adolescents and young adults. *J Pediatr Nurs*. 2022 Jan;62:136–43.
63. Owusu BA, Doku DT. Towards an integrated type 1 diabetes management in low-resource settings: barriers faced by patients and their caregivers in healthcare facilities in Ghana. *BMC Health Serv Res*. 2024 Dec 1;24(1).

64. Hobabagabo AF, Wong R, El-Halabi S, Rwagasore E, Niyonsenga SP, Gishoma C, et al. Evaluating the Effect of Using Mobile Phone Reminders on the Adherence to Children and Young Adults With Type 1 Diabetes Attending Outreach Appointments. *Journal of Management and Strategy*. 2019 Mar 11;10(2):60.
65. Onwukwe O, Lundgrin EL. Association of HbA1C and comfort with diabetes self-management among adolescents and young adults with type 1 diabetes. *Frontiers in Clinical Diabetes and Healthcare*. 2024;5.
66. Leocadio P, Kelleher C, Fernández E, Hawkes CP. Adolescents' Experiences of Transition to Self-Management of Type 1 Diabetes: Systematic Review and Future Directions. Vol. 49, *Science of Diabetes Self-Management and Care*. SAGE Publications Inc.; 2023. p. 477–92.
67. Zemba D, Yalgado Ouédraogo Yempabou Sagna CHU Souro Sanou Solo Traore CHU Yalgado Ouédraogo Lassane Zoungrana CHU Yalgado Ouédraogo Patricia Somé CHU Yalgado Ouédraogo S Aimée Kissou CD, Guira Université Joseph Ki Zerbo Ténin Marceline Yaméogo O. Diabetes knowledge and associated factors in adolescents and young adults with type 1 diabetes in Ouagadougou (Burkina Faso). *Res Sq [Internet]*. 2023; Available from: <https://doi.org/10.21203/rs.3.rs-2530739/v1>

68. Passanisi S, Galletta F, Bombaci B, Cherubini V, Tiberi V, Minuto N, et al. Device-Related Skin Reactions Increase Emotional Burden in Youths With Type 1 Diabetes and Their Parents. *J Diabetes Sci Technol*. 2024 May 28;
69. Merlo EM, Tutino R, Myles LAMK, Lia MC, Minasi D. Alexithymia, intolerance to uncertainty and mental health difficulties in adolescents with Type 1 diabetes mellitus. *Ital J Pediatr*. 2024 Dec 1;50(1).
70. Davis V, Telang SB, Jain S, Ramos MVD, Ward MA, Jindal I, et al. Parental perception of the factors that affect diabetes management in youth. *Clinical Diabetes*. 2019 Jan 1;37(1):50–6.
71. Heinemann L, Braune K, Carter A, Zayani A, Krämer LA. Insulin Storage: A Critical Reappraisal. Vol. 15, *Journal of Diabetes Science and Technology*. SAGE Publications Inc.; 2020. p. 147–59.
72. Rasmussen M, Hach M, Iwersen J, Anil G, Rosborg H, Larsen J, et al. The Human Insulin Thermal Solution project—a private sector initiative to address the thermostability of insulin. *Lancet Diabetes Endocrinol*. 2024 May;12(5):292–4.
73. Richter B, Bongaerts B, Metzendorf MI. Thermal stability and storage of human insulin. Vol. 2023, *Cochrane Database of Systematic Reviews*. John Wiley and Sons Ltd; 2023.

74. The United Republic of Tanzania (URT) Ministry of Health and Community Development, Gender, Labour and Social Welfare. Standard Treatment Guidelines and National Essential Medicines List for Tanzania Mainland. 2021.
75. Dean AG, Sullivan KM. OpenEpi: Open Source Epidemiologic Statistics for Public Health, [Internet]. Atlanta, GA, USA; 2013 [cited 2024 Aug 25]. Available from: <https://www.openepi.com>
76. Lewin AB, Lagreca AM, Geffken GR, Williams LB, Duke DC, Storch EA, et al. Validity and reliability of an adolescent and parent rating scale of type 1 diabetes adherence behaviors: The self-care inventory (SCI). *J Pediatr Psychol*. 2009 Oct;34(9):999–1007.
77. HbA1C Operation Guide [Internet]. China: Hunan Kangxin Biotechnology Co. Ltd; [cited 2024 Dec 9]. Available from: <https://youtu.be/0F-bVKNL8jM>
78. Maguire M, Delahunt B. Doing a Thematic Analysis: A Practical, Step-by-Step Guide for Learning and Teaching Scholars. * [Internet]. 2017. Available from: <http://ojs.aishe.org/index.php/aishe-j/article/view/335>
79. Gregory JW, Cameron FJ, Joshi K, Eiswirth M, Garrett C, Garvey K, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Diabetes in adolescence. *Pediatr Diabetes*. 2022 Nov 1;23(7):857–71.

80. Datye KA, Patel NJ, Jaser SS. Measures of Adherence and Challenges in Using Glucometer Data in Youth with Type 1 Diabetes: Rethinking the Value of Self-Report. *J Diabetes Res.* 2017;2017.
81. Azar S, Maroun Abou Jaoude N, Kędzia A, Niechciał E. Barriers to Type 1 Diabetes Adherence in Adolescents. Vol. 13, *Journal of Clinical Medicine*. Multidisciplinary Digital Publishing Institute (MDPI); 2024.

LIST OF APPENDICES

Appendix I: Consent Form for Quantitative Method: English Version

Hello!

My Name is Dr. Leonard Malasa, a principal investigator and I am conducting a study "SELF-CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL, AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA." and I am requesting your participation.

PURPOSE OF THE STUDY:

The aim of this study is to assess self-care management challenges for glycaemic control among adolescents with Type 1 diabetes mellitus in Dar Es Salaam, Tanzania.

HOW TO PARTICIPATE:

If you will be willing to participate, I will ask you to sign this consent form to approve your willingness. You will be asked to provide some information such as age, sex, level of education, duration of illness and the way you/your child takes care of himself/herself to ensure good blood sugar control and you will be given a questionnaire to fill by yourself. Then a blood sample will be drawn from you/your child to measure y blood sugar (random blood sugar) here and some sample will be taken to laboratory for glycosylated haemoglobin measurement. When the glycosylated haemoglobin results are out you will be called (through the mobile

number you will provide) to be given the results. You might also be called to come for some discussion depending on your availability.

CONFIDENTIALITY:

Information obtained from you/your child will be confidential. No name or identity will be recorded and the information obtained from you will not be shared to anyone else except the research team for the purpose of this study only to improve better care for patients with type 1 diabetes mellitus.

COSTS:

You will not be required to pay anything for your participation. There will be transport reimbursement in case we will call you/your child to participate in the discussion and care will be provided for the patient in case of emergency on that day.

VOLUNTARY PARTICIPATION & RIGHTS TO WITHDRAW:

Your participation is voluntary, and you have the right to withdraw from participating in our study at any time. Whatever your decision may be, it will not affect in any way your rights to care and treatment.

RISKS

We don't expect risk by taking blood for investigations except that you will feel some pain when the needle pierces your skin for drawing blood.

BENEFITS:

Your participation in this study will help you to know your random blood glucose and your glycaemic control after glycosylated results are out. We hope that the

information from this research will be useful in contributing to improving the quality of care among adolescents with type 1 diabetes mellitus.

CONTACT PERSONS

If you have any questions about this study, please do not hesitate to contact:

Dr. Leonard Malasa,
Principal Investigator,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

In case of any information about your rights as a participant in this study please contact:

The Chairperson,
Institutional Research Ethics Committee,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Consent Form

I will be grateful if you will agree to participate in this study.

I _____

Have understood the above information and my questions have been answered by the investigator to my satisfaction. I agree to take part in this research.

Signature of the participant: _____ Date _____

Signature of Investigator _____ Date: _____

Appendix II: Consent Form for Quantitative Method: Swahili Version

Habari!

Jina langu ni Dk. Leonard Malasa, mtafiti mkuu na ninafanya utafiti kuhusu "USIMAMIZI WA KUJITUNZA KWA UDHIBITI WA SUKARI NA CHANGAMOTO ZAKE MIONGONI MWA VIJANA WENYE UGONJWA WA KISUKARI AINA YA 1 JIJINI DAR ES SALAAM, TANZANIA" na ninaomba ushiriki wako.

KUSUDI LA UTAFITI:

Madhumuni ya utafiti huu ni kuchunguza changamoto za usimamizi binafsi katika kudhibiti kiwango cha sukari mwilini (kwenye damu) miongoni mwa vijana wenye kisukari cha aina ya 1.

JINSI YA KUSHIRIKI:

Iwapo utakuwa tayari kushiriki, nitakuomba utie sahihi kwenye fomu hii ya idhini ili kuidhinisha nia yako. Nitakuuliza maswali kwa ajili ya taarifa kadhaa kama vile umri, jinsia, kiwango cha elimu, muda wa ugonjwa na jinsi unavyojisimamia binafsi katika kudhibiti kiwango cha sukari mwilini. Vilevile utapewa dodoso kujaza wewe mwenyewe pia na mwisho sampuli ya damu itachukuliwa kutoka kwako/mtoto wako ili kupima kiwango cha sukari kwenye damu na sampuli nyingine itapelekwa maabara kwa kipimo cha Kiwango cha sukari mwilini kwa kipindi cha miezi mitatu iliyopita (glycosylated haemoglobin). Majibu yakiwa tayari kwa kipimo kitakachofanyika maabara utapigiwa simu kupewa majibu. Unaweza pia kuitwa kuja kwa majadiliano kulingana na upatikanaji wako.

USIRI:

Taarifa tutakazopata kutoka kwako/mtoto wako zitakuwa siri. Hatutaandika jina na taarifa hizi hazitatumika kwa kusudi jingine isipokuwa utafiti huu tu ili kuboresha huduma bora kwa wagonjwa walio na kisukari cha aina ya kwanza.

GHARAMA:

Hutahitajika kulipa chochote kwa ushiriki wako. Kutakuwa na malipo ya usafiri endapo tutakuita wewe/mtoto wako kushiriki katika majadiliano. Na siku hiyo ikitokea dharua mfano. Kiwango cha sukari kushuka, utapatiwa/mtoto wako atapatiwa matibabu.

USHIRIKI WA HIARI KUJIONDOA USHIRIKI:

Kushiriki kwako ni kwa hiari, na una haki ya kujiondoa kushiriki katika utafiti wetu wakati wowote. Uamuzi wako hautaathiri kwa namna yoyote haki zako za matibabu.

MADHARA:

Hatutarajii madhara yoyote wakati wa kuchukua damu kwa ajili ya uchunguzi, isipokuwa utasikia maumivu kiasi wakati sindano inapochoma ngozi yako/yam toto wako kwa ajili ya kutoa damu.

FAIDA:

Ushiriki wako katika utafiti huu itakusaidia kujua sukari yako ya damu leo na pia kujua kiwango kwa sukari mwili kwa kipindi cha miezi mitatu iliyopita pindi matokea ya maabara yatakapotoka. Tunatumai kuwa matokeo ya utafiti huu

yatakuwa muhimu katika kuchangia kuboresha huduma kwa wagonjwa wenye kisukari cha aina ya 1.

MAWASILIANO

Ikiwa una maswali yoyote kuhusu utafiti huu, tafadhali usisite kuwasiliana na:

Dr. Leonard Malasa

Principal Investigator

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

Iwapo kuna taarifa yoyote kuhusu haki zako kama mshiriki katika utafiti huu tafadhali wasiliana na:

Mwenyekiti,

Kamati ya Maadili ya Utafiti,

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Consent Form

Nitashukuru ikiwa utakubali kushiriki katika utafiti huu.

Mimi _____

Nimeelewa maelezo hapo juu na maswali yangu yamejibiwa na mpelelezi kwa kuridhika kwangu. Ninakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki: _____

Tarehe _____

Sahihi ya mtafiti: _____

Tarehe _____

Appendix III: Assent Form for Quantitative Method: English Version

Hello!

My Name is Dr. Leonard Malasa, a principal investigator and I am conducting a study "SELF-CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL, AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA."" If you want to, you can be part of this research study. People do research to try to find answers to questions.

WHY ARE WE DOING THIS RESEARCH STUDY?

The aim of this study is to assess self-care management challenges for glycaemic control among adolescents with Type 1 diabetes mellitus in Dar Es Salaam, Tanzania.

WHY ARE YOU BEING ASKED TO BE IN THIS RESEARCH STUDY?

Being one of individuals with type 1 diabetes mellitus, your participation in this study important for us to be able to explore self-care management challenges for glycaemic control.

WHAT WILL HAPPEN DURING THIS STUDY?

In this study we will take some information by asking you some questions such as age, sex, level of education, duration of illness and the way you take care of yourself to ensure good blood sugar control and then you will be given a questionnaire to fill it by yourself. Lastly, blood sample will be taken from you to measure blood glucose.

WHAT ARE THE GOOD THINGS (BENEFIT) THAT MIGHT HAPPEN IN THIS STUDY?

Being in this research study, there are benefits to you. You will be able to know your blood sugar right away but also you will know your blood sugar control for the past three months. We hope that the information from this study will be useful in contributing to improving the quality of care among adolescents with Type 1 diabetes mellitus in future.

WHAT ARE THE PROBLEMS THAT MIGHT HAPPEN IN THIS STUDY?

Sometimes people have problems in research studies that make them feel bad. However, we don't expect risk by taking blood that you will feel some pain when the needle pierces your skin for drawing blood. Some problems might happen that the researchers don't know about. It is important to let the researchers, and your parents know if there is anything that you don't like about the research study right away.

WHO WILL BE TOLD THE THINGS WE LEARN ABOUT YOU IN THIS STUDY?

Information obtained from you and the results of your investigations will be confidential and will be of help in this study and better care for patients with Type 1 diabetes mellitus in the future. Your name will not be in any report of the results of this study.

WILL YOU GET ANY MONEY/GIFTS FOR BEING IN THIS RESEARCH STUDY?

There will be no payment/gifts for being in this study. But you will be given some money for transport when you be called to come for a discussion.

WHAT IF YOU OR YOUR PARENTS DON'T WANT YOU TO BE IN THIS STUDY?

Your parent needs to give us permission for you to be in this study. You do not have to be in this study if you don't want to, even if your parent has already given us permission.

WHAT IF YOU CHANGE YOUR MIND?

You may stop being in the study at any time. If you want to stop, just tell us so and we will stop right away. If you decide to stop, no one will be angry or upset with you. You can ask questions at any time.

WHO SHOULD YOU ASK IF YOU HAVE ANY QUESTIONS?

If you have any inquiries about this study, please do not hesitate to contact:

Dr. Leonard Malasa,

Principal Investigator,

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

In case of any information about your rights as a participant in this study please contact:

The Chairperson,

Institutional Research Ethics Committee,

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Investigator's Statement Regarding Assent Discussion:

I have explained this study to and answered questions of the child, as appropriate, and the parent or guardian of the child whose name is at the top of this form. I informed them that he or she could stop being in the study and can ask questions at any time. From my observations, the child seemed to agree to take part in the study.

Signature of the participant: _____ Date _____

Signature of Investigator: _____ Date: _____

Appendix IV: Assent Form for Quantitative Method: Swahili Version

Habari!

Jina langu ni Dk. Leonard Malasa, mtafiti mkuu na ninafanya utafiti kuhusu "USIMAMIZI WA KUJITUNZA KWA UDHIBITI WA SUKARI NA CHANGAMOTO ZAKE MIONGONI MWA VIJANA WENYE UGONJWA WA KISUKARI AINA YA 1 JIJINI DAR ES SALAAM, TANZANIA". Ukitaka, unaweza kuwa sehemu ya utafiti huu. Watu hufanya utafiti kujaribu kupata majibu ya maswali.

KWANINI TUNAFANYA UTAFITI HUU?

Madhumuni ya utafiti huu ni kuchunguza changamoto za usimamizi wa kujitegemea kwa udhibiti wa glycaemic miongoni mwa vijana wenye kisukari cha aina ya 1 huko Dar Es Salaam, Tanzania.

KWANINI UNAOMBWA UWEPO KATIKA UTAFITI HUU?

Kwa kuwa mmoja wa watu walio na kisukari cha aina ya 1, ushiriki wako katika utafiti huu ni muhimu kwetu ili kuweza kuchunguza changamoto za usimamizi wa kujitunza kwa udhibiti wa glycaemic.

NINI KITAENDELEA KATIKA UTAFITI HUU?

Katika utafiti huu tutachukua baadhi ya taarifa kwa kukuuliza baadhi ya maswali kama vile umri wako, jinsia, kiwango cha elimu, muda wa ugonjwa na jinsi unavyojisimamia binafsi kudhibiti kiwango cha sukari mwilini. Vilevile utapewa dodoso ili kulijaza wewe mwenyewe na mwisho sampuli ya damu itachukuliwa kutoka kwako ili kupima kiwango cha sukari ya damu.

NI MAMBO GANI MEMA (MANUFAA) YANAYOWEZA KUTOKEA KATIKA UTAFITI HUU?

Kwa kuwa katika utafiti huu, kuna manufaa kwako. Utaweza kujua sukari yako ya damu mara moja lakini pia utajua udhibiti wako wa sukari ya damu kwa miezi mitatu iliyopita. Tunatumai kuwa maelezo kutoka kwa utafiti huu yatakuwa muhimu katika kuchangia kuboresha ubora wa huduma miongoni mwa vijana walio na kisukari cha aina ya 1 katika siku zijazo.

NI MATATIZO GANI YANAYOWEZA KUTOKEA KATIKA UTAFITI HUU?

Wakati mwingine watu wana matatizo katika tafiti za utafiti zinazowafanya wajisikie vibaya. Hata hivyo, hatutarajii hatari kwa kuchukua damu kwamba utasikia maumivu wakati sindano inapochoma ngozi yako kwa ajili ya kutoa damu. Baadhi ya matatizo yanaweza kutokea ambayo watafiti hawajui kuyahusu. Ni muhimu kuwajulisha watafiti na wazazi wako ikiwa kuna jambo lolote ambalo hupendi kuhusu utafiti huo mara moja.

NANI ATAAMBIWA MAMBO TUNAYOJIFUNZA KUHUSU WEWE KATIKA UTAFITI HUU?

Taarifa zitakazopatikana kutoka kwako na matokeo ya uchunguzi wako zitakuwa siri na zitasaidia katika utafiti huu na huduma bora kwa wagonjwa walio na kisukari cha aina ya 1 katika siku zijazo. Jina lako halitakuwa katika ripoti yoyote ya matokeo ya utafiti huu.

JE, UTAPATA PESA/ZAWADI YOYOTE KWA KUWA KATIKA UTAFITI HUU?

Hakutakuwa na malipo/zawadi kwa kuwa katika utafiti huu. Lakini utapewa pesa za usafiri ukiitwa kuja kufanya discssion.

VIPI IKIWA WEWE AU WAZAZI WAKO HAWAPENDI UWEPO KATIKA UTAFITI HUU?

Mzazi wako anahitaji kutupa ruhusa ili uwe katika utafiti huu. Si lazima uwe katika utafiti huu ikiwa hutaki, hata kama mzazi wako tayari ametupa ruhusa.

VIPI UKABADILI MAWAZO YAKO?

Unaweza kuacha kuwa katika utafiti wakati wowote. Ikiwa unataka kuacha, tuambie hivyo na tutaacha mara moja. Ukiamua kuacha, hakuna mtu atakayekasirika au kukukasirisha. Unaweza kuuliza maswali wakati wowote.

UKIWA NA MASWALI YOYOTE UMUULIZE NANI?

Ikiwa una maswali yoyote kuhusu utafiti huu, tafadhali usisite kuwasiliana na:

Dr. Leonard Malasa,

Principal Investigator,

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

Iwapo kuna taarifa yoyote kuhusu haki zako kama mshiriki katika utafiti huu tafadhali wasiliana na:

Mwenyekiti,
Kamati ya Maadili ya Utafiti,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Taarifa Ya Utafiti Kuhusu Mjadala Wa Ridhaa:

Nimeueleza utafiti huu na kujibu maswali ya mtoto, inavyofaa, na mzazi au mlezi wa mtoto ambaye jina lake liko juu ya fomu hii. Niliwajulisha kwamba angeweza kuacha kuwa katika utafiti na anaweza kuuliza maswali wakati wowote. Kutokana na uchunguzi wangu, mtoto alionekana kukubali kushiriki katika utafiti.

Sahihi ya mshiriki: _____

Tarehe _____

Sahihi ya mtafiti: _____

Tarehe _____

Appendix V: Standardized Questionnaire: English version

- 1. Participant's Serial no:.....**
- 2. Contact of the study participants,**
Mobile:.....
- 3. Age.....**
- 4. Sex**

[.....] Male

[.....] Female
- 5. At what age were you diagnosed to have diabetes:.....**
- 6. Mode of payment when you visit health facility**

[.....] Health Insurance

[.....] CHF

[.....] Exemption

[.....] Cash
- 7. Are you current studying?**

[.....] Yes

[.....] No..... ***What is your occupation..... Go to Qn. 10.....***
- 8. If studying, what type of school?**

[.....] Boarding school

[.....] Day school

[.....] Not applicable
- 9. Are your teachers aware that you have diabetes?**

[.....] Yes

[.....] No

[.....] Not applicable

10. Education level

[.....] Primary level

[.....] Secondary school (Ordinary level)

[.....] Secondary school Advanced level

[.....] College

[.....] University

11. Is there any other family member with type 1 diabetes mellitus

[.....] Yes

[.....] No

12. Who do you stay with?

[.....] Both biological parents

[.....] Only one biological parent, Mention: ***Father [.....] Mother [.....]***

[.....] Other caregiver(s)

[.....] Alone

13. Which insulin regimen do you use:

[.....] Twice-daily insulin (both short and intermediate)

[.....] Basal bolus insulin (3x a day)

[.....] Short-acting with main meal + intermediate twice daily or (morning &

evening)

14. How do you store your insulin?

[.....] In the refrigerator

[.....] Other storing methods.

Mention:.....

[.....] Just room temperature

15. What is your perceived knowledge on diabetes

1. Very Limited Knowledge
2. Somewhat Limited Knowledge
3. Moderate Knowledge
4. Quite Knowledgeable
5. Extremely Knowledgeable

16. Can you mention the components of diabetes self-care management that you know?

(Tick all that apply)

[.....] Insulin injection

[.....] Glucose monitoring

[.....] Diet

[.....] Exercise

[.....] Cooperation with diabetes team (Healthcare providers)

17. How many times do you check blood glucose per day?

.....

18. Do you do exercise (physical activity)?

[.....] Yes

[.....] No.....*Go to Qn. 21*

19. Which type of exercise do you do?

[.....] Running

[.....] Walking

[.....] Sports

[.....] Weight lifting

20. How many times per week do you do exercise (physical activity)?

.....

21. How many minutes do you spend doing exercise (physical activity) at a time?

.....

22. Do you face any stigma and discrimination because of your diabetes?

[.....] Yes

[.....] No.....*Skip Qn. 24*

23. If yes (from qn.21), from who do you mostly experience?

[.....] Family member

[.....] Peers at school/work

[.....] Teachers/Boss

[.....] Not applicable

24. RBG results:.....Mmol/L

25. HbA1c Results:.....%

Mshiriki Na:.....

Mawasiliano ya mshiriki, Simu:.....

Umri.....(Miaka)

Jinsia

[.....] Me

[.....] Ke

Ukiligundulika kuwa na kisukari ukiwa na umri gani:.....

Unalipa kwa njia gani ukienda hospitali

[.....] Bima ya afya

[.....] Bima ya afya ya jamii (CHF)

[.....] Msamaha

[.....] Pesa taslimu

Je, unasoma kwa sasa?

[.....] Ndio

[.....] Hapana.....*Nenda swali Na. 10*

Kama unasoma, Je ni?

[.....] Shule ya bweni

[.....] Shule ya kutwa

[.....] Haihusiki

Je, walimu wako wanafahamu kama una ugonjwa wa kisukari?

[.....] Ndio

[.....] Hapana

[.....] Haihusiki

l. Kiwango cha elimu

[.....] Shule ya msingi

[.....] Shule ya sekondari (O-level)

[.....] Shule ya sekondari (A-level)

[.....] Chuo cha kati

[.....] Chuo kikuu

l. Je, kuna mtu mwingine katika familia mwenye ugonjwa wa kisukari?

[.....] Ndio

[.....] Hapana

l. Unaishi na nani?

[.....] Wazazi wote wawili

[.....] Mzazi mmoja Taja: ***Baba [.....] Mama [.....]***

[.....] Mlezi/walezi wengine

l. Unatumia Insulin namna gani?

[.....] Mara mbili kwa siku (inayofanya kazi haraka na Inayofanya kwa kaimu ya kati)

[.....] Mara tatu kwa siku (Basal bolus)

[.....] Mara tatu kwa siku (Inayofanya kazi haraka wakati wa mlo mkuu + Ya kaimu ya kati mara mbili kwa siku (asubuhi na jioni)

i. Je unatunzaje Insulin?

[.....] Kwenye jokofu (friji)

[.....] Natumia njia nyingine za utunzaji. Taja ni njia

zipi:.....

[.....] Natunza kwenye joto la kawaida tu

ii. Je, unafikiri una ufahamu kiasi gani kuhusu ugonjwa wa kisukari?":

Kidogo Sana

Kiasi Fulani

Wastani

Ufahamu Kabisa

Nina ufahamu Sana

iii. Je, unaweza kutaja vipengele vya usimamizi/kuzingatia kujihudumia kama mgonjwa wa kisukari (Ili sukari ikae sawa) unavyovijua?

(Chagua yote uwezayo)

[.....] Kuchoma Insulini

[.....] Kupima sukari

[.....] Kuzingatia lishe (chakula)

[.....] Kufanya mazoezi

[.....] Kushirikiana na wadudumu wa afya

iv. Unapima sukari mara ngapi kwa siku?

.....

3. Je, huwa unafanya mazoezi?

[.....] Ndio

[.....] Hapana.....*Nenda swali Na. 21*

4. Unafanya mazoezi ya aina gani?

[.....] Kutembea

[.....] Kukimbia

[.....] Michezo km. mpira n.k

[.....] Kunyenya vitu vizito k.m vyuma

5. Unafanya mazoezi mara ngapi kwa wiki?

.....

6. Unatumia dakika ngapi kila ukifanya mazoezi?

.....

7. Je, huwa unakabiliwa na unyanyapaa na ubaguzi wowote kwa sababu ya ugonjwa wako wa kisukari?

[.....] Ndio

[.....] Hapana.....*Ruka swali Na. 22*

8. Kama ni ndio (Swali na.21), je, unapata unyanyapaa kutoka kwa nani?

[.....] Wanafamilia

[.....] Wenzangu shuleni/kazini

[.....] Walimu wangu/mkuu wangu wa kazi

- i. Majibu ya sukari:.....Mmol/L
- ii. Majibu ya HbA1c:.....%

Appendix VII: Self Care Inventory-Revised Version (SCI-R): English

Version

This survey measures what you actually do, not what you are advised to do. How have you followed your diabetes treatment plan in the past 1-2 months?

	Never	Rarely	Sometimes	Usually	Always
Check blood glucose with monitor	1	2	3	4	5
Record blood glucose results	1	2	3	4	5
Take the correct dose of insulin	1	2	3	4	5
Take insulin at the right time	1	2	3	4	5
Eat the correct food portions	1	2	3	4	5
Eat meals/snacks on time	1	2	3	4	5
Keep food records	1	2	3	4	5
Treat low blood glucose with just	1	2	3	4	5 Never had

the recommended amount of carbohydrate					low blood glucose []
Carry quick acting sugar to treat low blood glucose	1	2	3	4	5
1. Come in for clinic appointments	1	2	3	4	5
2. Exercise	1	2	3	4	5
3. I adjust insulin dosage based on glucose values, food, and exercise	1	2	3	4	5

Appendix VIII: Self Care Inventory-Revised Version (SCI-R): Swahili Version

Utafiti huu hupima kile unachofanya hasa, (si kile unachoshauriwa kufanya). Je, umefuataje mpango wako wa matibabu ya kisukari katika kipindi cha miezi 1-2 iliyopita?

	Kamwe (Hapana)	Mara chac he	Wakati mwing ine	Kwa kawaid a	Daima (Siku zote)
Napima kiwango cha sukari kwenye damu na mashine ya kupimia	1	2	3	4	5
Naandika kiwango cha sukari baada ya kupima	1	2	3	4	5
Nachoma dozi sahihi ya insulini	1	2	3	4	5
Nachoma insulini kwa wakati sahihi	1	2	3	4	5
Nakula	1	2	3	4	5

kiwango/kiasi sahihi cha chakula					
Nakula chakula/vitafunio kwa wakati	1	2	3	4	5
Natunza (naandika) kumbukumbu ya chakula ninachokula	1	2	3	4	5
Natibu sukari ya kushuka kwa kula kiasi cha wanga kilichopendekezwa	1	2	3	4	5 Haijawahi kutokea sukari kushuka []
Nabeba chakula kinachoongeza sukari haraka kutibu sukari ikishuka	1	2	3	4	5

1. Nahudhuria kliniki ya kisukari kulingana na miadi (Kama nilivopangiwa)	1	2	3	4	5
2. Nafanya mazoezi	1	2	3	4	5
3. Narekebisha dozi ya insulin kulingana na kiwango cha sukari, aina/kiasi cha chakula, na mazoezi	1	2	3	4	5

Appendix IX: Laboratory Results Sheet

S/No	PARTICIPANT SERIAL NO.	RBG (Mmol/L)	HbA1c (%)
*			
*			
*			
*			
*			
*			
*			
*			
*			

.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
.			
...155			

Appendix X: Consent Form for Qualitative Method: English Version

Hello!

My Name is Dr. Leonard Malasa, a principal investigator and I am conducting a study "SELF-CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL, AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA." and I am requesting your participation.

PURPOSE OF THE STUDY:

The aim of this study is to assess self-care management challenges for glycaemic control among adolescents with Type 1 diabetes mellitus in Dar Es Salaam, Tanzania.

HOW TO PARTICIPATE:

If you are willing to participate, I will ask you to sign this consent form to approve your willingness. You are/(you are child is) invited to participate in a focus group discussion with other participants to share your challenges in diabetes self-care management. These discussions will be audio-recorded to ensure accurate documentation of the information shared. The recordings will only be accessed by the research team and will be deleted after transcription and analysis.

REFRESHMENTS AND MEDICAL SUPPORT

Light snacks will be provided during the focus group discussions. If you experience any symptoms of hypoglycaemia such as sweating, tremors, rapid heartbeat, anxiety, hunger, dizziness, weakness, fatigue, blurred vision, or difficulty

concentrating, please immediately inform a member of the research team. Appropriate snacks will be provided to address mild symptoms. In case of severe symptoms, appropriate medical care will be provided promptly to ensure your safety and well-being.

CONFIDENTIALITY:

Information obtained from you/your child will be confidential. No name or identity will be recorded in published materials, and the information obtained from you will not be shared with anyone else except the research team for the purpose of this study only, to improve better care for patients with type 1 diabetes mellitus. While we will maintain strict confidentiality of all recorded discussions, we ask that all participants respect the privacy of fellow group members by not sharing specific comments outside the discussion setting.

COSTS AND COMPENSATION

You will not be required to pay anything for your participation. There will be transport reimbursement for your attendance at the focus group discussion. Care will be provided for the patient in case of emergency.

VOLUNTARY PARTICIPATION & RIGHTS TO WITHDRAW

Your participation is voluntary, and you have the right to withdraw from participating in our study at any time, including during the focus group discussion. Whatever your decision may be, it will not affect in any way your rights to care and treatment.

RISKS

We don't expect significant risks from participation in the focus group discussions.

BENEFITS

Your/your child's participation in this study will help to know the challenges of self-care management in type 1 diabetes mellitus and we hope that the information from this research will be useful in contributing to improving the quality of care among adolescents with type 1 diabetes mellitus.

CONTACT PERSONS

If you have any questions about this study, please do not hesitate to contact:

Dr. Leonard Malasa,
Principal Investigator,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

In case of any information about your rights as a participant in this study please contact:

The Chairperson,
Institutional Research Ethics Committee,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.
Mobile: 0784-645777 Email: irec@ku.ac.tz

Consent Form

I will be grateful if you will agree to participate in this study.

I _____

Have understood the above information and my questions have been answered by the investigator to my satisfaction. I agree to take part in this research.

Signature of the participant: _____ Date _____

Signature of Investigator _____ Date: _____

Appendix XI: Consent Form for Qualitative Method: Swahili Version

Habari!

Jina langu ni Dk. Leonard Malasa, mtafiti mkuu na ninafanya utafiti kuhusu "USIMAMIZI WA KUJITUNZA KWA UDHIBITI WA SUKARI NA CHANGAMOTO ZAKE MIONGONI MWA VIJANA WENYE UGONJWA WA KISUKARI AINA YA 1 JIJINI DAR ES SALAAM, TANZANIA" na ninaomba ushiriki wako.

KUSUDI LA UTAFITI:

Madhumuni ya utafiti huu ni kuchunguza changamoto za usimamizi binafsi katika kudhibiti kiwango cha sukari mwilini miongoni mwa vijana wenye kisukari cha aina ya 1.

JINSI YA KUSHIRIKI:

Ikiwa uko tayari kushiriki, nitakuomba utie sahihi kwenye fomu hii ya idhini ili kuidhinisha nia yako. Umealikwa/(mtoto wako amevalikwa) kushiriki katika majadiliano ya kikundi na washiriki wengine ili kushiriki changamoto katika kudhibiti ugonjwa wa kisukari. Majadiliano haya yatarekodiwa kwa sauti ili kuhakikisha uhifadhi sahihi wa habari iliyoshirikiwa. Rekodi hizo zitatumwa na timu ya watafiti pekee na zitafutwa baada ya kunukuu na kuchanganua.

VIBURUDISHO NA MSAADA WA KIMATIBABU

Vitafunio vitatolewa wakati wa majadiliano ya kikundi. Iwapo utapata dalili zozote za kushuka kwa sukari mwilini kama vile kutokwa na jasho, kutetemeka, mapigo ya moyo Kwenda haraka, wasiwasi, njaa, kizunguzungu, udhaifu, uchovu, kutoona vizuri, au ugumu wa kuzingatia, tafadhali mjulishe mara moja mshiriki wa timu ya

utafiti. Vitafunio vinavyofaa vitatolewa ili kushughulikia dalili zisizo kali. Ikiwa utapata dalili kali, huduma ya matibabu zitatolewa mara moja ili kuhakikisha usalama wako na ustawi.

USIRI:

Taarifa utakazopata kutoka kwako/mtoto wako zitakuwa siri. Hakuna jina au utambulisho utakaorekodiwa katika nyenzo zilizochapishwa, na taarifa itakayopatikana kutoka kwako haitashirikiwa na mtu mwingine yeyote isipokuwa timu ya utafiti kwa madhumuni ya utafiti huu pekee, ili kuboresha huduma bora kwa wagonjwa walio na kisukari cha aina ya 1. Ingawa tutadumisha usiri mkubwa wa mijadala yote iliyorekodiwa, tunaomba washiriki wote pia waheshimu ufaragha wa wanakikundi wenzetu kwa kutosambaza maoni mahususi nje ya mpangilio wa majadiliano.

GHARAMA:

Hutahitajika kulipa chochote kwa ushiriki wako. Kutakuwa na malipo ya usafiri endapo kwako/mtoto wako kuja kushiriki katika majadiliano. Na kama ikitokea dharua mfano. Kiwango cha sukari kushuka, mshiriki atapatiwa matibabu ambayo yatagharamiwa na mradi wa utafiti huu.

USHIRIKI WA HIARI KUJIONDOA USHIRIKI:

Kushiriki kwako ni kwa hiari, na una haki ya kujiondoa kutoka kwa kushiriki katika utafiti wetu wakati wowote, ikijumuisha wakati wa majadiliano ya kikundi. Hata uamuzi wako uwe upi, hautaathiri kwa njia yoyote haki zako za matunzo na matibabu.

MADHARA

Hatutarajii madhara yoyote wakati wa majadiliano

FAIDA:

Tunatumai kuwa matokeo ya utafiti huu yatakuwa muhimu katika kuchangia kuboresha huduma kwa wagonjwa wenye kisukari cha aina ya 1.

MAWASILIANO

Ikiwa una maswali yoyote kuhusu utafiti huu, tafadhali usisite kuwasiliana na:

Dr. Leonard Malasa

Principal Investigator

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

Iwapo kuna taarifa yoyote kuhusu haki zako kama mshiriki katika utafiti

huu tafadhali wasiliana na:

Mwenyekiti,

Kamati ya Maadili ya Utafiti,

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Consent Form

Nitashukuru ikiwa utakubali kushiriki katika utafiti huu.

Mimi _____

Nimeelewa maelezo hapo juu na maswali yangu yamejibiwa na mpelelezi kwa kuridhika kwangu. Ninakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki: _____

Tarehe _____

Sahihi ya mtafiti: _____

Tarehe _____

Appendix XII: Assent Form for Qualitative Method: English Version

Hello!

My Name is Dr. Leonard Malasa, a principal investigator and I am conducting a study "SELF-CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL, AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA." If you want to, you can be part of this research study. People do research to try to find answers to questions.

WHY ARE WE DOING THIS RESEARCH STUDY?

The aim of this study is to assess self-care management challenges for glycaemic control among adolescents with Type 1 diabetes mellitus in Dar Es Salaam, Tanzania.

WHY ARE YOU BEING ASKED TO BE IN THIS RESEARCH STUDY?

Being one of individuals with type 1 diabetes mellitus, your participation in this study is important for us to be able to explore self-care management challenges for glycaemic control.

WHAT WILL HAPPEN DURING THIS STUDY?

In this study we are inviting you to participate during focus group discussion with other participants to share your challenges in diabetes self-care management. These discussions will be audio-recorded to ensure accurate documentation of the information shared. The recordings will only be accessed by the research team and will be deleted after transcription and analysis.

WHAT ARE THE GOOD THINGS (BENEFIT) THAT MIGHT HAPPEN IN THIS STUDY?

Being in this research study, there are benefits to you. We hope that the information from this study will be useful in contributing to improving the quality of care among adolescents with Type 1 diabetes mellitus in future.

WHAT ARE THE PROBLEMS THAT MIGHT HAPPEN IN THIS STUDY?

Sometimes people have problems in research studies that make them feel bad. However, we don't expect risk by participating in a focus group discussion. Some problems might happen that the researchers don't know about. It is important to let the researchers, and your parents know if there is anything that you don't like about the research study right away.

REFRESHMENTS AND MEDICAL SUPPORT

Light snacks will be provided during the focus group discussions. If you experience any symptoms of hypoglycaemia such as sweating, tremors, rapid heartbeat, anxiety, hunger, dizziness, weakness, fatigue, blurred vision, or difficulty concentrating, please immediately inform a member of the research team. Appropriate snacks will be provided to address mild symptoms. In case of severe symptoms, appropriate medical care will be provided promptly to ensure your safety and well-being.

WHO WILL BE TOLD THE THINGS WE LEARN ABOUT YOU IN THIS STUDY?

Information obtained from you will be confidential and will be of help in this study and better care for patients with Type 1 diabetes mellitus in the future. Your name will not be in any report of the results of this study.

WILL YOU GET ANY MONEY/GIFTS FOR BEING IN THIS RESEARCH STUDY?

There will be no payment/gifts for being in this study. But you will be given some money for transport reimbursement.

WHAT IF YOU OR YOUR PARENTS DON'T WANT YOU TO BE IN THIS STUDY?

Your parent needs to give us permission for you to be in this study. You do not have to be in this study if you don't want to, even if your parent has already given us permission.

WHAT IF YOU CHANGE YOUR MIND?

You may stop being in the study at any time. If you want to stop, just tell us so and we will stop right away. If you decide to stop, no one will be angry or upset with you. You can ask questions at any time.

WHO SHOULD YOU ASK IF YOU HAVE ANY QUESTIONS?

If you have any inquiries about this study, please do not hesitate to contact:

Dr. Leonard Malasa,
Principal Investigator,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

In case of any information about your rights as a participant in this study please contact:

The Chairperson,

Institutional Research Ethics Committee,

Kairuki University,

322 Chwaku Street, Mikocheni,

P.O.Box 63500,

Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Investigator's Statement Regarding Assent Discussion:

I have explained this study to and answered questions of the child, as appropriate, and the parent or guardian of the child whose name is at the top of this form. I informed them that he or she could stop being in the study and can ask questions at any time. From my observations, the child seemed to agree to take part in the study.

Signature of the participant: _____ Date _____

Signature of Investigator: _____ Date: _____

Appendix XIII: Assent Form for Qualitative Method: Swahili Version

Habari!

Jina langu ni Dk. Leonard Malasa, mtafiti mkuu na ninafanya utafiti kuhusu
"USIMAMIZI WA KUJITUNZA KWA UDHIBITI WA SUKARI NA CHANGAMOTO ZAKE

MIONGONI MWA VIJANA WENYE UGONJWA WA KISUKARI AINA YA 1 JIJINI DAR ES SALAAM, TANZANIA". Ukitaka, unaweza kuwa sehemu ya utafiti huu. Watu hufanya utafiti kujaribu kupata majibu ya maswali.

KWANINI TUNAFANYA UTAFITI HUU?

Madhumuni ya utafiti huu ni kuchunguza changamoto za usimamizi wa kujitegemea kwa udhibiti wa kisukari miongoni mwa vijana wenye kisukari cha aina ya 1, Dar Es Salaam, Tanzania.

KWANINI UNAOMBWA UWEPO KATIKA UTAFITI HUU?

Kwa kuwa mmoja wa watu walio na kisukari cha aina ya 1, ushiriki wako katika utafiti huu ni muhimu kwetu ili kuweza kuchunguza changamoto za usimamizi wa kujitegemea kudhibiti wa kisukari.

NINI KITAENDELEA KATIKA UTAFITI HUU?

Katika utafiti huu tunakualisha kushiriki katika majadiliano kuhusu changamoto za usimamizi wa kujitegemea kudhibiti wa kisukari. Majadiliano haya yatarekodiwa kwa sauti ili kuhakikisha uhifadhi sahihi wa habari iliyoshikishwa. Rekodi hizo zitatumwa na timu ya watafiti pekee na zitafutwa baada ya kunukuu na kuchanganua.

NI MAMBO GANI MEMA (MANUFAA) YANAYOWEZA KUTOKEA KATIKA SOMO HILI?

Kwa kuwa katika utafiti huu, kuna manufaa kwako pia. Tunatumai kuwa maelezo yako kutokana na utafiti huu yatakuwa muhimu katika kuchangia kuboresha ubora wa huduma miongoni mwa vijana walio na kisukari cha aina ya 1 katika siku zijazo.

NI MATATIZO GANI YANAYOWEZA KUTOKEA KATIKA SOMO HILI?

Wakati mwingine watu wana matatizo katika tafiti za utafiti zinazowafanya wajisikie vibaya. Hata hivyo, hatutarajii madhara yoyote kwa wewe kushiriki katika majadiliano haya. Baadhi ya matatizo yanaweza kutokea ambayo watafiti hawajui kuyahusu. Ni muhimu kuwajulisha watafiti na wazazi wako ikiwa kuna jambo lolote ambalo hupendi kuhusu utafiti huu mara moja.

VIBURUDISHO NA MSAADA WA KIMATIBABU

Vitafunio vitatolewa wakati wa majadiliano. Iwapo utapata dalili zozote za kushuka kwa sukari mwilini kama vile kutokwa na jasho, kutetemeka, mapigo ya moyo Kwenda haraka, wasiwasi, njaa, kizunguzungu, udhaifu, uchovu, kutoona vizuri, au ugumu wa kuzingatia, tafadhali mjulishe mara moja mshiriki wa timu ya utafiti. Vitafunio vinavyofaa vitatolewa ili kushughulikia dalili zisizo kali. Ikiwa utapata dalili kali, huduma ya matibabu zitatolewa mara moja ili kuhakikisha usalama wako na ustawi.

NANI ATAAMBIWA MAMBO TUNAYOJIFUNZA KUHUSU WEWE KATIKA UTAFITI HUU?

Taarifa zitakazopatikana kutoka kwako na matokeo ya uchunguzi wako zitakuwa siri na zitasaidia katika utafiti huu na huduma bora kwa wagonjwa walio na kisukari cha aina ya 1 katika siku zijazo. Jina lako halitakuwa katika ripoti yoyote ya matokeo ya utafiti huu.

JE, UTAPATA PESA/ZAWADI YOYOTE KWA KUWA KATIKA UTAFITI HUU?

Hakutakuwa na malipo/zawadi kwa kuwa katika utafiti huu. Lakini utapewa pesa za usafiri waw ewe kuja kushiriki katika utafiti huu.

VIPI IKIWA WEWE AU WAZAZI WAKO HAWAPENDI UWEPO KATIKA UTAFITI HUU?

Mzazi wako anahitaji kutupa ruhusa ili uwe katika utafiti huu. Si lazima uwe katika utafiti huu ikiwa hutaki, hata kama mzazi wako tayari ametupa ruhusa.

VIPI UKABADILI MAWAZO YAKO?

Unaweza kuacha kuwa katika utafiti wakati wowote. Ikiwa unataka kuacha, tuambie hivyo na tutaacha mara moja. Ukiamua kuacha, hakuna mtu atakayekasirika au kukukasirisha. Unaweza kuuliza maswali wakati wowote.

UKIWA NA MASWALI YOYOTE UMUULIZE NANI?

Ikiwa una maswali yoyote kuhusu utafiti huu, tafadhali usisite kuwasiliana na:

Dr. Leonard Malasa,
Principal Investigator,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0653 451570 Email: leonard.malasa@ku.ac.tz

Iwapo kuna taarifa yoyote kuhusu haki zako kama mshiriki katika utafiti huu tafadhali wasiliana na:

Mwenyekiti,
Kamati ya Maadili ya Utafiti,
Kairuki University,
322 Chwaku Street, Mikocheni,
P.O.Box 63500,
Dar es Salaam, Tanzania.

Mobile: 0784-645777 Email: irec@ku.ac.tz

Taarifa Ya Utafiti Kuhusu Mjadala Wa Ridhaa:

Nimeueleza utafiti huu na kujibu maswali ya mtoto, inavyofaa, na mzazi au mlezi wa mtoto ambaye jina lake liko juu ya fomu hii. Niliwajulisha kwamba angeweza kuacha kuwa katika utafiti na anaweza kuuliza maswali wakati wowote. Kutokana na uchunguzi wangu, mtoto alionekana kukubali kushiriki katika utafiti.

Sahihi ya mshiriki: _____

Tarehe _____

Sahihi ya mtafiti: _____

Tarehe _____

Appendix XIV: FGD Interview guiding questions (English version)

1. What difficulties do you encounter in managing your insulin treatment? This could include issues with availability, storage, dose calculation, or administration.
2. What obstacles do you face when it comes to monitoring your blood glucose levels? Consider aspects such as access to glucometers and test strips, ability to use the equipment, and interpret or recording the results.
3. How challenging is it for you to maintain proper dietary control for managing your blood sugar? This may involve access to healthy food options, understanding carbohydrate counting, or other diet-related issues.
4. What barriers do you experience when trying to incorporate exercise into your diabetes management routine?
5. Could you share any challenges you've faced in working with your healthcare team for diabetes management, including adhering to appointments?

6. Are there any other factors that make self-care management of your diabetes difficult? This might include knowledge on the disease and/or self-care awareness, Transitional phase of growth, experiences with stigma or discrimination, levels of support from family or peers, or challenges in school or work environments, psychosocial challenges.

Appendix XV: FGD Interview guiding questions (Swahili version)

1. Elezea, ni changamoto zipi unazipata katika utumiaji wa insulin? (inaweza kuwa upatikanaji wa insulin, utunzaji, kukadiria dozi, uchomaji).
2. Je, ni vikwazo gani unavyokumbana navyo linapokuja suala la kupima ili kufuatilia viwango vyako vya sukari kwenye damu? (kama vile upatikanaji wa mashine za kupimia, strips za kuchomeka kwenye mashine ili upime, uwezo (ufahamu wa kutumia mashine), kutafsiri majibu, kutunza/kurekodi majibu).
3. Je, ni changamoto gani unapata kuhusu lishe sahihi ili kwa kudhibiti kiwango cha sukari yako kwenye damu? (uelewa wa chakula sahihi, upatikanaji wa chakula, changamoto katika kukadiria kiwango cha chakula cha wanga, au masuala mengine yanayohusiana na lishe)
4. Je, ni vikwazo gani unavyopitia unapojaribu kujumuisha mazoezi katika utaratibu wako wa kudhibiti kisukari?
5. Je, unaweza kutushirikisha changamoto zozote ambazo umekumbana nazo kushirikiana na wataalamu/wahudumu wa afya kwa ajili ya udhibiti wa kisukari ikiwemo uhudhuriaji wa clinic?
6. Je, kuna mambo mengine ambayo hufanya usimamizi/ufutiliaji binafsi wa kisukari chako kuwa mgumu? (uelewa juu ya ugonjwa na/au ufahamu wa kujitunza, changamoto ya ujana/rika/mpito ya ukuaji, unyanyapaa au ubaguzi, usaidizi kutoka kwa familia au marafiki, au changamoto katika mazingira ya shule/kazi, changamoto ya kisaikolojia na kijamii au mengine)

Appendix XVI: Ethical Clearance Certificate

KAIRUKI UNIVERSITY (KU)

70 Chwaku Street,
Mikocheni,
P.O BOX 65300,
Dar es Salaam,
Tanzania.



Tel: +255-22-2700021/4
Fax: +255-22-2775591
Email: irec@ku.ac.tz
Website: www.ku.ac.tz

Ref. No. KU/IREC/27.10/556

15 April, 2025

Dr. Leonard James Malasa,
Kairuki University,
70 Chwaku Street,
Mikocheni,
P. O. Box 65300.

Dar es Salaam, Tanzania.

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING HEALTH RESEARCH

I am pleased to inform you that the research titled: **Self-care Management Practices, Glycemic Control, and Associated Challenges among Adolescents with Type 1 Diabetes Mellitus in Dar es Salaam, Tanzania (Malasa, L. J., 2024)** has been granted ethical approval.

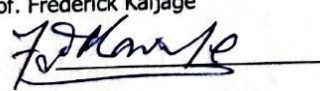
This approval is in effect for one year from the above date.

- Any changes in the procedures should be reported to the Institutional Research Ethics Committee.
- Significant changes will require the submission of a revised request for ethical approval.
- You will be required to submit **a study progress report** every six months.

Permission to publish your findings should be sought from the National Institute for Medical Research (NIMR) before submission to a publisher and not concurrently.

CHAIR PERSON

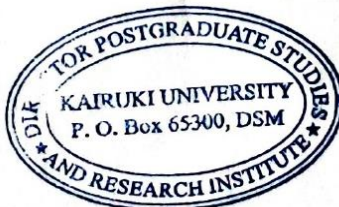
Name: Prof. Frederick Kaijage

Signature: 

SECRETARY

Name: Prof. Columba Mbekenga

Signature: 



Appendix XVII: Permission Letter from Temeke Regional Referral



JAMHURI YA MUUNGANO WA TANZANIA
WIZARA YA AFYA.
HOSPITAL YA RUFAA YA MKOA YA TEMEKE

Barua pepe: barua@temekerrh.go.tz, S.L.P 45232 Dar es Salaam, Simu: 0222856007



Kumb. Na. MA. 472/554/01.80

Tarehe: 15/04/2025

Leonard James Malasa,
Chuo cha Kairuki,
S.L.P 65300,
DAR ES SALAAM.

YAH: OMBI LA KUFANYA UTAFITI (RESEARCH) "SELF CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA"

Tafadhali husika na somo tajwa hapo juu.

2. Tumepokea barua yako ya tarehe 10 Aprili, 2025 kuhusu ombi lako la kufanya Utafiti (Research) "**Self Care Managment Practices, Glycemic Control and Associated Challenges Among Adolescents with type 1 Diabetes Mellitus in Dar es Salaam, Tanzania**" katika Taasisi yetu.
3. Ombi lako limekubaliwa, utatakiwa kulipa ada kiasi cha **Tshs. 100,000/=** Hivyo wasiliana na mhasibu wa mapato wa Hospitali **Ndg. Lusajo Nsajigwa** kwa namba **0717 959495** ili akupatie control Number kwa ajili ya malipo ya ada ili uweze kuruhusiwa kufanya utafiti.
4. Asante kwa ushirikiano.

Kny: MKURUGENZI MSAIDIZI
HOSPITALI YA RUFAA YA MKOA WA TEMEKE
21/04/2025
P.O. Box 45232
Dkt. Huseba Mwangi
DAR ES SALAAM
Kny: MKURUGENZI

HOSPITALI YA RUFAA YA MKOA YA TEMEKE

Nakala: CSCO

- **Tafadhali hakikisha taarifa
ya utafiti inabaki hospitalini**

Hospital

Appendix XVIII: Permission Letter from Amana Regional Referral



THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH

AMANA REGIONAL REFERRAL HOSPITAL



Telegram "HEALTH", DODOMA
Phone No.: +255 026 – 2323267
Email: ps@afya.go.tz

P.O. Box 25411
DAR ES SALAAM
Phone: 022—2861903

Date: 17/04/2025

REF. NO. MoHCDGEC/ARRH/R.1/VOL IV/79

Director, Postgraduate Studies and
Research Institute,
Kairuki University,
P.O. Box 65300,
DAR ES SALAAM.

Re: PERMISSION FOR DATA COLLECTION

Refer to your letter dated 10th April, 2025 which requested us to allow **Dr. Leonard James Malasa** to conduct research and collect data in our institution.

We are here to acknowledge your request with the following conditions, that he must submit the results of his research after completion of analysis in order the hospital to make use of data's to solve hospital problems.

Regards.


Dr. Rose Ntambuto
FOR: MEDICAL OFFICER INCHARGE
AMANA REGIONAL REFERRAL HOSPITAL
MEDICAL OFFICER I/C
AMANA REGIONAL REFERRAL HOSPITAL
P.O. Box 25411
DAR ES SALAAM

Hospital

Appendix XIX: Permission Letter from Mwananyamala Regional Referral

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH

Telephone Address:

Telephone: 022-2760500



Mwananyamala Regional
Referral Hospital,
P.O. Box 61665
Dar es Salaam.

RE: NO: MA. 239/240/01/28

DATE: 24th April, 2025

Principal Investigator (PI),
Kairuki University,
P.O.BOX 65300,
DAR ES SALAAM.

REF: DR. LEONARD JAMES MALASA - TO CONDUCT DATA COLLECTION IN
MWANANYAMALA REGIONAL REFERRAL HOSPITAL.

The captioned subject refers

2. May you be informed that your request to research Titled "***Self-care Management Practices, Glycemic Control and Associated Challenges among Adolescents with Type 1 Diabetes in Dar es Salaam, Tanzania***" at Mwananyamala Regional Referral Hospital start on 24th April, 2025 to 24th July, 2025, has been granted.

3. You will be obliged to pay Tsh. 100,000/= an attachment fee through a control number that will be issued upon your arrival at Mwananyamala Regional Referral Hospital.

4. May he report to the Administration and HR department head for further instruction.

Thanks.

Mashala R. K.
FOR: MEDICAL OFFICER INCHARGE
MWANANYAMALA REGIONAL REFERRAL HOSPITAL

COPY:

Head of Pediatric Department -

Dr. Leonard James Malasa

MWANANYAMALA REGIONAL
REFERRAL HOSPITAL

- Report to Pediatric Department

Appendix XX: Plagiarism

KARUKU UNIVERSITY
SCHOOL OF MEDICINE

DEPARTMENT OF PAEDIATRICS AND CHILD HEALTH



SELF-CARE MANAGEMENT PRACTICES, GLYCEMIC CONTROL AND ASSOCIATED CHALLENGES AMONG ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA

BY
LEONARD JAMES MALASA, MD

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN PAEDIATRICS AND CHILD HEALTH

YEAR 2025

SUPERVISOR: PROF. FLORENCE SALVATORY KALABAMU, MD, MMED
CO-SUPERVISOR: DR. MAULIDI R. FATAKI, MD, MMED, MPH

Match Overview

24%

Rank	Source	Similarity
1	diapers.malasa.ac.tz.BE...	3%
2	diapers.alqulib.edu	1%
3	ijournal.ac.be	1%
4	gabrisvinda.com	1%
5	www.humanities.org	1%
6	www.pumpu.com	1%
7	explore.to.mla.ca	<1%
8	gms.mla.edu.cn.org	<1%
9	explore.to.mla.ca	<1%
10	www.mla.edu.cn.gov	<1%
11	www.science.gov	<1%
12	china.ac.uk	<1%



Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author: Leonard Malasa

Assignment title: Dissertation

Submission title: Self-Care Management Practices, Glycaemic Control, and Asso...

File name: 1_Dissertation_Report_Malasa.docx

File size: 3.68M

Page count: 114

Word count: 24,225

Character count: 142,078

Submission date: 12-Aug-2025 10:57AM (UTC+0200)

Submission ID: 2728618210



Copyright 2025 Turnitin. All rights reserved.