

CLINICAL PRACTICE GUIDELINES FOR **DIABETES** MANAGEMENT **IN NIGERIA**

(2nd Edition)



BY
DIABETES ASSOCIATION OF NIGERIA (DAN)
A MEMBER OF INTERNATIONAL DIABETES FEDERATION (IDF)

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2.0 DEDICATION

This book is dedicated to Almighty God, who has continued to use the members, instruments and partners of Diabetes Association of Nigeria to keep the millions of Nigerians living with diabetes alive and healthy.

3.0 FOREWORD

It is really an honour for us to write the foreword of this 2nd Edition of the Clinical Practice Guidelines for the management of Diabetes Mellitus in Nigeria.

This monograph aims to provide healthcare professionals, scientists, health economists, policy makers and our national agencies with evidence-based information on the current management of diabetes mellitus.

The potential impact of diabetes mellitus as a developmental issue was recognized by the United Nations in 2006 in Resolution 61/225 when it stated that “diabetes is a chronic debilitating and costly disease associated with severe complications, which poses severe risks for families, member states and the entire world and serious challenges to the achievement of internationally agreed developmental goals including the Millennium Development Goals (MDGs).”

There is now extensive evidence on the optimal management of diabetes offering the opportunity of improving the immediate and long-term quality of life of those living with diabetes.

Unfortunately, such optimal management is not reaching many in Nigeria, perhaps the majority of the people who could benefit.

Reasons include the size, complexity and even inaccessibility of the evidence base, and the complexity of diabetes care itself. This guideline seeks to address these problems and we highly recommend it and commend the effort of the authors.

Prof. Chris O. Anah, FWACP, FRCP

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4.0 ACKNOWLEDGMENT

On behalf of the people living with Diabetes in Nigeria, the Diabetes Association of Nigeria (DAN) expresses her gratitude to all who contributed so generously with their time and talents to this 2nd Edition of our “Clinical Practice Guidelines for Diabetes Management in Nigeria” and to the sponsors for their support (namely: Federal Ministry of Health, Olusegun Obasanjo Foundation, Nestle Nigeria Plc, Bayer HealthCare, Glaxo Smithkline (GSK), Megalife Sciences, NovoNordisk and Norvartis Pharma).

It represents an enormous body of work from a very large number of dedicated experts and staff.

5.0. LIST OF ABBREVIATIONS

ABI - Ankle-Brachial Index
ACE – Angiotensin-Converting Enzyme
ADA - American Diabetes Association
AHS - Abuja Heart Study
ARB - Angiotensin Receptor Blocker
BMI – Body Mass Index
CBOs - Community Based Organizations
CDA – Canadian Diabetes Association
CHD – Coronary Heart Disease
CHF - Congestive Heart Failure
CVD – Cardiovascular Disease
CKD - Chronic Kidney Disease
CSOs -Civil Society Organizations
CSI - Continuous Subcutaneous Infusion
C/S – Caesarian Section
DM – Diabetes mellitus
DFU - DM foot ulcers
DPP-4 - Dipeptidyl peptidase-4
DPN - Diabetic Peripheral Neuropathy
DKA - Diabetic Ketoacidosis
DRS - Diabetes Retinopathy Study
DSME - Diabetes Self-Management Education
ECG - Electrocardiogram
ESRD - End-Stage Renal Disease
FBOs - Faith Based Organization
FDA – Food and Drug Administration, USA
FG – Federal Government
FPG – Fasting Plasma Glucose
FRSC - Federal Road Safety Commission
GATS - Global Adult Tobacco Survey
GDM - Gestational Diabetes
GIP - Gastric Inhibitory Peptide (aka glucose-dependent Insulinotropic peptide)
GLP-1- Glucagon Like Peptides
2-HrPP -2 Hour Post-Prandial
HbA1c - Glycosylated Haemoglobin
HDL-C – High Density Cholesterol
HE -HyperGlycaemic Emergencies
HHS – Hyperosmolar Hyperglycaemic State
ICCCF -Innovative Care for Chronic Conditions Framework
IDF - International Diabetes Federation
IFG - Impaired Fasting Glucose
IGT - Impaired glucose tolerance
LDL-C- Low Density Cholesterol
LOPS - Loss of Peripheral Sensation
MDG(s) - Millennium Development Goal (s)
mhGAP - Mental Health Gap Action Programme
MNT - Medical Nutrition Therapy
MODY - Maturity-Onset Diabetes in Young
MRDM - Malnutrition Related Diabetes Mellitus
NAFDAC- National Food Drug Administration and Control
NCD(s) - Non-communication Disease (s)
NDLEA -National Drug Law Enforcement Agency
NGOs - Non-Governmental Organizations
NICE – National Institute of Clinical Excellence
NOMA -National Policy on Cancer Onis
NPDR - Nonproliferative Diabetes Retinopathy
NPI - National Programme on Immunization
NNRA - Nigeria Nuclear Regulatory Agency
OGTT - Oral Glucose Tolerance Test
PAD - Peripheral Arterial Disease
PCOS - Polycystic ovarian syndrome
PDR - Proliferative Diabetic Retinopathy
RAS - Renin-Angiotensin System
SMBG - Self-Monitoring of Blood Glucose
TB - Tuberculosis
TCHOL – Total Cholesterol
TG- Triglyceride
TDHS - Tropical hand ulcer
TZD - Thiazolidinediones
UKPDS - UK Prospective Diabetes Study
WHO- World Health Organization
WHO FCTC - WHO Framework Convention on Tobacco Control
WHA - World Health Assembly

6.0 PREFACE

The management of Diabetes Mellitus (DM) has always been challenging for patients and care providers alike, especially in developing countries. The problem lies in the fact that there are very few diabetes specialists and available clinical practice guidelines for the management of the increasing population of persons living with diabetes. In spite of the importance of guidelines in the management of diabetes mellitus, health care providers are often unaware of its place in ensuring good glycaemic, lipid, weight and blood pressure control. Consequently, compliance with, and adherence to guideline provisions, remain poor among care-givers.

In settings like Nigeria where specialist diabetes care providers are limited especially in rural settings, clinicians managing diabetic patients must be knowledgeable and skilled in the use of guidelines and also show commitment to it.

This monograph is written with the above issues in mind. It is structured in such a way that information about diabetes, its diagnosis, classification, complications, monitoring, drug and nutritional management could be easily understood and applied. This guideline is also intended for medical students, post-graduates and other health practitioners in Nigeria who want to know more about diabetes and are in a position to advise patients and policy makers. During the development of this guideline, the Diabetes Association of Nigeria (DAN) had the primary goal to improve the quality of life and productivity of Nigerians living with diabetes through:

- Early diagnosis
- Prevention of short-term and long-term morbidities.
- Prevention of premature mortality
- Promotion of self-care practices and empowerment of people living with diabetes
- Reduction of the personal, family, and societal burden of diabetes.

The successful establishment of diabetes health-care teams and infrastructures to support it is critical for the achievement of these goals. This also includes provision of education for health-care professionals and people living with diabetes.

The appendices (I - X) provide more useful information for most questions patients and care-givers would need answers to.

Evidently, the 2nd edition of CLINICAL PRACTICE GUIDELINES FOR DIABETES MANAGEMENT IN NIGERIA is firmly grounded in science, being the best thoughts of experts and leaders in the Nigerian diabetes community over the years as reflected in the annals of Diabetes Association of Nigeria.

It's being implemented in Nigeria since the publication of the maiden edition in 2011.

Adherence and commitment to Guidelines provisions are recommended for all practitioners involved in the identification and care of diabetics in Nigeria.

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7.0 Executive Summary

Diabetes Mellitus is a common endocrine-metabolic disorder affecting about 371 million people currently worldwide with at least 5 million Nigerians (2.2% mean national prevalence) affected. In Nigeria, it is associated with a high morbidity and mortality.

Generally, guidelines are derived by different methods based on appropriateness and available resources. Evidence from well-conducted multicenter trials is graded highly, so are those from meta-analysis that incorporate quality ratings in the analysis. Evidence from well-conducted trials at one or more institutions, and evidence from meta-analysis that incorporate quality ratings in the analysis are also highly graded. Second level gradings are supportive evidence from well-conducted cohort studies, including evidence from well-conducted prospective cohort study or registry and evidence from a well-conducted meta-analysis of cohort studies. Next is Supportive evidence from well-conducted case-control studies.

The Clinical Guideline Development team recognized the limited resources available for the project. And the fact that there is no need to ‘reinvent the wheel’; it therefore relied on existing literatures from the American Diabetes Association (ADA), the World Health Organisation (WHO) guidelines and International Diabetes Federation (IDF). The team made specific recommendations that fitted-in with the Nigerian practice environment and consensus of the experts.

Diabetes mellitus is diagnosed by the presence of elevated plasma glucose with or without symptoms of diabetes mellitus or its complications.

Classic symptoms are polyuria, polydipsia, unexplained weight loss, polyphagia, recurrent infections, eye symptoms, poor obstetric history, foot sepsis/gangrene, erectile dysfunction etc. It is important to emphasize that blood glucose may be elevated without having the classic symptoms of diabetes mellitus.

A fasting plasma glucose of 7.0mmol/l (126mg/dl) or a casual (Random) plasma glucose of 11.1 mmol/l (200mg/dl) or a 2- Hour plasma glucose of 11.1mmol/l (200mg/dl) during a standard 75 gm oral glucose tolerance test (OGTT) is diagnostic.

Use of HbA1c has been adopted internationally for diagnosing diabetes with a cut-off of 6.5% or greater.

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are intermediate stages in the natural history of disordered glucose metabolism between normal glucose homeostasis and diabetes. Individuals with IFG and/or IGT are now referred to as having pre-diabetes; indicating the relatively high risk for developing overt diabetes.

Diabetes is a chronic life-long illness that requires continuing medical care and patient self-management education to prevent acute complications and reduce or retard the risk of long-term end-organ damage.

People living with diabetes should receive medical care from a physician-coordinated team. Such teams may include, but are not limited to endocrinologists/diabetologists, physicians, nurses, dietitians, pharmacists, and mental health professionals with expertise and a special interest in diabetes. It is essential in this collaborative and integrated team approach that individuals with diabetes assume an active role in their care.

Goals, targets and treatment plans are reasonable.

Care of diabetes has shifted to an approach that is more patient-centred and places the person living with diabetes at the centre of decision-making in the care model. Patient-centred care is respectful of and responsive to individual patient preferences, needs and values, and ensures that patient values guide all decision making.

Management basically comprises non-drug and drug approach.

Diabetes management in Nigeria must be relevant, flexible and adaptable to reflect our needs at all the 3-tiers of care and we cannot lose touch with new developments and technologies that can be used to treat diabetes effectively.

Evidently, the 2nd edition of CLINICAL PRACTICE GUIDELINES FOR DIABETES MANAGEMENT IN NIGERIA is firmly grounded in science, being the best thoughts of experts and leaders in the Nigerian diabetes community over the years as reflected in the annals of Diabetes Association of Nigeria.

Chapter One

TYPE OF GUIDELINE AND METHOD OF DEVELOPMENT

This is a consensus guideline drawn up by Diabetes Association of Nigeria (DAN) in collaboration with members of the Endocrine and Metabolism Society of Nigeria, (formerly Nigerian Society of Endocrinology and Metabolism). It was compiled from deliberations that spanned a number of years under the auspices of Diabetes Association of Nigeria. It is expected to be reviewed every 2 – 3 years.

1.1. Objectives

1. To provide and promote standardized clinical guidelines for Diabetes Care in Nigeria
2. To improve the quality of Care given to people living with diabetes in Nigeria at primary, secondary and tertiary health centres.
3. To Define Minimum Standard of Care

1.2. Goals and Targets

Targets are better thought of as ‘assessment levels’ or ‘intervention levels’.

- ⊙ It is evidence-based (usually from landmark studies e.g. DCCT, UKPDS etc).
- ⊙ Without some form of targeted control of a chronic endocrine-metabolic disorder (diabetes), it becomes difficult to promote care at all.
- ⊙ Achieving and maintaining good glycaemic control by treating-to-target, is the goal of using guideline.

1.3 Standards of Care

1.3.1. Standard Care

Involves:

- ⊙ Maintaining HbA1c below 6.5% which should minimize risk of developing complications.
- ⊙ Providing lifestyle and education support, and titrate therapies, to enable people with diabetes achieve HbA1c below 6.5 % (where feasible and desired), or lower if easily attained.
- ⊙ Advising those in whom target HbA1c levels cannot be reached that any improvement is beneficial.

- ⊙ Raising targets for people on insulin or sulfonylurea therapy in whom attainment of tighter targets may increase the risk of hypoglycaemic episodes, which may present particular problems for people with other physical or mental impairment.
- ⊙ Equivalent target levels for capillary plasma glucose levels are <6.0 mmol/l (<110 mg/dl) before meals, and <8.0 mmol/l (<145 mg/dl) 1-2 h after meals.

1.3.2 Comprehensive Care

- ⊙ The target levels here are as for *Standard care*, but it may be possible to devote more resources to achieving lower target levels without adverse impact on health.

1.3.3 Minimal Care

- ⊙ The target levels here are as for *Standard care*, but may need to be based on measurement of plasma glucose levels ALONE, especially in rural settings where facilities for HbA1c are not available.

1.4. Epidemiology

Diabetes is a common endocrine-metabolic disorder affecting about 371 million people currently worldwide with about 5 million Nigerians (2.2% mean national prevalence rate) affected. The prevalence in Nigeria varies from 0.65% in rural Mangu (North), 6.8% in PortHarcourt city (Niger Delta) to 11.0% in urban Lagos. The prevalence is on the increase and is projected by the World Health Organization (WHO) to rise to 552 million world-wide by the year 2030. In Nigeria, it is associated with a high morbidity and mortality.

Diabetes is a chronic illness that requires continuing medical care and patient self-management education to prevent acute complications and to reduce the risk of long-term complications.

A minimum standard of care is intended to equip clinicians, patients, researchers, and healthcare professionals with the components of diabetes care, treatment goals, and tools for adequate patient management. It provides goals and targets that are suitable for most patients. However, individual preferences, comorbidities, and other patient factors may require modification of goals and targets occasionally.

These standards are not intended to preclude more extensive evaluation and management of the patient by other specialists as needed.

Standard Care is cost effective where there is a developed service base and in the Nigerian context, some healthcare facilities are able to provide this form of care.

1.5. Definition of Diabetes Mellitus

It is a chronic metabolic disorder characterized by chronic hyperglycaemia, caused by an absolute or relative insulin deficiency or defective action or both resulting in disorder of carbohydrates, protein and fat metabolism. It is associated with long-term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart and blood vessels.

1.6. Diagnosis

Diabetes mellitus is diagnosed by the presence of elevated plasma glucose with or without symptoms of diabetes mellitus or its complications.

Symptoms are polyuria, polydipsia, unexplained weight loss, polyphagia, recurrent infections, eye symptoms, poor obstetric history, foot sepsis / gangrene, erectile dysfunction etc. It is important to emphasize that blood glucose may be elevated without having the classic symptoms of diabetes mellitus

A fasting plasma glucose of 7.0mmol/l (126mg/dl) or a casual (Random) plasma glucose of 11.1 mmol/l (200mg/dl) or a 2- Hour plasma glucose of 11.1mmol/l (200mg/dl) during a standard 75 gm oral glucose tolerance test (OGTT) is diagnostic.

For epidemiological studies the use of fasting plasma glucose level of 7.0mmol/l is recommended.

For clinical diagnosis the use of a second test, preferably a two-hour post prandial plasma glucose of 11.1 mmol/l (200mg) is recommended for confirmation.

A standard 75 gm oral glucose tolerance test is not required routinely for diagnosis. But it is required to diagnose impaired glucose tolerance in individuals whose plasma glucose levels are borderline.

Glycosylated haemoglobin (HbA1c): Use of HbA1c has been adopted by ADA, WHO and EASD for diagnosing Diabetes with a cut-off of 6.5% or greater. HbA1c assays are now highly standardized and their results can be uniformly applied both temporally and across populations.

Epidemiologic data show a relation between HbA1c and the risk of retinopathy similar to that shown for corresponding FPG and 2-Hour post prandial glucose thresholds.

The HbA1c is more convenient since fasting is not required and is likely to be more stable than glucose measurements.

HbA1c as a diagnostic test in Nigeria: Limitations and Applications

The limitations include:

- Greater cost
- Limited availability of HbA1c in the country
- Incomplete correlation between HbA1c and the average glucose in certain individuals
- Interferences from certain conditions e.g. Hb variants, conditions that affect red cell turnover.

To reduce interferences and improve HbA1c measurement the following are essential:

- Increasing awareness of HbA1c interferences
- Testing for interference from Hb variants for each method
- Encouraging use of methods without interference from Hb variants (see appendix X).
- HbS is the most common variant in Nigeria followed by HbC and HbE.

HbA1c test to diagnose diabetes should be performed using clinical laboratory equipment. Point-of-care instruments have not yet been shown to be sufficiently accurate or precise for diagnosing diabetes.

Where clinical laboratory HbA1c testing is not available or is inadequate, or if HbA1c testing is not possible due to factors interfering with its measurements, clinicians should continue to use the conventional recommended approaches to diagnose diabetes based on glucose measurements.

1.7 Clinical Presentation of Diabetes Mellitus in Adults

Individuals with diabetes mellitus present in different ways and up to half of all persons living with diabetes are undiagnosed and may have no symptoms. They get diagnosed incidentally.

Basically diabetic patients present in one of the following scenerios:

- a) during routine investigations (without any symptoms) (On the average people with type 2 DM get diagnosed after about 4 – 7 years of abnormal glucose tolerance).
- b) Patients seeking medical attention because of symptoms of diabetes, with or without symptoms of diabetic complications.
- c) Sometimes people present with symptoms of one or more diabetic complications for the first time.

1.7.1 Symptoms of Diabetes Mellitus

Diabetic patients commonly present with the following symptoms at point of diagnosis:

a) Polyuria: This is defined as passage of urine of more than 3 liters a day. Polyuria results from the osmotic effects of glucose and other solutes e.g. ketone bodies that should normally be reabsorbed by the kidney tubules after filtration.

b) Polydipsia: This is defined as excessive thirst, and with this condition people tend to drink too much liquid, usually water. With polydipsia people may never feel satisfied by the amount of water they drink. It results from dehydration and increase in plasma osmolarity.

c) Polyphagia: This refers to an increased urge to eat. In the diabetic state there is excess glucose in the blood but it is not available for metabolism within the cells.

d) Weight loss: As a result of insulin lack, be it relative or absolute, insulin sensitive cells are not able to utilize the basic energy source notably glucose effectively. This results in the use of alternative sources of energy notably fat deposited in fat cells and amino acids stored in the form of protein in skeletal muscle.

e) Recurrent infections: Diabetic patients are prone to both acute and chronic microbial infections as a result of defects of cell mediated and humoral immunity as well as defective phagocyte function. These defects have a direct correlation with glycaemic level and improve with reduction in hyperglycaemia. Diabetic patients may present for the first time with recurrent skin and soft tissue infections such as boils, carbuncles, cellulitis, or recurrent vaginal candidiasis with itching and whitish discharge, balanitis, and urinary tract infections, respiratory and other systemic infections.

f) Eye Symptoms: Visual symptoms range from blurring of vision caused by high glucose levels in the aqueous and vitreous humour and lens, to opacification of the lens (cataract) or retinopathy to outright blindness from cataract, maculopathy or retinal detachment.

g) Erectile dysfunction: Sexual dysfunction is common and bothersome for the diabetic patient. It may be the main reason for a clinic consultation. It may take the form of retrograde ejaculation or poor erection. Sexual dysfunction may also be present in women with diabetes mellitus.

h) Poor Obstetric History: Women with diabetes experience reproductive abnormalities such as delayed menarche, menstrual cycle irregularities as well as reduced fertility. Furthermore they are at risk of recurrent abortions, large babies with neonatal deaths.

i) Foot Sepsis and Foot Gangrene: Diabetes is the leading cause of non- traumatic lower limb amputation. Non- healing foot ulcer or foot sepsis may be the initial presenting feature of diabetes. Typically this complication starts spontaneously with blisters and occasionally following trivial trauma

j) Loss of Consciousness: Loss of consciousness could result from an acute complication of diabetes such as keto-acidosis, hyperosmolar hyperglycaemic state as a result of undiagnosed and/or untreated diabetes.

1.8. Diagnostic Criteria

1. FPG 126 mg/dl (7.0mmol/l). Fasting is defined as no caloric intake for at least 8 hours.
2. Symptoms of hyperglycemia and a casual (random) plasma glucose 200 mg/dl (11.1 mmol/l). Casual (random) is defined as any time of day without regard to time since last meal. The classic symptoms of hyperglycemia include polyuria, polydipsia, and unexplained weight loss.
3. 2-hour plasma glucose 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by the World Health Organization using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in 250mls of water.
4. HbA1c 6.5%

In the absence of unequivocal hyperglycemia, these criteria should be confirmed by repeat testing on a different day.

1.9. Pre-Diabetes

1.9.1 Definition

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are intermediate stages in the natural history of disordered glucose metabolism between normal glucose homeostasis and diabetes.

Patients with IFG and /or IGT are now referred to as having pre- diabetes; indicating the relatively high risk for developing diabetes.

A person with pre- diabetes has a fasting plasma glucose level between 100mg and 125mg % (6.1 – 6.9 mmol/L).

IGT is a 2hr OGTT value of between 140 mg % and 199mg% (7.8 and 11mmol /L).

Normal fasting blood glucose is < 108mg/dl (< 6.0 mmol/L).

Normal blood glucose following OGTT is < 140mg % (< 7.8mmol/L) after 2 hours.

IFG and IGT are not interchangeable. They represent different abnormalities of glucose regulation. IFG is a measure of disturbed carbohydrate metabolism in the basal state, while IGT is a dynamic measure of carbohydrate intolerance after a standardized glucose load

1.9.2 Pre-diabetes

Hyperglycemia not high enough to meet diagnosis of diabetes mellitus but greater than normal values is categorized as either impaired fasting glucose (IFG), or impaired glucose tolerance (IGT) depending on whether it is determined through fasting glucose or OGTT. Both IFG and IGT are termed pre-diabetes and constitute risk factors for future diabetes and cardiovascular disease.

- **Impaired Fasting Glucose:** This refers to FPG of 6.1 to 6.9mmol/L.
- **Impaired Glucose Tolerance:** This refers to 2-hour plasma glucose (following an OGTT) levels of 7.8 mmol/L to <11.1mmol/L.

Chapter Two

CLASSIFICATION OF DIABETES MELLITUS

The new classification of diabetes according to the WHO includes four clinical classes:

2.1 Type 1 diabetes: It is characterized by beta cell destruction caused by an autoimmune process, usually leading to absolute insulin deficiency. The onset is usually acute, developing over a period of a few days to weeks. Over 95 percent of persons with type 1 diabetes mellitus develop the disease before the age of 25, with an equal incidence in both sexes and an increased prevalence in the white population. Most cases have the "immune-mediated form" of type 1 diabetes mellitus with islet cell antibodies and often have other autoimmune disorders such as Hashimoto's thyroiditis, Addison's disease, vitiligo or pernicious anemia. A few patients, usually those of African or Asian origin, have no antibodies but have a similar clinical presentation; consequently, they are included in this classification and their disease is called the "idiopathic form" of type 1 diabetes mellitus.. In Nigeria Type 1 DM constitutes < 3% of diabetic patients.

2.2 Type 2 diabetes mellitus: It is characterized by insulin resistance in peripheral tissues and an insulin secretory defect of the beta cell. This is the most common form of diabetes mellitus and is highly associated with a family history of diabetes, older age, obesity and lack of exercise. It is more common in women, especially women with a history of gestational diabetes, and in blacks, Hispanics and Native Americans. Insulin resistance and hyperinsulinemia eventually lead to impaired glucose tolerance. Defective beta cells become exhausted, further fueling the cycle of glucose intolerance and hyperglycemia. The etiology of type 2 diabetes mellitus is multifactorial and genetically based, but it also has strong behavioral components. In Nigeria it constitutes about 96% of diabetic patients.

2.3 Other Specific Types of Diabetes: This includes diabetes due to various known etiologies. This group includes persons with genetic defects of beta-cell function (this type of diabetes was formerly called MODY or maturity-onset diabetes in young) or with defects of insulin action; persons with diseases of the exocrine pancreas, such as pancreatitis or cystic fibrosis; persons with dysfunction associated with other endocrinopathies (e.g., acromegaly); and persons with pancreatic dysfunction caused by drugs, chemicals or infections, and drug- or chemical-induced (such as in the treatment of AIDS or after organ transplantation). Malnutrition Related Diabetes Mellitus (MRDM) which is specific to the tropics and developing world (Nigeria inclusive) is a member of this class.

2.4 Gestational DM :Gestational Diabetes (GDM) refers to any degree of glucose intolerance with onset or first recognition during pregnancy

Note: Some patients cannot be clearly classified as type 1 or type 2 diabetes. Clinical presentation and disease progression vary considerably in both types of diabetes. Occasionally, patients who otherwise have type 2 diabetes may present with ketoacidosis. Similarly, patients with type 1 may have a late onset and slow (but relentless) progression of disease despite having features of autoimmune disease. Such difficulties in diagnosis may occur in children, adolescents, and adults. The true diagnosis may become more obvious over time.

Chapter Three

TYPE 2 DIABETES MELLITUS

3.1 Introduction:

Type 2 diabetes mellitus is a chronic disorder that results from the combination of insulin resistance and insulin secretory defect. It is the commonest form of DM and constitutes >95% of the diabetic population in Nigeria. Although type 2 diabetes mellitus typically affects individuals older than 40 years, it has been diagnosed in children and adolescents and this emerging scenario is the result of the epidemic of obesity and inactivity in children.

The diagnosis of diabetes mellitus is readily entertained when a patient presents with classic symptoms of polyuria, polydipsia, polyphagia, and blurring of vision; however, as many as 50% of patients with type 2 diabetes are asymptomatic, and their disease remains undiagnosed for many years.

Aetiological factors include multiple genes and environmental factors. Routine screening for people at risk is thus recommended.

3.1.1 Recommendations for DM detection: Screening for DM should be considered in people with the following risk factors occurring singly or in combination:

- Age - Older than 45 years.
- Obesity
- Family history of type 2 diabetes in a first-degree relative (eg, parent or sibling)
- History of previous impaired glucose tolerance (IGT) or impaired fasting glucose (IFG)
- Hypertension (140/90 mm Hg) or dyslipidemia (high-density lipoprotein [HDL] cholesterol level <40 mg/dL in men, and <50mg/dL in women and triglyceride level >150 mg/dL)
- History of gestational diabetes mellitus or of delivering a baby with a birth weight of 4Kg.

3.2 Management of Type 2 Diabetes

3.2.1. Initial evaluation

A complete medical evaluation should be performed to classify the diabetes, detect the presence of diabetes complications, review previous treatment and Glycaemic control in patients with established diabetes, assist in formulating a management plan, and provide a basis for continuing care. Initial Laboratory tests appropriate to the evaluation of each patient's medical condition should be performed.

3.2.2 Treatment

People living with diabetes should receive medical care from a physician-coordinated team. Such teams may include, but are not limited to endocrinologists/diabetologists, physicians, nurses, dietitians, pharmacists, and mental health professionals with expertise and a special interest in diabetes. It is essential in this collaborative and integrated team approach that individuals with diabetes assume an active role in their care.

The management plan should be formulated as an individualized therapeutic alliance among the patient and family, the physician, and other members of the health care team. Goals, targets and treatment plans are reasonable. Any plan should recognize diabetes self-management education (DSME) as an integral component of care. In developing the plan, consideration should be given to the patient's age, school or work schedule and conditions, physical activity, eating patterns, social situation and personality, cultural factors, and presence of complications of diabetes or other medical conditions.

Management basically comprises non-drug and drug approach.

a. Non-drug management of DM

i. Diabetes self management education (DSME)

Since diabetes is a lifelong disorder, education of the patient and the family is probably the most important obligation of the clinician who provides initial care. The best persons to manage a disease that is affected so markedly by daily fluctuations in environmental stress, exercise, diet, and infections are the patients themselves and their families. The "teaching curriculum" should include explanations by the physician or nurse of the nature of diabetes and its potential acute and chronic hazards and how they can be recognized early and prevented or treated. The common misconceptions about diabetes among Nigerians should be corrected and adequate correct information provided.

Recommendations

- People with diabetes and their family members where appropriate should receive DSME when their diabetes is diagnosed and as needed thereafter.
- Self-management behavior change is the key outcome of DSME and should be measured and monitored as part of care.
- DSME should address psychosocial issues, since emotional well-being is strongly associated with positive diabetes outcomes.

DSME is an essential element of diabetes care, and National Standards for DSME are based on evidence for its benefits. Education helps people with diabetes initiate effective self-care when they are first diagnosed. Ongoing DSME also helps people with diabetes maintain effective self-management as their diabetes presents new challenges and treatment advances become available. DSME helps patients optimize metabolic control, prevent and manage complications, and maximize quality of life in a cost effective manner.

- ii. **Self-monitoring of blood glucose** should be emphasized, especially in insulin-requiring diabetic patients, and instructions must be given on proper testing and recording of data. Patients who are unable to do self monitoring at home are advised to visit nearby health centers or laboratories on their own accord and have their blood glucose measured weekly at least.
 - SMBG should be carried out one to three times daily for patients using multiple insulin injections.
 - For patients using less frequent insulin injections, non-insulin therapies, or medical nutrition therapy (MNT) and physical activity alone, SMBG may be useful as a guide to the success of therapy.
 - To achieve postprandial glucose targets, postprandial SMBG is appropriate 2 or 3 times a week
 - When prescribing SMBG, ensure that patients receive initial instruction in, and routine follow-up evaluation of, SMBG technique and their ability to use data to adjust therapy.

Major clinical trials of insulin-treated patients that demonstrated the benefits of intensive Glycaemic control on diabetes complications have included SMBG as part of multifactorial interventions, suggesting that SMBG is a component of effective therapy. SMBG allows patients to evaluate their individual response to therapy and assess whether Glycaemic targets are being achieved. Results of SMBG can be useful in preventing hypoglycemia and adjusting medications (particularly prandial insulin doses), MNT, and physical activity.

Because the accuracy of SMBG is instrument and user dependent, it is important to evaluate each patient's monitoring technique, both initially and at regular intervals thereafter. In addition, optimal use of SMBG requires proper interpretation of the data. Patients should be taught how to use the data to adjust food intake, exercise, or drug therapy to achieve specific Glycaemic goals. These skills should be re-evaluated at each clinic visit.

Patients and relatives are educated on how to adjust therapy based on blood glucose results; insulin dose, food, and exercise in response to measured blood glucose values. Glycaemic targets should be individualized (In the elderly, tight glycaemic control should not be enforced) but generally desirable values are as listed below;

Glycosylated haemoglobin: <6.5%

Fasting plasma glucose: <110mg% (6.1mmol/L)

Post prandial glucose: <140mg% (7.8mmol/L)

- iii. **Foot Care** This is an essential aspect of self care as foot complications of DM are responsible for prolonged hospitalization and deaths. Foot care includes daily inspection of the feet, wearing comfortable and well fitting shoes, proper nail care preferable by filing the nails and avoidance of bare feet walking.

Health care providers should check the feet at least once a year or more often if there is a history of foot problems.

Tips on Foot Care in Diabetes mellitus

- **Inspect Your Feet**

Make sure to inspect your feet daily. Using a mirror can help you see all areas on the soles of your feet.

- **Does The Shoe Fit?**

Be certain that your shoes fit with room to wiggle your toes. Look inside your shoes before putting them on, in case there are any foreign objects hiding in there and wear clean well-fitting socks.

- **Toe The Line**

Wash your feet everyday and make sure that you dry them thoroughly. Inspect in-between your toes.

- **Nail Care**

Use a nail file to trim your nails.

- **Do Not Self-Treat**

See your doctor if you notice any problems with your feet

- **Prevent Cracking**

If your skin is dry, apply cream or petroleum jelly to feet and heels, but avoid the area between your toes.

- **Keep Circulation Flowing**

Try not to cross your legs when you sit down. Don't lap people or carry heavy load on laps while traveling. This can limit circulation.

- **Keeping It Moderate**

Protect your feet from temperatures that are too cold or too hot.

- **Regular exercise**

Regular exercise improves circulation to all your extremities.

- **Last But Never Least**

It's so important to practice preventative care like the tips listed here, every day. If you notice anything that does not look normal please follow up with your healthcare professional immediately.

iv. Exercise

Physical activities or exercise is one of the essentials in the prevention of type 2 diabetes mellitus. Regular physical activities improve metabolic control, as well as giving a sense of well being.

Aerobic or endurance exercise (e.g. walking or running) rather than anaerobic or resistance exercise (e.g. lifting weights) is preferable. Brisk walking for about 30 minutes twice to thrice weekly is recommended.

If possible, patients should have an electrocardiogram (ECG) done and should see a doctor for a cardiovascular check before starting an exercise program. Strenuous exercise should be avoided if blood glucose > 250 mg/dl (14mmol/L) or less than 80 mg/dl (4.5 mmol/L).

3.2.3 Dietary Management

This is usually provided by a dietician but in the absence of one the diabetes educator or the physician may offer dietary counseling. Individual instruction on diet with reference to available local food and measuring cups should be provided. Patients should be told about community agencies, such as Diabetes Association chapters, that can serve as a continuing source of instruction. Dietary prescription should be based on the following;

The component of a typical meal should be made up of

Carbohydrate	60 – 70%
Protein	20 – 25%
Fat	15 – 20%

Carbohydrate should be spread throughout the day so that you do not have too much at onetime because the more carbohydrate you eat at a time the increase in one's blood glucose. Starchy carbohydrates are a healthier carbohydrate option than sucrose and refined sugars.

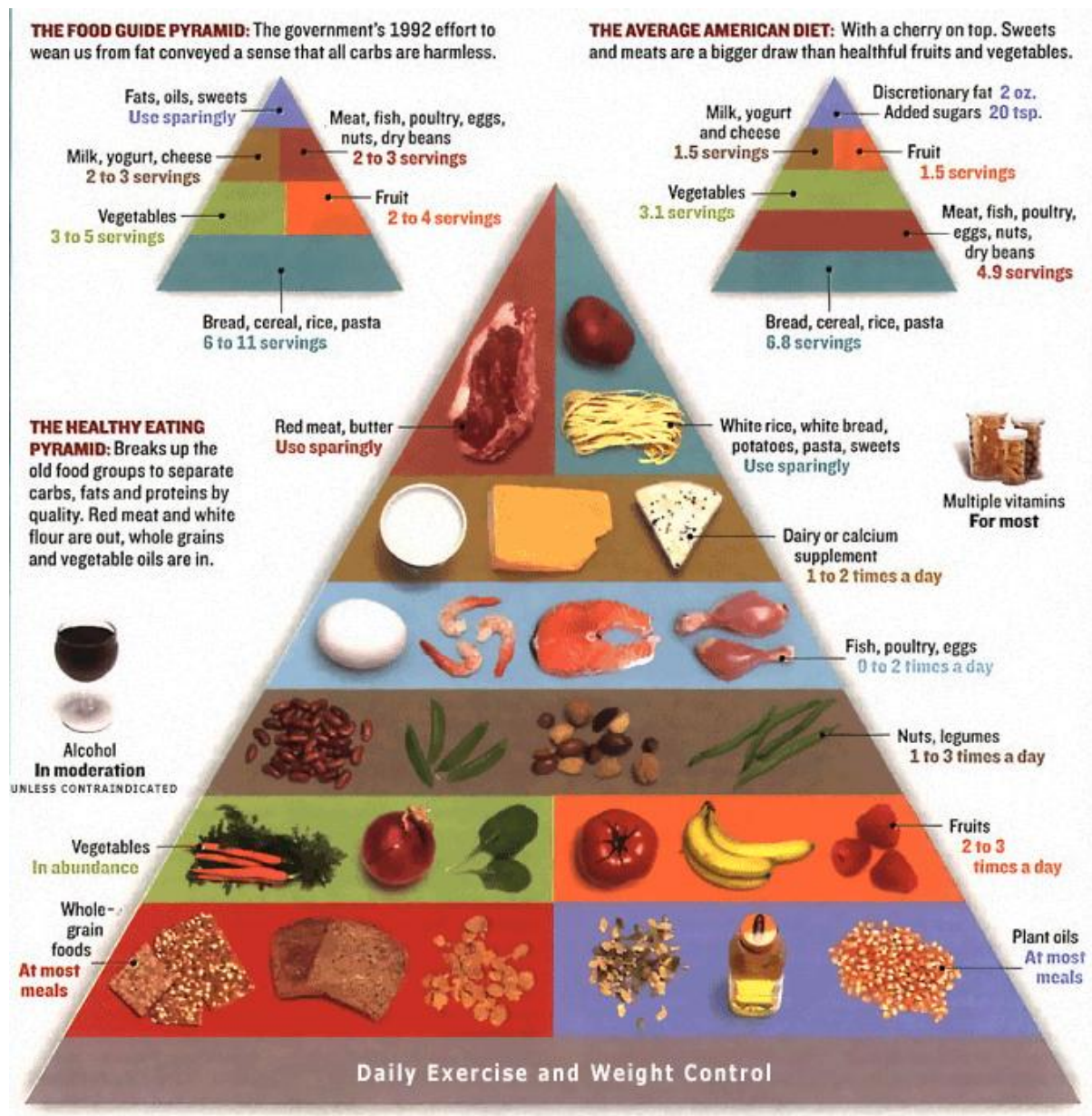
Examples of carbohydrates are bread, sweet potatoes, garri, maize, pap “*ogi*”, pasta, “*amala*”, yam and rice. Most of these also contain vitamins, fibres and minerals. They are as essential to people with DM as they are to people not having DM.

Fruits and vegetables should be included in meals.

Sources of cholesterol in the diet e.g. red meats, egg yolk, cheese, butter, cream, organ meat e.g. liver, “*shaki*”, “*roundabout*”, “*kponmo*”, kidney, etc should be controlled as excessive intake can increase blood cholesterol levels.

The Food pyramid shows that foods at the base be consumed more than those at the apex.

Figure 3.1: Food Pyramid of People living with Diabetes



3.2.4 Assessment of Glycaemic control: This comprises short term and long term glycaemic control. Short term glycaemic control is essentially carried out by assessing fasting plasma glucose and post prandial glucose levels. Long term glycaemic control basically consists of evaluation for glycosylated haemoglobin levels.

a. Glycosylated haemoglobin (HbA1C)

Recommendations

- Perform the A1C test at least two times a year
- Perform the A1C test quarterly in patients whose therapy has changed or who are not meeting Glycaemic goals.
- Clinic testing for A1C allows for timely decisions on therapy changes, when needed.

Because A1C is thought to reflect average glycaemia over 2 - 3 months, and has strong predictive value for diabetes complications, A1C testing should be performed routinely in all patients with diabetes at initial assessment and then as part of continuing care.

The A1C test is subject to certain limitations. Conditions that affect erythrocyte turnover (haemolysis, blood loss) and hemoglobin variants must be considered, particularly when the A1C result does not correlate with the patient's clinical situation.

Other metabolic parameters to be evaluated for include lipid parameters (total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and triglycerides)

Clinical parameters include the anthropometric indices and waist circumference measurement.

The table below shows the optimal metabolic and clinical parameters for people with DM.

TABLE 3.1: IDF Optimal Targets for Glycaemic, Lipid, Blood Pressure and Weight Control

Biochemical Index:		Optimal	
Capillary blood glucose values (finger-prick)		mmol/L	mg/dl
Fasting		4-6	72-108
2-hour post-prandial		4-8	72-144
Glycated haemoglobin (HbA1c) (%)			6.5
Weight BMI (kg/m ²)			<25
Blood Pressure (mmHg):			
Systolic			<130
Diastolic			<80
If persistent, dipstick for proteinuria			
Systolic			<125
Diastolic			<75
Lipids			
		Mol/L	Mg/dl
Total cholesterol		<5.2	<200
LDL cholesterol		≤2.6	≤95
HDL cholesterol		>1.1	>40
Men			>40
Women			>50
Triglycerides		<1.7	<150

3.3: Prevention of Type 2 Diabetes

Randomized controlled trials have shown that individuals at high risk for developing diabetes (those with IFG, IGT, or both) can be given interventions that significantly decrease the rate of onset of diabetes. These interventions include intensive lifestyle modification programs that have been shown to be very effective (58% reduction after 3 years). A 5–10% weight loss and moderate physical activity of ~30 min per day is recommended. Regarding the more controversial issue of drug therapy for diabetes prevention, the consensus is that metformin should be the only drug considered for use in diabetes prevention.

In Nigeria it is highly desirable to carry out community interventions using culture specific dietary counseling and education on weight normalization for preventing diabetes. Children in primary school are a good target for intervention on desirable weight and appropriate diet and exercise to change the cultural attitude of “big size is better”.

- Among individuals at high risk for developing type 2 diabetes, structured programs that emphasize lifestyle changes that include moderate weight loss (7% body weight) and regular physical activity (150 min/week), with dietary strategies including reduced calories and reduced intake of dietary fat, can reduce the risk for developing diabetes and are therefore recommended.
- Individuals at high risk for type 2 diabetes should be encouraged to increase dietary fiber (fruits and vegetables) and foods containing whole grains.

Saturated fat (palm oil intake should be reduced).

- Regular physical exercise is recommended
- Weight normalization is highly desirable

3.4: Drug Therapy for Type 2 Diabetes

Intervention at the time of diagnosis with metformin in combination with lifestyle changes (MNT and exercise) and continuing timely augmentation of therapy with additional agents (including early initiation of insulin therapy) as a means of achieving and maintaining recommended levels of Glycaemic control (i.e., A1C <7% for most patients). The overall objective is to achieve and maintain Glycaemic control and to change interventions when therapeutic goals are not being met.

3.4.1 Classes of anti-diabetic drugs

a. Insulin: Insulin is usually given subcutaneously either by injections or by an insulin pump. Research is underway regarding other routes of administration. In acute care settings, insulin may also be given intravenously. There are several types of insulin, characterized by the time of onset of action and duration of action.

b. Sulfonylureas: Sulphonylureas were the first widely used oral hypoGlycaemic medications. They are *insulin secretagogues*, triggering insulin release by direct action on the K_{ATP} channel of the pancreatic beta cells. The first generation of this class were once being marketed, but are no longer in use. The "second-generation" drugs are now more commonly used. They are more effective than first-generation drugs and have fewer side effects. All may cause weight gain. Sulfonylureas bind strongly to plasma proteins. Sulfonylureas are only useful in Type 2 diabetes, as they work by stimulating endogenous release of insulin. They work best with patients over 40 years old who have had diabetes mellitus for less than ten years. They cannot be used for type I diabetes, or diabetes in pregnancy. They can be safely used with metformin or -glitazones. The primary side effect is hypoglycaemia.

- First-generation agents (No longer recommended for clinical use):
 - tolbutamide (Orinase)
 - acetohexamide (Dymelor)
 - tolazamide (Tolinase)
 - chlopropamide (Diabinese)
- Second-generation agents (Currently recommended for clinical use):
 - Glipizide (Glucotrol)
 - Glyburide (Diabeta, Micronase, Glynase)
 - Glimepiride (Amaryl)
 - gliclazide (Diamicon)
 - glibenclamide (daonil)

c. Meglitinides

Meglitinides help the pancreas produce insulin and are often called "short-acting secretagogues." Their mode of action is original, by closing the potassium channels of the pancreatic beta cells, they open the calcium channels, hence enhancing insulin secretion.

They are taken with meals to boost the insulin response to each meal. Examples are

- (Prandin) repaglinide- The maximum dosage is 16 mg/day, taken 0 to 30 minutes before meals. If a meal is skipped, the medication is also skipped.
- (Starlix) nateglinides- The maximum dosage is 360 mg/day, usually 120 mg three times a day (TID). It also follows the same recommendations as repaglinide.

Adverse reactions include weight gain and hypoglycemia.

d. Insulin sensitizers

i. Biguanides

Biguanides reduce hepatic glucose output and increase uptake of glucose by the periphery, including skeletal muscle. Metformin, a biguanide, has become the most commonly used agent for type 2 diabetes in children, teenagers and adults. Amongst common diabetic drugs, metformin is the only widely used oral drug that does not cause weight gain. It must be used with caution in patients with impaired liver or kidney function

- Metformin (Glucophage). Should be used with caution, making sure cardiac and renal failures are excluded. However it should be temporarily discontinued before any radiographic procedure involving intravenous iodine contrast as patients are at an increased risk of acute renal failure.

Metformin is usually the first-line medication used for treatment of type-2 diabetes. Initial dosing is 500 mg twice daily, but can be increased up to 1000 mg twice daily. It is also available in combination with other oral diabetic medications

ii. Thiazolidinediones (TZD)

Thiazolidinediones, also known as "glitazones," bind to PPAR γ , a type of nuclear regulatory proteins involved in transcription of genes regulating glucose and fat metabolism. These PPARs act on Peroxisome Proliferator Responsive Elements (PPRE). The PPREs influence insulin sensitive genes, which enhance production of mRNAs of insulin dependent enzymes. The final result is better use of glucose by the cells. Examples are:

- Pioglitazone (Actos)

As a result of multiple retrospective studies, there is a concern about rosiglitazone's safety, - heart failure, although it is established that the group, as a whole, has beneficial effects on diabetes. Initial therapy with drugs of this type may prevent the progression of disease.

However, the European Medicines Agency recently recommended the suspension of the marketing authorizations for the rosiglitazone-containing anti-diabetes medicines: Avandia, Avandamet and Avaglim.

Data from clinical trials, observational studies and meta-analyses of existing studies that have become available over the last 3-6 years have suggested a possibly increased risk of ischaemic heart disease associated with the use of rosiglitazone.

The availability of recent studies has added to the knowledge about rosiglitazone and overall, the accumulated data support an increased cardiovascular risk of rosiglitazone. The Diabetes Association of Nigeria recommends discontinuation of clinical use of Rosiglitazone especially among patients with background cardiac problems.

e. Alphaglucosidase inhibitors

Alpha glucosidase inhibitors are "diabetes pills" but not technically hypoGlycaemic agents because they do not have a direct effect on insulin secretion or sensitivity. These agents slow the digestion of starch in the small intestine, by inhibiting dissacharidases so that glucose from the starch of a meal enters the bloodstream more slowly, and can be matched more effectively by an impaired insulin response or sensitivity. These agents are effective by themselves only in the earliest stages of IGT, but can be helpful in combination with other agents' in Type 2 diabetes. Examples are.

- Miglitol (Glyset)
- Acarbose (Precose/Glucobay)

Main side effect is bloating and flatulence.

They do have the potential to cause weight loss by lowering the amount of sugar metabolized.

f. Incretin Mimetics

Incretins are insulin secretagogues. The two main candidate molecules that fulfill criteria for being an incretin are glucagon like peptides (GLP-1) and Gastric inhibitory peptide (aka glucose-dependent Insulinotropic peptide or GIP). Both GLP-1 and GIP are rapidly inactivated by the enzyme Dipeptidyl peptidase-4 (DPP-4).

i. Glucagon-like peptide (GLP) analogs and agonists

GLP agonists bind to a membrane GLP receptor. As a consequence of this, insulin release from the pancreatic beta cells is increased. Endogenous GLP has a half life of only a few minutes; thus an analogue of GLP would not be practical. Exenatide is an agonist of GLP.

- Exenatide (also Exendin-4, marketed as Byetta)
- Exenatide is the first GLP-1 agonist approved for the treatment of Type 2 diabetes. Exenatide is not an analogue of GLP, but rather a GLP agonist. Exenatide has only 53% homology with GLP, which increases its resistance to degradation by DPP-4 and extends its half-life.
- Others are undergoing clinical trials.

These agents may also cause a decrease in gastric motility, responsible for the common side effect of nausea, and is probably the mechanism by which weight loss occurs.

ii. Dipeptidyl Peptidase-4 Inhibitors (DPP)

DPP-4 enzyme breaks down the insulin secretion stimulating peptides, GLP-1 and GIP, and delaying the breakdown by blocking the action of DPP-4, will improve glucose control. By blocking the enzymatic inactivation of the incretins, DPP-4 inhibitors make it possible for higher levels of active incretins to circulate and carry out their physiologic glucoregulatory functions.

The oral DPP-4 inhibitors Sitagliptin and Saxagliptin gained U.S. FDA approval in 2006 and 2009, respectively. Vildagliptin is approved for use in the European Union and countries in Southeast Asia and Africa. New DPP-4 inhibitors, such as alogliptin, are being investigated across the United States.

TABLE 3.2: Oral Anti-Diabetic Agents

Oral Agents	Abbrev.	Name of Drug	Starting Dose	Maximal Dose
	SU	Sulphonylureas		
	Gbm	Glibenclamide	2.5mg	20mg
	Gcz	Glizalazide	40mg	320mg
		Glizalazide MR	30mg	120 mg
	Gmp	Glimepiride	1mg	8mg
	Gpz	Glipizide	2.5 - 5mg	20mg
	Biguanides			
	Met	Metformin	500mg	2550mg
	TZD	Thiazolidinediones		
	Pio	Pioglitazone	15mg	30mg
	DPP4-I	<u>Dipeptidyl Peptidase-4 Inhibitors</u>		
	Vil	Vildagliptin	50mg	100mg
	Sita	Sitagliptin	50mg	100mg
	Sax	Saxagliptin	5mg	5mg

g. Amylin analogues

Amylin agonist/analogues slow gastric emptying and suppress glucagon. They have all the incretin actions except stimulation of insulin secretion. As of 2012, pramlintide was the only clinically available amylin analogue. Like insulin, it is administered by subcutaneous route. The most frequent and severe adverse effect of pramlintide is nausea, which occurs mostly at the beginning of treatment and gradually reduces.

3.5. Medical Nutrition Therapy (MNT)

3.5.1 General recommendations

- Individuals who have pre-diabetes or diabetes should receive individualized MNT as needed to achieve treatment goals, preferably provided by a registered dietitian familiar with the components of diabetes MNT. Advice should be given in clear and practical terms. Locally available food measures should be used.

3.5.2 Energy balance, overweight, and obesity

- In overweight and obese insulin-resistant individuals, modest weight loss has been shown to reduce insulin resistance. Thus, weight loss is recommended for all overweight or obese individuals who have or are at risk for diabetes.
- Reduction in total calorie consumption
- Use of balanced diet containing carbohydrate, high fibre fruits and vegetable
- Reduced fat and oil
- No sugar , sugary drinks or pastry

3.5.3 Carbohydrate intake in diabetes management

- Monitoring carbohydrate, whether by carbohydrate counting, exchanges, or experience-based estimation, remain a key strategy in achieving Glycaemic control.
- Nigerian dieticians should use culture-specific food and measures for patient education.

3.5.4 Other nutrition recommendations

- Non-nutritive sweeteners are safe when consumed within the acceptable daily intake.
- If adults with diabetes choose to use alcohol, daily intake should be limited to a moderate amount

Routine supplementation with antioxidants, such as vitamins E and C and carotene, is not advised because of lack of evidence of efficacy and concern related to long-term safety.

3.6 Physical Activities

Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss, and improve well being. Furthermore, regular exercise may prevent type 2 diabetes in high-risk individuals. Structured exercise interventions of at least 8 weeks' duration have been shown to lower A1C by an average of 0.66% in people with type 2 diabetes, even with no significant change in BMI. Higher levels of exercise intensity are associated with greater improvements in A1C and in fitness.

3.6.1 Evaluation of the diabetic patient before recommending an exercise program

Providers should use clinical judgment in this area. Certainly, high-risk patients should be encouraged to start with short periods of low-intensity exercise and increase the intensity and duration slowly.

Providers should assess patients for conditions that might contraindicate certain types of exercise or predispose to injury, such as uncontrolled hypertension, severe autonomic neuropathy, severe peripheral neuropathy or history of foot lesions, and advanced retinopathy. The patient's age and previous physical activity level should be considered.

3.6.2 Hypoglycaemia and exercise

In individuals taking insulin and/or insulin secretagogues, physical activity can cause hypoglycemia if medication dose or carbohydrate consumption is not altered. For individuals on these therapies, added carbohydrate should be ingested if pre-exercise glucose levels are <100 mg/dl (5.6 mmol/l). Hypoglycemia is rare in diabetic individuals who are not treated with insulin or insulin secretagogues, and no preventive measures for hypoglycemia are usually advised in these cases.

3.7 Psycho-social Assessment and Care

3.7.1 Recommendations

- Assessment of psychological and social situation should be included as an ongoing part of the medical management of diabetes.
- Psychosocial screening and follow-up should include, but is not limited to, attitudes about the illness, expectations for medical management and outcomes, affect/mood, general and diabetes-related quality of life, resources (financial, social, and emotional), and psychiatric history.

Psychological and social problems can impair the individual's or family's ability to carry out diabetes care tasks and therefore compromise health status. There are opportunities for the clinician to assess psychosocial status in a timely and efficient manner so that referral for appropriate services can be accomplished.

Issues known to impact self-management and health outcomes include but are not limited to attitudes about the illness, expectations for medical management and outcomes, affect/mood, general and diabetes-related quality of life, resources (financial, social, and emotional), and psychiatric problems.

3.8. Management of Diabetes and Intercurrent Illness

The stress of illness, trauma, and/or surgery frequently aggravates Glycaemic control and may precipitate diabetic ketoacidosis (DKA) or hyperglycaemic hyperosmolar state, life-threatening conditions that require immediate medical care to prevent complications and death. Any condition leading to deterioration in Glycaemic control necessitates more frequent monitoring of blood glucose and (in ketosis-prone patients) urine or blood ketones. Marked hyperglycemia requires temporary adjustment of the treatment program and, if accompanied by ketosis, vomiting, or alteration in level of consciousness, immediate interaction with the diabetes care team is needed. The patient treated with non-insulin therapies or MNT alone may temporarily require insulin. Adequate fluid and caloric intake must be assured. Infection or dehydration are more likely to necessitate hospitalization of the person with diabetes than the person without diabetes.

3.8.1 Hypoglycemia: Treatment of hypoglycemia (plasma glucose <70 mg/dl) requires ingestion of glucose- or carbohydrate-containing foods. Two cubes of sugar or half a bottle of mineral (coca cola or fanta etc)

Glucose (15–20g) is the preferred treatment for the conscious individual with hypoglycemia,

Recommendations

- Once SMBG glucose returns to normal, the individual should consume a meal or snack to prevent recurrence of hypoglycemia.
- Glucagon 1mg given im by patient or family member or health care worker

Ongoing activity of insulin or insulin secretagogues may lead to recurrence of hypoglycemia unless further food is ingested after recovery.

Prevention of hypoglycemia is a critical component of diabetes management. Teaching people with diabetes to balance insulin use, carbohydrate intake, and exercise is a necessary but not always sufficient strategy.

Chapter Four

TYPE 1 DIABETES MELLITUS

Type 1 diabetes mellitus is characterized by loss of the insulin-producing beta cells of the islets of Langerhans in the pancreas leading to a deficiency of insulin. This type of diabetes can be further classified as immune-mediated or idiopathic. The majority of type 1 diabetes is of the immune-mediated variety, where beta cell loss is a T-cell mediated autoimmune attack. In Nigeria it makes up less than 3% of diabetic patients

It is about 10% of diabetes mellitus cases in North America and Europe. There is no known preventive measure, both genes and environment contribute to the aetiology.

Type 1 diabetes can affect children or adults but was traditionally termed "juvenile diabetes" because it represents a majority of the diabetes cases in children.

The principal treatment of type 1 diabetes, even in its earliest stages, is the use of insulin injection combined with careful monitoring of blood glucose levels using blood testing monitors. Without insulin, diabetic ketoacidosis often develops which may result in coma or death.

4.1. Management of Type 1 Diabetes

Treatment emphasis is on patient education just as for type 2 diabetes, lifestyle adjustments (diet and exercise) and consistency and adherence to insulin therapy. Apart from the common subcutaneous injections, it is also possible to deliver insulin by a pump, which allows continuous infusion of insulin 24 hours a day at preset levels, and the ability to program doses (a bolus) of insulin as needed at meal times. An inhaled form of insulin was approved by the FDA in January 2006, although it was discontinued for business reasons in October 2007. Non-insulin treatments, such as monoclonal antibodies and stem-cell based therapies, are effective in animal models but have not yet completed clinical trials in humans.

Treatment need not significantly impair normal activities, if sufficient patient training, awareness, appropriate care, discipline in testing and dosing of insulin is taken. However, treatment is burdensome for patients; insulin is replaced in a non-physiological manner, and this approach is therefore far from ideal. The average glucose level for the type 1 patient should be as close to normal (80–120 mg/dl, 4.4–6.7 mmol/L) as is *safely* possible. Some physicians suggest up to 140–150 mg/dl (7.8–8.3 mmol/L) for those having trouble with lower values, such as frequent hypoglycaemic events. Values above 400 mg/dl

(22.2 mmol/l) are sometimes accompanied by discomfort and frequent urination leading to dehydration. Values above 600 mg/dl (33.3mmol/L) usually require medical treatment and may lead to ketoacidosis

Hypoglycemia (<70mg/dl) may lead to seizures or episodes of unconsciousness and must be treated immediately, with oral glucose e.g. two lumps of sugar or half a bottle of mineral (coca cola, fanta, sprite etc.). In the unconscious blood sugar is likely to be below 50mg/dl and intravenous administration of 20mls of 50% dextrose is ideal treatment, or an injection of 1mg glucagon im.

4.2. Glycaemic Goals in Diabetes Patients

- Lowering A1C to below or around 7% has been shown to reduce microvascular and neuropathic complications of type 1 and type 2 diabetes. Therefore, for microvascular disease prevention, the A1C goal for non-pregnant adults in general is <7%.
- In type 1 and type 2 diabetes, randomized controlled trials of intensive versus standard Glycaemic control have not shown a significant reduction in CVD outcomes during the randomized portion of the trials. Long-term follow-up of the DCCT and UK Prospective Diabetes Study (UKPDS) cohorts suggests that treatment to A1C targets below or around 7% in the years soon after the diagnosis of diabetes is associated with long-term reduction in risk of macrovascular disease. Until more evidence becomes available, the general goal of <7% appears reasonable for many adults for macrovascular risk reduction.
- Conversely, less stringent A1C goals than the general goal of <7% may be appropriate for patients with a history of severe hypoglycemia, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions, and those with longstanding diabetes in whom the general goal is difficult to attain despite DSME, appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin.

4.3 Working in Partnership with the Patients (Patient-centred care)

Diabetes self management education (DSME) is delivered in a problem based approach that focuses on helping those with diabetes make informed self-management choices. Care of diabetes has shifted to an approach that is more patient centered and places the person living with diabetes at the center of decision making in the care model. Patient-centered care is respectful of and responsive to individual patient preferences, needs, and values and ensures that patient values guide all decision making.

Chapter Five

GESTATIONAL DIABETES MELLITUS

5.1 Definition

GDM is defined as any degree of glucose intolerance that begins or is first detected during pregnancy. Although most cases resolve with delivery, the definition applies whether or not the condition persists after pregnancy and does not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy.

5.2 General Information on GDM

Approximately 7% of all pregnancies (ranging from 1 to 14% depending on the population studied and the diagnostic tests employed) have GDM. Studies done in Nigeria show that incidence of diabetes mellitus (DM) among pregnant women was 1.7%. Pre-gestational diabetes accounted for 39% while gestational diabetes was responsible for 61% of cases.

The current consensus is that women with unequivocal GDM have a significant risk of adverse perinatal outcomes, and increased risk of later type 2 DM. Fetuses from pregnancies with GDM have a higher risk of macrosomia (associated with higher rate of birth injuries), asphyxia, neonatal hypoglycemia, and neonatal hyperinsulinemia. Uncontrolled GDM predisposes fetuses to accelerated and excessive fat accumulation, insulin resistance, pancreatic exhaustion secondary to prenatal hyperglycemia, and, possibly higher risk of child and adult obesity and type 2 DM later in adult life.

Because of the risks of GDM to the mother and neonate, screening and diagnosis are warranted. Women at high risk for GDM should be screened for diabetes as soon as possible after the confirmation of pregnancy.

At the first prenatal visit a GDM risk assessment is carried out

5.3 Screening for and Diagnosis of GDM

Criteria for very high risk are:

- Pre pregnancy BMI > 25kg/m²
- Prior history of GDM or delivery of large-for-gestational-age infant (weighing > 4kg or > 9lb at birth).
- Bad obstetric history (recurrent miscarriages, still birth, neonatal deaths, previous C/S)
- presence of glycosuria in index pregnancy
- Family history of DM in first degree relative or in 2 second degree relatives
- Grand multipara
- History of abnormal glucose tolerance (impaired FPG or IGT)
- diagnosis of Polycystic ovarian syndrome (PCOS)
- Systemic arterial Hypertension
- strong family history of type 2 diabetes
- member of an ethnic group with a high prevalence of diabetes (Nigerians inclusive)

All women of greater than low risk of GDM, including those above not found to have diabetes early in pregnancy, should undergo GDM testing at 24–28 weeks of gestation.

5.3.1 Low risk status, which does not require GDM screening, is defined as women with all of the following characteristics:

- age <25 years
- weight normal before pregnancy
- member of an ethnic group with a low prevalence of diabetes
- no known diabetes in first-degree relatives
- no history of abnormal glucose tolerance
- no history of poor obstetrical outcome

5.3.2 Testing for Gestational Diabetes

i. One-step approach

Perform a diagnostic OGTT without prior plasma or serum glucose screening. The one-step approach may be cost-effective in high-risk patients or populations (Nigeria inclusive).

ii. Two-step approach

Perform an initial screening by measuring the plasma or serum glucose concentration 1 h after a 50-g oral glucose load (glucose challenge test [GCT] and perform a diagnostic OGTT on that subset of women exceeding the glucose threshold value on the GCT. When the two-step approach is used, a glucose threshold value 140 mg/dl (7.8 mmol/l) identifies 80% of women with GDM, and the yield is further increased to 90% by using a cut-off 130 mg/dl (7.2mmol/l).

Table 5.1 – Diagnosis of GDM with a 100-g or 75-g glucose load

	mg/dl	mmol/l
100-g glucose load		
Fasting	95	5.3
1-h	180	10.0
2-h	155	8.6
3-h	140	7.8
75-g glucose load		
Fasting	95	5.3
1-h	180	10.0
2-h	155	8.6

Two or more of the venous plasma concentrations must be met or exceeded for a positive diagnosis.

The test should be done in the morning after an overnight fast of between 8 and 14 h and after at least 3 days of unrestricted diet (150 g carbohydrate per day) and unlimited physical activity. The subject should remain seated and should not smoke throughout the test.

With either approach, the diagnosis of GDM is based on an OGTT. Diagnostic criteria for the 100-g OGTT are derived from the original work of O'Sullivan and Mahan modified by Carpenter and Coustan and are shown at the top of Table 5.1. Alternatively, the diagnosis can be made using a 75-g glucose load and the glucose threshold values listed for fasting, 1 h, and 2 h (Table 5.1, bottom).

5.4 Recommendations

1. Screen for GDM using risk factor analysis and, if appropriate, use of an OGTT.
2. Women with GDM should be screened for diabetes 6–12 weeks postpartum and should be reclassified and followed up with subsequent screening for the development of diabetes or pre-diabetes. Of women with GDM, 14 – 60% will develop type 2 DM later in life, and 30-50% will have GDM with consecutive pregnancies.

5.5 Management of Gestational Diabetes

All women with GDM should receive nutritional counseling and be instructed in blood glucose self-monitoring and exercise. If blood glucose levels cannot be maintained in the normal range (fasting < 95 mg/dl and 1 h after meals < 130 mg/dl) insulin therapy should be initiated. Maternal and fetal monitoring is required in order to minimize maternal and fetal/neonatal morbidity and perinatal mortality. After delivery all women with GDM have to be re-evaluated as to their glucose tolerance by a 75 g OGTT (WHO criteria).

5.5.1 Goals for Glycaemic control for women with GDM

- a. Preprandial:** 95 mg/dl (5.3 mmol/l) and either
- 1-h postmeal: 140 mg/dl (7.8 mmol/l) or
 - 2-h postmeal: 120 mg/dl (6.7 mmol/l)

b. Women with pre-existing type 1 or type 2 diabetes who become pregnant; the following is recommended as optimal Glycaemic goals, if they can be achieved without excessive hypoglycemia:

- premeal, bedtime, and overnight glucose 60–99 mg/dl
- peak postprandial glucose 100–129 mg/dl
- A1C 6.0%

5.6 GDM: RECENT DEVELOPMENTS (HAPO Study)

- Important new evidence regarding the relationship between maternal glucose levels and fetal growth and pregnancy complications have emerged over the last 5 years following the publication of the Hyperglycaemia and Adverse Pregnancy Outcome (HAPO) Study.
- This study was designed to address the question of whether the risk of an adverse outcome for the baby can be related to degrees of maternal glucose intolerance below the established cut-off points for diabetes.
- Data from 23,316 women from 15 centres in 9 countries who underwent a 2-hour 75gm OGTT during the 24th to 32nd weeks of gestation were analysed to find the correlation, if any, of varying levels of maternal hyperglycaemia with predetermined primary and secondary outcomes.
- The primary outcomes included Birth Weight (BW) above the 90th centile for Gestational Age (GA), primary caesarean delivery, clinically diagnosed neonatal hypoglycaemia and cord-blood serum C-peptide levels above the 90th centile, while delivery before 37 weeks of gestation, shoulder dystocia or birth injury, need for neonatal intensive care, hyperbilirubinaemia and pre-eclampsia were the secondary outcomes.
- They noted that although there were no obvious thresholds at which risks increased, there were strong associations between levels of maternal glucose levels (not in the diabetic range) with the primary outcomes.
- The associations with the secondary outcomes were also significant but they tended to be weaker than with the primary outcomes.
- The multinational HAPO Study highlighted the important influence of maternal glycaemia on offspring BW, demonstrating a linear relationship b/w maternal FPG and OGTT at 1hr & 2hrs with BW \geq 90th percentile.
- The results indicate that it would be beneficial to both mother and baby to identify the presence of maternal glucose intolerance early enough so that treatment can be commenced as soon as possible.

- This is because the advantages of treatment in women with GDM have been proven in other large studies done about the same time as the HAPO trial.
- In March 2010, the International Association of Diabetes and Pregnancy Study Group (IADPSG) carefully considered the HAPO and other studies and released recommendations to guide the detection and diagnosis of GDM.
- This new guideline recommend the diagnosis of GDM once ≥ 1 glucose value reaches or exceeds the values quoted following 1 or 2-hour 75gm OGTT (see Table 5.2):

Table 5.2 THE IADPSG NEW DIAGNOSTIC CRITERIA FOR GDM

PROPOSED DIAGNOSTIC THRESHOLDS		
DIAGNOSIS	mmol/L	mg/dL
GDM		
FPG	5.1	92
1-hour Plasma Glucose	10.0	180
2-hour Plasma Glucose	8.5	153
Overt DM in PREG		
Fasting Plasma Glucose	7.0	126
HbA1c	$\geq 6.5\%$	
RPG	11.1	200

5.6.1 Highlights of the IADPSG Recommendations (2010)

- It represents a radical re-drawing of the diagnosis.
- Consensus recommends a one-step 75g OGTT for all women not already known to be diabetic at 24 – 28 weeks gestation.
- GDM is diagnosed where one or more threshold value is exceeded.
- Majority of patients can be identified by assessing FPG and 1hr values at OGTT.
- Increased number of women needing intervention e.g C/S
- Increase in women needing individualized care and more clinic visits.
- An advantage, because more clinic visits provide an opportunity for education, intervention and reduction in long-term complications of GDM.

- The ADA has also adopted the recommendations with effect from January 2011.
- Although, other researchers are concerned that this will likely lead to an increase in the number of women with a diagnosis of GDM and about the psychological consequences of the report of GDM on the women, the Australian study (Australian Carbohydrate Intolerance Study in Pregnant Women [ACHIOS]) found that women in the intervention group reported at 3-months post partum lower rates of depression and higher quality of life.

5.7 Management of DM in Pregnancy

Women with diabetes should also receive routine antenatal care offered other women in addition to specific care for their condition.

Apart from routine antenatal care, women with DM in pregnancy would need to have their blood sugar optimized:

- FPG: 4 – 6mmol/L
- 2-hr PPG: 6.1 -- 6.7mmol/L
- HbA1c: $\leq 6.0\%$

5.7.1 Rationale for Quality Care

- Both major malformations and pregnancy wastages can be reduced when excellent pre-pregnancy and early post-conception diabetic control are achieved, since organogenesis is essentially completed by 7 weeks gestation, often before the woman knows she is pregnant.

5.7.2 Medical Nutrition Therapy (Diet)

- Objective: Provide adequate caloric and nutrient needs during pregnancy while achieving desirable glycaemic targets without inducing excessive ketonuria, ketosis or postprandial hyperglycaemia.

Recommendations:

- Average weight gain allowed 12.5kg (2.5kg in 1st trimester and 5.0kg each in 2nd & 3rd trimesters).
- 25 kcals/kg/day
- CHO 35 – 40%
- Protein 20 – 25%
- Fat 35 – 40%
- Diet be tried for 2 weeks before adding insulin if the initial FPG is $\leq 95\text{mg/dl}$ (5.3mmol/L)

5.7.3 Exercise

- Has clear benefit
- Arm ergometry is safe and efficacious for sedentary, obese, unfit and aging pregnant women with DM

5.7.4 Oral Hypoglycaemic Agents & DM in Pregnancy

- Another recent issue in DM IN PREGNANCY is the reconsideration of oral hypoglycaemic agents (OHA) in its management.
- These agents are presently not recommended for use in pregnancy and diabetics who were being controlled on OHA are usually converted to insulin during pregnancy because of the theoretical risks to the fetus.
- The early agents were found to cross the placenta and induce fetal macrosomia and a state of severe hyperinsulinaemic hypoglycaemia in the neonate (by stimulating the pancreas).
- They were also associated with major congenital anomalies in animal studies.
- Different classes of OHA are available for the management of the T2DM patient.

These include:

- Sulphonylureas (e.g. chlorpropamide, tolbutamide, glibenclamide/glyburide and gliclazide)
- Non-sulphonylurea insulin secretagogues
- (e.g. repaglinide)
- Biguanides (e.g. Metformin)
- α -Glucosidase inhibitors (e.g. acarbose, Voglibose)
- Thiazolidinediones (e.g. Pioglitazone).

Glibenclamide

- A total of 404 women with GDM were randomized to receive either **Glyburide** or insulin in a study by Langer *et al*.
- Near normoglycaemic levels were achieved equally well with either regimen, with no difference in the rate of fetal macrosomia. Glyburide was not detected in the cord serum of any baby and there were no apparent neonatal complications referable to the agent.
- The rates of neonatal hypoglycaemia and admissions to the neonatal intensive care units were similar. However, a follow-up study by Conway *et al* showed that women with FBG>110mg/dL did not adequately respond to glyburide therapy.
- Both NICE and CDA include Glibenclamide as an option for DM in pregnancy but is not licensed for this indication.

METFORMIN

- On the other hand, **Metformin** has not shown such success.
- Although it has been reported to reduce the incidence of gestational diabetes in women who use the drug throughout pregnancy, studies have demonstrated adverse outcomes with its use, including an increase in neonatal jaundice, increased incidence of pre-eclampsia and perinatal mortality rates, more neonatal hypoglycaemia cases and higher caesarean section rates when compared with insulin.
- Both NICE and CDA include metformin as an option for treatment of GDM and NICE also includes metformin as an option for T2DM in pregnancy with the proviso that it is not licensed for this indication.

Acarbose

- Not recommended and should be avoided during pregnancy.

Thiazolidinediones

- Manufacturers advise pregnant women to avoid them.

Generally, if these OHAs offered effective glycaemic control without risks to the fetus, they would potentially be preferred. This is because the patient will be able to continue on their existing therapy, the ease of administration (tablets) and storage, convenience, cost, patient compliance and safety considerations (use of needles).

5.7.5 Insulin

Is the Gold-standard in the treatment of pregnant women with Pre-Gestational DM & GDM especially those who fail diet and lifestyle modification.

Table 5.3 Starting Total Daily Insulin during Pregnancy

Weeks (Gestation)	Total Daily Insulin
Week 1 – 18	0.7 U/kg actual body weight
Weeks 18 – 26	0.8 U/kg actual body weight
Weeks 26 – 36	0.9 U/kg actual body weight
Weeks 36 – 40	1.0 U/kg actual body weight

5.8 Concluding Remarks:

- Until recently, despite four decades of research, there has been no consensus on the diagnostic criteria for gestational diabetes mellitus (GDM) and whether screening is of any value or not.
- This had led to difficulties in blending research findings from different countries due to the application of different diagnostic criteria in these studies.
- Since large studies have shown benefits to the mother and baby when GDM is treated, the need for early detection and diagnosis then becomes more obvious.
- The publication of the Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) Study and the recommendations by the International Association of Diabetes and Pregnancy Study Group (IADPSG) appear to have set the stage for more uniform and globally accepted criteria for the diagnosis of GDM.
- Various authoritative bodies around the world (IDF, WHO etc) are expected to adopt these criteria and translate the recommendations into local practice.
- Also, a new interest appears to be developing in the use of oral anti-diabetic agents in the management of GDM. Due to their relatively lower cost, ease of administration and effective glucose-lowering abilities, they could find a place in the treatment of GDM if adverse neonatal complications can be safely excluded.

Chapter Six

MANAGEMENT OF DIABETIC KETOACIDOSIS (DKA)/ HYPEROSMOLAR HYPERGLYCAEMIC STATE

6.1 Introduction

Diabetic KetoAcidosis (DKA) is caused by reduced insulin levels, decreased glucose use, and increased gluconeogenesis from elevated counter regulatory hormones, including catecholamines, glucagon, and cortisol. DKA primarily affects patients with type 1 diabetes, but also may occur in patients with type 2 diabetes, and is most often caused by omission of treatment, infection or alcohol

A diagnosis of diabetic ketoacidosis requires the patient's plasma glucose concentration to be above 250 mg per dL (although it usually is much higher), the pH level to be less than 7.30, and the bicarbonate level to be 18 mEq per L or less. Beta-hydroxybutyrate is a better measurement of the degree of ketosis than serum ketones. Intravenous insulin and fluid replacement are the mainstays of therapy, with careful monitoring of potassium levels. Bicarbonate therapy rarely is needed. Infection, insulin omission, and other problems that may have precipitated ketoacidosis should be treated.

6.2 Causes of Diabetic Ketoacidosis

- Infection, particularly pneumonia, urinary tract infection, and sepsis
- Inadequate insulin treatment or noncompliance
- New-onset diabetes
- Cardiovascular disease, particularly myocardial infarction
- Selected drugs that may contribute to diabetic ketoacidosis
 - Atypical antipsychotic agents
 - Corticosteroids

Table 6.1 Diagnostic Criteria**Diagnostic Criteria for Diabetic Ketoacidosis and Hyperosmolar HyperGlycaemic State**

	Mild DKA	Moderate DKA	Severe DKA	HHS
Plasma glucose (mg per dL [mmol per L])	> 250 (13.9)	> 250	> 250	> 600 (33.3)
Arterial Ph	7.25 to 7.30	7.00 to 7.24	< 7.00	> 7.30
Serum bicarbonate (mmol/L)	15 to 18	10 to < 15	< 10	> 15
Urine ketones	Positive	Positive	Positive	Small
Serum ketones -hydroxybutyrate	Positive High	Positive High	Positive High	Small Normal or elevated
Effective serum osmolality (mOsm per kg)*	Variable	Variable	Variable	> 320
Anion gap†	> 10	> 12	> 12	Variable
Alteration in sensorium or mental obtundation	Alert	Alert/drowsy	Stupor/coma	Stupor/coma

DKA = diabetic ketoacidosis; HHS = hyperosmolar hyperGlycaemic state.

*-Effective serum osmolality = $2 \times \text{measured Na (mEq per L)} + (\text{glucose [mg per dL]} \div 18)$.

†-Anion gap = $\text{Na}^+ - (\text{Cl}^- + \text{HCO}_3^- [\text{mEq per L}])$.

Adapted from Kitabchi AE, Umpierrez GE, Murphy MB, Barrett EJ, Kreisberg RA, Malone JI, et al. HyperGlycaemic crises in diabetes. Diabetes Care 2004;27(suppl 1):S95,

6.3. Pathogenesis of DKA

The most severe and life threatening complication of poorly controlled diabetes is diabetic ketoacidosis (DKA). DKA is characterized by metabolic acidosis, hyperglycemia and hyperketonemia. Diagnosis of DKA is accomplished by detection of hyperketonemia and metabolic acidosis (as measured by the anion gap) in the presence of hyperglycemia.

The anion gap refers to the difference between the concentration of cations other than sodium and the concentration of anions other than chloride and bicarbonate. The anion gap therefore, represents an artificial assessment of the unmeasured ions in plasma. Calculation of the anion gap involves sodium (Na^+), chloride (Cl^-) and bicarbonate (HCO_3^-) measurements and it is defined as $[\text{Na}^+ - (\text{Cl}^- + \text{HCO}_3^-)]$ where the sodium and chloride concentrations are measured as mEq/L and the bicarbonate concentration is mmol/L. The anion gap will increase when the concentration of plasma K^+ , Ca^{2+} , or Mg^{2+} is decreased, when organic ions such as lactate are increased (or foreign anions accumulate), or when the concentration or charge of plasma proteins increases. Normal anion gap is between 8-12mEq/L and a higher number is diagnostic of metabolic acidosis. Rapid and aggressive treatment is necessary as the metabolic acidosis will result in cerebral edema and coma eventually leading to death.

The hyperketonemia in DKA is the result of insulin deficiency and unregulated glucagon secretion from α -cells of the pancreas. Circulating glucagon stimulates the adipose tissue to release fatty acids stored in triglycerides. The free fatty acids enter the circulation and are taken up primarily by the liver where they undergo fatty acid oxidation to acetylCoA. Normally, acetyl CoA is completely oxidized to CO_2 and water in the TCA cycle. However, the level of fatty acid oxidation is in excess of the liver's ability to fully oxidize the excess acetyl CoA and, thus, the compound is diverted into the ketogenesis pathway. The ketones (ketone bodies) are β -hydroxybutyrate and acetoacetate with β -hydroxybutyrate being the most abundant. Acetoacetate will spontaneously (non-enzymatic) decarboxylate to acetone. Acetone is volatile and is released from the lungs giving the characteristic sweet smell to the breath of someone with hyperketonemia. The ketones are released into the circulation and because they are acidic lower the pH of the blood resulting in metabolic acidosis.

Insulin deficiency also causes increased triglyceride and protein metabolism in skeletal muscle. This leads to increased release of glycerol (from triglyceride metabolism) and alanine (from protein metabolism) to the circulation. These substances then enter the

liver where they are used as substrates for gluconeogenesis which is enhanced in the absence of insulin and the elevated glucagon. The increased rate of glucose production in the liver, coupled with the glucagon-mediated inhibition of glucose storage into glycogen results in the increased glucose release from the liver and consequent hyperglycemia. The resultant hyperglycemia produces an osmotic diuresis that leads to loss of water and electrolytes in the urine. The ketones are also excreted in the urine and this results in an obligatory loss of Na^+ and K^+ . The loss in K^+ is large, sometimes exceeding 300 mEq/L/24 h. Initial serum K^+ is typically normal or elevated because of the extracellular migration of K^+ in response to the metabolic acidosis. The level of K^+ will fall further during treatment as insulin therapy drives K^+ into cells. If serum K^+ is not monitored and replaced as needed, life-threatening hypokalemia may develop.

6.4. Signs and Symptoms of DKA

Diabetic ketoacidosis can develop in less than 24 hours. Patients with DKA usually present with polyuria, polydipsia, polyphagia, weakness, and Kussmaul's respiration. Nausea and vomiting are present in 50-80% of patients, and abdominal pain is present in about 30%. Coffee-ground emesis, usually from hemorrhagic gastritis, occurs in about 25% of vomiting patients. Often, the patient's breath will have a fruity odor. Body temperature usually is normal or low, even with an infection. If the patient's temperature is elevated, infection invariably is present. Signs of dehydration, such as dry mucous membrane, tachycardia, and hypotension, often are found. Most patients are about 10% dehydrated. Consciousness ranges from alert to confused to a comatose state in less than 20% of patients

6.5. Standard Laboratory Assessment for Patients with Diabetic Ketoacidosis

Plasma glucose

Electrolytes with calculated anion gap and effective osmolality

Blood urea nitrogen and creatinine

-hydroxybutyrate or serum ketones if not available

Complete urinalysis with urine ketones by dipstick

Arterial blood gas or venous pH level if not available

Complete blood count with differential

Electrocardiography

if indicated

Bacterial cultures of urine, blood, throat, or other sites of suspected infection

Chest radiography if pneumonia or cardiopulmonary disease is suspected.

A1C level may help determine whether this is an acute episode in a patient with well-controlled, undiagnosed, or poorly controlled diabetes

The severity of DKA is determined primarily by the pH level, bicarbonate level, and mental status, and not by the blood glucose measurement. Although the bicarbonate level typically is low, it may be normal or high in patients with vomiting, diuretic use, or alkali ingestion. If the serum osmolality is less than 320 mOsm per kg (320 mmol per kg), etiologies other than DKA should be considered. Osmolality can be calculated using the formula for effective osmolality (mOsm per kg):

$$2 \times \text{Na}^+ (\text{mmol/L}) + \frac{\text{plasma glucose (mg/dL)}}{18}$$

In this equation, Na^+ is the serum sodium level. Although potassium is included in some formulas, it is not included in the formula recommended by the ADA. Blood urea nitrogen is not included in this measurement because urea has less osmotic activity.

Treatment of DKA is a medical emergency and should be treated as such in the hospital with frequent monitoring and charting of both treatment and blood glucose and vital signs. A priority of treatment should be to protect and maintain the airway, particularly in the obtunded patient. Attention to airways and respiration is of paramount importance in the unconscious, and to treat shock if present. Blood glucose should be evaluated every one to two hours until the patient is stable, the blood urea nitrogen, serum creatinine, sodium, potassium, bicarbonate levels should be monitored every two to six hours depending on the severity of DKA. Cardiac monitoring may be warranted for patients with significant electrolyte disturbances. Treatment also should be directed at the underlying cause of the DKA, including antibiotics for suspected or identified infection. Although it is important to monitor urinary output, urinary catheterization is not advised routinely.

6.6 Fluids

Fluid deficits are typically 100 mL per kg of body weight. Fluid replacement alone will lower blood glucose. Studies have found that during the first four hours of therapy for DKA, up to 80% of the decline in glucose concentration may be caused by rehydration. Normal saline is the ideal replacement fluid or half normal saline in the case of HHS. The first litre of fluid is given fast in half an hour, second litre in one hr, third litre in 2 hrs, 4th litre in 3hrs and then a litre 4hrly till patient is adequately rehydrated. Patients who are able to drink can take some or all of their fluid replacement orally. Fluid intake should be modified based on urinary output and cardiac status. Urinary output will decrease as the osmotic diuretic effect of hyperglycemia is reduced.

6.7 Insulin therapy

Regular insulin is commenced at a dose of 20iu iv start followed by hrly low dose of 5-10iu. With this regime blood glucose drops at an approximate rate of 50mg per hour.

6.8 DKA versus Hyperosmolar HyperGlycaemic State

Diagnostic criteria: blood glucose > 250 mg per dL, venous pH < 7.3, bicarbonate < 15 mmol/L, moderate ketonuria or ketonemia.

6.8.1 Hyperosmolar HyperGlycaemic State

Diagnostic criteria: blood glucose > 600 mg per dL, venous pH > 7.3, bicarbonate > 15 mEq per L, and altered mental status or severe dehydration.

6.9 Management of DKA

After the initial history and physical examination, immediately obtain blood glucose, electrolytes, blood urea nitrogen, creatinine, urine for urinalysis. When the blood glucose level has dropped below 250 mg per dL, the patient may be given fluid with 5% Dextrose, such as 0.45 normal saline. If dextrose is not given, further ketosis may occur.

6.9.1 Insulin

An intravenous insulin drip is the current standard of care for diabetic ketoacidosis, primarily because of the more rapid onset of action. Insulin may be mixed in a standard concentration of 1 U per 10 mL of normal saline. Common adult rates are 5 to 7 U per hour. A standard regimen is given till the blood glucose is 250mg/dl. When the blood glucose level is less than 250 mg per dL, the intravenous insulin rate usually is decreased, or the patient is switched to subcutaneous insulin to maintain plasma glucose in the range of 150 to 200 mg per dL (8.3 to 11.1 mmol per L) until metabolic control is achieved.

6.9.2 Potassium

Serum potassium levels can be low, normal, or high. A potassium level reflects both egress of potassium from cells secondary to the existing acidosis and the degree of intravascular contraction. Because of this and other circumstances, a normal or high serum potassium level does not reflect the actual total-body deficits of potassium that uniformly exist secondary to the ongoing osmotic diuresis. An initial low potassium concentration attests to severe depletion and should be managed aggressively.

Potassium should be started as soon as adequate urine output is confirmed. Usually 20 to 30mmol of potassium is given for each litre of first 3 litre fluid replacement. If the potassium level is less than 3.3mmol per L, potassium replacement should be given immediately and insulin should be started only after the potassium level is above 3.3mmol/L.

6.9.3 Bicarbonate

Studies of patients with a pH level of 6.9 or higher have found no evidence that bicarbonate is beneficial, and some studies have suggested bicarbonate therapy may be harmful for these patients. Bicarbonate therapy lowers potassium levels; therefore, potassium needs to be monitored carefully. Selected patients with mild ketoacidosis who are alert and taking oral fluids may be treated under observation and sent home without hospital admission.

6.10 Common Complications of DKA

These include hypoglycemia, hypokalemia, and recurrent hyperglycemia. These may be minimized by careful monitoring. Hyperchloremia is a common but transient finding that usually requires no special treatment. Cerebral edema is a rare but important complication of DKA. Although it can affect adults, it is more common in young patients, occurring in 0.7 to 1.0 percent of children with DKA. Early signs of cerebral edema include headache, confusion, and lethargy. Papilledema, hypertension, hyperpyrexia, and diabetes insipidus also may occur. Patients typically improve mentally with initial treatment of DKA, but then suddenly worsen. Dilated ventricles may be found on CT or magnetic resonance imaging. Treatment of suspected cerebral edema should not be delayed for these tests to be completed. In more severe cases, seizures, pupillary changes, and respiratory arrest with brain-stem herniation may occur. Once severe symptoms occur, the mortality rate is greater than 70 percent, and only about 10 percent of patients recover without sequelae. Avoiding overhydration and limiting the rate at which the blood glucose level drops may reduce the chance of cerebral edema. However, some patients may present with cerebral edema before treatment is started. About 10 percent of the patients initially diagnosed with cerebral edema have other intracranial pathology such as subarachnoid hemorrhage. Mannitol therapy and hyperventilation have been recommended based on limited evidence.

6.11 Transition to Standard Regimen and Prevention of Recurrence

A blood glucose concentration of less than 200 mg per dL, a bicarbonate level of 18 mmol/L or greater, and a venous pH level of greater than 7.3 indicate that the DKA has resolved. Typical duration of therapy is about 48 hours. If the patient can eat when DKA has resolved, a standard subcutaneous insulin regimen by injection should be started. Intravenous insulin should continue for one to two hours after initiation of subcutaneous insulin. For patients who are unable to eat, intravenous insulin may be continued to maintain the blood glucose in a target range (i.e., 80 to 140 mg per dL [4.4 to 7.8 mmol per L]). Prevention of another episode should be part of the treatment of DKA. Most patients with DKA will need lifetime insulin therapy after discharge from the hospital. Education about diabetes is a cornerstone of prevention that also has been found to reduce length of stay.

6.12 Strategies for prevention of DKA

These include: Patients education, Blood sugar monitoring, Sick day monitoring of blood sugar, and increasing insulin dosage instead of omitting insulin. Easily digestible diet eg pap when sick. Signs to watch out for and when to seek help in the hospital.

Chapter Seven

DIABETES AND COMMON CO-MORBIDITIES

7.1 Cardiovascular disease (CVD)

CVD is the major cause of morbidity and mortality for individuals with diabetes and the largest contributor to the direct and indirect costs of diabetes. The common conditions coexisting with type 2 diabetes (e.g., hypertension and dyslipidemia) are clear risk factors for CVD, and diabetes itself confers independent risk. Numerous studies have shown the efficacy of controlling individual cardiovascular risk factors in preventing or slowing CVD in people with diabetes. Large benefits are seen when multiple risk factors are addressed globally, viz: hypertension, dyslipidaemia, aspirin therapy, and smoking cessation in people with diabetes.

7.1.1 Diabetes and Hypertention

a. Screening and diagnosis

- Blood pressure should be measured at every routine diabetes visit. Patients found to have a systolic blood pressure of 130 mmHg or a diastolic blood pressure of 80 mmHg should have blood pressure confirmed on a separate day. Repeat systolic blood pressure of >130 mmHg or diastolic blood pressure of >80 mmHg confirms a diagnosis of hypertension.

b. Goals

- Patients with diabetes should be treated to a systolic blood pressure <130 mmHg.
- Patients with diabetes should be treated to a diastolic blood pressure <80 mmHg.

c. Treatment

- Patients with a systolic blood pressure of 130–139 mmHg or a diastolic blood pressure of 80–89 mmHg may be given lifestyle therapy alone for a maximum of 3 months and then, if targets are not achieved, be treated with the addition of pharmacological agents.
- Patients with more severe hypertension (systolic blood pressure 140 mmHg or diastolic blood pressure 90 mmHg) at diagnosis or follow-up should

receive pharmacologic therapy in addition to lifestyle therapy. (A)

- Pharmacologic therapy for patients with diabetes and hypertension should be with a regimen that includes either an ACE inhibitor or an angiotensin receptor blocker (ARB). If one class is not tolerated, the other should be substituted. If needed to achieve blood pressure targets, a thiazide diuretic should be added to those with an estimated GFR ≥ 30 ml/min per 1.73 m^2 and a loop diuretic for those with an estimated GFR <30 ml/min per 1.73 m^2 .
- Multiple drug therapy (two or more agents at maximal doses) is generally required to achieve blood pressure targets.
- If ACE inhibitors, ARBs, or diuretics are used, kidney function and serum potassium levels should be closely monitored.
- In pregnant patients with diabetes and chronic hypertension, blood pressure target goals of 110–129/65–79 mmHg are suggested in the interest of long-term maternal health and minimizing impaired fetal growth. ACE inhibitors and ARBs are contraindicated during pregnancy.

Hypertension is a common comorbidity of diabetes, affecting the majority of patients, with prevalence depending on type of diabetes, age, obesity, and ethnicity. Hypertension is a major risk factor for both CVD and microvascular complications. In type 1 diabetes, hypertension is often the result of underlying nephropathy, while in type 2 it usually coexists with other cardiometabolic risk factors.

7.1.2 Blood Pressure Measurement

Measurement of blood pressure in the office should be done by a trained individual. Measurement in the seated position, with feet on the floor and arm supported at heart level, after 5 min of rest. Cuff size should be appropriate for the upper arm circumference. Elevated values should be confirmed on a separate day. Because of the clear synergistic risks of hypertension and diabetes, the diagnostic cutoff for a diagnosis of hypertension is lower in people with diabetes (blood pressure $\geq 130/80$) than in those without diabetes (blood pressure $\geq 140/90$ mmHg) .

Home blood pressure self-monitoring and 24-h ambulatory blood pressure monitoring may provide additional evidence of “white coat” and masked hypertension and other discrepancies between office and “true” blood pressure, and studies in nondiabetic populations show that home measurements may better correlate with CVD risk than office measurements..

7.2 Treatment goals

Randomized clinical trials have demonstrated the benefit (reduction of CHD events, stroke, and nephropathy) of lowering blood pressure to <140 mmHg systolic and <80 mmHg diastolic in individuals with diabetes. Epidemiologic analyses show that blood pressure >115/75 mmHg is associated with increased cardiovascular event rates and mortality in individuals with diabetes. Therefore, a target blood pressure goal of <130/80 mmHg is reasonable if it can be safely achieved.

7.3 Treatment strategies

Although there are no well-controlled studies of diet and exercise in the treatment of hypertension in individuals with diabetes, studies in nondiabetic individuals have shown anti-hypertensive effects similar to pharmacologic monotherapy of reducing sodium intake and excess body weight; increasing consumption of fruits, vegetables, and low-fat dairy products; avoiding excessive alcohol consumption; and increasing activity levels. These nonpharmacological strategies may also positively affect glycemia and lipid control.

Lowering of blood pressure with regimens based on a variety of antihypertensive drugs, including ACE inhibitors, ARBs, β -blockers, diuretics, and calcium channel blockers, has been shown to be effective in reducing cardiovascular events. There is an advantage on cardiovascular outcomes of initial therapy with low-dose thiazide diuretics

In people with diabetes, inhibitors of the renin-angiotensin system (RAS) may have unique advantages for initial or early therapy of hypertension. In a nonhypertension trial of high-risk individuals, including a large subset with diabetes, an ACE inhibitor reduced CVD outcomes. In patients with congestive heart failure (CHF), including diabetic subgroups, ARBs have been shown to reduce major CVD outcomes, and in type 2 patients with significant nephropathy, ARBs were superior to calcium channel blockers for reducing heart failure. The compelling benefits of RAS inhibitors in diabetic patients with albuminuria or renal insufficiency provide additional rationale for use of these agents.

Most patients with hypertension require multi-drug therapy to reach treatment goals, especially diabetic patients whose targets are lower. Many patients will require three or more drugs to reach target goals. If blood pressure is refractory to multiple agents, clinicians should consider an evaluation for secondary forms of hypertension.

During pregnancy in diabetic women with chronic hypertension, target blood pressure goals of systolic blood pressure 110–129 mmHg and diastolic blood pressure 65–79 mmHg are reasonable, as they contribute to long-term maternal health. Lower blood pressure levels

may be associated with impaired fetal growth. During pregnancy, treatment with ACE inhibitors and ARBs is contraindicated, since they are likely to cause fetal damage. Antihypertensive drugs known to be effective and safe in pregnancy include methyldopa, labetalol, diltiazem, clonidine, and prazosin. Chronic diuretic use during pregnancy has been associated with restricted maternal plasma volume, which might reduce uteroplacental perfusion.

7.4 Diabetes Dyslipidaemia/Lipid Management

7.4.1 Recommendations

- In most adult patients, measure fasting lipid profile at least annually. In adults with low-risk lipid values (LDL cholesterol <100 mg/dl, HDL cholesterol >50 mg/dl, and triglycerides <150 mg/dl), lipid assessments may be repeated every 2 years. (E)

7.4.2 Treatment goals

- Lifestyle modification focusing on the reduction of saturated fat, *trans* fat, and cholesterol intake and increased intake of fruits and vegetables; weight loss (if indicated); and increased physical activity should be recommended to improve the lipid profile in patients with diabetes.
- Statin therapy should be added to lifestyle therapy, regardless of baseline lipid levels, for diabetic patients:
 - with overt CVD
 - Without CVD who are over the age of 40 and have one or more other CVD risk factors.
- For lower-risk patients than the above (e.g., without overt CVD and under the age of 40), statin therapy should be considered in addition to lifestyle therapy if LDL cholesterol remains above 100 mg/dl or in those with multiple CVD risk factors.
- In individuals without overt CVD, the primary goal is an LDL cholesterol <100 mg/dl (2.6 mmol/l). (A)
- In individuals with overt CVD, a lower LDL cholesterol goal of <70 mg/dl (1.8 mmol/l), using a high dose of a statin, is an option.
- If drug-treated patients do not reach the above targets on maximal tolerated statin therapy, a reduction in LDL cholesterol of ~30–40% from baseline is an alternative therapeutic goal.

- Triglycerides levels <150 mg/dl (1.7 mmol/l) and HDL cholesterol >40 mg/dl (1.0 mmol/l) in men and >50 mg/dl (1.3 mmol/l) in women are desirable. However, LDL cholesterol–targeted statin therapy remains the preferred strategy.
- If targets are not reached on maximally tolerated doses of statins, combination therapy using statins and other lipid-lowering agents may be considered to achieve lipid targets but has not been evaluated in outcome studies for either CVD outcomes or safety.
- Statin therapy is contraindicated in pregnancy.

7.4.3 Dyslipidemia treatment and target lipid levels

For most patients with diabetes, the first priority of dyslipidemia therapy (unless severe hypertriglyceridemia is the immediate issue) is to lower LDL cholesterol to a target goal of <100 mg/dl (2.60 mmol/l)). Lifestyle intervention, including MNT, increased physical activity, weight loss, and smoking cessation, may allow some patients to reach lipid goals. Nutrition intervention should be tailored according to each patient's age, type of diabetes, pharmacological treatment, lipid levels, and other medical conditions and should focus on the reduction of saturated fat, cholesterol, and *trans* unsaturated fat intake. Glycaemic control can also beneficially modify plasma lipid levels, particularly in patients with very high triglycerides and poor Glycaemic control.

In those with clinical CVD or over age 40 with other CVD risk factors, pharmacological treatment should be added to lifestyle therapy regardless of baseline lipid levels. Statins are the drugs of choice for LDL cholesterol lowering.

a. Alternative LDL cholesterol goals

Virtually all trials of statins and CVD outcomes have tested specific doses of statins against placebo, other doses of statin, or other statins, rather than aiming for specific LDL cholesterol goals. As can be seen in placebo-controlled trials, statins generally achieved LDL cholesterol reductions of 30–40% from baseline.

Recent clinical trials in high-risk patients, such as those with acute coronary syndromes or previous cardiovascular events, have demonstrated that more aggressive therapy with high doses of statins to achieve an LDL cholesterol of <70 mg/dl led to a significant reduction in further events. Therefore, a reduction in LDL cholesterol to a goal of <70 mg/dl is an option in very-high-risk diabetic patients with overt CVD.

b. Treatment of other lipoprotein fractions or targets

Severe hypertriglyceridemia may warrant immediate therapy of this abnormality with lifestyle and usually pharmacologic therapy (fibric acid derivative or niacin) to reduce the risk of acute pancreatitis. In the absence of severe hypertriglyceridemia, therapy targeting HDL cholesterol or triglycerides has intuitive appeal but lacks the evidence base of statin therapy. If the HDL cholesterol is <40 mg/dl and the LDL cholesterol is between 100 and 129 mg/dl, niacin might be used, especially if a patient is intolerant to statins. Niacin is the most effective drug for raising HDL cholesterol. It can significantly increase blood glucose at high doses, but recent studies demonstrate that at modest doses (750–2,000 mg/day), significant improvements in LDL cholesterol, HDL cholesterol, and triglyceride levels are accompanied by only modest changes in glucose that are generally amenable to adjustment of diabetes therapy.

Combination therapy, with a statin and a fibrate or a statin and niacin, may be efficacious for treatment for all three lipid fractions, but this combination is associated with an increased risk for abnormal transaminase levels, myositis, or rhabdomyolysis. The risk of rhabdomyolysis is higher with higher doses of statins and with renal insufficiency and seems to be lower when statins are combined with fenofibrate than gemfibrozil.

7.5 Antiplatelet agents

Recommendations

- Use aspirin therapy (75–162 mg/day) as a primary prevention strategy in those with type 1 or type 2 diabetes at increased cardiovascular risk, including those who are >40 years of age or who have additional risk factors (family history of CVD, hypertension, smoking, dyslipidemia, or albuminuria).
- Use aspirin therapy (75–162 mg/day) as a secondary prevention strategy in those with diabetes with a history of CVD.
- For patients with CVD and documented aspirin allergy, clopidogrel (75 mg/day) should be used.
- Combination therapy with ASA (75–162 mg/day) and clopidogrel (75 mg/day) is reasonable for up to a year after an acute coronary syndrome.
- Aspirin therapy is not recommended in people under 30 years of age due to lack of evidence of benefit and is contraindicated in patients under the age of 21 years because of the associated risk of Reye's syndrome.

Several clinical trials demonstrate the efficacy of using aspirin as a preventive measure for cardiovascular events, including stroke and myocardial infarction. Many trials have shown an ~30% decrease in myocardial infarction and a 20% decrease in stroke in a wide range of patients, including young and middle-aged patients, patients with and without a history of CVD, men and women, and patients with hypertension.

7.6 Smoking Cessation

Recommendations

- Advise all patients not to smoke.
- Include smoking cessation counseling and other forms of treatment as a routine component of diabetes care.

Smoking is related to the premature development of microvascular complications of diabetes and may have a role in the development of type 2 diabetes.

A number of large randomized clinical trials have demonstrated the efficacy and cost-effectiveness of smoking cessation counseling in changing smoking behavior and reducing tobacco use. The routine and thorough assessment of tobacco use is important as a means of preventing smoking or encouraging cessation. Special considerations should include assessment of level of nicotine dependence, which is associated with difficulty in quitting and relapse.

7.7. Diabetes and Coronary Heart Disease (CHD) Screening/Treatment Recommendations

- In asymptomatic patients, evaluate risk factors to stratify patients by 10-year risk, and treat risk factors accordingly.

7.7.1 Treatment

- In patients with known CVD, ACE inhibitor, aspirin, and statin therapy (if not contraindicated) should be used to reduce the risk of cardiovascular events.
- In patients with a prior myocardial infarction, add β -blockers (if not contraindicated) to reduce mortality.
- In patients >40 years of age with another cardiovascular risk factor (hypertension, family history, dyslipidemia, microalbuminuria, cardiac autonomic neuropathy, or smoking), aspirin and statin therapy (if not contraindicated) should be used to reduce the risk of cardiovascular events.
- In patients with CHF, TZD use is contraindicated.
- Metformin may be used in patients with stable CHF if renal function is normal. It should be avoided in unstable or hospitalized patients with CHF.

Chapter Eight

CHRONIC COMPLICATIONS OF DIABETES

8.1 Nephropathy: Screening and Treatment

Diabetic nephropathy occurs in 20–40% of patients with diabetes and is the single leading cause of end-stage renal disease (ESRD). Persistent albuminuria in the range of 30–299 mg/24 hrs (microalbuminuria) has been shown to be the earliest stage of diabetic nephropathy in type 1 diabetes and a marker for development of nephropathy in type 2 diabetes. Microalbuminuria is also a well-established marker of increased CVD risk. Patients with microalbuminuria who progress to macroalbuminuria (300mg/24h) are likely to progress to ESRD. However, a number of interventions have been demonstrated to reduce the risk and slow the progression of renal disease

8.1.1 General recommendations

- To reduce the risk or slow the progression of nephropathy, optimize glucose control.
- To reduce the risk or slow the progression of nephropathy, optimize blood pressure control.

8.1.2 Screening

- Perform an annual test to assess urine albumin excretion in type 1 diabetic patients with diabetes duration of 5 years and in all type 2 diabetic patients, starting at diagnosis.
- Measure serum creatinine at least annually in all adults with diabetes regardless of the degree of urine albumin excretion. The serum creatinine should be used to estimate GFR and stage the level of chronic kidney disease (CKD), if present.

8.1.3 Treatment

- In the treatment of the nonpregnant patient with micro- or macroalbuminuria, either ACE inhibitors or ARBs should be used.
- While there are no adequate head-to-head comparisons of ACE inhibitors and ARBs, but there is clinical trial support for each of the following statements:

- In patients with type 1 diabetes, hypertension, and any degree of albuminuria, ACE inhibitors have been shown to delay the progression of nephropathy.
- In patients with type 2 diabetes, hypertension, and microalbuminuria, both ACE inhibitors and ARBs have been shown to delay the progression to macroalbuminuria.
- In patients with type 2 diabetes, hypertension, macroalbuminuria, and renal insufficiency (serum creatinine >1.5 mg/dl), ARBs have been shown to delay the progression of nephropathy.
- If one class is not tolerated, the other should be substituted.
- Reduction of protein intake to 0.81g/kgbw/day in individuals with diabetes and the earlier stages of CKD and to 0.8g/kgbw/day in the later stages of CKD may improve measures of renal function (urine albumin excretion rate, GFR) and is recommended.
- When ACE inhibitors, ARBs, or diuretics are used, monitor serum creatinine and potassium levels for the development of acute kidney disease and hyperkalemia.
- Continued monitoring of urine albumin excretion to assess both response to therapy and progression of disease is recommended.
- Consider referral to a physician experienced in the care of kidney disease when there is uncertainty about the etiology of kidney disease (active urine sediment, absence of retinopathy, rapid decline in GFR), difficult management issues, or advanced kidney disease.

Intensive diabetes management with the goal of achieving near normoglycemia has been shown in large prospective randomized studies to delay the onset of microalbuminuria and the progression of micro- to macroalbuminuria in patients with type 1 and type 2 diabetes. The UKPDS provided strong evidence that control of blood pressure can reduce the development of nephropathy. In addition, large prospective randomized studies in patients with type 1 diabetes have demonstrated that achievement of lower levels of systolic blood pressure (<140 mmHg) resulting from treatment using ACE inhibitors provides a selective benefit over other antihypertensive drug classes in delaying the progression from micro- to macroalbuminuria and can slow the decline in GFR in patients with macroalbuminuria. In type 2 diabetes with hypertension and normoalbuminuria, ACE inhibition has been demonstrated to delay progression to microalbuminuria.

In addition, ACE inhibitors have been shown to reduce major CVD outcomes (i.e., myocardial infarction, stroke, death) in patients with diabetes, thus further supporting the use of these agents in patients with microalbuminuria, a CVD risk factor. ARBs have also been shown to reduce the rate of progression from micro- to macroalbuminuria as well as ESRD in patients with type 2 diabetes. Some evidence suggests that ARBs have a smaller magnitude of rise in potassium compared with ACE inhibitors in people with nephropathy. It is important to note that the benefits of both ACE inhibitors and ARBs in those with diabetic nephropathy are strongly associated with the reduction in albuminuria. Combinations of drugs that block the rennin-angiotensin-aldosterone system (e.g., an ACE inhibitor plus an ARB, a mineralocorticoid antagonist, or a direct renin inhibitor) have been shown to provide additional lowering of albuminuria. However, the long-term effects of such combinations on renal or cardiovascular outcomes from large clinical trials is not favourable.

Other drugs, such as diuretics, calcium channel blockers, and β -blockers, should be used as additional therapy to further lower blood pressure in patients already treated with ACE inhibitors or ARBs or as alternate therapy in the rare individual unable to tolerate ACE inhibitors or ARBs.

Studies in patients with varying stages of nephropathy have shown that protein restriction helps slow the progression of albuminuria, GFR decline, and occurrence of ESRD. Protein restriction should be considered particularly in patients whose nephropathy seems to be progressing despite optimal glucose and blood pressure control and use of ACE inhibitor and/or ARBs.

8.2 Assessment of albuminuria status and renal function

Screening for microalbuminuria can be performed by measurement of the albumin-to-creatinine ratio in a random spot collection (preferred method); 24-h or timed collections are more burdensome and add little to prediction or accuracy. Measurement of a spot urine for albumin only, whether by immunoassay or by using a dipstick test specific for microalbumin, without simultaneously measuring urine creatinine, is somewhat less expensive but susceptible to false-negative and -positive determinations as a result of variation in urine concentration due to hydration and other factors.

Because of variability in urinary albumin excretion, two of three specimens collected within a 3 to 6-month period should be abnormal before considering a patient to have crossed one of these diagnostic thresholds. Exercise within 24 h, infection, fever, CHF, marked hyperglycemia, and marked hypertension may elevate urinary albumin excretion over baseline values.

Serum creatinine should be used to estimate GFR and to stage the level of CKD, if present.

Complications of kidney disease correlate with level of kidney function. When the estimated GFR is <60 ml/min per 1.73 m^2 , screening for anemia, malnutrition, and metabolic bone disease is indicated. Early vaccination against hepatitis B is indicated in patients likely to progress to end-stage kidney disease.

8.3 Retinopathy: Screening and Treatment

Diabetic retinopathy is a highly specific vascular complication of both type 1 and type 2 diabetes, with prevalence strongly related to the duration of diabetes. Diabetic retinopathy is the most frequent cause of new cases of blindness among adults aged 20–74 years. Glaucoma, cataracts, and other disorders of the eye occur earlier and more frequently in people with diabetes.

In addition to duration of diabetes, other factors that increase the risk of, or are associated with, retinopathy include chronic hyperglycemia, the presence of nephropathy, and hypertension. Intensive diabetes management with the goal of achieving near normoglycemia has been shown in large prospective randomized studies to prevent and/or delay the onset and progression of diabetic retinopathy. Lowering blood pressure has been shown to decrease the progression of retinopathy. Several case series and a controlled prospective study suggest that pregnancy in type 1 diabetic patients may aggravate retinopathy; laser photocoagulation surgery can minimize this risk.

One of the main motivations for screening for diabetic retinopathy is the established efficacy of laser photocoagulation surgery in preventing vision loss.

8.3.1 General recommendations

- To reduce the risk or slow the progression of retinopathy, optimize Glycaemic control.
- To reduce the risk or slow the progression of retinopathy, optimize blood pressure control.

8.3.2 Screening

- Adults and children aged 10 years or older with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 5 years after the onset of diabetes.

- Patients with type 2 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist shortly after the diagnosis of diabetes.
- Subsequent examinations for type 1 and type 2 diabetic patients should be repeated annually by an ophthalmologist or optometrist. Less frequent exams (every 2–3 years) may be considered following one or more normal eye exams. Examinations will be required more frequently if retinopathy is progressing.
- Women with pre-existing diabetes who are planning pregnancy or who have become pregnant should have a comprehensive eye examination and be counseled on the risk of development and/or progression of diabetic retinopathy. Eye examination should occur in the first trimester with close follow-up throughout pregnancy and 1 year postpartum.

8.3.3 Treatment

- Promptly refer patients with any level of macular edema, severe non-proliferative diabetes retinopathy (NPDR), or any proliferative diabetic retinopathy (PDR) to an ophthalmologist who is knowledgeable and experienced in the management and treatment of diabetic retinopathy.
- Laser photocoagulation therapy is indicated to reduce the risk of vision loss in patients with high-risk PDR and clinically significant macular edema and in some cases of severe NPDR.
- The presence of retinopathy is not a contraindication to aspirin therapy for cardioprotection, as this therapy does not increase the risk of retinal hemorrhage.

The Diabetes Retinopathy Study (DRS) showed that panretinal photocoagulation surgery reduced the risk of severe vision loss from PDR from 15.9% in untreated eyes to 6.4% in treated eyes. The benefit was greatest among patients whose baseline evaluation revealed high-risk characteristics (chiefly disc neovascularization or vitreous hemorrhage). Given the risks of modest loss of visual acuity and contraction of the visual field from panretinal laser surgery, such therapy is primarily recommended for eyes with PDR approaching or having high-risk characteristics.

As retinopathy is estimated to take at least 5 years to develop after the onset of hyperglycemia, patients with type 1 diabetes should have an initial dilated and comprehensive eye examination within 5 years after the onset of diabetes. Patients with type 2 diabetes, who generally have had years of undiagnosed diabetes and who have a

significant risk of prevalent diabetic retinopathy at time of diabetes diagnosis, should have an initial dilated and comprehensive eye examination soon after diagnosis. Examinations should be performed by an ophthalmologist or optometrist who is knowledgeable and experienced in diagnosing the presence of diabetic retinopathy and is aware of its management. Subsequent examinations for type 1 and type 2 diabetic patients are generally repeated annually. Less frequent exams (every 2–3 years) may be cost effective after one or more normal eye exams while examinations will be required more frequently if retinopathy is progressing.

Examinations can also be done with retinal photographs (with or without dilation of the pupil) read by experienced experts. In-person exams are still necessary when the photos are unacceptable and for follow-up of abnormalities detected. This technology has great potential in areas where qualified eye care professionals are not available and may enhance efficiency and reduce costs when the expertise of ophthalmologists can be utilized for more complex examinations and for therapy.

8.4 Neuropathy: Screening and Treatment

The diabetic neuropathies are heterogeneous with diverse clinical manifestations. They may be focal or diffuse. Most common among the neuropathies are chronic sensorimotor Diabetic Peripheral Neuropathy (DPN) and autonomic neuropathy. Although DPN is a diagnosis of exclusion, complex investigations to exclude other conditions are rarely needed.

The early recognition and appropriate management of neuropathy in the patient with diabetes is important for a number of reasons:

- (1) Nondiabetic neuropathies may be present in patients with diabetes and may be treatable;
- (2) A number of treatment options exist for symptomatic diabetic neuropathy;
- (3) Up to 50% of DPN may be asymptomatic, and patients are at risk of insensate injury to their feet;
- (4) Autonomic neuropathy may involve every system in the body; and
- (5) Cardiovascular autonomic neuropathy causes substantial morbidity and mortality. Specific treatment for the underlying nerve damage is currently not available, other than improved Glycaemic control, which may slow progression but not reverse neuronal loss. Effective symptomatic treatments are available for some manifestations of DPN and autonomic neuropathy

8.4.1 Recommendations

- All patients should be screened for distal symmetric polyneuropathy (DPN) at diagnosis and at least annually thereafter using simple clinical tests.
- Electrophysiological testing is rarely needed, except in situations where the clinical features are atypical.
- Screening for signs and symptoms of cardiovascular autonomic neuropathy should be instituted at diagnosis of type 2 diabetes and 5 years after the diagnosis of type 1 diabetes. Special testing is rarely needed and may not affect management or outcomes.
- Medications for the relief of specific symptoms related to DPN and autonomic neuropathy are recommended, as they improve the quality of life of the patient.

8.4.2 Diagnosis of neuropathy

a. Distal symmetric polyneuropathy

Patients with diabetes should be screened annually for Distal symmetric polyneuropathy (DPN) using tests such as pinprick sensation, vibration perception (using a 128-Hz tuning fork), 10-g monofilament pressure sensation at the distal plantar aspect of both great toes and metatarsal joints, and assessment of ankle reflexes. Combinations of more than one test have >87% sensitivity in detecting DPN. Loss of 10-g monofilament perception and reduced vibration perception predict foot ulcers.

Diabetic autonomic neuropathy

The symptoms and signs of autonomic dysfunction should be elicited carefully during the history and physical examination. Major clinical manifestations of diabetic autonomic neuropathy include resting tachycardia, exercise intolerance, orthostatic hypotension, constipation, gastroparesis, erectile dysfunction, sudomotor dysfunction, impaired neurovascular function, and hypoGlycaemic autonomic failure.

Cardiovascular autonomic neuropathy, a CVD risk factor, is the most studied and clinically important form of diabetic autonomic neuropathy. Cardiovascular autonomic neuropathy may be indicated by resting tachycardia (>100 bpm), orthostasis (a fall in systolic blood pressure >20 mmHg upon standing without an appropriate heart rate response), or other disturbances in autonomic nervous system function involving the skin, pupils, or gastrointestinal and genitourinary systems.

Gastrointestinal neuropathies (e.g., esophageal enteropathy, gastroparesis, constipation, diarrhea, fecal incontinence) are common, and any section of the gastrointestinal tract may be affected. Gastroparesis should be suspected in individuals with erratic glucose control or with upper gastrointestinal symptoms without other identified cause.. Constipation is the most common lower-gastrointestinal symptom but can alternate with episodes of diarrhea.

Diabetic autonomic neuropathy is also associated with genitourinary tract disturbances. In men, diabetic autonomic neuropathy may cause erectile dysfunction and/or retrograde ejaculation. Evaluation of bladder dysfunction should be performed for individuals with diabetes who have recurrent urinary tract infections, pyelonephritis, incontinence, or a palpable bladder.

8.4.3 Symptomatic treatments

Distal peripheral neuropathy (DPN)

The first step in management of patients with DPN should be to aim for stable and optimal Glycaemic control. Patients with painful DPN may benefit from pharmacological treatment of their symptoms: e.g. amitryptiline, Carbamazepine, gabapentin, pregabalin etc.

8.4.4 Treatment of autonomic neuropathy

Gastroparesis symptoms may improve with dietary changes and prokinetic agents such as metoclopramide or erythromycin. Treatments for erectile dysfunction may include phosphodiesterase type 5 inhibitors and this may have a positive impact on the quality of life of the patient.

8.5. Foot Care

8.5.1 Recommendations

- For all patients with diabetes, perform an annual comprehensive foot examination to identify risk factors predictive of ulcers and amputations. The foot examination should include inspection, assessment of foot pulses, and testing for loss of protective sensation (10-g monofilament plus testing any one of the following: vibration using 128-Hz tuning fork, pinprick sensation, ankle reflexes, or vibration perception threshold).
- Provide general foot self-care education to all patients with diabetes.
- A multidisciplinary approach is recommended for individuals with foot ulcers and high-risk feet, especially those with a history of prior ulcer or amputation.
- Initial screening for peripheral arterial disease (PAD) should include a history for claudication and an assessment of the pedal pulses. Consider obtaining an ankle-brachial index (ABI), as many patients with PAD are asymptomatic.
- Consider exercise, medications, and surgical options.

8.5.2 Amputation and foot ulceration,

These are serious consequences of diabetic neuropathy and/or peripheral arterial disease (PAD). They are common and major causes of morbidity and disability in people with diabetes. Early recognition and management of risk factors can prevent or delay adverse outcomes.

The risk of ulcers or amputations is increased in people who have the following risk factors:

- previous amputation
- past foot ulcer history
- peripheral neuropathy
- foot deformity
- peripheral vascular disease
- vision impairment
- diabetic nephropathy (especially patients on dialysis)
- poor Glycaemic control
- cigarette smoking
- predisposition to microtrauma

At least annually, all adults with diabetes should undergo a comprehensive foot examination to identify high-risk conditions. Clinicians should ask about history of previous foot ulceration or amputation, neuropathic or peripheral vascular symptoms, impaired vision, tobacco use, and foot care practices. A general inspection of skin integrity and musculoskeletal deformities should be done in a well-lit room. Vascular assessment should include inspection and assessment of pedal pulses.

These should be regularly performed during the screening exam: normally the 10-g monofilament and one other test. One or more abnormal tests would suggest loss of peripheral sensation (LOPS), while at least two normal tests (and no abnormal test) would rule out LOPS. The last test listed, vibration assessment using a biothesiometer or similar instrument, is widely used in the U.S; however, identification of the patient with LOPS can easily be carried out without this or other expensive equipment.

8.6 Screening for Peripheral Artery Disease (PAD)

Screening for PAD should include a history for claudication and an assessment of the pedal pulses. A diagnostic ABI should be performed in any patient with symptoms of PAD. Due to the high estimated prevalence of PAD in patients with diabetes and the fact that many patients with PAD are asymptomatic, it is suggested that a screening ABI be performed in patients over 50 years of age and be considered in patients under 50 years of age who have other PAD risk factors (e.g., smoking, hypertension, hyperlipidemia, or duration of diabetes >10 years). Patients with significant symptoms or a positive ABI need further vascular assessment, exercise, medications, and surgical options.

Patients with diabetes and high-risk foot conditions should be educated regarding their risk factors and appropriate management. Patients at risk should understand the implications of the loss of protective sensation, the importance of foot monitoring on a daily basis, the proper care of the foot, including nail and skin care, and the selection of appropriate footwear. Patients with loss of protective sensation should be educated on ways to substitute other sensory modalities (hand palpation, visual inspection) for surveillance of early foot problems. Family members are required to assist in their care.

Daily washing of the feet with soap and soft cloth, careful inspection for bruises or lacerations is recommended. Never walk bare footed and don't travel in tight shoes

People with neuropathy or evidence of increased plantar pressure (e.g., erythema, warmth, callus, or measured pressure) may be adequately managed with well-fitted walking shoes or athletic shoes that cushion the feet and redistribute pressure. Callus can be debrided with a scalpel by a foot care specialist or other health professional with experience and training in foot care. People with bony deformities (e.g., hammertoes, prominent metatarsal heads, bunions) may need extra-wide or -depth shoes. People with extreme bony deformities (e.g., Charcot foot) who cannot be accommodated with commercial therapeutic footwear may need custom-molded shoes.

Foot ulcers and wound care may require care by a podiatrist, orthopedic or vascular surgeon, or rehabilitation specialist experienced in the management of individuals with diabetes. For a complete discussion, see the ADA's consensus statement on diabetic foot wound care (*David G. Armstrong and Lawrence A. Lavery, Clinical care of the Diabetic Foot. Alexandria ; American Diabetes Association 2010*).

Chapter Nine

DIABETES CARE IN SPECIAL GROUPS

9.1 Children and Adolescents

Classification of Diabetes in Children

9.1.1 Primary Diabetes Mellitus

a. Neonatal diabetes mellitus: is a very rare condition. Is defined as hyperglycaemia that requires insulin for about 2 weeks and clears.

b. Type1 diabetes mellitus: Beta cell destruction from an autoimmune process. Usually leads to absolute insulin deficiency. Affected children are not obese and manifest recent weight loss and short duration of symptoms (increased thirst and frequent urination). Presence of ketosis at diagnosis (about 35% present with ketoacidosis).

Often a 'honeymoon' period follows control of blood sugar and insulin may not be required for a while.

Ultimate complete destruction of beta cell leads to lifelong dependence on exogenous insulin for survival. There is ongoing risk for ketoacidosis.

About 5% have a positive family history of diabetes mellitus in first or second degree relative.

c. Type 2 DM in children:

May range from predominantly insulin resistance with relative insulin deficiency to a predominant secretory defect with insulin resistance. It is characterized by the following:

1. Overweight at diagnosis with little or no weight loss. In fact, obesity is the hall mark.
2. Little or no thirst and no increase in urination
3. Strong family history of diabetes
4. 45-80% have one parent with Diabetes Mellitus.
5. DM may span many generations in family members
6. 74-100% have a first or second degree relative with diabetes
7. As many as 30% will have ketonuria at diagnosis
8. 5% will come in with ketoacidosis
9. Patient is likely to be African, Asian Hispanic or Indian American.

10. About 90% of children with type 2 diabetes have acanthosis nigricans (dark patches on skin of neck, between the fingers and toes, back of the neck and axilla).

11. Polycystic ovary

Diabetes autoantibody testing should be considered in all paediatric patients with a clinical diagnosis of type 2 diabetes viz islet cell antibodies, glutamic acid decarboxylase antibodies and c-peptide measurement. Presence of autoantibodies will indicate an earlier need for insulin, and associated other autoimmune diseases.

d. MODY (Maturity Onset Diabetes of the Young)

Rare form of diabetes with several genetic varieties. Results from defects of insulin producing cells caused by genetic defects.

MODY occurs in all ethnic groups.

e. Secondary forms of Diabetes In children

Result from:

1. Genetic defects in insulin action e.g. lipodystrophy
2. Diseases of the exocrine pancreas e.g. cystic fibrosis
3. Endocrinopathies e.g. Cushing's syndrome
4. Drug or chemical induced e.g. glucocorticoids
5. Infections e.g. congenital rubella
6. Other genetic syndromes e.g. Prader Willi syndrome

Type 1 diabetes constitutes <3% of the diabetic patients in Nigeria.

Three-quarters of all cases of type 1 diabetes are diagnosed in individuals <18 years of age. Because children are not simply “small adults,” it is appropriate to consider the unique aspects of care and management of children and adolescents with type 1 diabetes. Children with diabetes differ from adults in many respects, including changes in insulin sensitivity related to sexual maturity and physical growth, ability to provide self-care, supervision in child care and school, and unique neurologic vulnerability to hypoglycemia and DKA. Attention to such issues as family dynamics, developmental stages, and physiologic differences related to sexual maturity are all essential in developing and implementing an optimal diabetes regimen.

Ideally, the care of a child or adolescent with type 1 diabetes should be provided by a multidisciplinary team of specialists trained in the care of children with pediatric diabetes. At the time of initial diagnosis, it is essential that diabetes education be provided in a timely fashion, with the expectation that the balance between adult supervision and self-care should be defined by, and will evolve according to, physical, psychological, and

emotional maturity. MNT should be provided at diagnosis, and at least annually thereafter, by an individual experienced with the nutritional needs of the growing child and the behavioral issues that have an impact on adolescent diets, including risk for disordered eating.

9.2 Glycaemic control

Recommendations

- Consider age when setting Glycaemic goals in children and adolescents with type 1 diabetes, with less stringent goals for younger children.

Glycaemic goals need to be modified to take into account the fact that most children <6 or 7 years of age have a form of hypoGlycaemic unawareness. Their counterregulatory mechanisms are immature and they may lack the cognitive capacity to recognize and respond to hypoglycaemic symptoms, placing them at greater risk for severe hypoglycemia and its sequelae. In addition, and unlike the case in adults, young children below the age of 5 years are at risk for permanent cognitive impairment after episodes of severe hypoglycemia. Extensive evidence indicates that near normalization of blood glucose levels is seldom attainable in children and adolescents after the honeymoon (remission) period.

In selecting Glycaemic goals, the benefits on long-term health outcomes of achieving a lower A1C must be weighed against the unique risks of hypoglycemia and the difficulties achieving near normoglycemia in children and youth.

9.3 Screening and management of chronic complications in children and adolescents with type 1 diabetes

i. Nephropathy

Recommendations

- Annual screening for microalbuminuria, with a random spot urine sample for microalbumin-to-creatinine ratio, should be initiated once the child is 10 years of age and has had diabetes for 5 years.
- Confirmed, persistently elevated microalbumin levels on two additional urine specimens should be treated with an ACE inhibitor, titrated to normalization of microalbumin excretion if possible.

ii. Hypertension

- Treatment of high-normal blood pressure (systolic or diastolic blood pressure consistently between the 90–95th percentile for age, sex, and height) should include dietary intervention and exercise aimed at weight control and increased physical activity, if appropriate. If target blood pressure is not reached with 6–12 months of lifestyle intervention, pharmacologic treatment should be initiated.
- Pharmacologic treatment of high blood pressure (systolic or diastolic blood pressure consistently above the 95th percentile for age, sex, and height or consistently >130/80 mmHg for adolescents) should be initiated along with lifestyle intervention as soon as the diagnosis is confirmed.
- ACE inhibitors should be considered for the initial treatment of hypertension.
- The goal of treatment is a blood pressure consistently <130/80 or below the 90th percentile for age, sex, and height, whichever is lower.

Hypertension in childhood is defined as an average systolic or diastolic blood pressure >95th percentile for age, sex, and height percentile measured on at least 3 separate days. “High-normal” blood pressure is defined as an average systolic or diastolic blood pressure >90th but <95th percentile for age, sex, and height percentile measured on at least 3 separate days.

iii. Dyslipidemia

a. Screening

- If there is a family history of hypercholesterolemia (total cholesterol >240 mg/dl) or a cardiovascular event before age 55 years, or if family history is unknown, then a fasting lipid profile should be performed on children >2 years of age soon after diagnosis (after glucose control has been established). If family history is not of concern, then the first lipid screening should be performed at puberty (10 years). All children diagnosed with diabetes at or after puberty should have a fasting lipid profile performed soon after diagnosis (after glucose control has been established).
- For both age-groups, if lipids are abnormal, annual monitoring is recommended. If LDL cholesterol values are within the accepted risk levels (<100 mg/dl [2.6 mmol/l]), a lipid profile should be repeated every 5 years.

b. Treatment

- Initial therapy should consist of optimization of glucose control and MNT, decrease in the amount of saturated fat in the diet.
- After the age of 10, the addition of a statin is recommended in patients who, after MNT and lifestyle changes, have LDL >160 mg/dl (4.1 mmol/l) or LDL cholesterol >130 mg/dl (3.4 mmol/l) and one or more CVD risk factors. (E)
- The goal of therapy is an LDL cholesterol value <100 mg/dl (2.6 mmol/l).

People diagnosed with type 1 diabetes in childhood have a high risk of early subclinical and clinical CVD.

iv. Retinopathy**Recommendations**

- The first ophthalmologic examination should be obtained once the child is 10 years of age and has had diabetes for 3–5 years.
- After the initial examination, annual routine follow-up is generally recommended. Less frequent examinations may be acceptable on the advice of an eye care professional.

Although retinopathy most commonly occurs after the onset of puberty and after 5–10 years of diabetes duration, it has been reported in prepubertal children and with diabetes duration of only 1–2 years. Referrals should be made to eye care professionals with expertise in diabetic retinopathy, an understanding of the risk for retinopathy in the pediatric population, and experience in counseling the pediatric patient and family on the importance of early prevention/intervention.

v. Hypothyroidism**Recommendations**

- Patients with type 1 diabetes should be screened for thyroid peroxidase and thyroglobulin antibodies at diagnosis.
- TSH concentrations should be measured after metabolic control has been established. If normal, they should be rechecked every 1–2 years, or if the patient develops symptoms of thyroid dysfunction, thyromegaly, or an abnormal growth rate. Free T4 should be measured if TSH is abnormal.

Autoimmune thyroid disease is the most common autoimmune disorder associated with diabetes, occurring in 17–30% of patients with type 1 diabetes. The presence of thyroid auto-antibodies is predictive of thyroid dysfunction, generally hypothyroidism but less commonly hyperthyroidism. Subclinical hypothyroidism may be associated with increased risk of symptomatic hypoglycemia and with reduced linear growth. Hyperthyroidism alters glucose metabolism, potentially resulting in deterioration of metabolic control.

9.4 “Adherence”

No matter how sound the medical regimen, it can only be as good as the ability of the family and/or individual to implement it. Family involvement in diabetes remains an important component of optimal diabetes management throughout childhood and into adolescence. Health care providers who care for children and adolescents, therefore, must be capable of evaluating the behavioral, emotional, and psychosocial factors that interfere with implementation and then must work with the individual and family to resolve problems that occur and/or to modify goals as appropriate.

In Nigeria, financial constraints to adherence is a big problem as the majority of patients and their relatives cannot afford their drugs and are not covered by any insurance.

9.5 School and Day Care

Since a sizeable portion of a child's day is spent in school, close communication with school or day care personnel is essential for optimal diabetes management, safety, and maximal academic opportunities need to be assured .

9.6. Pre-Conception Care

9.6.1 Recommendations

- A1C levels should be as close to normal as possible (<7%) in an individual patient before conception is attempted.
- Starting at puberty, preconception counseling should be incorporated in the routine diabetes clinic visit for all women of child-bearing potential.
- Women with diabetes who are contemplating pregnancy should be evaluated and, if indicated, treated for diabetic retinopathy, nephropathy, neuropathy, and CVD.
- Medications used by such women should be evaluated before conception, since drugs commonly used to treat diabetes and its complications may be contraindicated or not recommended in pregnancy, including statins, ACE inhibitors, ARBs, and most non-insulin therapies.

Major congenital malformations remain the leading cause of mortality and serious morbidity in infants of mothers with type 1 and type 2 diabetes. Observational studies indicate that the risk of malformations increases continuously with increasing maternal glycemia during the first 6–8 weeks of gestation, as defined by first-trimester A1C concentrations. There is no threshold for A1C values below which risk disappears entirely. However, malformation rates above the 1–2% background rate of non-diabetic pregnancies appear to be limited to pregnancies in which first-trimester A1C concentrations are >1% above the normal range for a nondiabetic pregnant woman.

Preconception care of diabetes appears to reduce the risk of congenital malformations.

Women contemplating pregnancy need to be seen frequently by a multidisciplinary team experienced in the management of diabetes before and during pregnancy. The goals of preconception care are to:

- 1) Involve and empower the patient in the management of her diabetes,
- 2) Achieve the lowest A1C test results possible without excessive hypoglycemia,
- 3) Assure effective contraception until stable and acceptable glycemia is achieved, and
- 4) Identify, evaluate, and treat long-term diabetic complications such as retinopathy, nephropathy, neuropathy, hypertension, and CHD.

Among the drugs commonly used in the treatment of patients with diabetes, a number may be relatively or absolutely contraindicated during pregnancy. Statins, ACE inhibitors, and ARBs are contraindicated in pregnancy. Among the oral antidiabetic agents, metformin and acarbose are classified as category B (no evidence of risk in humans) and all others as category C. Potential risks and benefits of oral antidiabetic agents in the preconception period must be carefully weighed, recognizing that data are insufficient to establish the safety of these agents in pregnancy.

9.7 Older People

Diabetes is an important health condition for the aging population; at least 20% of patients over the age of 65 years have glucose intolerance including diabetes, and this number can be expected to grow rapidly in the coming decades. Older individuals with diabetes have higher rates of premature death, functional disability, and coexisting illnesses such as hypertension, CHD, and stroke than those without diabetes. Older adults with diabetes are also at greater risk than other older adults for several common geriatric syndromes, such as polypharmacy, depression, cognitive impairment, urinary incontinence, injurious falls, and persistent pain.

The care of older adults with diabetes is complicated by their clinical and functional heterogeneity. Some older individuals developed diabetes years earlier and may have significant complications; others who are newly diagnosed may have had years of undiagnosed diabetes with resultant complications or may have few complications from the disease. Some older adults with diabetes are frail and have other underlying chronic conditions, substantial diabetes-related comorbidity, or limited physical or cognitive functioning. Other older individuals with diabetes have little comorbidity and are active. Life expectancies are highly variable for this population, but often longer than clinicians realize. Providers caring for older adults with diabetes must take this heterogeneity into consideration when setting and prioritizing treatment goals.

9.7.1 Recommendations

- Older adults who are functional, cognitively intact, and have significant life expectancy should receive diabetes treatment using goals developed for younger adults.
- Glycaemic goals for older adults not meeting the above criteria may be relaxed using individual criteria, but hyperglycemia leading to symptoms or risk of acute hyperglycaemic complications should be avoided in all patients.
- Other cardiovascular risk factors should be treated in older adults with consideration of the time frame of benefit and the individual patient. Treatment of hypertension is indicated in virtually all older adults, and lipid and aspirin therapy may benefit those with life expectancy at least equal to the time frame of primary or secondary prevention trials.
- Screening for diabetes complications should be individualized in older adults, but particular attention should be paid to complications that would lead to functional impairment.

However, patients with poorly controlled diabetes may be subject to acute complications of diabetes, including dehydration, poor wound healing, and hyperglycaemic hyperosmolar coma. Glycaemic goals at a minimum should avoid these consequences.

Although control of hyperglycemia may be important in older individuals with diabetes, greater reductions in morbidity and mortality may result from control of other cardiovascular risk factors rather than from tight Glycaemic control alone.

Special care is required in prescribing and monitoring pharmacologic therapy in older adults. Metformin is often contraindicated because of renal insufficiency or significant heart failure. TZDs can cause fluid retention, which may exacerbate or lead to heart failure. They are contraindicated in patients with CHF. Sulfonylureas, other insulin secretagogues, and insulin can cause hypoglycemia. Insulin use requires that patients or caregivers have good visual and motor skills and cognitive ability. Drugs should be started at the lowest dose and titrated up gradually until targets are reached or side effects develop.

Screening for diabetes complications in older adults also should be individualized. Particular attention should be paid to complications that can develop over short periods of time and/or that would significantly impair functional status, such as visual and lower-extremity complications.

9.8 Diabetes Care for Inpatients

Hospitalized patients with hyperglycemia typically fall into 3 three categories:

- Medical history of diabetes: diabetes previously diagnosed and acknowledged by the patient's treating physician.
- Unrecognized diabetes: hyperglycemia (fasting blood glucose 126 mg/dl or random blood glucose 200 mg/dl) occurring during hospitalization and confirmed as diabetes after hospitalization by standard diagnostic criteria but unrecognized as diabetes by the treating physician during hospitalization.
- Hospital-related hyperglycemia: hyperglycemia (fasting blood glucose 126 mg/dl or random blood glucose 200 mg/dl) occurring during the hospitalization that reverts to normal after hospital discharge

9.8.1 Recommendations

- All patients with diabetes admitted to the hospital should have their diabetes clearly identified in the medical record.
- All patients with diabetes should have an order for blood glucose monitoring, with results available to all members of the health care team.
- Goals for blood glucose levels:
 - Critically ill surgical patients' blood glucose levels should be kept as close to 110 mg/dl (6.1 mmol/l) as possible and generally <140 mg/dl (7.8 mmol/l). (A) These patients require an intravenous insulin protocol that has demonstrated efficacy and safety in achieving the desired glucose range without increasing risk for severe hypoglycemia.
 - Critically ill nonsurgical patients' Glycaemic targets are less well defined. Intravenous insulin infusion protocols targeting blood glucose levels <110–140

mg/dl have been shown to reduce morbidity and mortality (e.g. GKI consisting of 500ml 5%. Dextrose with added 5iu of regular insulin and 13mmol KCl) as required.

- For non–critically ill patients, there is no clear evidence for specific blood glucose goals. Since cohort data suggest that outcomes are better in hospitalized patients with fasting glucose <126 mg/dl and all random glucose <180–200, these goals are reasonable if they can be safely achieved. Insulin is the preferred drug to treat hyperglycemia in most cases.
- Scheduled prandial insulin doses should be appropriately timed in relation to meals and should be adjusted according to point-of-care glucose levels.
- Using correction dose or “supplemental” insulin to correct premeal hyperglycemia in addition to scheduled prandial and basal insulin is recommended.
- Glucose monitoring for those at high risk for hyperglycemia, including high-dose glucocorticoids therapy, initiation of enteral or parenteral nutrition, or other medications such as octreotide or immunosuppressive medications.
- If hyperglycemia is documented and persistent, initiation of basal/bolus insulin therapy may be necessary. Such patients should be treated to the same Glycaemic goals as patients with known diabetes.
- A plan for treating hypoglycemia should be established for each patient. Episodes of hypoglycemia in the hospital should be tracked.
- All patients with diabetes admitted to the hospital should have an A1C obtained if the result of testing in the previous 2–3 months is not available.
- A diabetes education plan including “survival skills education” and follow-up should be developed for each patient.
- Patients with hyperglycemia in the hospital who do not have a diagnosis of diabetes should have appropriate plans for follow-up testing and care documented at discharge.

It is clear that uncontrolled hyperglycemia is associated with adverse outcomes in critically ill patients and that achieving levels of glucose control below 140 mg/dl are reasonable, provided that protocols that minimize risk for hypoglycemia are utilized and that personnel are well educated in the direct application of these protocols.

9.8.2 Oral drugs

Each of the major classes of noninsulin glucose-lowering drugs has significant limitations for inpatient use. Additionally, they provide little flexibility or opportunity for titration in a setting where acute changes often demand these characteristics. Therefore, insulin, when used properly, is preferred for the majority of hyperGlycaemic patients in the hospital setting.

9.8.3 Insulin

a. Subcutaneous insulin therapy.

Subcutaneous insulin therapy may be used to attain glucose control in most hospitalized patients with diabetes outside of the critical care arena. The components of the daily insulin dose requirement can be met by a variety of insulins,. Subcutaneous insulin therapy should cover both basal and nutritional needs and is subdivided into scheduled insulin and supplemental, or correction-dose, insulin. Correction-dose insulin therapy is an important adjunct to scheduled insulin, both as a dose-finding strategy and as a supplement when rapid changes in insulin requirements lead to hyperglycemia. If correction doses are frequently required, the appropriate scheduled insulin doses should be increased to accommodate the increased insulin needs.

b. Intravenous insulin infusion.

The only method of insulin delivery specifically developed for use in the hospital is continuous intravenous infusion, using regular crystalline insulin. The medical literature supports the use of intravenous insulin infusion in preference to the subcutaneous route of insulin administration for several clinical indications among nonpregnant adults. These include DKA and hyperosmolar state; general preoperative, intraoperative, and postoperative care; the postoperative period following heart surgery; following organ transplantation; with cardiogenic shock; exacerbated hyperglycemia during high-dose glucocorticoid therapy; type 1 patients who are NPO; or in critical care illness in general. It may be used as a dose-finding strategy in anticipation of initiation or reinitiation of subcutaneous insulin therapy in type 1 or type 2 diabetes.

c. Transition from intravenous to subcutaneous insulin therapy.

For those who will require subcutaneous insulin, the very short half-life of intravenous insulin necessitates administering the first dose of subcutaneous insulin before discontinuation of the intravenous insulin infusion. If short or rapid-acting insulin is used, it should be injected 1–2 h before stopping the infusion. If intermediate- or long-acting insulin is used alone, it should be injected 2–3 h before. A combination of short/rapid- and intermediate/long-acting insulin is usually preferred. Basal insulin therapy can be initiated at any time of the day.

d. Self-management in the hospital

Self-management of diabetes in the hospital may be appropriate for competent adult patients who have a stable level of consciousness, have reasonably stable daily insulin requirements, successfully conduct self-management of diabetes at home, have physical skills needed to successfully self-administer insulin and perform SMBG, have adequate

oral intake, and are proficient in carbohydrate counting, use of multiple daily insulin injections or insulin pump therapy, and sick-day management. The patient and physician, in consultation with nursing staff, must agree that patient self-management is appropriate under the conditions of hospitalization. For patients conducting self-management in the hospital, it is imperative that basal, prandial, and correction doses of insulin and results of bedside glucose monitoring be recorded as part of the patient's hospital medical record. While many institutions allow patients on insulin pumps to continue these devices in the hospital, others express concern regarding use of a device unfamiliar to staff, particularly in patients who are not able to manage their own pump therapy. If a patient is too ill to self-manage either multiple daily injections or Continuous subcutaneous infusion (CSII), then appropriate subcutaneous doses can be calculated on the basis of their basal and bolus insulin needs during hospitalization, with adjustments for changes in nutritional or metabolic status.

e. Preventing hypoglycemia

Hypoglycemia, especially in insulin-treated patients, is the leading limiting factor in the Glycaemic management of type 1 and type 2 diabetes. In the hospital, multiple additional risk factors for hypoglycemia are present, even among patients who are neither “brittle” nor tightly controlled. Patients with or without diabetes may experience hypoglycemia in the hospital in association with altered nutritional state, heart failure, renal or liver disease, malignancy, infection, or sepsis. Additional triggering events leading to iatrogenic hypoglycemia include sudden reduction of corticosteroid dose, altered ability of the patient to self-report symptoms, reduction of oral intake, emesis, new NPO status, inappropriate timing of short- or rapid-acting insulin in relation to meals, reduction of rate of administration of intravenous dextrose, and unexpected interruption of enteral feedings or parenteral nutrition.

Despite the preventable nature of many inpatient episodes of hypoglycemia, institutions are more likely to have nursing protocols for the treatment of hypoglycemia than for its prevention. Tracking such episodes and analyzing their causes are important quality improvement activities.

f. Diabetes care providers in the hospital

Inpatient diabetes management may be effectively provided by primary care physicians, endocrinologists, or hospitalists, but involvement of appropriately trained specialists or specialty teams may reduce length of stay, improve Glycaemic control, and improve outcomes. In the care of diabetes, implementation of standardized order sets for scheduled and correction-dose insulin may reduce reliance on sliding-scale management. A team approach is needed to establish hospital pathways. To achieve Glycaemic targets

associated with improved hospital outcomes, hospitals will need multidisciplinary support for using insulin infusion therapy outside of critical care units or will need to develop protocols for subcutaneous insulin therapy that effectively and safely achieve Glycaemic targets

g. DSME in the hospital

Teaching diabetes self-management to patients in hospitals is a challenging task. Patients are ill, under increased stress related to their hospitalization and diagnosis, and in an environment not conducive to learning. Ideally, people with diabetes should be taught at a time and place conducive to learning, as outpatients in a recognized program of diabetes education.

For the hospitalized patient, diabetes “survival skills” education is generally a feasible approach. Patients and/or family members receive sufficient information and training to enable safe care at home. Those newly diagnosed with diabetes or who are new to insulin and/or blood glucose monitoring need to be instructed before discharge. Those patients hospitalized because of a crisis related to diabetes management or poor care at home need education to prevent subsequent episodes of hospitalization. An assessment of the need for a home health referral or referral to an outpatient diabetes education program should be part of discharge planning for all patients.

h. MNT in the hospital

Current nutrition recommendations advise individualization based on treatment goals, physiologic parameters, and medication usage. Because of the complexity of nutrition issues in the hospital, a registered dietitian, knowledgeable and skilled in MNT, should serve as an inpatient team member. The dietitian is responsible for integrating information about the patient’s clinical condition, eating, and lifestyle habits and for establishing treatment goals in order to determine a realistic plan for nutrition therapy.

i. Bedside blood glucose monitoring

Implementing intensive diabetes therapy in the hospital setting requires frequent and accurate blood glucose data. This measure is analogous to an additional “vital sign” for hospitalized patients with diabetes. Bedside glucose monitoring using capillary blood has advantages over laboratory venous glucose testing because the results can be obtained rapidly at the “point of care,” where therapeutic decisions are made.

Bedside blood glucose testing is usually performed with portable meters that are similar or identical to devices for home SMBG. Staff training and ongoing quality control activities are important components of ensuring accuracy of the results. Ability to track the occurrence of hypo- and hyperglycemia is necessary. Results of bedside glucose tests should be readily available to all members of the care team.

For patients who are eating, commonly recommended testing frequencies are premeal and at bedtime. For patients not eating, testing every 4–6 h is usually sufficient for determining correct insulin doses. Patients on continuous intravenous insulin typically require hourly blood glucose testing until the blood glucose levels are stable, then every 2 hours.

j. Discharge planning

It is important to anticipate the postdischarge antihyperglycaemic regimen in all patients with diabetes or newly discovered hyperglycaemia. The optimal program will need to consider the type and severity of diabetes, the effects of the patient's illness on blood glucose levels, and the capacities and desires of the patient. Smooth transition to outpatient care should be ensured, especially in those new to insulin therapy or in whom the diabetes regimen has been substantially altered during the hospitalization. All patients in whom the diagnosis of diabetes is new should have, at minimum, "survival skills" training before discharge. More expanded diabetes education can be arranged in the community. For those with hyperglycemia who do not require treatment upon discharge, follow-up testing through their primary care physician should be arranged, since many of these individuals are found to have diabetes when tested after discharge.

9.9. Diabetes Care in the school and Day Care settings

Recommendations

All school staff members who have responsibility for a student with diabetes should receive training on steps to take in ensuring proper care of their student while in school. .

9.9.1 Emergency and disaster preparedness

Recommendations

- People with diabetes should maintain a disaster kit that includes items important for their diabetes self-management and continuing medical care.
- The kit should be reviewed and replenished at least twice yearly.

9.9.2 Employment for diabetic patients

Any person with diabetes, whether insulin treated or noninsulin treated, should be eligible for any employment for which he/she is otherwise qualified. Questions are sometimes raised by employers about the safety and a health care professional with expertise in diabetes to determine any impact on safe performance of the job. Hyperglycemia is not

typically a barrier to employment unless long-term complications are present that interfere with the performance of the job.

9.9.3 Recommendations

- Improving health care professional education regarding the standards of care through formal and informal education programs.
- Delivery of DSME, which has been shown to increase adherence to standard of care.
- Adoption of practice guidelines, with participation of health care professionals in the process. Guidelines should be readily accessible at the point of service, such as on patient charts, in examining rooms, in “wallet or pocket cards,” on PDAs, or on office computer systems. Guidelines should begin with a summary of their major recommendations instructing health care professionals what to do and how to do it.
- Use of checklists that mirror guidelines have been successful at improving adherence to standards of care.
- Systems changes, such as provision of automated reminders to health care professionals and patients, reporting of process and outcome data to providers, and especially identification of patients at risk because of failure to achieve target values or a lack of reported values.

Chapter Ten

STATE OF DIABETES CARE IN NIGERIA: AN OVERVIEW

10.1 Introduction:

Diabetes mellitus is the commonest endocrine-metabolic disorder characterized by chronic hyperglycaemia giving rising to risk of microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular (ischaemic heart disease, stroke and peripheral vascular disease) damage.

It is associated with reduced life expectancy and diminished quality of life. Recent estimates indicate there were 371 million people in the world with diabetes in the year 2012 and this is projected to increase to 552 million by 2030. This increase in prevalence is expected to be more in the Middle Eastern crescent, Sub-Saharan Africa and India.

In Africa, the estimated prevalence of diabetes is 1% in rural areas, up to 7% in urban sub-Sahara Africa, and between 8-13% in more developed areas such as South Africa and in population of Indian origin.

The prevalence in Nigeria varies from 0.65% in rural Mangu (North), 6.8% in Port Harcourt and to 11% in urban Lagos (South) and World Health statistics indicate that Nigeria has the highest number of people living with diabetes in Sub-Sahara Africa.

10.2 Review of some Nigerian Studies:

Cobban was one of the first to remark on the relative rarity of diabetes in University College Hospital, Ibadan in the 1950s.

10.2.1 1997 National NCD survey: Akinkugbe et al in their National survey of Non-communicable diseases in Nigeria (1997) documented the national prevalence of diabetes (age-adjusted) to be 2.2% with male: female ratio of 1:1.1 and a significant increase in prevalence with age. Thus below the age of 45 years, crude prevalence in males is 1.6% and 1.9% in females.

After the age of 45years, it rises to 5.4% in males and 5.6% in females - a threefold increase in each gender. The same survey estimated that not less than 1.05% million Nigerians are likely to be diabetic with only about 225,000 being aware of their condition and about 198,000 were on treatment.

The above figures were most probably higher because Nigerians below the age of 15 years were not included in the survey and results were not available for some states due to technical and logistic reasons.

10.2.2 Pattern of Diabetes in Niger Delta Region: A follow-up cross-sectional study of people living with diabetes in Rivers state (a core Niger Delta state not included in the 1997 survey) revealed diabetes to be a substantial health problem with 780 type 2 diabetics presenting at diagnosis with the following complications viz neuropathy 439 (56.3%), erectile dysfunction 283 (36.3%), nephropathy 72 (9.2%) and retinopathy 57 (7.3%) (Table 10.1).

10.2.3 Undiagnosed diabetes: It is a fact that type 2 diabetes has an asymptomatic pre-clinical phase which is not benign, thus underscoring the need for primary prevention and population screening in order to diagnose early and institute therapy.

The prevalence of undiagnosed diabetes has been found to range from 4.8% in one study of outpatients attending a family practice clinic to as high as 18.9% in another study. In the latter study, the prevalence of diabetes was found to be higher by as much as 68% in persons of a higher socio-economic status.

Earlier studies reported lower prevalence rates for undiagnosed diabetes in the Nigerian population. Nyenwe et al reported 6.8% in Port Harcourt while a study in Lagos reported as low as 1.7% in Lagos metropolis in 1988.

10.2.4 Diabcare Nigeria Multi-Centre Study: In 2008, the landmark Diabcare Nigeria study was prospectively conducted across seven tertiary health centres in Nigeria with the objective of assessing the clinical and laboratory profile, evaluating the quality of care of Nigerian diabetics with a view to planning improved diabetes care.

The clinical parameters studied include: types of diabetes, anthropometry, blood pressure, chronic complications of diabetes and treatment types. Laboratory data assessed include: fasting plasma glucose (FPG), 2 Hour post-prandial (2-HrPP), glycated haemoglobin (HbA1c), urinalysis, serum lipids, electrolytes, urea and creatinine.

A total of 531 patients, 209 (39.4%) males and 322 (60.6%) females enrolled. Mean age of the patients was 57.1 ± 12.3 years with mean duration of diabetes of 8.8 ± 6.6 years. Majority (95.4%) had type 2 diabetes mellitus compared to type 1 (4.6%), $p < 0.001$. The mean FPG, 2-HrPP glucose and HbA1c were 8.1 ± 3.9 mmol/L, 10.6 ± 4.6 mmol/L and 8.3 ± 2.2 % respectively. Only 170 (32.4%) and 100 (20.4%) patients achieved the ADA and IDF glycaemic targets respectively. Most patients (72.8%) did not practise self-monitoring

of blood glucose. Hypertension was found in 322(60.9%), with mean systolic BP 142.0 ± 23.7 mmHg and mean diastolic BP 80.7 ± 12.7 mmHg (See tables 10.2 and 10.3). Diabetes complications found were peripheral neuropathy 59.2%, retinopathy 35.5%, cataracts 25.2%, cerebrovascular disease 4.7%, diabetic foot ulcers 16.0% and nephropathy 3.2%.

(See tables 10.2 and 10.3)

It was obvious from that survey that the status of Diabetes Care in terms of glycaemic control, control to goal of other cardiovascular risk factors, management practices and presence of late complications of diabetes were below optimum expected.

10.2.5 Dyslipidaemia: Dyslipidaemia is also common. In a study of 600 patients with type2 diabetes, up to 89% had lipid abnormalities. Elevated LDL-C, TCHOL, TG and reduced HDL-C were noted in 74%, 42%, 13%, and 53% respectively of the study subjects. The commonly noted combined lipid abnormalities were elevated TG and reduced HDL-C. Only small proportions (8%) of the subjects with dyslipidaemia were on treatment for it.

10.2.6 Prognostic Indices of Diabetes Mortality: From January through December 2006, subjects with diabetes mellitus (DM) in a tertiary hospital in Nigeria were prospectively studied after admission to assess their short-term outcome which was defined as death. The total mortality, causes of death, associated complications and duration of hospital stay were noted. The predictive factors for DM morbidity were evaluated using chi test, logistic regression. Student's t-test was computed for quantitative data.

A total of 1,327 subjects were admitted to the Medical wards for the duration of the study and the crude death rate was 11%. DM related admissions made up 206 (15%) of all the medical admissions and the case fatality rate was 16% (33). The most common reasons for DM admission were hyperglycaemic emergencies (HE), 88 (40%) and hypertension, 44 (21%). The most common causes of deaths were HE, 15 (46%) and DM foot ulcers (DFU), 10 (30%) while DFU and cerebrovascular disease (CVD) had the highest case fatality rates of 28% and 25% respectively. DFU had the most prolonged duration of admission ranging from 15–122 days. DFU, CVD and having type 2 DM were highly predictive of fatal outcomes. The odds ratio and 95% CI for these factors were 4.5 (1.5–12.7), 3.0 (0.9– 9.92 and 3.1 (0.7–14) respectively. (See table 10.4).

In a similar study on mortality in inpatients in a tertiary hospital, diabetic patients constituted 10.4% of all hospital inpatients over a 10 year period. The case fatality for the patients with diabetes was 17.2% with acute diabetic complications viz keto-acidosis, hyperosmolar state and hypoglycaemia being the most common cause of death in the patients (39.8%).

Table 10.1: Pattern of Diabetes in Niger Delta Region

Parameters	Type 1	Type 2	Other types	GDM
Total Number (n)%	25(3.0%)	780 (94%)	10 (1.2%)	15 (1.8%)
Positive family history of DM (1 st degree)	3 (12%)	408 (52.3%)	Nil	8 (53.3%)
Polyuria	25 (100%)	713 (91.4%)	10 (100%)	11 (73.3%)
Polydipsia	25 (100%)	720 (92.3%)	10 (100%)	11 (73.3%)
Polyphagia	12 (48%)	392 (50.3%)	-	-
Lassitude	25 (100%)	655 (84%)	10 (100%)	13 (86.7%)
Weight Loss	25 (100%)	590 (75.6%)	10 (100%)	7 (46.7%)
Blurring of vision	13 (52%)	491 (62.9%)	10 (100%)	4 (26.7%)
Recurrent carbuncles (Boils)	9 (36%)	79 (10.1%)	-	-
Pruritus vulvae	8 (32%)	223 (28.6%)	-	15 (100%)
Coma	8 (32%)	39 (5.1%)	-	-
Pancreatic calcification	-	-	10 (100%)	-
Peripheral neuropathy	3 (12%)	439 (56.3%)	-	7 (46.7%)
Erectile dysfunction	-	283 (36.3%)	-	-
Hypertension:	-			
*Antedated	-	106 (13.6%)	-	-
*Simultaneously	-	197 (25.3%)	-	5 (33.3%)
Retinopathy:				
*Background	-	57 (7.3%)	-	-
*Proliferative	-	-	-	-
Nephropathy	-	72 (9.3%)	-	-
Dietary (mono) therapy	-	7 (0.9%)	-	-
Insulin therapy	25 (100%)	176 (22.6%)	10 (100%)	15 (100%)
Oral Hypoglycaemic Agents (OHA)	-	593 (76.0%)	-	-

Note: - i. DM 1st degree: Diabetes mellitus in first degree family member. (Mother, father or siblings)
 ii. Erectile dysfunction (ED): Defined as the inability to achieve and maintain erection sufficient enough to allow satisfactory sexual intercourse
 iii. OHA: Oral Hypoglycaemic agent

Table 10.2: Diabcare Nigeria Multi-Centre Study: HbA_{1c} Levels Stratified by Different Guidelines

Guideline	Definition	Range (%)	N	Proportion of patients achieving target, n (%)
ADA	Recommendation for adults with diabetes	<7%	525	170 (32.4)
IDF (Type 2)	Target	<6.5	489	100 (20.4)

$$\chi^2 = 3.74 \quad = 0.053$$

N: number of valid patient data used in the analysis

n (%): number of patients (percent patient)

ADA: American Diabetes Association, IDF: International Diabetes Federation

Table 10.3: Diabcare Nigeria Multi-Centre Study: Diabetes Complications by HbA_{1c} Categories

Diabetes complications	Mean HbA1c, %	HbA1c categories, n (%)		
		<6.5 % (N=105)	6.5 to 7.5% (N=142)	>7.5% (N=278)
Eye complications				
All eye complications	8.31 ± 2.16	51 (48.6)	66 (46.5)	135 (48.6)
Adv. Eye disease	8.71 ± 1.91	4 (3.8)	5 (3.5)	21 (7.6)
Background retinopathy	8.44 ± 2.16	32 (30.5)	47 (33.1)	102 (36.7)
Cataract	8.3 ± 2.21	26 (24.8)	36 (25.4)	69 (24.8)
Legal blindness	9.04 ± 1.86	0 (0.0)	1 (0.7)	6 (2.2)
Photocoagulation	9.2 ± 0.0	0 (0.0)	0 (0.0)	1 (0.4)
Leg complications				
All leg complications	8.71 ± 2.35	23 (21.9)	24 (16.9)	75 (27.0)
Active ulcer/gangrene	8.17 ± 2.03	3 (2.9)	7 (4.9)	10 (3.6)
Bypass/angioplasty	11.25 ± 2.9	0 (0.0)	0 (0.0)	2 (0.7)
Foot pulse absent	8.57 ± 2.23	12 (11.4)	9 (6.3)	34 (12.2)
Healed ulcer	9.06 ± 2.52	12 (11.4)	12 (8.5)	43 (15.5)
Leg amputations	7.06 ± 1.27	4 (3.8)	1 (0.7)	3 (1.1)
Other complications				
All other complications	8.37 ± 2.13	52 (49.5)	85 (59.9)	172 (61.9)
Cerebral stroke	7.76 ± 2.12	5 (4.8)	10 (7.0)	9 (3.2)
End stage renal failure	7.7 ± 0.49	0 (0.0)	1 (0.7)	1 (0.4)
MI/CABG/angioplasty	0.0 ± 0.0	0 (0.0)	(0.0)	0 (0.0)
Signs of neuropathy	8.4 ± 2.14	51 (48.6)	82 (57.7)	171 (61.5)

N: number of valid patient data used in the analysis

n (%): number of patients (percent patient)

SD: standard deviation

MI/CABG/angioplasty: myocardial infarct/coronary angioplasty bypass graft/angioplasty

Table 10.4: Prognostic Indices of Diabetes Mortality

Admission diagnosis	Frequency
HyperGlycaemic emergencies (HE)	82 (40%)
Poorly controlled blood pressure	44 (21%)
DM foot ulcers (DFU)	36 (17.5%)
Cerebrovascular disease (CVD)	20 (9.8%)
Hypoglycemia	7 (3%)
Peptic ulcer disease (PUD)	6 (3%)
Tropical hand ulcer (TDHS)	2 (1%)
Koch's disease	2 (1%)
Retroviral infection	1 (0.7%)
Chronic renal failure	6 (3%)
Total	206 (100%)

Table 10.5: Causes of Deaths in DM Subjects

Causes of death	%of total DM deaths	Case fatality rate
HE	15 (46%)	18%
CVD	5 (16%)	25%
DFU	10 (30%)	28%
Hypoglycemia	1 (3%)	14%
CRF	1 (3%)	16%
Bleeding PUD	1 (3%)	16%

HE=HyperGlycaemic emergencies; CVD=Cerebral vascular disease; DFU=diabetic foot ulcer; CRF=chronic renal failure; PUD=peptic ulcer disease

Table 10.6: Morbidity and Mortality Data According to the Age Groups

Age Classes	DM admissions	Hypertension	DM-related deaths
<34years	20 (10%)	0	2 (6%)
35-64years	116 (56%)	23 (52%)	19 (57.6%)
>65 years	70 (34%)	21 (48%)	12 (36.4%)

10.3 Priorities, Needs and Recommendations

The crucial issues arising from these Nigerian studies are: most Nigerians living with diabetes mellitus have suboptimal glycaemic control, are hypertensives, not meeting blood pressure and lipid targets and have chronic complications.

Our national aims and objectives towards improving diabetes care, cure and prevention should focus on the following priorities, needs and recommendations:

10.3.1 Improve health outcomes for people with diabetes Complications of type 1 and type 2 diabetes can be prevented or significantly delayed. The essential medicines, diagnostic and monitoring technologies and education required are cost-effective, but tragically inaccessible to many. A sustainable system to provide the essentials to people with diabetes is required. Development and appropriate use of health services, especially primary care services, can avert costly end-stage complications and optimise the impact of funds spent on healthcare.

The following recommendations should be implemented to improve health outcomes of Nigerians living with diabetes:

a. Provide essential care to all people with diabetes

- Risk assessment and early diagnosis
- Access to essential low-cost medicines and supplies
- Self-care education
- Improve medicine-distribution systems
- Integrate diabetes and NCD care into health services for communicable diseases

b. Improve healthcare systems so that essential diabetes care can be reliably delivered

- Improve the training, continuing education and support of health professionals
- Integrate training of health work force, covering diabetes and related NCDs and infectious diseases
- Create shared record keeping systems to coordinate care over time and across caregivers
- Extend health services to all areas of the country.

c. Provide care and support for people with diabetes complications

- Programmes for detection and management of the complications of diabetes
- Access to treatment, rehabilitation and social support for people who develop disabilities

d. Clinical Practice Guideline.

- **Outpatient glycaemic, Lipid and Blood Pressure control:** Achieving and maintaining good glycaemic control by treating-to-target, is the goal of using guideline. This is achieved by being **proactive** when glycaemic control is not at, or drifts away from acceptable targets (see table 10.7). The **definitive action** often required is prompt anti-hyperglycaemic treatment to the next step in the **treatment Algorithm** (see figure 10.1).
- **Out-patient Initiation of Basal Insulin (eg. Glargine) + Oral agents**
 - Basal Insulin is administered as a total daily dose at bedtime (22.00hrs)
 - Dose calculation (titration) e.g.: (weight) 70kg x 0.2IU = 14IU of Insulin
 - Continue SU at half maximum dose & metformin at 2gm daily
 - Monitor effect of bedtime Insulin by the fasting blood sugar
- **Out-patient Substitution Therapy with Basal Insulin (eg. Glargine)**
 - If control is not achieved with a total Basal Insulin dose of 25-30IU, add bolus (meal time) insulin (guided by pre meal blood glucose levels).
 - Twice daily biphasic insulin can also be used; given 30min before breakfast and dinner.
 - Sulphonylureas should be discontinued
 - If no contraindications Metformin can be continued if patient is obese.
- **Annual Review**
 - Screening for proteinuria/microalbuminuria
 - Screening for retinopathy
 - Foot examination
 - Education (as needed)

Table 10.7: IDF Optimal Targets for Glycaemic, Lipid, Blood Pressure and Weight Control

Biochemical Index:		Optimal	
Capillary blood glucose values (finger-prick)		mmol/L	mg/dl
Fasting		4-6	72-108
2-hour post-prandial		4-8	72-144
Glycated haemoglobin (HbA1c) (%)			<6.5
Weight BMI (kg/m ²)			<25
Blood Pressure (mmHg):			
Systolic			<130
Diastolic			<80
If persistent, dipstick for proteinuria			
Systolic			<125
Diastolic			<75
Lipids			
		Mol/L	Mg/dl
Total cholesterol		<5.2	<200
LDL cholesterol		≤2.6	≤95
HDL cholesterol			
Men		>1.1	>40
Women		>1.3	>50
Triglycerides		<1.7	<150

Figure 10.1: Algorithm on the glycaemic management of T2DM

Adapted from IDF clinical practice guideline for Type 2 Diabetes in Sub-Sahara Africa

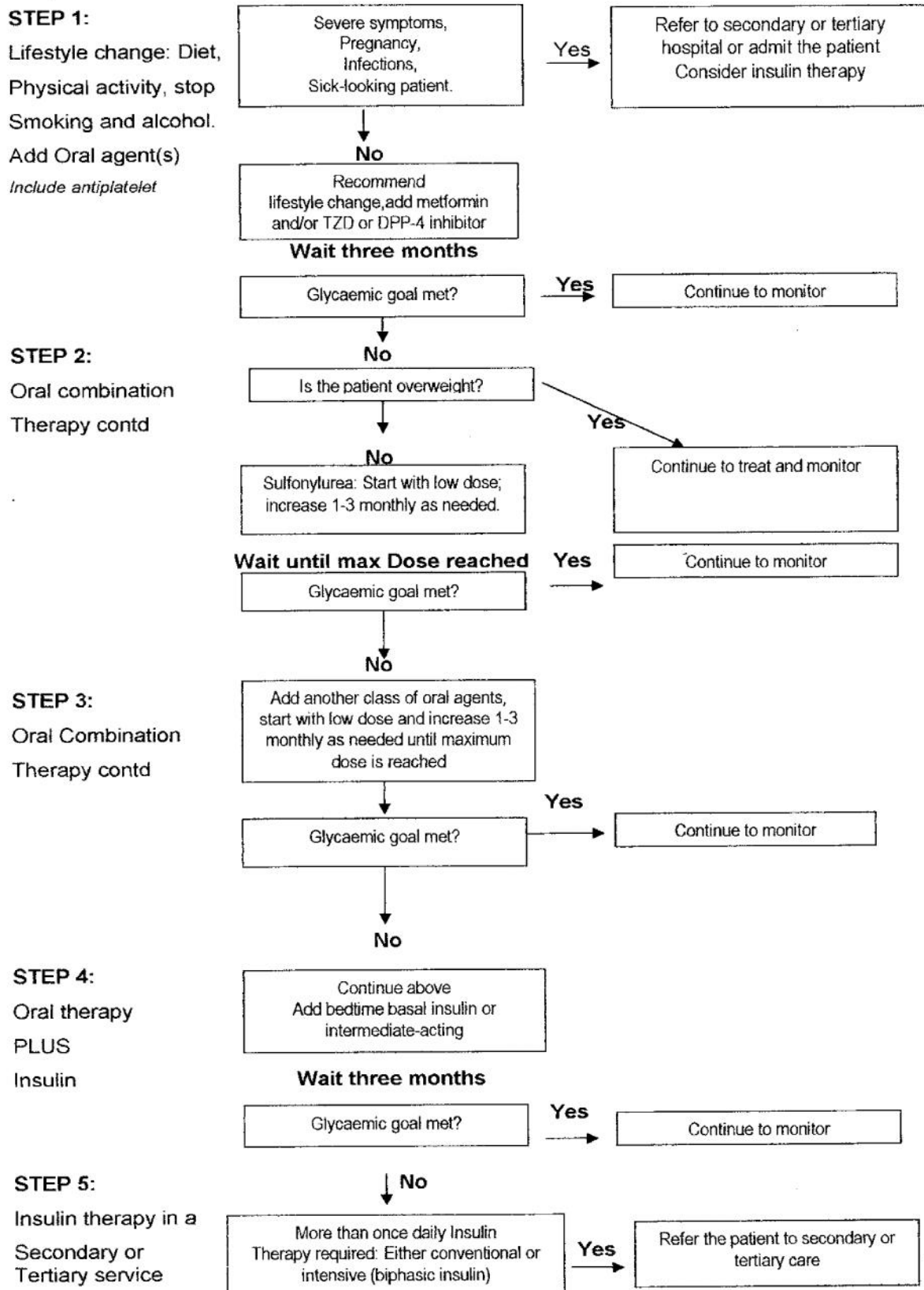


Table 10.8: Oral Anti-Diabetic Agents

Oral Agents	Abbrev.	Name of Drug	Starting Dose	Maximal Dose
	SU	Sulphonylureas		
	Gbm	Glibenclamide	2.5mg	20mg
	Gcz	Glizidazide	40mg	320mg
		Glizidazide MR	30mg	120 mg
	Gmp	Glimepiride	1mg	8mg
	Gpz	Glipizide	2.5 - 5mg	20mg
	Biguanides			
	Met	Metformin	500mg	2550mg
	TZD	Thiazolidinediones		
	Pio	Pioglitazone	15mg	30mg
	DPP4-I	<u>Dipeptidyl Peptidase-4 Inhibitors</u>		
	Vil	Vildagliptin	50mg	100mg
	Sita	Sitagliptin	50mg	100mg
	Sax	Saxagliptin	5mg	5mg

10.3.2 Prevent the Development of type 2 diabetes: The onset of type 2 diabetes in people at high risk can be prevented or significantly delayed. This is cost-effective. Failure to invest in prevention strategies means that the number of people with diabetes will continue to increase at unsustainable rates. The key modifiable risk factors for type 2 diabetes – physical inactivity, inappropriate nutrition and obesity – are not just a matter of personal choice. Environments that encourage sedentary behaviour and high-energy low-nutrient diets pose almost insurmountable barriers to healthy lifestyles. Such environments are found in all aspects of our modern life – in work, in communities and in leisure.

The following recommendations should be advocated and implemented to prevent the development of type 2 diabetes:

a. Adopting a 'Health in All Policies' approach

- Ensure all public policy sectors (education, transport, housing etc.) protect and promote health
- Strengthen multi-stakeholder partnerships to prevent diabetes

b. Make healthy nutrition available to all - especially to pregnant women and children

- Promote breastfeeding
- Promote healthy diet through education
- Control marketing and advertising of unhealthy food and beverages
- Labelling food products
- Access to healthy food for disadvantaged population groups
- Promote physical activity through education
- Create adequate environments and facilities to promote physical activity

c. Consider a 'High-Risk' Prevention Programme where appropriate

- Implement a prevention programme for people at high-risk of type 2 diabetes

10.3.3 Stop discrimination against people with diabetes: Millions of people with diabetes face stigma and discrimination. This promotes a culture of secrecy that can create barriers to services, employment, and even marriage, and may stop people with diabetes playing an active role in society. This burden is greater for children, indigenous peoples, ethnic minorities, women and the poor. Nobody should suffer discrimination and stigma because of their diabetes. Action is required at international and national levels to ensure that the human rights of people with or at risk of diabetes are protected.

The following recommendations should be advocated and implemented to stop discrimination against people with diabetes:

a. Enable people with diabetes to claim their rights and responsibilities

- Sign an International Charter of Rights for People with Diabetes and domesticate it.
- Provide legal support and advice for people with diabetes

b. Increase public awareness of diabetes and reduce diabetes related stigma

- Develop information campaigns to raise awareness of diabetes and reduce stigma
- Identify and support high profile and community level champions of diabetes

c. Empower people with diabetes to be at the centre of the diabetes response

- Involve people with diabetes in all phases of diabetes policy and programme design
- Support the creation and capacity building of organisations and networks of people with diabetes

10.4 The UN Summit on NCDs

The United Nations High-Level Summit on Diabetes & NCDs, which held in September 2011 was a unique opportunity to reverse the current diabetes and global NCD epidemic. In order for its Declarations to be successful, it is vital that world leaders commit to specific actions.

The UN general assembly, the principal decision – making body of the UN which represents all UN member states, held a UN summit on Diabetes and other Non-communication Disease (NCD's) in order to bring global attention to these diseases and agreed on a plan of action to address them part of which includes;

1. Form and strengthen Diabetes & NCD alliance at local, national, regional and international levels with specific objectives.
2. IDF is leading the global diabetes community to maximize the opportunity of the UN Summit on NCDs for diabetes. The Diabetes Associations are keys to the success of this, in bringing global advocacy to the national and local level.

10.5 Conclusion:

Most Nigerians living with diabetes have suboptimal glycaemic control, are hypertensives, not meeting blood pressure and lipid targets and have chronic complications. Improved quality of care and treatment to targets is recommended to reduce diabetes related morbidity and mortality.

Our top national diabetes priorities should include:

- Equitable, universal access to care, essential medicines and supplies
- Prevent type 2 diabetes through healthy lifestyle promotion
- Development and implementation of a National Diabetes Programme (which will include regular national diabetes survey, diabetes registry etc).

Chapter Eleven

PREVENTION AND CONTROL OF NON-COMMUNICABLE DISEASES IN NIGERIA: CHALLENGES AND STRATEGIC DIRECTIONS

11.1 Introduction

Non-communicable diseases (NCDs) are chronic diseases that are typically non-contagious or non-infectious in nature, causing long term debilitation and disability if not prevented or controlled. Major NCDs in Nigeria include: Diabetes mellitus, cardiovascular diseases (hypertension, coronary heart disease, stroke and attendant Chronic Renal Diseases), cancers, sickle cell disease, asthma, mental health disorders, road traffic injuries/violence, and oral health disorders.

NCDs contribute significantly to adult morbidity, disability/mortality and pose a heavy socio-economic burden on individuals, societies and the entire health system.

NCDs caused an estimated 35million death in 2005. This figure represented 60% of all deaths globally with 80% due to NCDs occurring in low and middle income countries (Nigeria inclusive) and approximately 16million deaths involving people under 60 years of age and are regarded as premature deaths that could be prevented.

Total deaths from NCDs are projected to increase by a further 17% over the next ten years. The rapidly increasing burden of these diseases is affecting poor and disadvantaged populations disproportionately, contributing to widening health gaps between and within countries.

Without action on NCDs, countries within the WHO Africa region will witness the largest rise in NCDs death (27%) from 2004-2015, followed by the Eastern Mediterranean (25%), South –East Asia and Western Pacific Regions.

As NCDs are largely preventable, the number of premature deaths can be greatly reduced by appropriate interventions. Failure to reduce the impact of NCDs on developing countries will make it difficult to attain the health-related Millennium Development Goals (MDGs) which the United Nations set out in 2000 with outlined targets to combat infectious diseases such as HIV/AIDS, malaria and TB but did not include any reference to NCDs.

11.2 Burden of Major NCDs in Nigeria

The economic burden of NCDs in the country has been estimated to be an annual loss of \$800 million which will reach an accumulated loss of \$7.6 billion by 2015 from Diabetes, heart diseases and stroke alone.

In spite of the higher burden posed to national economies by NCDs e.g. hypertension (20% estimated national prevalence in 2010) compared to communicable diseases e.g. HIV/AIDS (4.1% national prevalence in 2010); the funding on HIV/AIDS alone was 5 Billion naira (\$33.3M) compared to a paltry sum of 60 Million naira (\$375,000) on NCDs in 2010 appropriation.

It is in recognition of the nature, magnitude and severity of these problems and challenges posed by NCDs that the Federal Ministry of Health (FMOH) established the NCD Control Programme in 1988 to serve as the arrowhead of the response to NCDs in Nigeria. The strategic thrust of the NCD control programme is to generate reliable data and information base for an evidence-based National NCD Policy and Strategic Plan of Action to guide prevention, control and management of NCDs in Nigeria.

Available data from the National Survey on NCDs 1990 – 1992 (published in 1997) involving ages 15 years and above defined the epidemiological situation of the problem. It showed that 4.3 million (11.2%) Nigerians have hypertension with higher urban than rural prevalence. The prevalence was found higher at both extremes of the socio-economic spectrum.

Akinkugbe et al in their National survey of Non-communicable diseases in Nigeria (1997) documented the national prevalence of diabetes (age-adjusted) to be 2.2% with male: female ratio of 1:1.1 and a significant increase in prevalence with age. Thus below the age of 45 years, crude prevalence in males is 1.6% and 1.9% in females respectively.

After the age of 45 years, it rises to 5.4% in males and 5.6% in females - a three fold increase in each gender. The same survey estimated that not less than 1.05% million Nigerians are diabetic with only about 225,000 being aware of their condition and about 198,000 were on treatment. Diabetes was found to significantly co-exist with smoking and hypertension.

The above figures were most probably higher because Nigerians below the age of 15 years were not included in the survey and results were not available for some states due to technical and logistic reasons.

Prognostic Indices of diabetes mortality: From January through December 2006, subjects with diabetes mellitus (DM) in a tertiary hospital in Nigeria were prospectively studied after admission to assess their short-term outcome which was defined as death. The total mortality, causes of death, associated complications and duration of hospital stay were noted.

A total of 1,327 subjects were admitted to the Medical wards for the duration of the study and the crude death rate was 11%. DM related admissions made up 206 (15%) of all the medical admissions and the case fatality rate was 16% (33). The most common reasons for DM admission were hyperglycaemic emergencies (HE), 88 (40%) and hypertension, 44 (21%). The most common causes of deaths were HE, 15 (46%) and DM Foot Ulcers (DFU), 10 (30%) while DFU and cerebrovascular disease (CVD) had the highest case fatality rates of 28% and 25% respectively. DFU had the most prolonged duration of admission ranging from 15–122 days. DFU, CVD and having type 2 DM were highly predictive of fatal outcomes. (see tables 11.1-11.3).

Nigeria has the highest burden of sickle cell disease globally. According to the national NCDs survey, 23.04% have Sickle cell trait (Haemoglobin AS) resulting in an estimated 150,000 babies being born annually with the disorder (20 per 100,000 births). However, the survey shows that about 0.5% of adult Nigerians have sickle cell disease (SCD) due to loss of affected children early in life.

Cancer prevalence is on the increase. 100,000 incident cases of cancers are currently diagnosed annually and it is estimated that by the year 2015 the burden would have increased fivefold if nothing is done. The problem is further compounded by the lack of integration of routine screening into primary health care. Majority of cancers in Nigeria are diagnosed at a very late stage and there are very few centres offering radiotherapy and other oncology services. There is currently no population-based national cancer data; however, using available data from some population-based cancer registries in Nigeria, WHO estimates incidence and mortality of most frequent cancers in Nigerians (see table 11.4).

As at 2001, Nigeria ranked second on the weighted scale of countries with very high road traffic crashes. In the year 2006; 9,972 deaths and 38,067 persons were injured from road traffic crashes.

According to a national mental health survey in 2002 about 17million (12.1%) Nigerians experienced mental disorder at the time of the survey while about 8 million (5.8%) were found to have a current episode of mental health disorder. In a recent review only about 21% of those affected received any form of treatment.

11.3 Common NCD Risk Factors

The major risk factors for NCDs are unhealthy nutrition (increasing consumption of fast foods, low consumption of proteins, fruits and vegetables, excessive intake of salt and refined sugars etc), overweight and obesity, lack of physical activity, harmful or excessive alcohol intake, use of tobacco and substance abuse. According to the WHO report on global tobacco epidemic, the current smoking rate for adult Nigerian males is 9.0% and 0.2% in females. Other risk factors of NCDs include advancing age, occupational exposure and climate change.

Tobacco is increasingly associated with NCDs particularly chronic respiratory diseases and lung cancers. The report from the Global Youth Tobacco Survey (GYTS) showed that more than 1 in 10 youths aged 13-15 years are current cigarette smokers in Nigeria. The likelihood of initiating tobacco smoking varied from 3.6% overall to a peak of 16.2% (17.8% in girls). The use of other tobacco products among the youths currently ranges from 13.1% to a peak of 23.3%.

11.4 Rationale for Action

In developed countries deaths from NCDs have declined significantly, but the reverse is the case for developing countries such as ours. Therefore, it is no exaggeration to describe the situation as an impending disaster; a disaster for health of the individual, family, communities and national economies.

Presently, the developing countries have no incentives for international funding of non-communicable diseases and as a result neglected the control of NCDs. Majority of people in the low-income economies including Nigeria have limited access to healthy foods, safe places for physical activity and health services. Furthermore, some major NCDs like cancers, sickle cell disease and mental health disorders are not budgeted for and are not covered by the National Health Insurance Scheme (NHIS) thus posing high financial burden on the affected individuals and the community.

11.5 International Commitments and National Activities

Nigeria is committed to the following resolutions, declarations and reports dealing with NCDs:

- Resolution World Health Assembly (WHA) 51.18 on NCDs May 1998
- WHO DG's Report to the WHA on the Global strategy for the prevention and control of NCDs – 2000
- Global Strategy for Infant and Young Child Feeding – 2002
- WHO Framework Convention on Tobacco Control (FCTC) – 2003
- Global Strategy on Diet, Physical Activity and Health – 2004
- 2008-2013 Action Plan for the Global Strategy for the prevention and control of NCDs – 2008
- WHO Global Strategy to Reduce the Harmful use of Alcohol
- United Nations General Assembly Resolution 64/265 on NCD summit – May 2010
- Brazzaville Declaration on NCDs in the African Region – April 2011
- First Global Ministerial Conference on Healthy Lifestyles and NCDs – Moscow Declaration – June 2011.

11.6 What has been done so far: National Activities towards NCD prevention and control:

- Establishment of the NCD Control Programme in 1988.
- National Surveys of major NCDs for ages 15 years and above (1990-1992), repeated in 2008-2010).
- Integration of WHO Package of Essential NCDs (WHO PEN) into primary health care services in 2009.
- Development of a draft National NCD Policy for Top Management Committee and National Council on Health approval.
- Ongoing advocacy, social mobilization, communication, awareness creation and screening for major NCDs and risk factors especially hypertension, diabetes, sickle cell disease, overweight and obesity.
- Annual commemoration of NCD related Global Days with activities such as Press briefing, awareness campaign rallies, sensitization workshops/seminars for the general public, school children etc.
- Ban on tobacco advertisement (1990) and tobacco smoking in public places in FCT in 2008 as an enforcement of decree 20 of 1990.
- Nigeria signed (2004) and ratified (2005) the WHO Framework Convention on Tobacco Control (WHO FCTC).
- Domestication of the WHO FCTC in progress.

- Passage of the National Bill on tobacco control by the National Assembly in May 2011.
- Advocacy to Chief Medical Directors, Medical Directors, State Directors of PHC and NCD focal persons on tobacco dependence and cessation (2005/2008).
- Establishment of tobacco free clubs in secondary schools and cessation clinics in tertiary institutions.
- Conducted the pre-test on the WHO/CDC Global Adult Tobacco Survey (GATS) in Nigeria in June 2011.
- Commencement of the pilot phase of the Abuja Heart Study (AHS)
- Domestication of WHO Mental Health Gap Action Programme (mhGAP) in progress and finalization of Mental Health policy and Legislation (August 2011).
- The FMOH established 4 Sickle Cell Disease prevention and management centers in Federal Medical Centres Abakaliki, Ebuta Metta, Gombe and Keffi in collaboration with MDGs office (May 2011).
- Introduction of immunization against Hepatitis B Virus (HBV) into the National Programme on Immunization (NPI) in 2004 for the prevention of liver cancer.
- Vaccination of adolescent girls against high risk serotypes of Human Papilloma Viruses for the prevention of cancer of the cervix commenced (February 2011).
- There is a national policy on Cancrum Oris (NOMA) and supporting treatment and rehabilitation centre in Sokoto.
- The FMOH in collaboration with Federal Road Safety Commission (FRSC) launched the UN decade of action on road safety 2011-2020 which aimed at reduction of disabilities and deaths from road traffic accidents.
- Agencies have been set up by the Federal Government (FG) to control the use of narcotic agents (National Drug Law Enforcement Agency – NDLEA), to reduce disabilities, morbidity and mortality associated with substandard drugs, micro-nutrients deficiencies and carcinogenic agents in food substances (National Food Drug Administration and Control – NAFDAC), to regulate the use of nuclear applications in health, industries, including oil and gas etc to reduce the risk of exposure to damaging radiation (Nigeria Nuclear Regulatory Agency – NNRA).
- Inauguration of Nigerian NCD alliance, an affiliate of Global NCD Alliance with stakeholders from Diabetes Association of Nigeria, Nigerian Heart Foundation, Nigerian Cancer Society and Nigerian Thoracic Society in February 2011.
- Inauguration and establishment of the Technical Working Group (TWG) on the UN summit on NCDs by the Federal Minister of Health with membership drawn from the academia, the ministry, industry, civil society and non-governmental organizations in July 2011.

11.7 Challenges to NCDs Prevention and Control in Nigeria

These include:

- Inadequate/low political commitment to NCDs by government at all levels
- Lack of interest by developmental partners to see NCDs as a major public health problem
- Inadequate funding of NCDs by government compared to other health issues with less morbidity and mortality burden.
- Lack of multi-sectoral collaboration on NCDs with relevant stakeholders
- Paucity of reliable national data on NCDs and associated risk factors
- There is inadequate research funding for NCDs by government and developmental partners
- Paucity of relevant skilled human resources in the prevention, control and management of NCDs
- Inadequate relevant infrastructure for the screening, early detection/diagnosis, and management of NCDs
- Under representation in international genomic and environmental research endeavors for the study of NCDs.

11.8 UN Declaration on NCDs Prevention and Control

Tackling diabetes & other NCDs constitutes one of the major challenges for development in the twenty-first century. The global financial crisis has provided a reminder to the vulnerability of economies and health systems. The UN General Assembly, the principal decision-making body of the UN which represents all UN member states, decided to hold a summit on Non-communicable diseases (NCDs) in order to bring global attention to these diseases and agree on a plan of action to address them. The UN summit (19 – 20th September 2011), therefore, addressed the prevention and control of NCDs worldwide with a particular focus on developmental and economic impacts, particularly for developing countries.

The summit generated global momentum and commitment to implement the Global strategy for the Prevention and control of NCDs and its related 2008 – 2013 Action Plan.

The High-level meeting offered an unprecedented opportunity to prioritize NCDs on the global agenda and secured support and commitment from heads of state (including HE Dr. Goodluck Jonathan) and governments for a coordinated global response to these diseases.

This is only the second time the United Nations General Assembly has called such a High-level meeting on a health issue, the first being the 2001 summit that dealt with the response to the HIV/AIDS epidemic.

11.8.1 The Summit Outcome: The most important part of the summit was the adoption of the Political Declaration (PD) (see table 11.5). This is the first ever political declaration on NCDs and includes 22 commitments that governments worldwide must now be held accountable to.

They cover the spectrum of the NCD response from National policies and plans, essential medicines and technologies, health system strengthening, prevention, resourcing, research and development, international cooperation and monitoring and evaluation. While some commitments could have been stronger despite the absence of conclusive (key) goals and specific targets (see table 6: proposed by World Health but not yet adopted by the UN) the political declaration represents a major step change for NCDs. It demonstrates that world leaders have finally recognised the magnitude and impact of the NCD problem.

It also shows that world leaders now understand that the response to date has been inadequate in terms of resourcing and political commitment. This declaration is a 'watershed' event and will accelerate international progress on NCDs and provide a framework for saving millions of people from preventable death and disability.

11.8.2 Recommendations and Way forward

With a political declaration in our hands, we now must look to the future. For this is just the beginning, not the end. We must keep the momentum up for NCDs and ensure that commitments are translated into action through implementing specific recommendations:

a. Political commitment:

- Advocacy for increased political commitment to NCDs and related matters at all levels of government

b. Education:

- Inclusion of NCDs prevention and control into school curriculum at all levels
- At the health training institutions, curriculum on health promotion needs to be revised to incorporate NCDs prevention and control.

c. Funding:

- Financial resources that are commensurate with the burden of NCDs should be allocated from the national budgets to support NCD primary prevention and case management using the primary health care approach and establish sustainable innovative and new financing mechanisms at national, state and local levels.

- Improved funding of NCDs along with other health issues of public health importance
- Advocacy for creating a global funding mechanism for prevention and control of NCDs.

d. Partnerships/intersectoral collaboration:

- Decisions made outside the health sector often have a major bearing on elements that influence the risk factors. More health gains in terms of prevention are achieved by influencing public policies in domains such as trade , food and pharmaceutical production, agriculture, urban development and taxation policies than by changes in health policy alone.
- Advocacy for increased collaboration with developmental partners and relevant stakeholders including food and beverages industries to ensure healthy lifestyles
- Strengthen NCDs health promotion at all levels of healthcare in collaboration with relevant Civil Society Organizations (CSOs), Non-Governmental Organizations (NGOs), Faith Based Organization (FBOs), Community Based Organizations (CBOs) etc.
- Inclusion of NCDs as a new MDG goal 9 with globally agreed targets and indicators.

e. Legislation:

- Enactment of relevant laws for the prevention and control of major NCDs must be given top priority.
- Enforcement of existing laws relating to the major NCDs and their risk factors.
- Implement the following package of six cost-effective policy interventions (the MPOWER package) which builds on the measures for reducing demand contained in the World Health Framework Convention for Tobacco Control:
 - a. Monitor tobacco use and tobacco prevention policies.
 - b. Protect people from tobacco smoke in public and work places.
 - c. Offer help to people who want to stop using tobacco.
 - d. Warn people about the dangers of tobacco.
 - e. Enforce bans on tobacco advertising, promotion and sponsorship
 - f. Raise tobacco taxes and prices.

f. Training and Research:

- Appropriate funding of multi-disciplinary models of NCDs research in relevant institutions to generate reliable national data for intervention.
- Training and capacity building of health personnel in all areas of NCDs prevention, early detection/diagnosis, control and management using modern technology.

11.9 Conclusion

NCDs are increasing in prevalence in developing countries including Nigeria, and their complications pose an immense public health burden. These diseases are highly correlated to risk factors like smoking, alcohol intake, obesity, unhealthy diet and physical inactivity. The United Nations, World Health Organisation, NGOs, Civil Society Organisations etc are urging health decision-makers to develop effective strategies to halt the growing trend and burden of NCDs through primary (mainly), secondary and tertiary measures.

Table 11.1: Prognostic Indices Of Diabetes Mortality

Admission diagnosis	Frequency
HyperGlycaemic emergencies (HE)	82 (40%)
Poorly controlled blood pressure	44 (21%)
DM foot ulcers (DFU)	36 (17.5%)
Cerebrovascular disease (CVD)	20 (9.8%)
Hypoglycemia	7 (3%)
Peptic ulcer disease (PUD)	6 (3%)
Tropical hand ulcer (THU)	2 (1%)
Koch's disease	2 (1%)
Retroviral infection	1 (0.7%)
Chronic renal failure	6 (3%)
Total	206 (100%)

Table 11.2: Causes of Deaths In DM Subjects

Causes of death	%of total DM deaths	Case fatality rate
HE	15 (46%)	18%
CVA	5 (16%)	25%
DFU	10 (30%)	28%
Hypoglycemia	1 (3%)	14%
CRF	1 (3%)	16%
Bleeding PUD	1 (3%)	16%

HE=HyperGlycaemic emergencies; CVA=Cerebral vascular accident; DFU=diabetic foot ulcer; CRF=chronic renal failure; PUD=peptic ulcer disease

Table 11.3: Morbidity and Mortality Data according to the Age Groups

Age Classes	DM admissions	Hypertension	DM-related deaths
<34years	20 (10%)	0	2 (6%)
35-64years	116 (56%)	23 (52%)	19 (57.6%)
>65 years	70 (34%)	21 (48%)	12 (36.4%)

Table 11.4: Incidence and Mortality Of Most Frequent Cancers In Men, Women And Both Sexes In Nigeria

Incidence %		
Men	Women	Both Sexes
Prostate – 18.2	Breast – 30.7	Breast – 18.6
Liver – 15.7	Cervix – 23.6	Cervix – 14.3
Colo-rectum – 7.4	Liver – 4.6	Prostate – 7.2
Non-Hodgkins Lymphoma – 7.8	Colo-rectum – 3.5	Liver – 8.9
Bladder – 4.2	Ovary – 3.1	Colo-rectum – 5.1

Mortality %		
Men	Women	Both Sexes
Prostate – 17.7	Breast – 24.8	Breast – 13.9
Liver – 18.5	Cervix – 22.9	Cervix – 12.8
Colo-rectum – 7.0	Liver – 6.5	Prostate – 7.8
Non-Hodgkins Lymphoma – 7.8	Colo-rectum – 4.1	Liver – 11.8
Bladder – 3.6	Ovary – 3.4	Colo-rectum – 5.4

Table 10.5 Summary Table of Political Declaration on NCD Prevention and Control

Issue	Commitments
National Policies and Plans	<ul style="list-style-type: none"> - In 2013, establish and strengthen multisectoral national policies and plans for NCDs - Integrate NCD policies and programmes into health planning processes and national development agendas. <i>NB: it will be up to governments to decide how to structure this. Some governments will have specific plans for diabetes, cancer etc within an overarching NCD framework. Others may have one NCD Plan covering the four major diseases including diabetes and their common risk factors.</i>
Essential Medicines and Technologies	<ul style="list-style-type: none"> - Increase access to affordable, safe, effective and quality medicines and diagnostics and technologies, including through the full use of TRIPS flexibilities. - Improve diagnostic services, and collaborate with the private sector to improve affordability, accessibility and maintenance of diagnostic equipment and technologies. - Encourage alliances and networks to develop new medicines, vaccines, diagnostics and technologies, learning from the experiences in HIV/AIDS.
Prevention	<ul style="list-style-type: none"> - Advance implementation of cost-effective, population wide interventions to reduce NCD risk factors, via implementation of international agreements and strategies, education, legislative, regulatory and fiscal measures. - Strengthen and implement public policies, such as education and information programmes in and out of schools and public awareness campaigns. - Promote implementation of WHO set recommendations on marketing of foods and non-alcoholic beverages to children. - Eliminate industrially-produced trans-fats in foods, and to implement interventions to reduce consumption of salt, sugars and saturated fats. - Encourage policies that support the production and manufacture of healthy foods. - Introduce policies and actions aimed at promoting healthy diets and increasing physical activity. - Promote the inclusion of NCD prevention and control within sexual and reproductive health and maternal and child health programmes, particularly at the primary healthcare level. - Promote and support breastfeeding for 6 months from birth to reduce risk of under-nutrition, promote infant/child growth and development, and reduce risk of obesity and NCDs later in life.
Health System Strengthening	<ul style="list-style-type: none"> - Universal coverage in national health systems, especially through primary healthcare and social protection mechanisms. - Strengthen health systems that support primary healthcare, deliver cost-effective and integrated essential services for prevention, treatment and care of NCDs. - Prioritise surveillance, early detection, screening, diagnosis and treatment of NCDs. - Production, training and retention of health workers. - Information systems for health planning and management, including through population-based national registries. - Strengthen procurement, storage and distribution of medicine
Resourcing	<ul style="list-style-type: none"> - Explore the provision of adequate, predictable and sustained financial resources via domestic, bilateral, regional and multilateral channels, and innovative financing mechanisms. - Enhance the quality of aid, and call for the fulfilment of ODA-related

Partnerships	<p>commitments including the 0.7% of gross national income of ODA by developing countries by 2015, and the Istanbul Programme for Action for Least Developed Countries for 2011-2020.</p> <ul style="list-style-type: none"> - According to national priorities, increase and prioritise budgetary allocations for NCDs. - Provide technical assistance and capacity building to developing countries for NCDs and the promotion of access to medicines for all. - Recognise that price and tax measures are an effective and important means of reducing tobacco consumption, and determine and establish taxation policies where appropriate. <p>- In 2012, UN Secretary General to present recommendations for a multisectoral NCD partnership.</p> <p>- Foster partnerships between government and civil society, building on the contribution of health-related NGOs and patient organisations.</p>
International Cooperation	<ul style="list-style-type: none"> - Acknowledge the contribution of international cooperation and assistance in NCDs - Call upon WHO, and other lead UN agencies, international financial institutions, development banks to work together in a coordinated manner to support national NCD efforts - Call for the fulfilment of Official Development Assistance (ODA) assistance-related commitments, and enhance the quality of ODA through the principles of the Paris Declaration on Aid Effectiveness - Importance of North-South, South-South and triangular cooperation in NCDs.
Research and Development	<ul style="list-style-type: none"> - Strengthen national capacity for quality research and development for NCDs, and promote the use of ICT. - Support NCD-related research and its translation.
Monitoring and Evaluation	<ul style="list-style-type: none"> - In 2012, develop a comprehensive global monitoring framework for NCDs and a set of voluntary global targets and indicators. - Consider national targets and indicators. - Strengthen country-level surveillance and monitoring systems.
Follow Up	<ul style="list-style-type: none"> - In 2013, UN Secretary General present a report on progress made against the PD, including on multisectoral action and the impact on internationally agreed development goals. - In 2014, hold a comprehensive review and assessment on the progress achieved.

Table 11.6: Goal and Priority Targets for NCDs

An overarching goal	<ul style="list-style-type: none"> • By 2025, reduce preventable deaths from cardiovascular disease, diabetes, cancer and chronic respiratory diseases by 25%*¹
Leadership and international cooperation	<ul style="list-style-type: none"> • By 2012, establish a partnership initiative so that WHO can coordinate follow up action with member states, all relevant UN agencies, development banks, other international and regional organizations, foundations, NGOs and private sector • By 2013, countries to establish, and strengthen, a coordinated, multi-sectoral national response to NCDs with a costed national NCD prevention and control plan and a national monitoring and evaluation system • By 2013, countries integrate NCD prevention and control into the mainstream of national development planning, including poverty reduction strategies, and national budget allocation • By 2015, ensure the integration of action on NCDs into internationally agreed development goals
Prevention	<ul style="list-style-type: none"> • By 2025, reduce prevalence of current daily tobacco smoking by 40%* and, by 2040, reduce prevalence of tobacco use to less than 5% of global population • By 2025, reduce salt intake to less than 5g per person per day* • By 2025, reduce per capita consumption of alcohol by 10% and the prevalence of heavy episodic drinking by 10%* • By 2025, reduce prevalence of insufficient physical activity by 10%²
Health systems and treatment	<ul style="list-style-type: none"> • By 2015, countries to develop and introduce strategies to integrate health-system management of NCDs, especially at primary health care levels • By 2015, demonstrate significantly improved access to affordable, safe, effective and quality-assured medicines (including for palliative care), vaccines and technologies for people at high risk of cardiovascular disease and people living with cancer, diabetes, chronic respiratory disease and cardiovascular disease
Monitoring, reporting and accountability	<ul style="list-style-type: none"> • By 2012, establish a high-level monitoring and accountability commission on NCDs to ensure ongoing monitoring of commitments from the UN Summit • In 2014, undertake an extensive review of the progress achieved in realising the commitments from the UN Summit

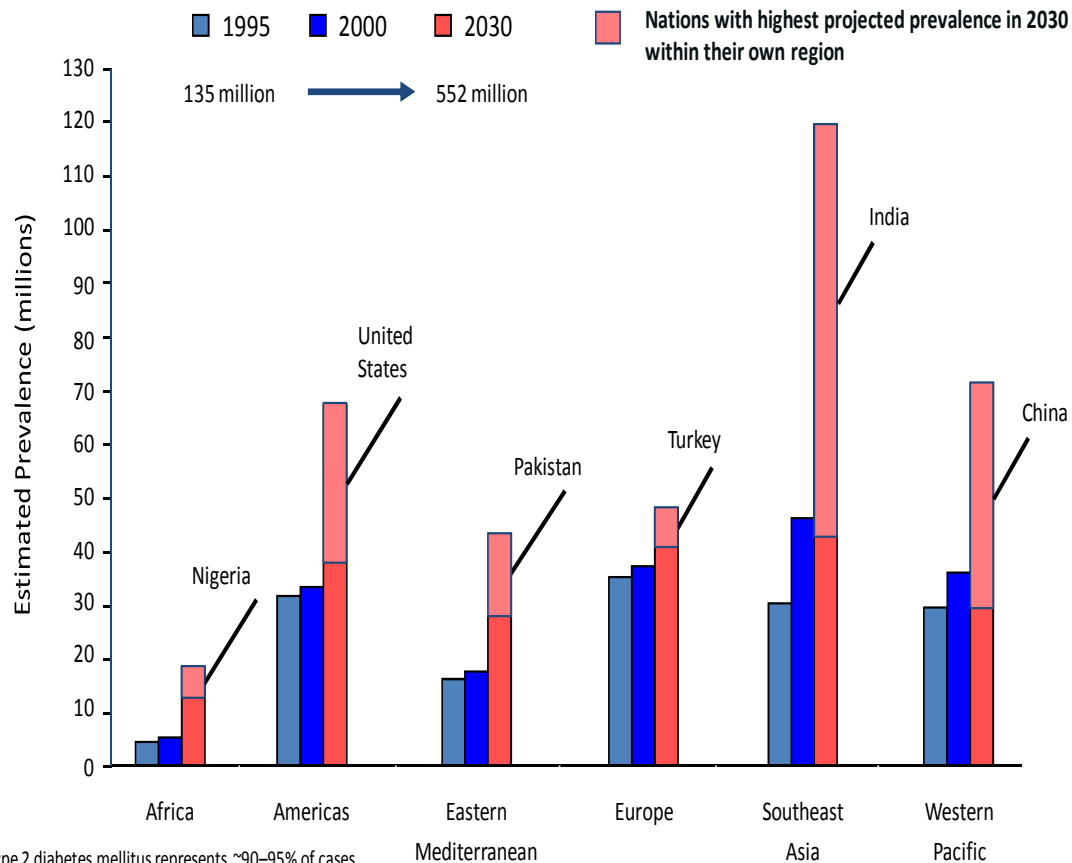
Note:

1 This target and others indicated by * are Proposals on NCDs targets from a WHO Technical Working Group

2 Prevalence of physical inactivity is defined as less than 150minutes of moderate physical activity or its equivalent per week among persons aged 15+ years - consistent with 2010 Global Health Report and 2010 Global Recommendations on Physical Activity

1. APPENDIX I*

Global Prevalence of Diabetes* Projected to More Than Quadruple between 1995 and 2030



*Type 2 diabetes mellitus represents ~90–95% of cases.

Adapted from World Health Organization. Country and regional data. Available at: www.who.int/diabetes/facts/world_figures/en/
 Accessed February 17, 2009. King H, et al. *Diabetes Care*. 1998; 21: 1414–1431.

2. APPENDIX II*

SETTING UP A PRIMARY LEVEL DIABETES SERVICE

A) REQUIREMENT FOR A DIABETES CLINIC:

- **Staff**

At any given time at least one of the following:

- At least one or two doctors – medical officer, clinical officer or assistant medical officer
- Trained Nurses
- Health attendant/ward maid
- Cleaner

- **Clinical Requirement**

1. Clinic room (s) with nearby toilet (consulting room, nurses' station, reception, pharmacy, lab unit etc.)
2. Furniture and fittings:
 - doctor's table
 - nurses table
 - examination couch with sheets and screen
 - storage cupboard/cabinet

3. Equipment:

- Clinical practice guidelines
 - Glucometer with appropriate strips
 - Urine test strips
 - Earthenware pot (if no fridge) for storage of insulin
 - Tape measure
 - Weight scale
 - Height measure
 - Sphygmomanometer (B.P. Machine) with 2 cuff sizes
 - Stethoscope
 - Monofilament
 - Education posters and leaflets
 - Emergency treatment tray
4. Maintaining an inventory and statistics: An inventory book detailing all clinic equipment, including literature available, should be kept and reviewed weekly or monthly. This will allow the clinic to be adequately equipped at all times.
Keeping monthly clinic statistics of new patients and follow-up
 5. Two observation wards (for males & females each); *this is optional*

* Adapted from the International Diabetes Federation (IDF) Type 2 Diabetes Clinical Practice Guideline for Sub-Saharan Africa, July 2006

3. APPENDIX III*

KEY ELEMENTS OF GOOD DIABETES CARE

The World Health Organization's Innovative Care for Chronic Conditions Framework (ICCCF) contains eight elements:

- Support a paradigm shift (from a focus on acute, episodic care to one that also includes chronic conditions);
- Manage the political environment;
- Build integrated healthcare;
- Align sectoral policies for health;
- Use healthcare personnel more effectively;
- Centre care on the patient and family;
- Support patients in their communities;
- Emphasize prevention (primary prevention is relevant to type 2 diabetes, while prevention of complications is relevant to both type 1 and type 2 diabetes).

* Adapted from the International Diabetes Federation (IDF) Diabetes Atlas, Fourth Edition, 2009.

4. APPENDIX IV *

TABLE OF ORAL GLUCOSE LOWERING AGENTS

CLASS & NAME OF DRUG	STARTING DOSE	MAXIMAL DOSE	MAJOR SIDE EFFECTS	CONTRAINDICATIONS
SULPHONYL-UREAS				
Glibenclamide	2.5mg	20mg	Hypoglycaemia, weight gain, skin rashes	Pregnancy, caution in liver and renal disease
Gliclazide	40mg	320mg	”	”
Glimepiride	1mg	8mg	”	”
Glipizide	5mg	40mg	”	”
Chlorpropamide	100mg	500mg	”	<div> <div>”</div> <div>”</div> <div>”</div> <div>”</div> </div> Not Recommended in Nigeria
Tolbutamide	500mg	2500mg	”	
Tolazomide	100mg	1000mg	”	
Acetohexamide	250mg	1500mg	”	
BIGUANIDES				
Metformin	500mg	2550mg	Abdominal pain, nausea, loose bowel motions, lactic acidosis	Renal, heart and liver failure; pregnancy
THIAZOLIDINE DIONES				
Rosiglitazone	4mg	8mg	Liver impairment, fluid retention, weight gain, dilutional anaemia	Renal, heart and liver failure; pregnancy
Pioglitazone	15mg	45mg	”	”
MEGLITINIDES				
Nateglinide	180mg	360mg	Hypoglycaemia, weight gain, dyspepsia	Heart and liver failure, pregnancy
Repaglinide	1.5mg	16mg	”	
ALPHA-GLUCOSIDASE INHIBITORS				
Acarbose	25mg	300mg	Dyspepsia, loose bowel motions	None
Meglitol	25mg	300mg	”	”
DIPEPTIDYL PEPTIDASE-4 INHIBITORS (DPP4-I)				
Vildagliptin	50mg	100mg		
Sitagliptin	50mg	100mg		
Saxagliptin	5mg	5mg		

* Adapted from the International Diabetes Federation (IDF) Type 2 Diabetes Clinical Practice Guideline for Sub-Saharan Africa, July 2006

5. APPENDIX V *

TABLE OF RECOMMENDED ANTI-HYPERTENSIVES FOR MANAGEMENT OF HYPERTENSION IN PEOPLE LIVING WITH DIABETES MELLITUS

CLASS	INDICATION	CONTRA-INDICATION	SIDE EFFECTS
<i>ACE inhibitors</i>	LVH, Nephropathy, Cardiac failure, Myocardial infarction	Renal A. Stenosis, End stage renal disease, Pregnancy	Cough, First dose, hypotension, Angioneurotic oedema, Hyperkalaemia, Skin rashes, Neutropenia, thrombocytopenia
Angiotensin II Receptor blockers	LVH, Nephropathy Cardiac failure, Myocardial infarction	Renal A. Stenosis End stage renal disease, Pregnancy	Hyperkalaemia
Thiazide diuretics	High volume Hypertension	Pregnancy	Hyperglycaemia, Hyperuricaemia, Hypercaemia, Hypokalaemia, Dyslipidaemia
Loop diuretics	Nephropathy, Heart failure	Pregnancy	Hypokalaemia, Hypomagnesaemia, Hyponatraemia, Hypocalcaemia, Hyperuricaemia, Hypochloraemic acidosis ototoxicity
<i>Beta blockers</i> (Preferably selective 1 antagonists)	Ischaemic heart disease, Arrhythmias, Hyperthyroidism, Migraine, Essential tremors, Hypertrophic obstructive cardiomyopathy	Obstructive airway disease, Heart block, Severe heart failure, Raynauds phenomenon, Active peripheral vascular disease, severe liver disease, Pregnancy	Bronchial constriction, Heart failure
Dihydropyridine (Calcium blockers)	Obstructive airway disease, Peripheral vascular disease	Unstable angina, Acute Myocardial infarction, Aortic stenosis, Hypertrophic obstructive cardiomyopathy pregnancy	Palpitations, Headaches, Peripheral oedema
Non-dihydropyridine (Calcium blockers -1 adrenoceptor blocker)	Arrhythmias BPH, Raynauds phenomenon, Pheochromocytoma	WPWS, Heart block, Heart Failure Pregnancy	Worsening of heart failure and heart block First dose hypotension, Urinary frequency and incontinence, Palpitations
Centrally acting anti-adrenergic agents	Pregnancy	Parkinsons disease, Pheochromocytoma	Postural hypertension, Drowsiness, impotence

* Adapted from the International Diabetes Federation (IDF) Type 2 Diabetes Clinical Practice Guideline for Sub-Saharan Africa, July 2006

6. APPENDIX VI

BALANCED DIET

Advice on a weekly balanced diet suitable for the Nigerian Community



Fruit and Vegetables	Bread, Rice, Potatoes and other Starchy Foods	Milk and Dairy products	Foods and Drinks high in Fat and/or Sugar	Meat, Fish and alternatives
33%	33%	15%	7%	12%

Key Points:

Fruit and vegetables

- This group provides a range of vitamins and minerals and fibre.
- Aim for at least 5 portions of fruit and vegetables per day e.g. an apple, dessert bowl of salad, a handful of grapes, a small glass of fruit juice, 3 heaped tablespoons of vegetables. Try to include a wide variety to ensure you get all the vitamins and minerals you need.



Bread, rice, potatoes, and other starchy foods

- This group provides energy, fibre and B vitamins.
- Try to include a portion at each meal time e.g. 1- 2 slices of bread, 2 - 3 tablespoons of breakfast cereals, 2 -3 heaped tablespoons of cooked rice and 3 - 4 heaped tablespoons of cooked pasta. Choose high fibre varieties e.g. wholegrain or wholewheat.



Milk and dairy products

- This group provides calcium, protein and vitamins B12, A and D.
- Choose lower fat options i.e. skimmed or semi-skimmed milk, low fat hard cheese, light soft cheeses or low fat yoghurt.
- Aim for at least 2- 3 servings during the day which is the equivalent of a pint of milk per day.



Foods and drinks high in fat and/or sugar

- Rich source of energy but provides little in the way of essential fats, vitamins and minerals.
- Reduce intake of high fat/ sugar food and drinks.



Meat, fish and alternatives

- This group provides protein, iron, omega 3 oils and zinc.
- Swap to heart healthier fats; avoid frying foods in lard, coconut oil and butter. Instead choose olive, rapeseed or sunflower oil.
- To reduce total fat intake choose lean varieties and trim off any visible fat prior to cooking. Grill, bake or boil whenever possible.



7. APPENDIX VII*

NATIONAL DIABETES PREVENTION PLANS

Government initiatives should include:

- **Advocacy**

- Supporting national associations and non-government organizations
- Promoting the economic case for prevention

- **Community support**

- Providing education in schools on nutrition and physical activity
- Promoting opportunities for physical activity through urban design (e.g. to encourage cycling and walking)
- Supporting sports facilities for the general population

- **Fiscal and legislative**

- Examining food pricing, labelling and advertising
- Enforcing environmental and infrastructure regulation (e.g. urban planning and transportation policy to enhance physical activity)

- **Engagement of private sector**

- Promoting health in the workplace
- Ensuring healthy food policies in food industry

- **Media communication**

- Improving level of knowledge and motivation of the population (press, TV and radio)

* Adapted from the International Diabetes Federation (IDF) Diabetes Atlas, Fourth Edition, 2009.

8. APPENDIX VIII*

NATIONAL DIABETES PROGRAMMES GOALS AND OBJECTIVES

National Diabetes Programmes: Goals and Objectives

- The following themes consistently appeared in the respondents' specification of their country's NDP goals:
- Raising public awareness: national promotion, information and education
- Prevention: primary (reduce diabetes incidence), secondary (early diagnosis and behaviour change), tertiary (reduce complications, mortality, minimize impact)
- Improve quality of diabetes treatment and care: accessible, community-based, multi-disciplinary teams, patient-centred approach
- Ongoing professional development/training for diabetes care personnel (health workers)
- Development of national clinical guidelines for diabetes
- Support for research into diabetes
- Establish a diabetes registry

* Adapted from the International Diabetes Federation (IDF) Diabetes Atlas, Fourth Edition, 2009.

9. APPENDIX IX

OECD HEALTHCARE QUALITY INDICATORS FOR DIABETES

Area	Indicator name
Process of care	Annual HbA1c testing
	Annual LDL cholesterol testing
	Annual screening for nephropathy
	Annual eye examination
Proximal outcomes	HbA1c control
	LDL cholesterol control
Distal outcomes	Lower-extremity amputation rates
	Kidney disease in persons with diabetes
	Cardiovascular mortality in people with diabetes

* Adapted from the International Diabetes Federation (IDF) Diabetes Atlas, Fourth Edition, February, 2009.

Organisation for Economic Co-operation and Development (OECD)

10. APPENDIX X***METHODS AND INTERFERENCE WITH Hb VARIANTS**

Method	Interference* from		HbAE	HbAD
	HbAS	HbAC		
Abbott Architect/Aeroset	Yes	Yes	-	-
Axis-Shield Afinion	No	No	No	No
Bayer A1cNOW	Yes	Yes	No	No
Beckman Synchron System	No	No	No	No
Bio-Rad D-10	No	No	No	No
Bio-Rad Variant II A1c	No	No	No	No
Bio-Rad Variant II Turbo A1c	No	No	Yes	Yes
Dade Dimension	No	No	No	No
Olympus AU system	Yes	Yes	No	No
Ortho-Clinical Vitros	No	No	No	No
Primus HPLC (affinity)	No	No	No	No
Roche Cobas Integra Gen.2	No	No	No	No
Roche/Hitachi (Tina Quant II)	No	No	No	No
Siemens Advia (original version)	Yes	Yes	-	-
Siemens DCA 2000	No	No	No	No
Tosoh A1c 2.2 Plus	No	No	Yes	No
Tosoh G7	No	No	Yes	No
Tosoh G8	No	No	Yes	No

*Clinical significance >10% difference at 6 and 9% HbA1c

11. APPENDIX XI

**DIABETES ASSOCIATION OF NIGERIA: DATA PROFORMA FOR
ENROLMENT, AUDIT, REGISTRY, CARE & RESEARCH**

Section 1: Patient Demographics

Medical Record No. Centre: Chapter:

1.1. Date of Birth / / 1.2. Sex ☐ Male ☐ Female *if FEMALE* → 1.2.1. Currently pregnant ☐ No ☐ Yes

1.3. Date of Visit / / 1.4. Initial Visit ☐ No ☐ Yes 1.5. Ethnic group

1.6. Nationality:

Section 2: Diabetes Type & Management

2.1. Date of Diagnosis / / 2.2. Type of Diabetes ☐ Type 1 ☐ Type 2 ☐ GDM ☐ Don't Know ☐ Other

2.3. Management Method ☐ Diet Only ☐ Acarbose ☐ GLP1 Agonist ☐ Sulphonylurea ☐ Insulin *if INSULIN* → 2.3.1 Insulin year started

☐ Metformin ☐ Glitazone ☐ DPP4 Inhibitor ☐ Nil

Section 3: Height, Weight & Smoking Status

3.1. Weight Kg

3.2. Height m BMI → kg/m²

3.3. Smoking Status ☐ Current Smoker ☐ Past Smoker ☐ Never Smoked

Section 4: Blood Pressure

4.1. Blood Pressure (most recent measured After 5 mins sitting) / mmHg

4.2. Anti-hypertensive treatment ☐ No ☐ Yes *if YES* → 4.2.1. Select from below

☐ ACE Inhibitor ☐ ACE + Thiazide ☐ ARB ☐ ARB+ ☐ Beta Blocker ☐ Calcium Antag ☐ Thiazides ☐ Others

Section 5: Diabetic Eye Disease – last 12 months

5.1. Saw Optometrist ☐ No ☐ Yes 5.2. Referred to ophthalmologist ☐ No ☐ Yes 5.3. Attended ophthalmologist ☐ No ☐ Yes

5.4. Visual acuity right eye 6/ 5.5. Visual acuity left eye 6/

5.6. Fundus examination in the past 12 months ☐ No ☐ Yes *if YES* → 5.6.1. Retinal camera ☐ No ☐ Yes 5.6.2. Right Retina ☐ Normal ☐ Non Diabetes Adnormality ☐ Diabetes Abnormality ☐ Not Visualised

5.7. Right Cataract ☐ No ☐ Yes 5.8. Left Cataract ☐ No ☐ Yes 5.6.3. Left Retina ☐ Normal ☐ Non Diabetes Adnormality ☐ Diabetes Abnormality ☐ Not Visualised

Section 6: Diabetic Foot Problems

6.1. Peripheral Neuropathy ☐ No ☐ Yes 6.2. Past History of Ulceration ☐ No ☐ Yes 6.3. Foot Deformity ☐ No ☐ Yes 6.4. Peripheral Vascular Disease ☐ No ☐ Yes 6.5. Current Foot Ulcer ☐ No ☐ Yes 6.6. Active Foot Lesion (other than foot ulcer) ☐ No ☐ Yes

Seen by other health professional in past 12 months

6.7. Attended Podiatrist ☐ No ☐ Yes 6.8. Attended Educator ☐ No ☐ Yes 6.9. Attended Dietician ☐ No ☐ Yes

Section 7: Medications & Lipids (most recent results last 12 months)

7.1. Anti-Lipid Rx ☐ No ☐ Yes 7.2. Statin Rx ☐ No ☐ Yes 7.3. Fibrate Rx ☐ No ☐ Yes 7.4. Vytorin Rx ☐ No ☐ Yes 7.5. Ezetrol Rx ☐ No ☐ Yes 7.6. Fish Oil Rx ☐ No ☐ Yes 7.7. Aspirin ☐ No ☐ Yes 7.8. Other anti-platelet therapies (eg. Clopidogrel) ☐ No ☐ Yes 7.9. Anticoagulant (eg. Warfarin) ☐ No ☐ Yes

7.10. Lipids measured ☐ No ☐ Yes *if YES* → Enter details below:

7.10.1 Cholesterol mmol/L 7.10.2 LDL mmol/L 7.10.3 HDL mmol/L 7.10.4 Triglycerides mmol/L 7.10.5 Above measured in Fasting specimen ☐ No ☐ Yes

Section 8: Complications/Events

Last 12 months Previous

8.1. Cerebral stroke ☐ No ☐ Yes ☐ No ☐ Yes 8.2. Myocardial infarction ☐ No ☐ Yes ☐ No ☐ Yes 8.3. Lower limb amputation ☐ No ☐ Yes ☐ No ☐ Yes 8.4. End stage renal disease ☐ No ☐ Yes ☐ No ☐ Yes 8.5. CABG/Angioplasty ☐ No ☐ Yes ☐ No ☐ Yes 8.6. Blindness ☐ No ☐ Yes ☐ No ☐ Yes 8.7. Severe hypoglycaemia ☐ No ☐ Yes ☐ No ☐ Yes 8.8. Erectile dysfunction ☐ No ☐ Yes ☐ No ☐ Yes

Section 9: Renal Function & Blood Glucose Control

9.1. eGFR > 60 ☐ No ☐ Yes 9.2. Result mL/min per 1.73m²

9.3. Microalbumin/Proteinuria Collected ☐ No ☐ Yes *if YES* → 9.3.1. Result mg/L 9.3.2. Units ☐ mg/L ☐ µg/min ☐ mg/24 hr ratio

9.4. Serum Creatinine µmol/L 9.5.1. Glycated Hb Result % (most recent in last 12 months) & FPG: mmol/L

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