Abridged NCD Guidelines

Diabetes, Asthma & Hypertension

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Foreword

Non-Communicable Diseases (NCDs) have emerged as a leading cause of preventable illness, disability, and premature death in Liberia. Conditions such as diabetes, hypertension, asthma, chronic respiratory diseases, sickle cell disease, and rheumatic heart disease continue to place a growing burden on individuals, families, communities, and the national health system.

The Government of Liberia, through the Ministry of Health, remains firmly committed to addressing this challenge by strengthening prevention, early detection, treatment, and long-term management of NCDs within an integrated and people-centered health system. This publication represents a significant milestone in our national response to Non-Communicable Diseases and Injuries.

These abridged guidelines developed, with the generous support of the World Diabetes Foundation and leadership from Ganta United Medical Hospitals, provide evidence-based, practical, and context-specific guidance to support policymakers, healthcare providers, program managers, and partners across all levels of the health system.

This document reinforces our commitment to Universal Health Coverage, health equity, and the integration of NCD services into primary healthcare. It aligns with national health policies, regional commitments, and global frameworks, including the WHO Global Action Plan for the Prevention and Control of NCDs.

I commend all stakeholders who contributed to the development of this guideline and encourage its widespread use to improve service delivery, strengthen community engagement, and ultimately improve health outcomes for all Liberians.

Together, we can reduce the burden of NCDs and build a healthier, more resilient nation.

Dr. Louise M. Kpoto, **MD, MPH, MMed-OBGYN, PhD, FWCS, FLCS**

Minister

Ministry of Health

Acknowledgement

On behalf of the Ministry of Health through the NCDI Unit, we extend our sincere gratitude to all individuals and institutions whose contributions made the development of these Non-Communicable Diseases and Injuries (NCDI) Guidelines an evidence-based document.

nvaluable support provided by the various program units at the Ministry of Health and our partners, including World Diabetes Foundation, Ganta United Methodist Hospital, Diabetes Endocrinology Society of Liberia, Non-Communicable Diseases Alliance (LiNCDA) for their commitment to strengthening National Health Systems laid the foundation for this work.

Special thanks go to the Technical Working Group (TWG) on NCDIs, whose expertise, dedication, and collaborative effort guided the process.

We are also grateful to World Diabetes Foundation, World Health Organization (WHO), PEN-PLUS, and other stakeholders for their technical input and strategic guidance toward aligning these guidelines with global best practices while remaining guided by our local context.

We furthermore recognize the contributions of Healthcare Professionals, and Subject Matters Experts who participated in consultations and shared their honest experiences.

Their contributions enriched the guidelines and ensured they reflect the needs of the vulnerable population mostly affected by NCDIs. This document is a testament of your unwavering support and collaboration that serves as a valuable resource in advancing equitable and effective NCDI care across Liberia.

Finally, we thank the funding agencies and development partners whose financial and logistical support enabled the successful completion of this initiative.

Congratulations

Catherine Cooper, MD

Catherine T. Cooper **MD**

Deputy Minister Chief Medical Officer-RL

Contributors

Those who primarily devoted efforts and expertise. The core team involved in the authoring and adaptation of the document include:

Ministry of Health (MoH)

Mrs. Jamesetta T.G. Smith, Director Non-Communicable Diseases & Injuries Unit, MoH
Mr. Dennis Kamah, Deputy Director NCDI unit
Dr. Williamatta Williams-Gibson, Technical Assistant, NCDI Unit
Dr. Hassan Suliaman Rogers, Program Pharmacist, NCDI Unit
Mr. Gontopoe Omedo Nuahn, National Coordinator-Diabetes and Hypertension, NCDI Unit
Mrs. Nancy K. Saydee, National Coordinator, Injuries, Assistive Tech. & Elderly Care, NCDI,
Ms. Hokie Jackson, National Coordinator Oral Health and Chronic Respiratory Diseases, NCDI
Mrs. Florence Yahnquee. Kiatamba, National Coordination, Cancer & Palliative, NCDI Unit
Mrs. Lovetta B. Dixon, Coordinator, Adolescents Nutrition, Nutrition Unit
Ms, Viavian S. Williams
Mrs. Musu Tulay, Communication Unit
Mrs. Grace Kamara, National Eye Health Unit

John F. Kennedy Medical Center

Dr. Neyarher Vaye Internist
Dr. Emmanuel K. Ekyinabah Internist
Dr. Hawa Soni-Koon Endocrinologist
Dr. Juliet Wheeyee Diggs Psychiatry
Dr. Clarence S. K. Wesseh Pediatrician
Dr. Yassah Barclay Internist
Dr. Philip Ireland Internist

Partners

Emmanuel Kpon Saye, Coordinator, Ganta United Methodist Hospital
Mr. Barkon Dweh, Special Assistant NCDs-WHO
Dr. Sentamu John Vanglist, Internist-Partners in Health

List of Abbreviations

ABI	Ankle-Brachial Index
ACEI	Angiotensin Converting Enzyme Inhibitors
ADA	American Diabetes Association
ANC	Antenatal Care
ARB	Angiotensin Receptor Blockers
BMI	Body Mass Index
BP	Blood Pressure
CABG	Coronary Artery Bypass Graft
CCU	Critical Care Unit
CHD	Coronary Heart Disease
CKD	Chronic Kidney Disease
CRP	C-reactive protein
CVD	Cardiovascular Disease
DCC	Diabetes Comprehensive Care
DESoL	Diabetes and Endocrine Society of Liberia
DKA	Diabetic Ketoacidosis
DM	Diabetes Mellitus
DFU	DM Foot Ulcers
DPP-4	Dipeptidyl petidase-4
DSME	Diabetes Self-Management Education
ECG	Electrocardiogram
EASD	European Association for the Study of Diabetes
eGFR	Estimated Glomerular Filtration Rate
FBG	Fasting Blood Glucose
FPG	Fasting Plasma Glucose
GDM	Gestation Diabetes Mellitus
G-I-K	Glucose-Insulin-Potassium
GLP-1	Glucagon Like Peptides
GoL	Government of Liberia
HbA1c	Glycosylated Hemoglobin
HAART	Highly Active Anti-Retroviral Therapy
HDL	High Density Lipoprotein
HDU	High Dependency Unit
HHS	Hyperosmolar-Hyperglycemic State
HE	Hyperglycemic Emergencies
HF	Heart Failure

ICU	Intensive Care Unit
IDF	International Diabetes Federation
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
IHD	Ischemic Heart Disease
LDL	Low Density Lipoprotein
LCPS	Liberia College of Physicians &Surgeons
MNT	Medical Nutrition Therapy

MODY	Maturity-Onset Diabetes in Young
MI	Myocardial Infarction
NCDI(s)	Non-Communicable Diseases and Injuries
OECD	Organization for Economic Cooperation and Development
OGLAs	Oral Glucose Lowering Agents
OGTT	Oral Glucose Tolerance Test
PLWD	People Living with Diabetes
PRN	As Needed
RBG	Random Blood Glucose
SBGM	Self-Blood Glucose Monitoring
T2DM	Type 2 Diabetes Mellitus
TCHOL	Total Cholesterol
TFTs	Thyroid Function Tests
TG	Triglyceride
TZD	Thiazolidinediones
UKPDS	UK Prospective Diabetes Study
WC	Waist Circumference
WDF	World Diabetes Foundation
WHO	World Health Organization
WHR	Waist Hip Ratio

Introduction

This document outlines essential programmatic standards for managing key non-communicable diseases (NCDs) at both primary and secondary care levels, with a primary focus on diabetes and hypertension conditions supported by funding from the World Diabetes Foundation. While the guidelines emphasize these two prevalent NCDs, they also incorporate other serious chronic conditions addressed by the PEN-Plus approach, sickle cell disease (SCD), rheumatic and congenital heart diseases. Notably, this guideline is for diabetes, hypertension and asthma. PEN-Plus complements the World Health Organization's Package of Essential Noncommunicable Disease Interventions (WHO PEN), which targets primary care management of common chronic NCDs. WHO PEN provides high-quality care at Primary health care level. WHO PEN model builds multidisciplinary teams-comprising of doctors, nurses, physician assistants, mid-wives, and other healthcare workers-who deliver longitudinal care, mentorship, and referral support, strengthening both hospital and primary care services.

This document is intended for clinicians, including mental health, and social workers involved with patient care at primary level. It offers clear definitions of clinical care standards, including diagnosis, treatment, patient support services and referral. These definitions guide planning, budgeting, and operations, and provide a basis for identifying essential medications, equipment, training requirements, and healthcare provider competencies. The standards presented here are informed by extensive experience implementing WHO PEN across 35 African countries and were developed through collaboration with clinical experts, ministries of health, healthcare providers, and other key partners specialized in managing diabetes, hypertension and Asthmas.

Chapter 1

DIABETES

1.0 Diabetes Mellitus

According to WHO Health Topic 2025, Diabetes is a chronic metabolic disease characterized by increased blood glucose level, which leads overtime to serious damage to the heart, blood vessels, eyes, kidneys, and nerves. High blood glucose occurs either when the pancreas does not produce enough insulin (DM type 1) or when the body cannot effectively use the insulin it produces (DM type 2). Figure one shows a detailed definition.

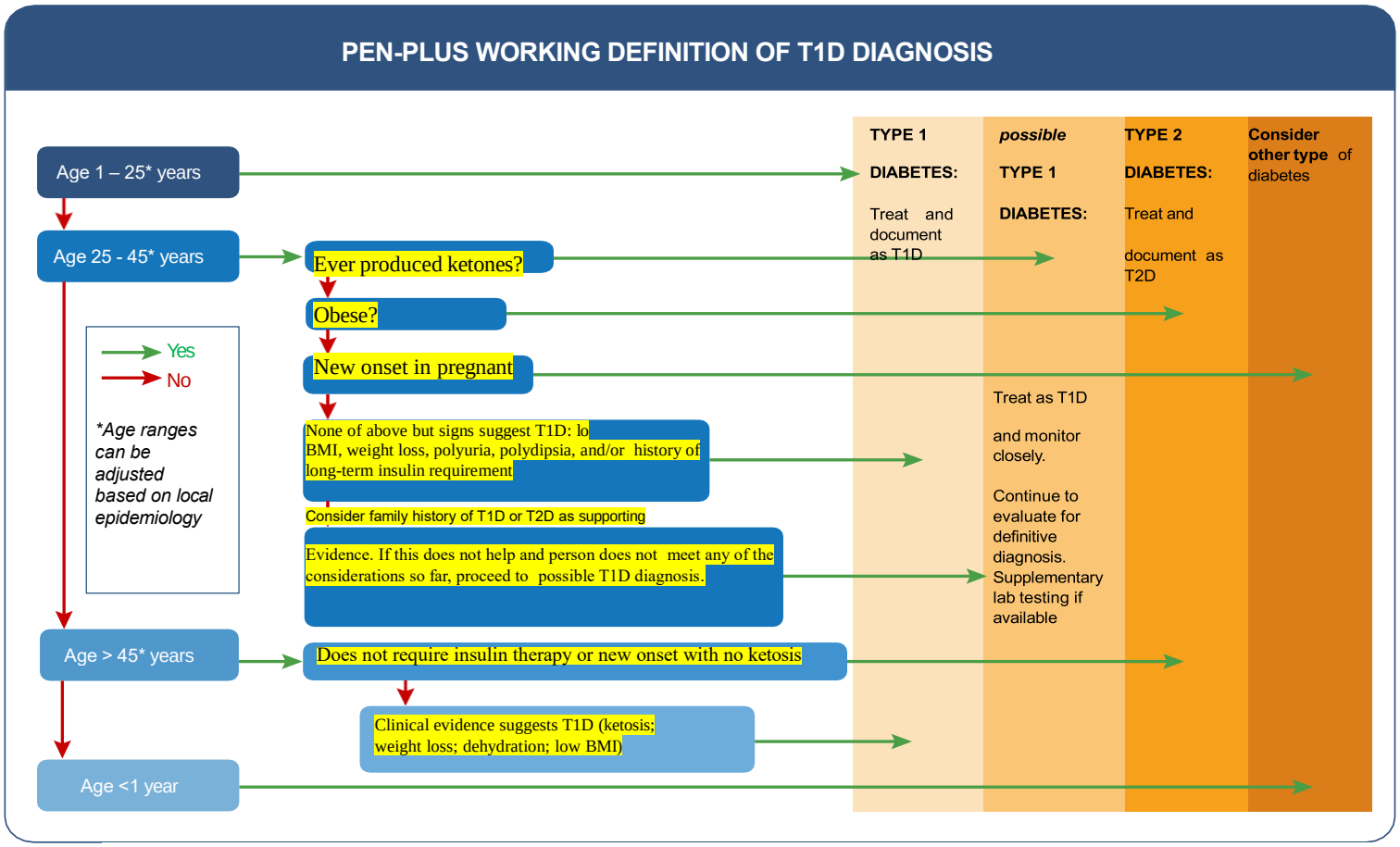


Figure 1: PEN-PLUS TYPE 1 Working Diagnosis

1.1 Epidemiology

Diabetes is found in every population in the world and in all regions, including rural parts of low- and middle-income countries. WHO estimates there were 422 million adults with diabetes worldwide in 2014. The age-adjusted prevalence in adults rose from 4.7% in 1980 to 8.5% in 2014, with the greatest increase in low- and middle-income countries.

1.2 Pathophysiology of Diabetes

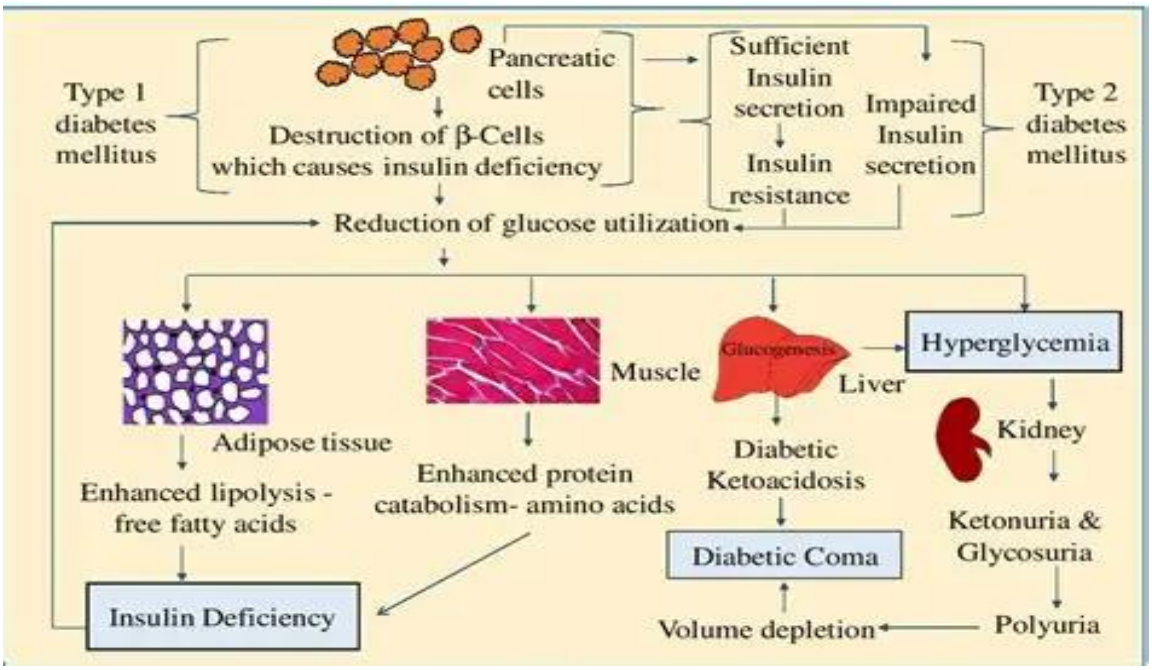


Figure 2: Source; 2023 Elsevier B.V.

The diagram illustrates the pathophysiology of diabetes mellitus, highlighting the differences and shared mechanisms between Type1 and Type2 diabetes. In Type1 diabetes, destruction of pancreatic beta cells leads to absolute insulin deficiency. In Type2 diabetes, insulin is produced but is insufficient or ineffective due to insulin resistance and impaired secretion. In both conditions, reduced insulin action results in decreased glucose utilization by body tissues, leading to persistent hyperglycemia. Adipose tissue responds by increasing lipolysis, releasing free fatty acids, while muscle tissue undergoes enhanced protein catabolism, producing amino acids. The liver uses these substrates for gluconeogenesis and ketogenesis, further worsening hyperglycemia and leading to diabetic ketoacidosis in severe cases. Excess glucose in the blood spills into the urine, causing glycosuria, polyuria, and volume depletion. If untreated, these metabolic disturbances may progress to diabetic coma and can be life-threatening.

1.3 Type1 Diabetes Mellitus (T1DM)

Pathophysiology: Autoimmune destruction of pancreatic β-cells → absolute insulin deficiency.

Mechanism:

Genetic predisposition + environmental trigger (e.g., viral infection) → immune-mediated β-cell destruction.

Results in no insulin production, leading to:

↓ glucose uptake by cells

↑ hepatic glucose production (gluconeogenesis, glycogenolysis)

Hyperglycemia, ketone formation, and metabolic acidosis (diabetic ketoacidosis).

1.4 Type 2 Diabetes Mellitus (T2DM)

Pathophysiology: Combination of insulin resistance and relative insulin deficiency.

Mechanism: Peripheral tissues (muscle, fat, liver) become less responsive to insulin → glucose uptake decreases Over time, β-cell dysfunction develops → insufficient insulin secretion. Persistent hyperglycemia and excess lipids/fat further worsen insulin resistance.

1.5 Clinical Presentation for Type 1 Diabetes

In type 1 diabetes, the pancreas is unable to produce insulin as a result, there is no to little insulin production in the body. The actual cause is unknown but it is an autoimmune disease in which the immune system sees the beta cells of the pancreas as foreign body, attacks and destroys it. Often starts in childhood and adolescents (4-16) years but can present as early as 1 years, or after 16 years of age.

1.6 Signs & Symptoms

- Frequent urination (Polyuria)
- Increase thirst (Polydipsia)
- Excessive hunger with craving for more food (Polyphagia)
- Unexplained weight loss
- Extreme tiredness and lack of energy
- Candida vulvovaginitis in girls
- Worsening signs and symptoms (suspect DKA)
- Deep breathing (Respiratory distress)
- Fruity breath smell
- Vomiting
- Abdominal pain (Stomach pain)
- Dehydration (Sunken eyes, poor skin turgor, dry mouth etc.)
- Altered level of consciousness

Table 1: Types of Diabetes

Type of diabetes	Description
Type 1 diabetes	Beta-cell destruction (immune-mediated) and absolute insulin deficiency; onset most common in childhood and early adulthood
Type 2 diabetes	Resistance to insulin and relative insulin deficiency. Onset most common in adulthood
Hybrid forms of diabetes	
Slowly evolving, immune mediated diabetes of adults	Similar to slowly evolving type 1 in adults but more often has features of the metabolic syndrome, a single GAD autoantibody, and retains greater beta-cell function.

Ketosis-prone type 2 diabetes	Presents with ketosis and insulin deficiency but later does not require insulin; common episodes of ketosis, not immune mediated.
Other specific types	
Monogenic diabetes: a) Monogenic defects of beta-cell function b) Monogenic defects in insulin action	Caused by specific gene mutations. Has several clinical manifestations requiring different treatment, some occurring in the neonatal period, others by early adulthood. Caused by specific gene mutations. Has features of severe insulin resistance without obesity; diabetes develops when beta-cells do not compensate for insulin resistance.
Diseases of the exocrine pancreas	Various conditions that affect the pancreas can result in hyperglycaemia (trauma, tumour, inflammation, etc.).
Endocrine disorders	Occurs in diseases with excess secretion of hormones that are insulin antagonists
Drug- or chemical-induced	Some medicines and chemicals impair insulin secretion or action; some can destroy beta-cells.
Infection-related diabetes	Some viruses have been associated with direct beta-cell destruction.
Uncommon specific forms of immune-mediated diabetes	Associated with rare immune-mediated diseases
Other genetic syndromes sometimes associated with diabetes	Many genetic disorders and chromosomal abnormalities increase the risk of diabetes
Unclassified diabetes	Used to describe diabetes that does not clearly fit into other categories. This category should be used temporarily, when there is no clear diagnostic category, close to the time of diagnosis, in particular.
Hyperglycemia first detected during pregnancy	
Diabetes mellitus in pregnancy	Type 1 or type 2 diabetes first diagnosed during pregnancy.
Gestational diabetes mellitus	Hyperglycemia below diagnostic thresholds for diabetes in pregnancy.

Some noticeable complications are diabetic retinopathy, nephropathy & neuropathy.

1.7 Diagnostic Criteria Types 1

Is diagnosed using any of the below listed of blood tests.

Key tests include:

- Random blood sugar test (≥200mg /dl or 11.1mmol) with classical signs and symptoms above
- Fasting blood glucose test (≥ 126mg/dl or 7mmol)
- HbA1c test (≥6.5%) with certified machine
- Sometimes oral glucose tolerance test (two hours after ogtt >200mg/dl or 11.1mmol)
- Other important investigation

Urinalysis (Glucose, ketones), C-peptide, Autoantibodies (GAD 65, Islet cell, Zinc transporter 8, Insulin)

Table 2:Testing for Type 2 Diabetes

Overweight or obese:
BMI >85th pertile for age and gender
Maternal history of diabetes or gestational diabetes millitus during the child's gestation
Family history of type 2 diabetes millitus in a first or second degree relative
High-risk race/ethnicity (black)
Signs of insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small for gestational age birth weight)
Who to Screen and the Frequency
Those with symptoms of acute hyperglycemia
Those with evidence of chronic complications
Those with hypertension
Those who are age 30 and above

Table 3: Diagnostic Criteria for Type II

	Fasting	**Random**
Normal Blood Glucose	80 mg/dl – 100mg/dl (4.4.0mmol/l – 5.5 mmol/l)	80mg/dl – 140mg/dl (4.4 mmol/l – 7.8 mmol.l)
Prediabetes	101mg/dl - 125mg/dl (5.6 – 6.9 mmol/l)	141mg/dl – 199mg/dl (7.8 mmol/l – 11.0 mmol/l)
Diabetes	≥126md/dl (≥7mmol/l)	≥200 mg/dl (11.1 mmol/l)
≥126mg/dl (7mmol/l fasting and ≥200 mg/dl (11mmol/l). If symptomatic: One test. If asymptomatic: Two tests on two separate days		

1.8 Treatment Plan

Insulin used for treating patient in Liberia

Insulin formulations can be grouped into basal (background) and bolus (meal) insulins. Basal insulin provides a steady level of insulin to control blood sugar (blood glucose, BG) between meals and overnight. Bolus insulin is a quicker-acting insulin taken before meals to cover the rise in BG caused by food.

Table 4: Available insulins and half-life

Insulin (U100)	Onset of action	Peak effect (h)	Duration (h)
Bolus insulin			
Regular (soluble) human (Actrapid)	30-60 min (short-acting)	2-4	5-8 h
Aspart (NovoRapid)	15 min (rapid-acting)	1-3	3-5
Lispro (Humalog)	15-30 min (rapid-acting)	1-2	≤5

Basal insulin			
NPH (cloudy in color, Snack needed between meals, risk of nighttime hypo)	2-4 h (intermediate-acting)	4-12	12-24
Glargine (Lantus, Basaglar)	2-4 h (long-acting)	8-12 (no peak)	22-24
Detemir (Levemir)	1-2 h (long-acting)	4-7 (no peak)	20-24

Premixed insulin containing NPH and Regular insulin (i.e., Mixtard and Humulin 70/30) twice a day is NOT recommended for use in Type 1 diabetes in children because of the inability to match insulin to food and to adjust the insulin components separately.

The NPH vial should be gently rolled (not shaken) 10-20 times to mix the insulin suspension before drawing it up into the syringe. When NPH is mixed with short- or fast-acting insulin, the clear insulin (short or rapid) is drawn into the syringe before the NPH (cloudy)

It is not recommended to mix long-acting insulins with other insulins.

- When in use, insulin can be stored at room temperature (below 25° or 30°C) for 4 weeks.
- When not in use, insulin should be stored in a nearby refrigerator but not near the freezer (Freezing damages the insulin).

1.9 Insulin requirements in Children

The starting dose of insulin for patients depends on the age, pubertal staging & weight. However, insulin sensitivity or requirement may change based on the injection site and technique, exercise, illnesses, duration of diabetes, amount and type of carbohydrate consumed.

- Children under 5 years: 0.3-0.5 units/kg/day
- Pre puberty children 5years and over: 0.7-1.0 units/kg/day
- During puberty: 1-2 units/kg/day
- Post-puberty: 0.7-1.0 units/kg/day

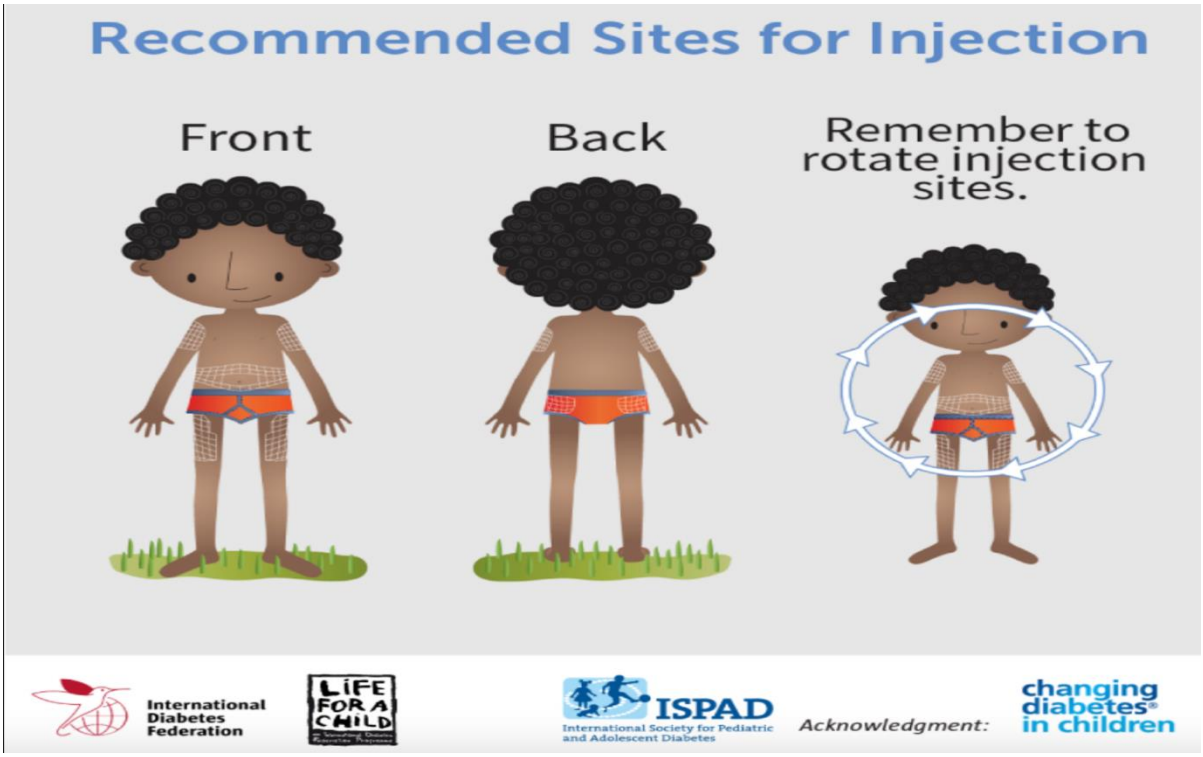
Honeymoon phase is a period following the initial diagnosis and treatment of type 1 diabetics, when patients' insulin requirement begins to drop. Patients who were initially started on an appropriate dose of insulin (Ex: 1unit/kg/day) may temporarily require less insulin dose, example 0.25 units /kg/day. This honeymoon period may last up to a year.

Note: The goal of providing correct dose of insulin for children/adolescent is to:

- Achieve appropriate blood glucose (BG) level without frequent hypoglycemia.
- Allow the child to grow and develop well. Monitor weight and height at every clinic visit.
- Achieve a HbA1c less than 8.5 for under 6, less than 8 for 6 to 12 years, less than 7.5 for 13 years and above (ADA)

1.1.10 Insulin Injections

- Inject Regular insulin 20-30 minutes before a meal and Rapid Acting Insulin 10-15 minutes before a meal.
- Rotate injections systematically to avoid lipo-hypertrophy, injecting at least 1 cm from previous injection.
- There should be a delay of 5-10 seconds after pushing in the syringe plunger or injecting by pen before removing the needle.
- The abdomen is the preferred site for administering regular insulin (quick absorption).
- Needles are designed as sterile, single-use devices. If they must be reused, limit one needle to no more than 5 times or when it becomes painful to use.
- Small syringes with half or 1unit markings (e.g., 30 unit or 50-unit, 100 U/mL) are preferable for use in small children, making it possible to dose in half units.



1.11. Finding Total Daily Dose (TDD)

TDD= Patient kg x Insulin requirement per age

Ex. A 7-year-old child with a weight of 20kg

Calculation:

TDD= 20kg X 0.7 IU

TDD= 14 IU

1.12. Maintenance Dose

NPH and Regular

a) Using fixed doses, prescribe NPH and Regular injections 2 times daily.

b) Using fixed doses, prescribe NPH and Regular injections 2 times daily plus correction dose using regular insulin (based on pre-meal glucose).

Correction dose is a prescribed amount of regular insulin used to reduce pre-meal hyperglycemia (high blood glucose level) to the patient's targeted range.

Intermediate or Basal Insulin (NPH): AM dose is required and PM dose is also required using the rule of third. Bedtime NPH has more risk of causing nocturnal hypoglycemia. Please increase dose with caution and monitor more closely at night 2 to 3am.

Regular or short acting or Bolus Insulin: AM dose is required and PM dose is also required using the rule of third.

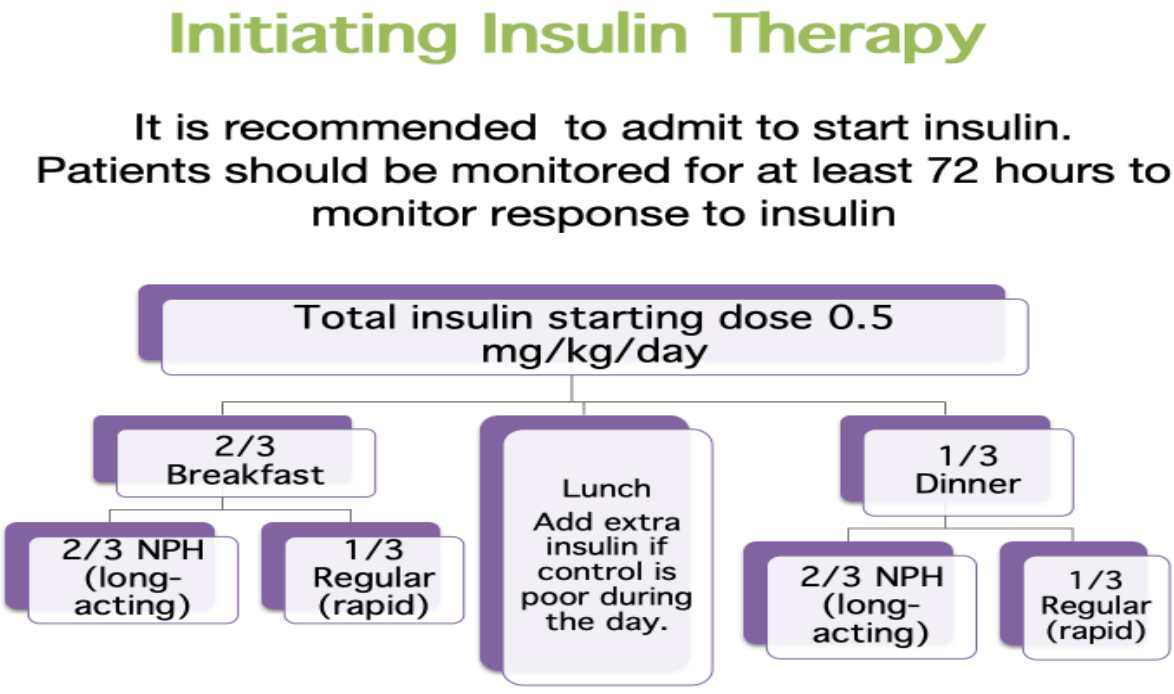


Figure 3: Initiating insulin Therapy. Source: World Diabetes Federation

Examples:

A 7-year-old child with a weight of 20kg, started on 0.7IU/Kg

TDD= 14 Units

TDD = 2/3 of the TDD will serve as AM dose

1/3 will serves as PM dose

2/3 x 14= 9 AM for **prebreakfast** (NPH and Short Action/Regular)

2/3 x 9= 6 unit Am dose is NPH

1/3 x 9= 3 unit Am dose is short acting

1/3 x 12= 5 PM dose of **pre-dinner** (NPH and Short Action/Regular)

2/3 x 5= 3 PM dose of NPH

1/3 x 5= 2 PM dose of Short Action/ Regular

Lunch time correction dose using regular insulin, if needed.

Using Lantus and Regular

Lantus 50% of TDD. Few patients may require only 40% of TDD

Regular= Fixed dose is 50% divided into 2-3 doses based on carbohydrate quantity and frequency of meal

OR

Carbohydrate counting (450/TDD) providing the grams of carbohydrate appropriate for every one unit of insulin taken.

Example: TDD= 14Units

Lantus= 50% of 14U = 7-unit Lantus at bedtime

Regular = Total 7 Units maximum

Fixed dose Prebreakfast (2Units for smallest carb.) Pre-lunch (3Units large carbohydrate lunch) Predinner (2Units small carbohydrate)

OR

Carbohydrate Counting (450/TDD) provide the grams of carbohydrate appropriate for every one unit of insulin.

Example:

TDD= 14units

450/14 = 32

Insulin to carb ratio = 32.

1 unit of insulin is provided for every 32grams of carbohydrate.

Table 5: Insulin Regimen

Insulin Regimen	Reasonable starting Regimen	Preferred		Optimal	Optimal / Preferred	Not Preferred		Not Preferred
Example	NPH:2 times daily Regular: 2 times daily with fixed doses	NPH:2 times daily Regular: 2 times daily with correction dose (based on pre meal glucose)	NPH:2 times daily Regular: 3 times daily with fixed doses Assumes 3 meals per day	NPH:2 times daily Regular: 3 times daily with correction dose (based on pre meal glucose) Assumes	Glargine: 1 time daily only Regular: 2-3 times daily	NPH:2 times daily	Glargine: 1 time daily	Mixed Insulin (70/30); 2 times daily

1. Can understand numbers (what is a high, low sugar
2. Knows numbers on syringe
3. 60 strips per month

If consistently checking
BG at lunch and there is hypoglycemia in evening

1. Can understand numbers (What is a high, low sugar
2. Know number of syringe
3. 90 strips per month

				3 meals per day				
	NPH: 15 AM, 10 PM Regular: 4 units 2 times daily Use rule of thirds 2/3 daily dose in morning (2/3 NPH; 1/3 regular) 1/3 daily dose in evening (2/3 NPH; 1/3 regular	NPH: 15 AM, 10PM Regular: 2 times daily before meals Correction dose based on chart Checking glucose before breakfast and dinner and giving an additional dose of insulin, based on scale on chart	NPH: 15 AM, 10PM Regular: 4 units 3 times daily Use 50/50 rule** NPH-50% of total dose -split into half in morning; half in evening Regular-50% of total dose-split into three	NPH: 15 AM, 10PM Regular: 3 times daily before meals Correction dose based on chart Checking glucose before breakfast, lunch and dinner giving an additional dose of insulin, based on scale on chart	Glargine: 25 units Daily Regular: 4 units 3 times daily Use 50/50 rule Glargine 50% total dose once daily Regular-50% of total dose-spilt into 2 or 3 doses	NPH: 15 AM, 10PM	Glargine: 25 units Daily	Mixed Insulin (70/30) 20 AM, 15 PM
Minimum # test strips/ day	1-2 per day (30-60 per month)	2 per day (60 per month)	1-2 per day (30-60 per month)	3 per day (90 per month)	1-2 per day (30-60 per month)	1-2 per day (30-60 per month)		

Pros	Easy to start with	Reduced risk of hypoglycemia, can reduce hyperglycemia by accounting for pre-meal glucose	Simple, closer to Physiologic Insulin requirements	Reduced risk of hypoglycemia, can reduce hyperglycemia by accounting for pre-meal glucose	Preferred if glargine is available ***	Reduced injections	Reduced injections	Reduced injections but maintains meals coverage
Cons	Assumes eating at the same time each day and the same amount of carbohydrates	Requires glucose checking prior to meals Requires a greater number of test strips Assumes consuming consistent meals with consistent carbohydrates	Assumes consuming THREE consistent meals with consistent carbohydrates Challenges with clients who are at work or school during the day	Requires glucose checking prior to meals Requires a greater number of test strips Assumes consuming THREE consistent meals with consistent carbohydrates	May be more expensive	Will have persistent hyperglycemia from not giving Insulin for carbohydrates consumed	Will have persistent hyperglycemia from not giving Insulin for carbohydrates consumed May be more expensive	High risk of hypoglycemia if reduced meal size or inconsistent meals
Patient considerations	Reasonable starting		Consider if hypergly	Consider if glucose is variable and	Best regimen	Consider during periods of food insecurity		Consider during periods

	regimen for most patients		cemia in evening and is consistently checking glucose at lunch	patient has demonstrated competency with previous regimens Requires checking glucose before all meals AND basic numeracy (understanding/ reading numbers).	if can afford	Or short-tern during periods where focusing on diabetes may be a challenge (ie teenager)	were focusing on diabetes may be a challenge (ie teenager) as long as no food insecurity

1.12. The correction dose should be added to the premeal insulin dose to keep patients in targeted ranges

Two methods

Individualized Correction factor & Scale

1. Correction dose= 1500/ TDD

Ex: 1500/14= 107, use 110 for ease of calculation

1 unit using 1ml (U-100) syringe drop a blood glucose by 110mg/dl. Correction begins from > 200mg/dl to prevent hypoglycemia after correction (200-110=90mg/dl- no risk of causing hypoglycemia with correction)

201 to 310 Add 1U

311 to 420 Add 2U

0.5 units using 0.5ml syringe (if available) can drop a blood glucose by 55mg/dl

Correction begins from 180mg/dl

181 to 235 Add 0.5 U

236 to 290 Add 1U

Table 1.13. Correction Dose (Add correction dose to pre-meal insulin dose when the blood glucose level is above the targeted range.

Table 6: Use only rapid-acting insulin or short-acting insulin for correction

Use this scale if Total daily dose of insulin is 10 - 19 Units per day (Correction factor 1: 120 Correct above 200)	
If Pre meal glucose is.	Then add this amount to the **usual insulin dose**
<250	No correction
251-400	1U
401-550	2U
>551	3U

Table 7:Use only rapid-acting insulin or short-acting insulin for correction

Use this scale if Total daily dose of insulin is 20 - 29 Units per day (Correction factor 1: 75 Correct above 200)	
If Pre meal glucose is.	Then add this amount to the **usual insulin dose**
<200	No correction
200-275	1 U
276-350	2 U
351-425	3 U
> 425	4 U

Table 8:Use only rapid-acting insulin or short-acting insulin for correction

Use this scale if Total daily dose of insulin is 30-49 Units per day (Correction factor 1:45 Correct above 200)	
If Pre meal glucose is..	Then add this amount to the **usual insulin dose**
<200	No correction
201-245	1 U
251-300	2 U
201-350	3 U
351-400	4 U
401-450	5 U
451-500	6 U
>500	7 U

Table 9:Use only rapid-acting insulin or short-acting insulin for correction

Use this scale if Total daily dose of insulin is >50 Units per day (Correction factor 1: 30 Correct above 200)	
If Pre meal glucose is..	Then add this amount to the **usual insulin dose**
<200	No correction
201-230	1 U
231-260	2 U
261-290	3 U
291-320	4 U
321-350	5 U
351-380	6 U
381-410	7 U
411-440	8 U

1.13 Adjusting Insulin for hypoglycemia and hyperglycemia

- Due to growth during childhood and changes to daily activities in all persons with T1D, insulin must be adjusted frequently.
- All patients must have a **blood glucose log** to record blood glucose. This is essential to adjusting insulin dose in the clinics.

1.14 Basics of Insulin Adjustment

Ability to adjust insulin depends on knowing 5 main factors:

1) Types of insulin being used
   For **twice a day Regular/NPH**: morning dose is usually 2/3 of the total daily dose, and evening dose is 1/3 of the total daily dose. Within those doses, Regular is 1/3 and NPH is 2/3. Based on R/N action times:

Table 10: ADJUSTING INSULIN

Adjust THIS insulin	**Based on BG at THIS time of day**
Morning Regular	Pre-Lunch
Morning NPH	Pre-dinner
Evening Regular	Bedtime
Evening NPH	Pre-breakfast

For **basal/bolus regimens** with Regular and long-acting insulin, Regular is often 50% of the total daily dose, and long-acting insulin is 50% of the total. If patient is on premeal Regular 3 times a day and bedtime long-acting insulin (i.e., Lantus, Basaglar, Detemir), also called Multiple Daily Injections (MDI):

Table 11: Adjusting insulin

Adjust THIS insulin	**Based on BG at THIS time of day**
Breakfast Regular	Pre-lunch
Lunch Regular	Pre-dinner
Dinner Regular	Bedtime
Bedtime long-acting insulin	Pre-breakfast

2) Target blood glucose (BG) values

Per ISPAD: pre-meal BG targets should be 72–144 mg/dL (4.0–8.0 mmol/L)

post-meal should be 72–180 mg/dL (4.0–10 mmol/L)

Bedtime goal of 90-150 mg/dL (5.0-8.3 mmol/L) is reasonable.

3) Results of BG testing several times a day

4) Patient's optimal insulin dose based on age and pubertal staging.

5) Patient's nutritional status (Fixed carbohydrate or carbohydrate counting)

1.15 How to Make an Actual Adjustment

- Short- and rapid-acting insulin — adjust by ½, one, or 2 units depending on total daily dose of insulin and how high BG readings are; start slowly if uncertain (Estimated 10 to 20% of TDD)
- Intermediate-acting and long-acting — adjust by 1 or 2 units at a time, depending on total daily dose
  and BG; start slowly
- Adjust only one insulin at a time unless patient has very high BGs at all times of day; can also adjust more than one insulin if patient has both hyperglycemia and hypoglycemia
- Do not make adjustments more often than every 3 days

Glucose Monitoring Sheet

Name: _____

Date: _____ Correction Factor: _____ Target Range: _____

Total daily dose: _____ Correction Table: Blood glucose range Regular insulin added

Prescription: Regular _____ _____ _____

_____ _____ _____

_____ _____ _____

Glargine (Lantus/Basaglar) _____ _____ _____

Insulin Carbohydrate ration_____ _____ _____

Date	Prebreak fast glucose	Insulin served	Food eaten/size	Pre-lunch blood glucose	Insulin served	Food eaten/size	Predinner blood glucose	Insulin served	Food eaten/size	Bedtime blood glucose	Exercise Reason for Hypo/Hyper

Figure 4: Glucose Monitoring Sheet

1.16 Management of Hypoglycemia

Hypoglycemia- blood glucose level less than 70mg/dl Patients may complain of hunger, shaking, weakness, confusion, headache, dizziness, seizure and loss of consciousness. Hypoglycemia kills and should be managed as an emergency. Hypoglycemia < 70 is concerning and must be managed. Hypoglycemia < 54mg/dl is serious and calls for immediate action.

1.17. Correcting hypoglycemia

1. Give 15grams fast acting carbohydrate and recheck blood glucose after 15 mins. If blood glucose less than 70mg/dl, repeat the above. Example of 15 grams fast acting carbohydrate include: 3 teaspoon sugar, 3 teaspoon honey, ½ glass juice or soda.

2. If unconscious and at home, place enough damp sugar in inner check/ beneath tongue of patient. Continue monitoring blood glucose, manage as # 1 if patient wakes up. For all unconscious patients at home,
    a. Call the clinic or your health care provider
    b. Take patient to the nearby clinic or health center
    c. Do not stop placing the damp sugar in the patients inner check or beneath tongue while in route to the health facility.
3. If unconscious and in hospital, give 10ml/kg of dextrose 10% and monitor blood glucose
4. Allow patient take a 15grams complex carbohydrate snack after correction (ex: one small apple, one small banana, half glass of milk or 2 pieces of cream crackers) or allow patient take their insulin and eat immediately after with no wait time. If this is not done, the patient could go back into hypoglycemia.
5. Do not stop the patient's usual insulin dose, even if they have had hypoglycemia. Give usual dose of insulin after correction of hypoglycemia.

1.18. Exercise and hypoglycemia prevention

Exercise lasting more than 30 mins. and above, places patients at risk of hypoglycemia. Patient must consider their blood glucose reading and the need to take snack before exercise. See chart below.

Table 122: INSULIN CALCULATION BASE ON KILOGRAM (kg)

Glucose Level	Weight of a person 10-30kg 22-66lb 1 stone 6 lb-4 stone 7lb	Weight of a person 30-50kg 66-110lb 4 stone 7lb- 7 stone 9lb	Weight of a person More than 50kg More than 110lb More than 7 stone-9lb
More than 15.0mmol/L or 270mg/dl	If unwell, do not exercise		
101. or 180mg/dl to 15.0mmol/L or 270mg/dl	0g	0g	0g
7.0 or 126mg/dl to 10.0mmol/L or 180mg/dl	5g	10g	20g
4.0 or 72mg/dl-6.9mmol/L or 125mg/dl	10g	20g	30g
Less than 4.0mmol/L or 71mg/dl	Treat Hypoglycemia		
5g carbohydrate options: Apple (half a small) Banana (quarter of medium) Carrot (half cup) Guava (quarter cup) Mango (quarter cup) Orange (half a small) Papaya (quarter cup) Pineapple (quarter cup) Pitanga berries (half cup) Star apple (half) Soursop (quarter cup) Sweetcorn (quarter cup) Sugar (one level spoon) Tropical almond (quarter cup)	10g carbohydrate options: Apple (one small) Banana (half a medium) Carrot (one cup) Guava (half cup) Mango (third cup) Orange (one small) Papaya (half cup) Pineapple (half cup) Pitanga berries (one cup) Star apple (one) Soursop (third cup) Sweetcorn (third cup) Sugar (two level tea spoons) Tropical almond (half cup)	20g carbohydrate options: Apple (one medium) Banana (medium) Carrot (two cups) Guava (one cup) Mango (half cup) Orange (one medium) Papaya (one cup) Pineapple (one cup) Pitanga berries (two cups) Star apple (two) Soursop (half cup) Sweetcorn (half cup) Sugar (four level tea spoons) Tropical almond (one cup)	30g carbohydrate options: Apple (one very large) Banana (large) Carrot (three cups) Guava (one & half cup) Mango (one cup) Orange (one very large) Papaya (one & half cup) Pineapple (one & half cup) Pitanga berries (three cups) Star apple (three) Soursop (one cup) Sweetcorn (one cup) Sugar (six level tea spoons) Tropical almond (one & half cup)

Different food has different effect on how it increases your blood glucose level. Reduce the amount of sugar containing food that you eat.

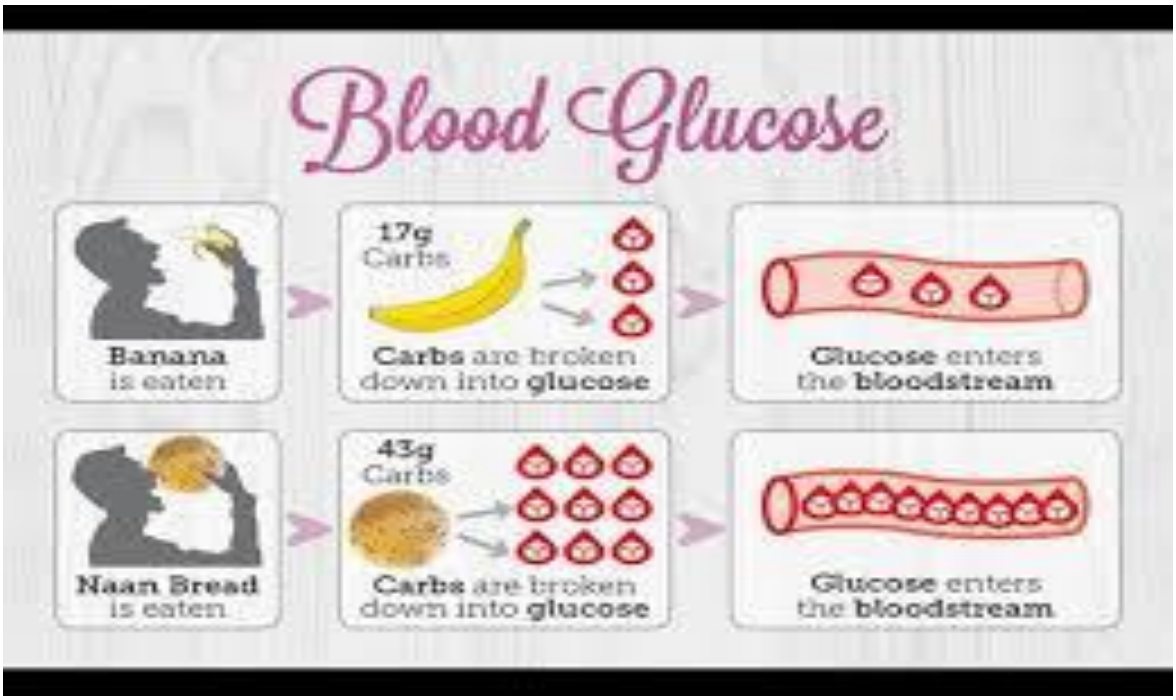
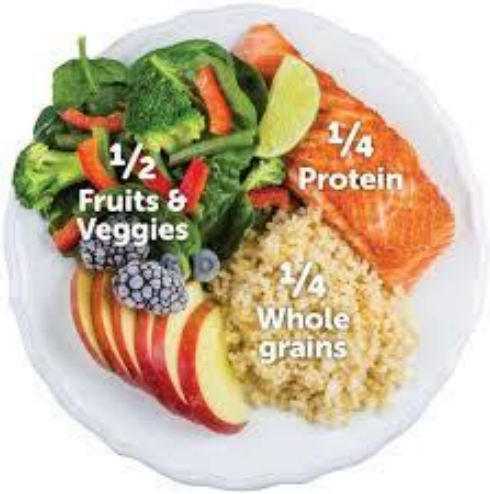


Figure 5: Nutrition

Always try to eat a healthy plate (Example shown below: plate should be divided as ½ plate vegetables and fruits, ¼ plate protein and ¼ plate carbohydrate). It is recommended that the number of units of regular insulin to be administered premeal, should be based on the amount of carbohydrate in the meal (Carbohydrate counting). This method makes use of the insulin carbohydrate ratio.



Carbohydrate Counting (450/TDD) gives an insulin to carb ratio to provide the grams of carbohydrate appropriate for every one unit of insulin.

Example: 450/14 = 32

Insulin to carb ratio = 1: 32. One unit of insulin is provided for every 32grams of carbohydrate. Ex: If 2 cups

of burger wheat have 31 grams, the patient will need 1 unit of regular insulin for this meal.

1.18. Sick Day Rule

When a patient with type 1 diabetes gets sick, the stress causes them to have higher blood glucose levels. Fever arising from all system except the gastrointestinal system (GI) causes hyperglycemia. If a patient is having persistently high blood glucose, he or she should contact their health care provider or go to the primary health center. This care can also be done at home for patients who can monitor their ketone (blood or urine) at home.

1. Never stop administering insulin. Patients might even need more insulin increase up to 25%.
2. Monitor your blood glucose level every 2 to 4 hours to check for hyperglycemia or hypoglycemia.
3. Keep patients well hydrated.

4. Monitor for urine ketones 1 to 2 times a day especially when blood glucose is 250mg/dl and above. Try to maintain blood glucose between 70 to 180mg/dl.

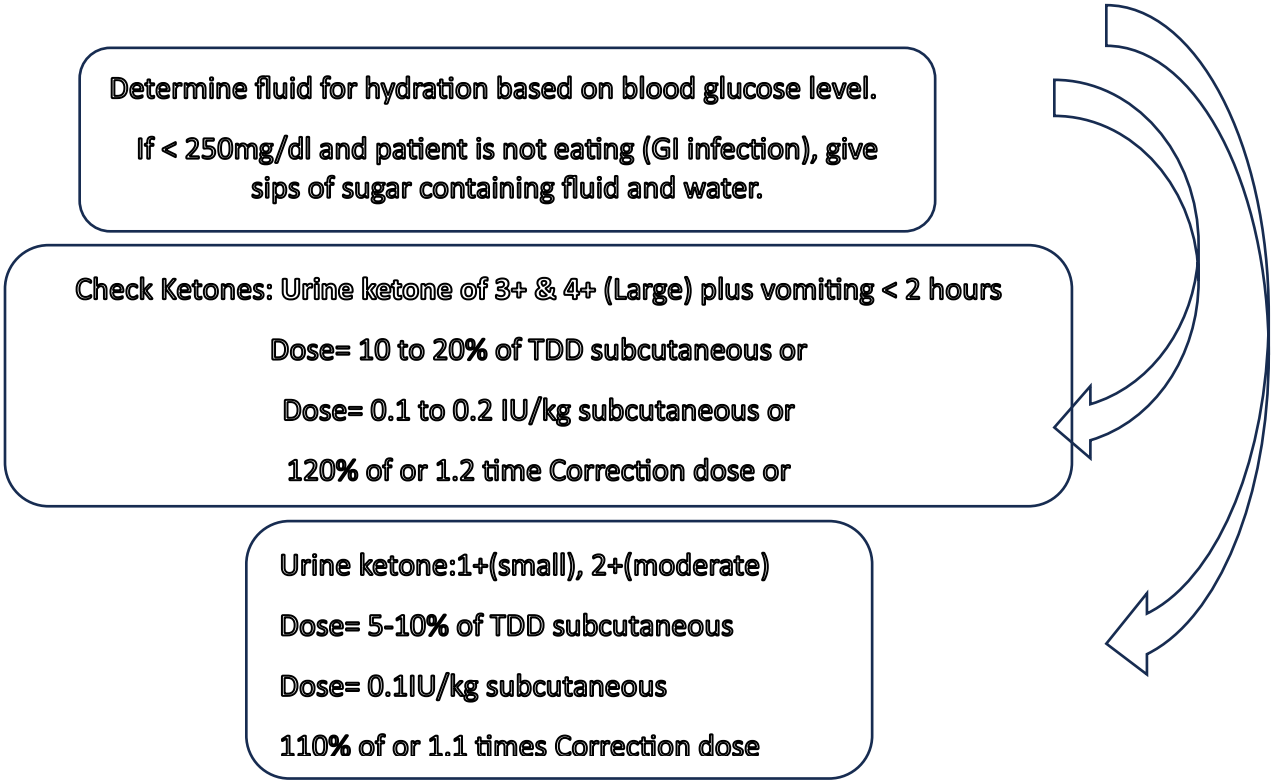


Figure 6: Fluid Calculation

Table 13: Diabetes-Ketoacidosis Management of Children <15 Years <50 kg

1. Initial Emergency Management

1. Assess if in shock (cap refill HR/ severity of dehydration mucous membrane skin tugor).
2. Assess level of consciousness (GCS) Weight
3. Weight
4. Lab: RBS, FBS, HbA1c, Ketones, FBC & Urea Lab preferable: urine and electrolyte, FBS

2. Correction of Shock

1. Give O2
2. Two time large IV Cannula
3. Give repeat boluses of IV normal saline 20ml/kg until perfusion improves.
4. Make sure that the child I adequately resuscitate good perfusion -before proceeding to the following step.
5. Use refill cap and HR over 10 to 15 mins. Repeat bolus until systolic B/P>90 Most require 500-1000mL

3. Correction of dehydration

1 Rehydrate the child with normal saline or Ragers Lactate. Use the table to caculate fluid replacement to give over 48 hours.

Weight	mL/kg/hr
0 kg	6.5
10-20 kg	6
20.1 – 40 kg	5
>40kg	4 (max 250mL/hr.)

4. Correction of Insulin

1. Start Insulin after circulation stable – at least hour after IV fluid
2. Give subcutaneous insulin 0.1h/kg every 2 hours. Eg. For 30 kg child give 3U sub cut every 2 hours
3. In children < 5 years give low dose rate of insulin (0.05U/kg every hour)
4. Once the blood glucose is < 15 mmol per hr. (270mmol/dL) use 5% dextrose saline (add 100 ml 50%dextrose to 1 liter saline. If only D5W available. Then run NS and D5W on 2 separate IV line Do not only give D5W.
5. Aim or glucose reduction of 5 mmol per hour (90mg/dL. A more rapid Declan may cause cerebral injury). If glucose drop rapidly or once glucose is < 9 mmol/L (162mf/dL) use 10% dextrose saline (add 50ml of 50% dextrose ampule to 500ml of 5% dextrose saline. If glucose continues to fall rapidly, decrease the rate of insulin delivery by 25% (eg. From 8Uto 6U)

5. Potassium correction

Potassium replace is needed for every patient:

1. Check K level if possible. (1K<3.5 delay insulin)
2. If no lab-do EKG. (Low K on EKG flattering of the T wave, widening of the OT Interval, and the appearance of U waves; High High K-Tall peaked, symmetrical T waves and shortening of the OT interval
3. If no lab, start replacing K after patient passes urine
4. Add 20 mmol (10 mmol 0f a 15% KC to each liter of fluid in the first 4 hours (except the first liter/ or boluses). Then 40 mmol to each liter after 4 hours.
5. Monitor K 6 hourly.
6. If Iv potassium is not available, give oral slow K, one tab 6 hourly or fruit juice/ bananas.
7. If no IV potassium, give insulin at a slow rate (subcut 0, 1u/kg 3 hourly or Iv 0.05LI/kg per hour

6. Treatment of Infection

If infection is suspected common, treat with broad spectrum antibiotics. Eg Ceftriaxone

7. Monitoring of management

1. Monitor hourly, heart rate, BP respiratory rate, GCS, Glucose.
2. Monitor urine Ketones in every sample of urine
3. Record fluid intake, insulin therapy and urine output. Catheterized if necessary Minimum urine output >0.5
4. Repeat electrolyte every 6 hours
5. If unconscious, consider naso-gastric tube to prevent aspiration

8. Transition to regular insulin regimen

1. Once awake, hungry, eating, drinking zips of water change to normal insulin regimen eg. Twice or three times daily subcut insulin, start at next meal. (If using IV insulin overlap IV insulin infusion with for subcut dose by 30 min).
2. Do not use urine ketones to decide when to change, as they may stay in urine for 12-24 hours

9. Transition to regular insulin regimen

1. Rapidly rising intra-cranial pressure may cause a change in neurological state
2. If suspected, exclude Hypoglycemia
3. Reduce the rate of fluid by one-third
4. Give mannitol 0.5-1g/kg IV over 20 min and repeat if no response in 30 min to 2 hrs.

Table 14: Diabetes-Ketoacidosis Management of Children >15

2. Initial Emergency Management

1. Assess if in shock (cap refill HR/ severity of dehydration mucous membrane skin tugor)
2. Assess level of consciousness (GCS) Weight
3. Weight
4. Lab: RBS, FBS, HbA1c, Ketones, FBC & Urea
   Lab preferable: urine and electrolyte, FBS

2. Correction of Shock

1. Give O2
2. Two time large IV Cannula
3. Give repeat boluses of IV normal saline 20ml/kg until perfusion improves.
4. Make sure that the child I adequately resuscitate good perfusion -before proceeding to the following step.
   Use refill cap and HR
   over 10 to 15 mins. Repeat bolus until systolic B/P>90
   Most require 500-1000mL

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1 Rehydrate the child with normal saline or Ragers Lactate. Use the table to caculate fluid replacement to give over 48 hours.

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5. Aim or glucose reduction of 5 mmol per hour 90mg/dL.
   A more rapid Declan may cause cerebral injury). If glucose drop rapidly or once glucose is < 9 mmol/L (162mf/dL) use 10% dextrose saline (add 50ml of 50% dextrose ampule to 500ml of 5% dextrose saline.
   If glucose continues to fall rapidly, decrease the rate of insulin delivery by 25% (eg. From 8Uto 6U) fluid may be required. Check fluid over dose
8. Be more critical in fluid replacement if young people age 18-25 year, elderly, pregnant heart or renal failure

5. Potassium correction

Potassium replace is needed for every patient:

1. Check K level if possible. (1K<3.5 delay insulin)
2. If no lab-do EKG. (Low K on EKG flattering of the T wave, widening of the OT Interval, and the appearance of U
   waves; High High K-Tall peaked, symmetrical T waves and
   shortening of the OT interval
3. If no lab, start replacing K after patient passes urine
4. Add 20 mmol (10 mmol 0f a 15% KC to each liter of fluid
   in the first 4 hours (except the first liter/ or boluses). Then 40 mmol to each liter after 4 hours.
5. Monitor K 6 hourly.
6. If Iv potassium is not available, give oral slow K, one tab 6

6. Treatment of Infection

If infection is suspected common, treat with broad spectrum antibiotics. Eg Ceftriaxone

7. Monitoring of management

1. monitor hourly, heart rate, BP respiratory rate, GCS, Glucose.
2. Monitor urine Ketones in every sample of urine
3. Record fluid intake, insulin therapy and urine out put. Catheterized if necessary Minimum urine output >0.5
4. Repeat electrolyte every 6 hours
5. If unconscious, consider naso-gastric tube to prevent aspiration

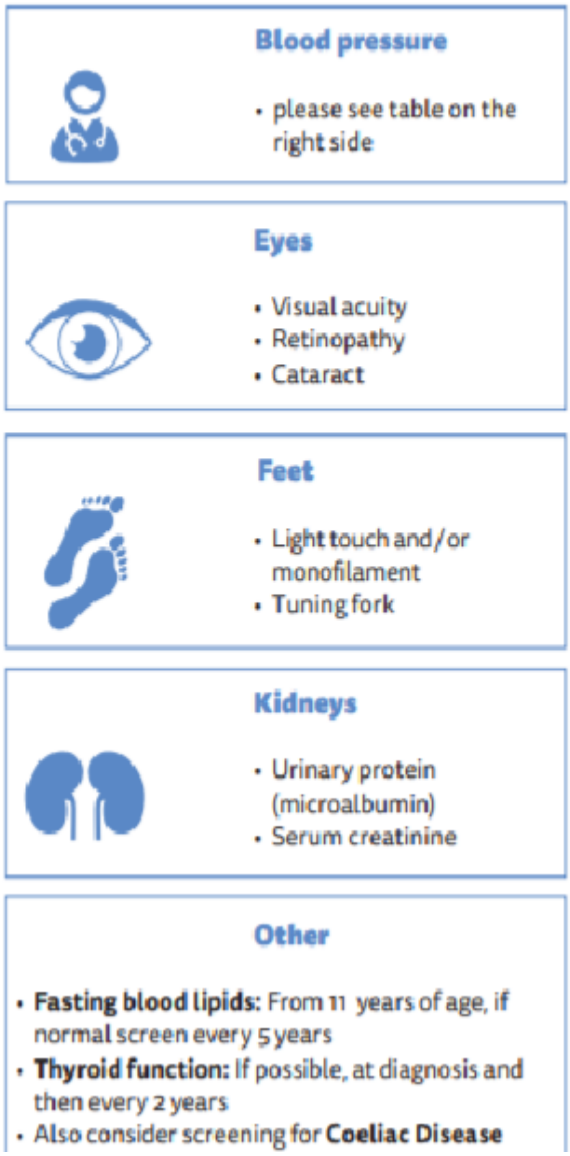
8. Transition to regular insulin regimen

1. Once awake, hungry, eating, drinking zips of water change to normal insulin regimen eg. Twice or three times daily subcut insulin, start at next meal. (If using IV insulin overlap IV insulin infusion with for subcut dose by 30 min).
2. Do not use urine ketones to decide when to change, as they may stay in urine for 12-24 hours

9. Transition to regular insulin regimen

1. Rapidly rising intra-crinial pressure may cause a change in neurological state
2. If suspected, exclude Hypoglycemia
3. Reduce the rate of fluid by one-third
4. Give mannitol 0.5-1g/kg IV over 20 min and repeat if no response in 30 min to 2 hrs.

ANNUALLY:



	Blood Pressure, mm Hg			
Age in years	Male		Female	
	Systolic	Diastolic	Systolic	Diastolic
3	100	59	100	61
4	102	62	101	64
5	104	65	103	66
6	105	68	104	68
7	106	70	106	69
8	107	71	108	71
9	109	72	110	72
10	111	73	112	73
11	113	74	114	74
12	115	74	116	75
13	117	75	117	76
14	120	75	119	77
15	120	76	120	78
16	120	78	120	78
17	120	80	120	78
18	120	80	120	80

Figure 7: Complication Screening in Type 1 Diabetes

1. 19. Type 2 Diabetes

In type 2, patients are resistant to insulin action and may have impaired insulin secretion.

Causes and Risk Factors:

- Family History of Diabetes
- Age & Puberty
- Eating too much fatty, salty, or sugary food

- Not moving enough (no exercise)
- Smoking and alcohol
- Drugs (Ex: Steroids)
- Being overweight/ Obese (too fat)
- PCOS
- Race (Black people)

1.20. Signs & Symptoms

- Frequent urination (Polyuria/ nocturia)
- Increase thirst (Polydipsia)
- Excessive hunger with craving for more food (Polyphagia)
- Vaginal discharge or *Candida* vulvovaginitis in females
- Occasional weight loss
- Lack of energy

1.21. Gestational Diabetes Mellitus (GDM)

Glucose intolerance with onset or first recognition during pregnancy, characterized by β-cell function that is unable to meet the body's insulin needs. Insulin resistance begins in mid pregnancy and progresses through the third trimester. A result of maternal adiposity and effects of placental hormones β -cells usually make more insulin to compensate for resistance – when they cannot meet the needs hyperglycemia occurs. GDM represents a state of chronic β-cell dysfunction in the face of insulin resistance. Insulin resistance and insulin levels are different prior to pregnancy in women who develop GDM and those who do not. Changes in insulin sensitivity are similar in both groups during pregnancy. However, in GDM women, insulin secretion does not increase adequately.

1.22. When to screen for GDM?

- Screening should be done at 24-28 weeks gestational age
- First trimester
- Screening in 1st trimester
- To rule out unidentified pre-existing diabetes
- Fasting plasma glucose ≥126 mg/dl (7 mmol/L)

Table 15: Categories of increased risk for diabetes (prediabetes)

HbA1c5.7 to 6.4% (39 to 46 mmol/dl)
FBG 100 TO 125 MG/DL (5.6 to 6.9mmom/mol)
2-hour post load glucose on the 75 g OGTT 140 to `99mg/dl (7.8 to 11.0 mmol/mol) IGT

A1C: glycated hemoglobin FBG: Fasting plasma glucose;
IFG: impaired fasting glucose tolerance test
OGTT oral glucose Terance test

- For all 3 tests, risk is continuous, extending below the lower limit of the range and becoming disproportionately greater at higher ends of the range

.23. Diagnostic Criterial For GDM

- Diagnosis based on a 75-gm glucose load given in fasting state
- GDM diagnosed when one or more of the following is present
- Fasting 92 - 125 mg/dl (5.0 – 6.9 mmol/L)
- hour post 75 gm load ≥180 mg/dl (10 mmol/L)
- 2-hour post 75 gm load >153mg/dl (8.5 mmol/L)

NOTE: If woman tests negative, screening at 32 weeks also may be necessary in presence of high risks.

1.24. Target

- Fasting: <95 mg/dl (< 5.3 mmol/l)
- 1 hour PP: < 140 mg/dl (< 7.8 mmol/L)
- hour PP: < 120 mg/dl (< 6.7 mmol/L)

1.25. Diabetes in pregnancy

It is a condition in which the patient was diagnosed with diabetes before the pregnancy.

- Women of reproductive age who already have diabetes:
- Uncontrolled diabetes increased risk to the mother and child eg: fetal losses, preterm labor, shoulder dystocia among others.

Care for pregnant women with diabetes:

- Change from oral hyperglycemic agents to insulin
- Aim for a narrower therapeutic goal
- HbA1c 7-7.5%
- Finger stick glucose monitoring at least 2 times a day
- At delivery, keep glucose BELOW 126mg/dl (7mmol/L)
- To avoid hypoglycemia in the baby. Do serial blood glucose monitoring to prevent death in babies born to diabetic mothers.
- Review other therapies eg: antihypertensive drugs
- Folic acid supplementation with midwives and obstetrics and gynecology to manage ANC, Labour and Postnatal care.

Other labs and Imaging for complications

- Urinalysis (Glucose, ketones)
- Complete blood count (CBC)
- Liver Function
- Renal function
- Lipid profile
- Cardiac function (EKG)
- Fundoscopic
- Foot exam (Monofilament test, Check for Ulcer)
- Screen for complication at diagnosis (diabetic retinopathy, nephropathy & neuropathy)

1.26 Treatment

Principles of Management

a. Non-pharmacological
    i. Education
    ii. Diet
    iii. Physical activity
    iv. Psychosocial support
b. Pharmacological
    i. Oral glucose lowering agents (OGLAs)
    ii. Insulin
    iii. Combination Therapies - Oral glucose lowering agents and insulin

1.27. Lifestyle Modifications for Diabetes Miletus (DM) Prevention

Increased physical activity (30 minutes /day of moderate exercise five days a week)

A healthy diet

- Increase dietary fiber (fruits and vegetables) and foods containing whole grains.
- Reduce excess calories and reduce intake of dietary fat.
- Saturated fat (palm oil intake should be reduced).

Weight loss (A 5–10% weight loss is recommended)

- Smoking increases the risk even further for diabetics to die from CHD, Stroke and PAD. (Avoid Smoking)
- 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
- Weight normalization is highly desirable

1.28. Pharmacological Treatment

Monotherapy

- Metformin is the preferred choice to start monotherapy.
- Maximize tolerance by titrating the dose from 500 to 2000 mg per day
- Prescribing it with or after meals and use extended-release preparations, if necessary.
- The metformin dose should be reduced to 1000 mg per day when renal function is in stage 3.
- Metformin is contraindicated when renal function is in stage 3B or above.
- In case of metformin intolerance or when it is contraindicated, a sulphonylurea such as glibenclamide/glyburide may be used but the patient should be warned about the increased risk for hypoglycemia.
- If metformin is not available or patient cannot tolerate metformin, consider sulfonylurea (Glibenclamide, Glyburide). The patient must learn how to prevent, recognize and treat hypoglycemia whenever starting a sulfonylurea.
- If not improving on maximum dose of metformin + life style modification, initiate combination therapy

1.29. Combination therapy

- Starting with combination of metformin and other class of OGLAs in case of failure to reach the target blood glucose levels with the maximum dose of Metformin.
- For adolescence and young adults not controlled with maximum dose of metformin and life style modification, start long-acting insulin once daily at 0.25 to 0.5 IU/kg/day
- Metformin (500mg/1000mg) +Sitagliptin (50mg) or Janumet/Januvia
- Chosen drug to combine with metformin should have complementary mechanism to metformin with no added side effects.
- Combination with a sulphonylurea, a DPP4 inhibitor (Sitagliptin, Vildagliptin) or GLP 1 inhibitor or a SGLT2 inhibitor (Canagliflozin, Dapagliglozin) may be the preferred option.
- Whenever possible, use fixed-dose combinations to increase adherence.

Table 16: Diabetes Drug and Mechanism Action

	Metformin (group of biguanides)	Glibenclamide (group of sulphonyreas)
Mechanism of action	Acts on the body (liver, muscles), to modulate the action of insulin	Stimulates the pancreas B cells to secrete insulin
Indication	BMI > 25 (overweight)	BMI < 25 (low to normal weight)
Side effects	Nausea, abdominal discomfort (gas, diarrhea)	Hypoglycemia, weight gain
Contraindications	Cr >130 µmol/L (>2.0 mg/dL)	Recurrent hypoglycemia
Initial dose	500 mg QD (morning)	5 mg QD (morning)
Maximum dose	1000mg BID	10 mg BID

Table 17: Drug Dosage

Step	Metformin		Glibenclamide	
	7 am	7 pm	7 am	7 pm
1	500 mg		5 mg	-
2	500mg	500mg	5 mg	5 mg
3	500 mg TIDs		10 mg	5 mg
4	1000 mg	1000 mg	10 mg	10 mg
5	Add glibenclamide		Add metformin	

Table 18: Glucose reasonable control range

	Reasonable control
Pre-meal and pre-bedtime glucose	**150-180 mg/dL (8.3-10 mmol/L)**
HbA1c	**7.5%-8%: Average blood sugar: 170-185 mg/dL (9.4-10.5 mmol/L)**
Table 7.5	

1.30. Initiate insulin therapy

Insulin alone or in combination with other OGL as may be used in Type 2 DM when:

Patients are unstable, have symptoms and signs of acute decompensation (acute illnesses) and hyperglycemic emergencies (DKA and HHS)

Indications for insulin use in type 2 diabetes

- Initial presentation with severe hyperglycemia when symptomatic
- Presentation in hyperglycemic emergency
- Peri-operative period especially major or emergency surgery
- Other medical conditions requiring tight glycemic control e. g acute MIs, strokes, sepsis, etc.
- Organ failure (e.g. renal, liver, heart)
- Pregnancy
- Latent autoimmune diabetes of adults (LADA)
- Contraindications to OGLAs

1.31. Referral (Internal and External)

- Urgent (same day) referral should occur if one of the following is detected:
- urine ketones >2+, or no improvement in glycaemia ≥18 mmol/L after management with metformin and/or gliclazide
- suspicion of ketoacidosis or HHS
- hypoglycaemia unresolved by treatment
- clinical suspicion of type 1 diabetes in newly diagnosed patient
- symptoms/signs of coronary heart disease and stroke
- recent deterioration of vision
- blood pressure >200/>110 mmHg

- blood pressure >180/>110 mmHg with headache, shortness of breath, blurred vision, changed mental state, nausea, vomiting, reduced urine output.

Chapter 2

Diabetes and other comorbidity conditions (TB & HIV/AIDS)

2.0 Diabetes & Tuberculosis (TB) Introduction

The control of tuberculosis (TB), particularly in the context of diabetes comorbidity, is founded on interventions at both the individual and community levels. At the individual level, the primary objective is to rapidly diagnose and effectively treat TB in order to cure the disease, restore patients' functional capacity, and enable them to resume normal activities of daily living, thereby safeguarding their socio-economic wellbeing. At the community level, TB control focuses on interrupting transmission through early case detection and prompt initiation of appropriate treatment, as undiagnosed and untreated individuals remain the main source of infection within communities. In addition to active case finding and treatment, tuberculosis preventive therapy (TPT) constitutes a critical complementary strategy, especially for high-risk populations such as people living with diabetes, who are more susceptible to progression from latent TB infection to active disease.

2.1. Detect and manage patients with Diabetes in TB

- All diabetic patients should be screened for chronic cough using simple screening questions such as: current cough of any duration (cough lasting less than two weeks, any unexplainable weight loss etc.) at the time of their diagnosis with diabetes and, if possible, during regular check-ups;
- Those with positive TB symptoms should be examined as per national guidelines. Other diagnostic procedures (for example, for EPTB) should also be pursued vigorously as per national guidelines;
- Screening for TB diseases on broader indications (for example, for all people in whom diabetes is diagnosed, regardless of symptoms) should be explored as part of the research agenda to improve the diagnosis of TB among people with diabetes;
- Diabetic patients presumptive of having TB are promptly referred to TB diagnostic and treatment centers for proper evaluation as per guidelines established by the national TB control program and timely initiation to treatment;
- Case-finding for TB should be intensified by increasing awareness in the communities of and knowledge about the associations between diabetes and TB, including joint risk factors among health-care workers and the populations they serve;
- Health-care facilities, including diabetes clinics, should have in place an infection control plan that includes administrative and environmental control measures to reduce transmission of TB within health-care settings as indicated below under TB IC, and

- Treatment of TB in diabetic patients should follow the existing TB and Diabetes treatment guidelines for Liberia.

2.2 Service Integration (Best Practice)

- Integrate TB and NCD services at facility level
- One-stop clinics where feasible
- Harmonized appointment schedules
- Shared patient records

2.3 Introduction Diabetes and HIV Co-management

People living with HIV (PLHIV) have an increased risk of developing Type 2 diabetes due to chronic inflammation, antiretroviral therapy (ART)–related metabolic effects, weight gain, and aging. Diabetes, in turn, further weakens immune function, increasing vulnerability to opportunistic infections and resulting in poorer HIV outcomes. Effective co-management of HIV and diabetes is therefore critical to improving glycemic control, achieving viral suppression, and enhancing survival. All adults and adolescents with diabetes should be routinely screened for HIV, especially those with recurrent infections (including tuberculosis and fungal infections), unexplained weight loss, persistent poor glycemic control, chronic diarrhea, disproportionate neuropathy, or high-risk exposure. HIV testing should follow national algorithms using rapid tests, confirmatory testing, and appropriate counseling with informed consent and confidentiality. Likewise, PLHIV should be screened for diabetes at diagnosis, before ART initiation, and at least annually, with closer monitoring for those on protease or integrase inhibitors. Management includes comprehensive clinical assessment, lifestyle interventions, individualized pharmacologic therapy, appropriate use of insulin when indicated, careful monitoring for drug–drug interactions, prompt treatment of infections, and close coordination between HIV and NCD services.

2.4 Detection of HIV in Patients with Diabetes

Who Should Be Screened?
All adults and adolescents with diabetes should be offered routine HIV testing, especially those with:

- Recurrent infections (TB, fungal, skin)
- Unexplained weight loss
- Poor glycemic control despite adherence
- Chronic diarrhea or neuropathy disproportionate to diabetes duration
- History of high-risk exposure

2.5 HIV Testing Approach

- Follow **national HIV testing algorithms**
- Use: Rapid HIV tests (serial or parallel)
- Confirmatory testing per national guidelines

- Ensure pre- and post-test counseling
- Confidentiality and informed consent

2.6 Detection of Diabetes in Patients Living with HIV

Who to Screen?
Screen PLHIV:

- At HIV diagnosis
- Before ART initiation
- Annually thereafter
- More frequently if on protease inhibitors (PIs) or integrase inhibitors (INSTIs)

2.7 Clinical Assessment in Diabetes HIV Co-morbidity

History

- ART regimen and duration
- Adherence to diabetes ART and medications
- Symptoms of hypoglycemia or hyperglycemia
- Opportunistic infections
- Lifestyle factors (diet, alcohol, smoking)

Physical Examination

- Weight, BMI, waist circumference
- Blood pressure
- Signs of insulin resistance (central obesity)
- Peripheral neuropathy
- Foot examination
- Skin and oral cavity (fungal infections)

2.8 Diabetes and HIV Co-management

- People living with HIV (PLHIV) have a higher risk of Type 2 diabetes due to:
    - Chronic inflammation
    - ART-related metabolic effects
    - Weight gain and aging
- Diabetes worsens immune function, increasing the risk of:
    - Opportunistic infections
    - Poor HIV outcomes
- **Co-management improves glycemic control, viral suppression, and survival**.

2.9 Management of Diabetes in Patients with HIV

Lifestyle Interventions (First-Line)

- Nutrition counseling (balanced diet, reduced refined sugars)
- Physical activity (≥150 minutes/week)

- Weight management
- Smoking and alcohol cessation

Table 19: Oral Hypoglycemic Agents

Drug	Considerations in HIV
Metformin	First-line; avoid in renal failure or advanced HIV wasting
Sulfonylureas	Risk of hypoglycemia—use cautiously

2.10 Insulin Therapy

- Preferred in:
  - Poor glycemic control
  - Advanced HIV
  - Acute illness
  - Pregnancy
- Adjust dose during infections or ART changes

2.11 Drug–Drug Interactions

- Review ART and diabetes medications at every visit
- Monitor for:
  - Hypoglycemia
  - Lactic acidosis (metformin + renal impairment)
- Coordinate care between **HIV and NCD clinics**

2.12 Management of Acute Complications

Infections

- Treat infections promptly (TB, fungal, bacterial)
- Intensify glucose monitoring during illness

Table 20: Monitoring & Follow-Up

Parameter	Frequency
Blood glucose	Each visit
HbA1c	Every 3–6 months
Viral load	Per HIV guidelines
Blood pressure	Each visit
Lipid profile	Annually
Renal function	At least annually
Foot exam	Every visit

2.13 Psychosocial & Adherence Support

- Address:
  - Dual stigma (HIV + diabetes)
  - Mental health (depression, anxiety)
- Strengthen:
  - Peer support groups
  - Treatment literacy
  - Community health worker follow-up

2.14 Service Integration (Best Practice)

- Integrate HIV and NCD services at facility level
- One-stop clinics where feasible
- Harmonized appointment schedules
- Shared patient records

Chapter 3

Asthma

3.0 Introduction

Asthma is a chronic inflammatory disease of the airways characterized by variable and often reversible airway obstruction and bronchial hyper-responsiveness. This condition results in recurrent respiratory symptoms such as wheezing, shortness of breath, chest tightness, and coughing, which may vary in frequency and severity over time. Asthma affects individuals of all ages and remains a major public health concern due to its impact on quality of life, productivity, and healthcare systems. The disease is influenced by a combination of genetic predisposition and environmental factors, including allergens, respiratory infections, air pollution, tobacco smoke, and occupational exposures. Inflammation of the airways leads to narrowing, increased mucus production, and heightened sensitivity to triggers, causing episodic breathing difficulties. Although asthma is not curable, it is a manageable condition. Early diagnosis, patient education, avoidance of triggers, and appropriate long-term pharmacologic therapy are essential to achieve good symptom control, prevent acute exacerbations, and reduce asthma-related morbidity and mortality.

3.1 Epidemiology of Asthma

Global Burden

Globally, asthma is ranked 16th among the leading causes of years lived with disability and 28th among the leading causes of burden of disease, as measured by disability-adjusted life years. Around 300 million people have asthma worldwide, and it is likely that by 2025 a further 100 million may be affected. There is a large geographical variation in asthma prevalence, severity, and mortality. While asthma prevalence is higher in high income countries, most asthma-related mortality occurs in low-middle income countries. Despite the advances in asthma treatment in recent decades, there are still gains to be made in terms of improving patient education, employing new diagnostic approaches, and implementing personalized case management.

3.2. Prevalence

An estimated 262 million people were affected by asthma globally in 2019 (WHO).

Mortality:

Asthma caused around 455,000 deaths in 2019. Most deaths occur in low- and middle-income countries (LMICs) due to limited access to proper diagnosis and treatment.

Trends: Although asthma prevalence is plateauing or decreasing in some high-income countries, it is rising in many LMICs, potentially due to urbanization, pollution, and westernized lifestyles. High-income countries often have higher prevalence (e.g., Australia, UK, USA), possibly due to better diagnostic systems.

Sub-Saharan Africa & South Asia: Lower reported prevalence but higher morbidity and mortality due to poor access to care and underdiagnosis. Asthma is more common in urban areas, likely because of increased exposure to allergens, pollutants, and sedentary lifestyle

3.3 Signs and Symptoms

- Wheezing (especially at night or early morning)
- Shortness of breath
- Chest tightness or pain
- Coughing (worse at night or with exercise)
- Symptoms triggered by allergens, cold air, or exercise
- Positive family history

3.4 Diagnosis

- Pediatric - Children Under six (6)
- Clinical symptoms: recurrent cough, wheezing, breathlessness, chest tightness
- Spirometry is difficult; diagnosis is clinical with response to bronchodilators
- Consider differential diagnoses: bronchiolitis, cystic fibrosis, congenital anomalies (laryngomalacia/tracheomalacia/bronchomalacia), foreign body aspiration.

3.5 Adults and Older Children

Spirometry: A critical diagnostic test for asthma, it measures Forced Expiratory Volume in 1 second (FEV1) and Forced Vital Capacity (FVC). The ratio of FEV1/FVC is used to identify airway obstruction. A ratio of < 0.75-0.80 suggests obstructive lung disease. After administering a bronchodilator, an increase in FEV1 of ≥12% confirms reversible airway obstruction, typical of asthma.

Peak Expiratory Flow (PEF): A daily peak flow measurement can reveal variability in airway obstruction, useful for diagnosing asthma. A variability of >20% is indicative of asthma.

Bronchial Challenge Test: In cases where spirometry is inconclusive, this test (typically involving methacholine or other agents) assesses airway hyper-responsiveness, common in asthma.

3.6 Classification of Asthma by Severity of Symptoms

Asthma is classified based on the severity of symptoms, frequency of attacks, and lung function. The classification are as follows:

Intermittent Asthma

- Symptoms: Occur ≤2 days per week
- Nighttime awakenings: ≤2 times per month
- Use of rescue inhaler (short-acting beta agonist): ≤2 days per week
- Interference with daily activities: None
- Lung function: Normal between exacerbations (FEV1 >80% predicted)

3.7. Mild Persistent Asthma

- Symptoms: Occur >2 days per week but not daily
- Nighttime awakenings: 3-4 times per month
- Use of rescue inhaler: >2 days per week but not daily
- Interference with daily activities: Minor limitation
- Lung function: FEV1 ≥80% predicted

3.8. Moderate Persistent Asthma

- Symptoms: Daily
- Nighttime awakenings: >1 time per week but not nightly
- Use of rescue inhaler: Daily
- Interference with daily activities: Some limitation
- Lung function: FEV1 60-80% predicted

3.1.9 Persistent Asthma

- Symptoms: Throughout the day
- Nighttime awakenings: Often (≥4 times per week)
- Use of rescue inhaler: Several times per day
- Interference with daily activities: Extremely limited
- unction: FEV1 <60% predicted

This classification helps guide treatment plans, with more severe asthma requiring stronger and more frequent medication use.

3.10. Principles of asthma management

Trigger identification and avoidance (smoke, dust, cold, etc

Follow the stepwise treatment below and increase to the next step if symptoms persist.

Use rescue medication (Short-Acting-Beta- Agonist /SABA) for symptoms of dyspnea, wheezing and chest tightness at any stage.

Begin anti-inflammatory medication (Inhaled corticoid steroid/ICS preferred) when symptoms occur two or more times per week.

The use of a spacer device is recommended when Metered-dose inhaler (MDI) canisters are used to reduce oropharyngeal and systemic depositions. In children below 4 years of age: use MDI with spacer with facemask; for children above 4 years of age: use MDI with spacer; For patients above 12 years of age: MDI may be used directly or dry powder inhaler is as effective. Elderly patients: use MDI with spacer; however, some may prefer dry powder inhaler. Do not use Long-Acting-Beta-Agonist (LABA) bronchodilators continuously as solo treatment Adding LABA to ICS is preferred approach when step-up therapy is needed.

Medium or high dose ICS may be necessary to control persistence symptoms, but risk more systemic absorption. Sustained-released theophylline is a bronchodilator with weak anti-inflammatory properties and frequent side effects*(use with caution) Ask about and check inhaler use. Encourage exercise (Individualized and monitor) Treat comorbidities (Eg. obesity). Provide education on how to increase medication if often breathless and breathlessness interferes with activities of daily living. Look for anxiety/ depression as breathlessness is frightening. Once condition is stable, review every 6 months.

3.12. Treatment (Pharmacological & Non-pharmacological) by Stages

Table 21. Flowchart: Asthma Management

Step 1: Initial Assessment → Symptoms + Spirometry

↓

Step 2: Mild Intermittent → SABA PRN

↓

Step 3: Mild Persistent → Low-dose ICS

↓

Step 4: Moderate Persistent → LABA + Low-dose ICS

↓

Step 5: Severe Persistent → High-dose ICS + LABA or Biologics Asthma Outpatient Management Chart

Figure 8: Asthma Management Flow Chart

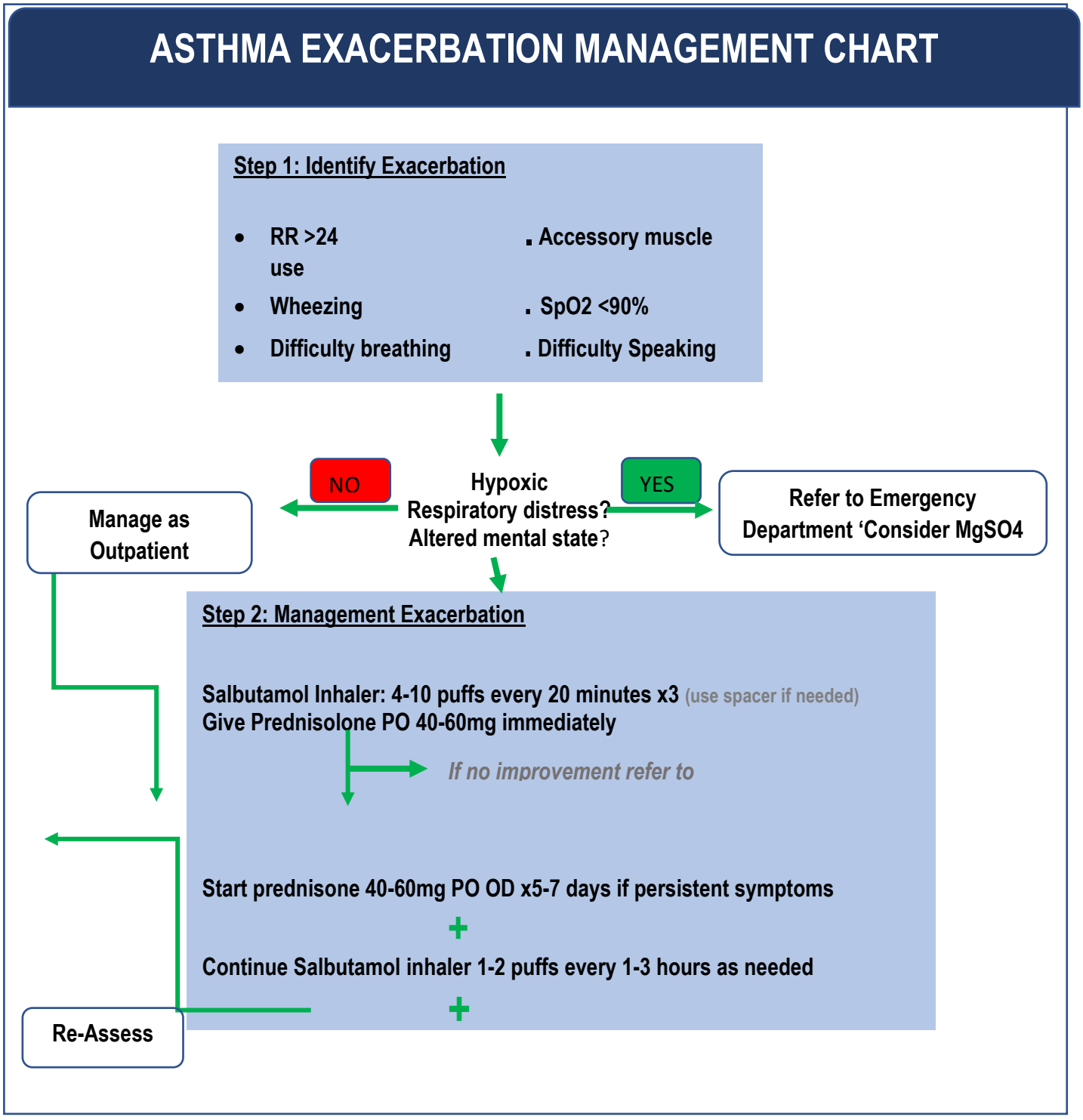


Figure 9: ASTHMA EXACERBATION MANAGEMENT CHART

3.13 Adult Medications and Dosages

1. Short-acting Beta-agonists (SABA) – Relievers

Salbutamol (Albuterol):

Dosage: 100-200 mcg per inhalation (2 puffs as needed)

Adult Medications and Dosages

1. Short-acting Beta-agonists (SABA)-Relivers

Salbutamol (Albuterol):

Dosage: 100-200mcg per inhalation (2 puffs as needed)

Usage: Used for quick relief of asthma symptoms (wheezing, coughing, chest tightness).

Route: Inhalation (metered-dose inhaler or nebulizer).

Levalbuterol:

Dosage: 45 mcg per inhalation (2 puffs as needed).

Route: Inhalation.

Treatment advice:

Only give oral salbutamol if no inhaler available. Only use ipratropium if salbutamol not working as risk to heart and not as effective

2. Long-acting Beta-agonists (LABA) - Controllers

Salmeterol:

Dosage: 50 mcg per inhalation (1 puff twice daily).

Usage: Used for long-term control in combination with inhaled corticosteroids.

Route: Inhalation.

Formoterol:

Dosage: 12 mcg per inhalation (1 puff twice daily).

Usage: Used for long-term asthma control, also combined with ICS.

Route: Inhalation.

Treatment advice

All inhaled steroids are equally effective – use the cheapest available.

3. Inhaled Corticosteroids (ICS) - Controllers

Budesonide:

Dosage: 200-400 mcg twice daily.

Usage: First-line treatment for long-term asthma control to reduce inflammation.

Route: Inhalation.

Fluticasone:

Dosage: 100-500 mcg twice daily, depending on severity.

Usage: Anti-inflammatory medication, reduces airway swelling and mucus production.

Route: Inhalation.

Treatment advice

Never use LABA without inhaled steroids as there is a risk of death. Do not give to children < 6 years

4. Leukotriene Receptor Antagonists (LTRAs)

Montelukast:

Dosage: 10 mg daily (for adults), 4-5 mg daily (for children 6-14 years).

Usage: Used for asthma triggered by allergies or exercise.

Route: Oral.

Treatment advice

In children inhaled steroids can affect growth: seek specialist help.

3.14 Biologic Therapies (for severe asthma)

Omalizumab:

Dosage: 150-375 mg every 2-4 weeks (depending on weight and IgE levels)

Usage: Used for allergic asthma not controlled with ICS and LABA.

Route: Subcutaneous injection.

Severe chronic side effects of steroids: thin bones, weight gain, diabetes, gastric ulcer.

Only use theophylline if dose can be monitored due to toxicity.

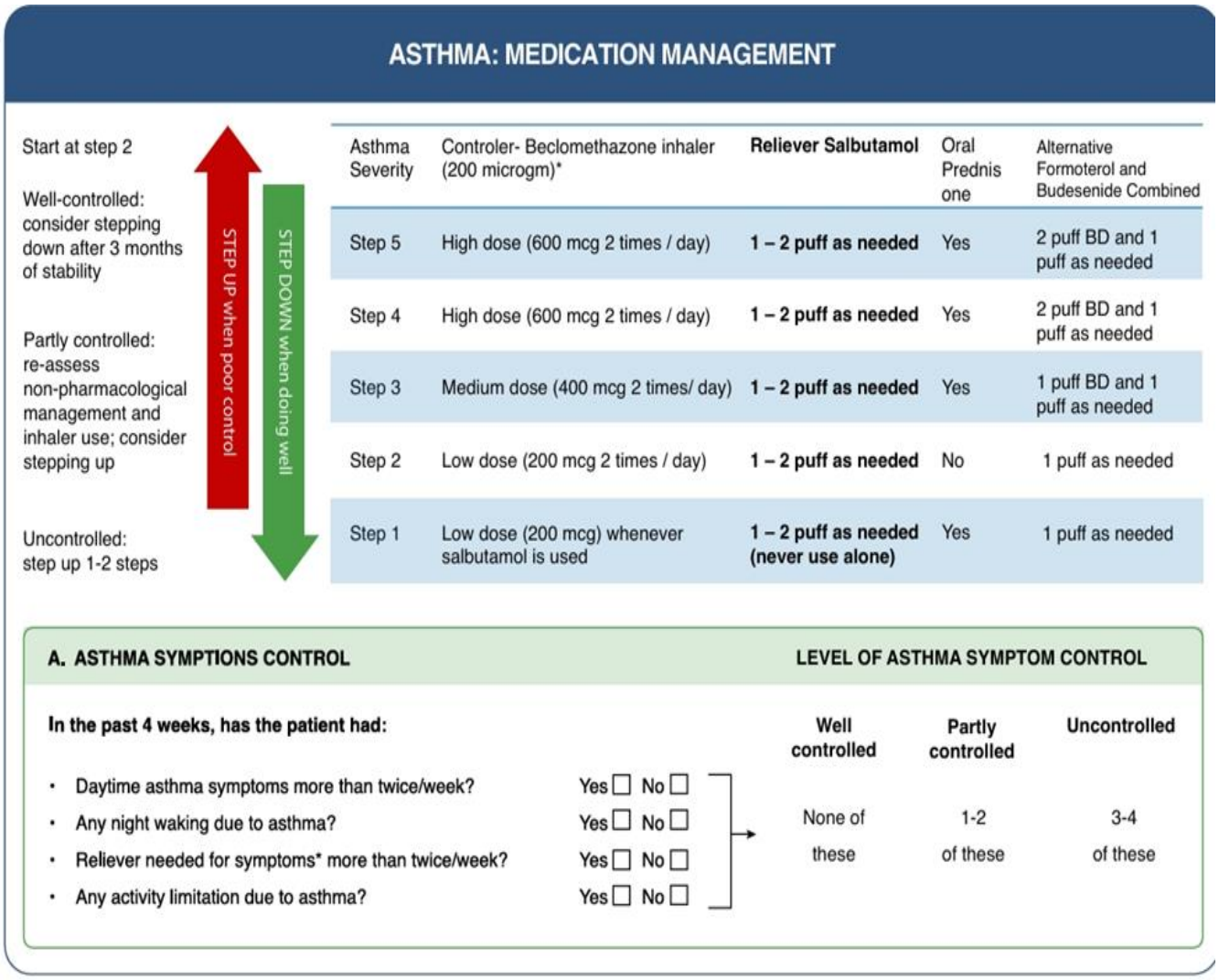


Figure 10: ASTHM MEDICATION MANAGEMENT

1. Short-acting Beta-agonists (SABA) - Relievers

Salbutamol (Albuterol)

Dosage: 100 mcg per inhalation, 1-2 puffs as needed (max 4-6 puffs/day) for children under 12 years. Nebulization: 2.5 mg every 4-6 hours as needed.

Mechanism: Stimulates beta-2 adrenergic receptors, relaxing bronchial smooth muscle.

Side Effects: Tremors, tachycardia, headache, hypokalemia.

Contraindications: Hypersensitivity, severe cardiac disease.

Interactions: Beta-blockers reduce efficacy; increased risk of hypokalemia with diuretics.

Precautions: Monitor in cardiovascular disease, hyperthyroidism.

2. Long-acting Beta-agonists (LABA) – Controllers Salmeterol

Dosage: 25 mcg inhalation twice daily for children 4 years and older.

Mechanism: Prolonged beta-2 receptor stimulation leading to bronchodilator.

Side Effects: Tachycardia, tremor, throat irritation.

Contraindications: Monotherapy without corticosteroids.

Interactions: CYP3A4 inhibitors increase levels.

Precautions: Not for acute attacks.

3. Inhaled Corticosteroids (ICS) – Controllers Budesonide

Dosage: 100-200 mcg twice daily for children under 12 years.

Mechanism: Suppresses airway inflammation.

Side Effects: Oral candidiasis, hoarseness.

Contraindications: Untreated infections.

Precautions: Rinse mouth after use.

4. Leukotriene Receptor Antagonists (LTRAs)

Montelukast Dosage: 4 mg daily (children 1-5 years), 5 mg daily (6-14 years), 10 mg daily (≥15 years).

Mechanism: Blocks leukotriene receptors, reducing inflammation.

Side Effects: Headache, mood changes.

Precautions: Monitor neuropsychiatric effects.

5. Biologic Therapy (Severe Asthma)

Omalizumab

Dosage: 75-375 mg every 2-4 weeks (for children ≥6 years).

Mechanism: Monoclonal antibody against IgE.

Side Effects: Anaphylaxis, injection site reactions.

3.16. Injectable Treatments for Asthma in Adults

Emergency and severe asthma management (clinic, health center, and hospital levels)

Epinephrine (for anaphylaxis or severe allergic asthma)

Dose: 0.3–0.5 mg IM every 5–15 minutes as needed

Precautions: Use with caution in patients with cardiovascular diseases.

Magnesium Sulfate (for severe exacerbations not responding to initial treatment)

Dose: 1–2 g IV over 20 minutes

Precautions: Monitor for hypotension and respiratory depression.

Hydrocortisone (systemic corticosteroid for severe attacks)

Dose: 100–200 mg IV every 6–8 hours

Duration: Continue until symptoms improve, then switch to oral corticosteroids.

Precautions: Risk of hyperglycemia, hypertension, and immunosuppression.

Methylprednisolone (alternative to hydrocortisone)

Dose: 40–80 mg IV every 6–12 hours

Duration: Continue until symptoms improve, then transition to oral steroids.

Aminophylline (second-line therapy for severe asthma exacerbation if other treatments fail)

Loading Dose: 5–6 mg/kg IV over 30 minutes

Maintenance Dose: 0.5–0.9 mg/kg/hr IV infusion

Precautions: Monitor for arrhythmias, nausea, and seizures.

3.17. Injectable Treatments for Asthma in Pediatrics

Emergency and Severe Asthma Management (Clinic, Health Center, and Hospital Levels)

Magnesium Sulfate

Dose: 25–50 mg/kg IV over 20 minutes (max 2 g).

Precautions: Monitor for hypotension and respiratory depression.

Hydrocortisone IV (preferred for infants and young children)

Dose: 4–8 mg/kg/day in divided doses every 6 hours.

Methylprednisolone IV (alternative corticosteroid for older children)

Dose: 1 mg/kg IV every 6 hours.

Aminophylline IV (used in refractory cases under close monitoring)

Loading Dose: 5–6 mg/kg IV over 30 minutes

Maintenance Dose: 0.5–1 mg/kg/hr IV infusion

Epinephrine (for severe asthma with anaphylaxis features)

Dose: 0.01 mg/kg IM every 5–15 minutes as needed (max 0.5 mg per dose).

3.18 The Absolute Contraindication for Aminophylline in Asthma Treatment Is:

Hypersensitivity to Aminophylline or Theophylline

Patients with a known allergy to aminophylline, theophylline, or ethylenediamine should not receive aminophylline, as it can trigger severe hypersensitivity reactions, including anaphylaxis.

Other Important Contraindications:

Uncontrolled cardiac arrhythmias (especially tachyarrhythmia) – Aminophylline can worsen arrhythmias due to its stimulant effects.

Peptic ulcer disease – It can increase gastric acid secretion, worsening ulcers.

Severe hypotension – It may cause further cardiovascular instability.

Seizure disorders – Aminophylline lowers the seizure threshold, increasing the risk of seizures.

Although aminophylline was used historically for asthma treatment, its use has declined due to narrow therapeutic index and risk of serious adverse effects.

3.19. Prevention of Recurrent Exacerbation of Asthmatic Attack

- Avoid exposure to common allergen (e.g.: pollen, mold)
- Avoid or limit exposure to unclean (dusty area, cement dust, saw dust) environment
- Stay away from irritants. (e.g.: tobacco, smoke from car absorb, secondary smoking)
- Take your prescribe medication regularly
- Mask up (use your mask in industrial or dusty environment)
- Avoid cold environment or use protective clothing

3.20. Patient Counseling

Medication adherence: Take asthma medications exactly as prescribed, including daily controller inhalers and correct use of reliever inhalers, even when symptoms improve.
Trigger avoidance: Identify and avoid common triggers such as dust, smoke, allergens, cold air, respiratory infections, and strong odors to reduce asthma attacks.
Inhaler technique and action plan: Learn and regularly review proper inhaler technique recognize early warning signs and manage exacerbations promptly.

Healthy lifestyle and follow-up: Maintain regular physical activity as tolerated, avoid smoking and second-hand smoke, get recommended vaccinations, and attend routine clinic visits for monitoring and adjustment of treatment.

Chapter 4

Hypertension

4.0 Introduction

Hypertension, commonly known as high blood pressure, is a serious chronic medical condition that occurs when the pressure within the blood vessels remains persistently elevated. It is clinically defined by a systolic blood pressure of 140 mmHg or higher and/or a diastolic blood pressure of 90 mmHg or higher. Hypertension often develops silently, with many individuals remaining asymptomatic until complications arise. Despite its silent nature, hypertension is a major public health concern because it significantly increases the risk of cardiovascular disease (CVD), which remains one of the leading causes of death worldwide. Uncontrolled high blood pressure contributes to progressive damage of vital organs, leading to severe complications such as myocardial infarction, heart failure, renal failure, stroke, and vascular dementia. These outcomes result in long-term disability, reduced quality of life, and increased healthcare costs. Early detection, consistent monitoring, lifestyle modification, and appropriate medical management are essential to prevent complications and reduce the global burden of hypertension.

4.1 Hypertension (HTN) Global Mortality & Morbidity

Hypertension is the number one cause of mortality and morbidity Globally. Uncontrolled blood pressure is one of the main risk factors for CVD and is estimated to be responsible for more than 10 million deaths per year. Large burden of hypertension - An estimated 1.4 billion people worldwide have high blood pressure, but just 1 in 7 people have it under control. Hypertension control can save most lives Hypertension control is simple, affordable and essential. Hypertension control program can be easily integrated in primary health systems.

4.2 Diagnosis

Hypertension in adults is diagnosed if the:

SYSTOLIC blood pressure is > 140 mm Hg

OR

DIASTOLIC blood pressure is > 90 mm Hg

BP should be elevated on **two separate** visits or days to ensure proper diagnosis

- Diastolic blood pressure ≥90 mmHg, on two different days. However, if the blood pressure is ≥160 mmHg or ≥100 mmHg at the first reading, second reading should be taken on the same day to establish the diagnosis
- If the patient had the blood pressure measurement done during the screening program at the community level, then the BP reading during clinic visit can be considered as the second reading
- If only the systolic, or only the diastolic blood pressure is raised, diagnose and manage according to the higher number
- If the first blood pressure (BP) is <140/90 mmHg, then no other blood pressure measurement is needed during that encounter
- If the first BP is >140/90 mmHg, perform a second BP and use the second reading as the recorded BP for the encounter.
- If there is a large difference between the first and second reading (>5 mmHg), it is reasonable to do a third measurement and use the third BP as the recorded BP.

This section does NOT apply to pregnant women. In pregnancy BP ≥140/90 can be a sign of pre-eclampsia which can be fatal.

Applying the B P cuff

- Explain the procedure to the patient.
- If the patient is wearing a thick-sleeved
- garment, ask the patient to uncover the arm
- by either removing the top garment or rolling up the sleeve. If the cuff is tied over the clothing, ensure that it is tied snugly and evenly.
- The patient's arm should be supported on the table and relaxed

Note:

- CVD risk reduction strategy is based on Identifying and treating hypertension
- Hypertension is mostly asymptomatic.
- Symptoms are present when there are associated complications.
- 90% of hypertension is identified as essential hypertension for which there is currently no known etiology.

4.3. HTN Risk Factors

There is an increased risk of developing hypertension if the following factors are present:

✓ **Non-modifiable risk factors**

- Older age
- Ethnicity (more common in people of African descent)
- Family history of hypertension

- Being male
- History of hypertension in pregnancy

✓ **Modifiable risk factors**

- Excess salt in the diet
- Unhealthy diet
- Being overweight
- Smoking
- Harmful use of alcohol
- Physical inactivity
- Use of drugs: steroids, NSAIDs

In 10% of hypertension cases, there is an identifiable cause. This is called secondary hypertension. Consider secondary hypertension in patients <30yrs and hypertension that is proving difficult to control.

4.4. Screening

Since hypertension is asymptomatic, consider screening for hypertension in:

- Age ≥ 30years
- BMI ≥ 30 or abdominal circumference >102cm in men; >88cm in women
- Family history of hypertension
- Medical history of hyperlipidemia, diabetes mellitus, heart disease, kidney disease, hypertension in pregnancy and/or stroke
- Medication such as steroids, NSAIDs
- Social history of smoking and alcohol intake of more than 330 ml of alcohol (e.g.: Guinness Stout, Cane juice or local gin shot (50ml)

4.5. Types of Hypertensions

Essential	Secondary
▪ Genetic ▪ Does not have an identifiable cause ▪ Becomes more common with age ▪ 95% of hypertension cases are essential	▪ Has an Identifiable cause ▪ Occur in patients younger the 40 years of age ▪ 5% of hypertension cases are secondary

Common Causes of Secondary

- Heart failure
- Chronic Kidney Disease
- Some medication (steroids, Ibuprofen, antidepressants)
- Pain
- Anxiety
- Excessive alcohol intake

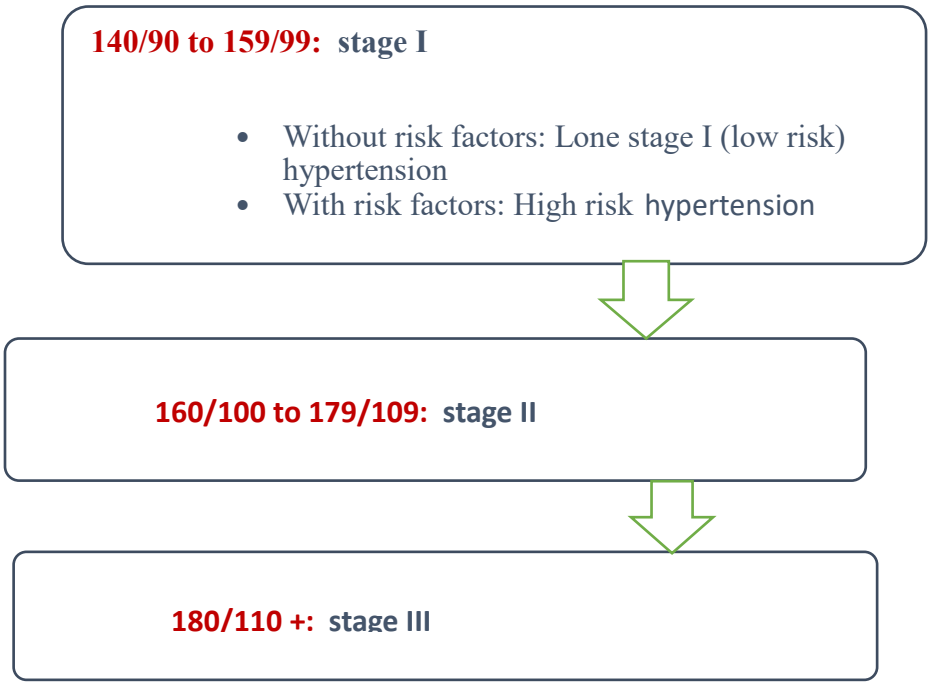


Figure 11: Stages of HTN. A Stage is defined by degree of hypertension

a patient has BP > 180/110 and with symptoms of end organ damage (headache, blurry vision, dyspnea, hematuria, chest pain):

1. **Give medications *before* transferring**
2. **Transfer to ER/County Hospital for admission**
3. **Recheck BP every 30 minutes (even during transit)**

Do not lower the blood pressure by more than 25%, because can cause stroke or lack of consciousness

Hypertensive emergency

Usually occurs at **BP > 180/110 mmHg**

When blood pressure rises acutely, this can result in signs of vital organ damage**:**

- Brain: headache, altered mentation, stiff neck, stroke
- Eyes: blurred vision
- Heart and aorta: chest pain and dyspnea (MI/HF)
- Kidneys: hematuria, acute kidney injury
- Fetus: preeclampsia and eclampsia

NOTE: When blood pressure rises acutely, this can result in signs of vital organ damage:

- Brain: headache, altered mentation, stiff neck, stroke
- Eyes: blurred vision
- Heart and aorta: chest pain and dyspnea (MI/HF)
- Kidneys: hematuria, acute kidney injury
- Fetus: preeclampsia and eclampsia

Heart disease:

Thickening of the heart muscle and eventually developing: diastolic heart failure (difficulty pumping blood) and /or coronary artery disease (disease of blood vessels in the heart causing heart attack)

Retinal hemorrhage:

Damage to the blood vessels in the eye can lead to blindness

Vascular disease:

Blood vessels in the legs and abdomen become diseased

Complications during pregnancy:

Damage to kidneys, low birth weight, early birth, preeclampsia

Figure 12: Complications of Hypertension

Initial treatment according to stage

Stage	BP range	Treatment and Follow up
I: Low Risk	140-159/90-99	Lifestyle modification → follow up in 3 months at NCD clinic
I: High Risk	140-159/90-99 + risk factor	Start **one antihypertensive** → follow up in 2-4 weeks
II	160-179/100-109	Start **two antihypertensives** → follow up in 2-4 weeks
III	>180/110	Start **three antihypertensives** → follow up in 2-4 weeks REFER TO THE HOSPITAL
Hypertensive Emergency	Any stage + danger signs	Treat, and refer urgently for ER and admission. At discharge → follow up in 2-4 weeks in NCD clinic

Figure 13: Initial Treatment According to the stage

Figure 15: Damage HTN Cause to the Heart

4.6. Principles of management

- BP≥140/90mmHg (or systolic BP≥130mmHg in diabetes, CVD and chronic kidney disease) requires treatment.
- Aim of treatment is to reduced risk of CVD

4.7. Perform baseline investigations:

- BMI and/or waist circumference
- Fasting blood glucose and/or HbA1c
- Urinalysis for proteinuria or renal function with creatinine clearance or eGFR
- Total serum +/- LDL cholesterol
- Conduct a CVD risk assessment (see below)

EKG if available

non-pharmacological management: lifestyle recommendations

If BMI > 30 or waist circumference >102cm in men; >88cm in women, advice weight loss.

- Advise a healthy diet with little fat, moderate portion of protein and starch with plenty of fruits and vegetables like the DASH diet. [72]
- Recommended salt intake should be ≤ 4 pinches of salt between three fingers (≤ 2g/day)
- Avoid adding salt to already cooked food.
- Aim to drink about 2 liters of water a day and avoid fizzy, carbonated and sweetened drinks.
- Alcohol intake should be no more than one large glass or bottle of beer/lager, a shot of spirits or a small glass of wine a day.
- Physical activity in the form of exercise should be recommended.
- Moderate intensity exercise for 30 –60 minutes 5 days or week. This should make the heart race beat faster, cause some breathlessness, prevent singing but allow talking.
- Guided Vigorous-intensity exercise can be done 15 –30 minutes 5 days a week and of enough intensity to prevent talking.
- Muscle strengthening exercises are advised for 2 days in the week in addition. Encourage physical activity choice that fits in with the person's lifestyle and in addition to their activities of daily living.
- Advise no tobacco smoking. There is no level of tobacco smoking or second- hand exposure to tobacco smoke that is safe.

4.8. Pharmacological treatment

See table below for treatment choices.

- Start with any of the four classes of antihypertensives: calcium channel blockers, thiazide diuretics, ACE inhibitors (ACEi) or Angiotensin receptor blockers (ARBs).
- The choice depends on the presence of pre-existing conditions and risk of side effects.
- In people of African descent and/or people >65 years start with either thiazide diuretic or calcium channel blocker, beta-blockers in ischemic heart disease,
- ACEis/ARBs in patients with severe proteinuria, diabetes mellitus, heart failure or kidney disease.
- If available ?? and BP ≥20/10 mmHg higher than the target on diagnosis or there are concerns about compliance, then can start on a fixed dose combination anti- hypertensive (usually a combination of CCB +/- ARB/ACEi+/-Thiazide diuretic).
- Educate about the importance of taking medication as prescribed.
- Review every 2-4 weeks and if needed increase up to maximum tolerated dose before adding next agent from another class.
- Repeat this process till on maximum tolerated doses of 4 classes.
- If using an ACEi or ARB, ideally renal function should be checked after every dose increase.
- Aim for treatment target <140/90 or SBP<130 if the patient has CVD, CKD or diabetes mellitus.

Table 21: Hypertensive Emergency Treatment

Medication	Dosing	Notes
HCTZ (immediate release)	10 mg orally	
Enalapril	10 mg orally	Contraindicated in pregnancy and renal failure (Cr≥2.0mg/dL)
Hydralazine	25 mg orally or 10mg IV	
Furosemide	80 mg orally or 40mg IV	If evidence of pulmonary edema

NOTE: The goal is to lower the BP slowly. It is important to check the patient's BP every 30 minutes because these medications take effect in 30 min – 1 hour (when given orally).

Table 22: ANTIHYPERTENSIVE DRUG CHOICES BY CLASS

Class	Example	Tarting Dose	Maximum dose	Common side Effects	Comments
Calcium channel blocker (CCB)	Amlodipine	5mg PO 1 x a day	10mg PO 1 x a day	Headache Oedema	
Thiazide diuretic	Hydrochlorothiazide	12.5mg PO 1 x a day	25mg PO 1 x a day	Hypokalemia Hyponatremia Hyperglycemia Hyperuricemia Erectile Dysfunction	
ACEI (Angiotensin-converting enzyme inhibitor)	Enalapril	5mg PO 1 x a day	40mg PO 1 x a day	Cough Hyperkalemia Raised creatinine	First choice in patients with diabetes. See below re ARBs in people of African descent
ARB (Angiotensin-receptor blocker)	Losartan	50mg PO 1 x a day	100mg PO 1 x a day	Vertigo Headache	Preferred in people of African descent as less likely angioedema

4.9. Cardio Vascular Disease (CVD) Prevention

- Use CVD risk chart for Liberia to assess CVD risk and if >20%, start on
- atorvastatin 20mg PO 1 x a day (or simvastatin) as **primary prevention**. Titrate to CVD risk.
- Aspirin is not indicated in primary prevention. The risks outweigh the benefits.
- If there is co-existing diabetes, the person is recommended to be on atorvastatin 20mg PO 1 x a day (or another statin) if they are >40 years as **primary prevention.**
- Once stable, review patient every 3-6 months: check adherence to lifestyle recommendations and medication.
- Check CVD risk and screen for diabetes and kidney disease yearly.

4.10. Management of severe hypertension

- Severe hypertension is a medical emergency**.** Patients are at significant risk of end-organ damage to the brain, eyes, heart, and kidneys and will need immediate assessment, treatment and close monitoring.
- If first reading is ≥180/110mmHg, assess for signs of strike stroke or CVA

- Face: ask the person to smile. Does one side of the mouth or face drop droop?
- Arms: ask the person to raise(unaided) both arms. Can they do this? Does one drift down?
- Speech: Ask the person to repeat a sentence. Can they repeat it correctly? Do they slur (or say out the words clearly) their words?
- Time: If any of the above are present, arrange for admission and management of stroke (see below) within a short Time

If no stroke or CVA, repeat after resting for 30 minutes unless there are signs of stroke or CV.

If second reading ≥180/100mmHg, check for other end-organ damage:

- Acute coronary syndrome (chest pain, chest tightness, palpitations). See 6.2.4
- Acute pulmonary edema (shortness of breath at rest, basal crepitations, ankle swelling).
- Renal failure (proteinuria, raised creatinine, reduced eGFR)
- Hypertensive encephalopathy (headaches, lethargy, convulsions, coma)
- Papillo-edema/retinal hemorrhages (identifiable on fundoscopy
- If there any symptoms and/or signs of end organ damage, **hypertensive crisis** is diagnosed.
- Admit the patient for immediate management.
- Use the mean arterial blood pressure (MAP) to monitor the patient's blood pressure = systolic BP+ (2 x diastolic BP) / 3 every 15 to 30 minutes.

Table 23: Treatment time to target blood pressure

Clinical presentation	**Timeline and target BP**
Hypertensive encephalopathy	Immediate Reduction by 20-25%
Acute coronary event	Immediate Aim for SBP<140mmHg
Acute pulmonary oedema	Immediate Aim for SBP<140mmHg
Acute ischemic stroke	Within an hour Reduction by 15%
Acute hemorrhagic stroke	Immediate Aim for SBP<180mmhg

4.11. Treatment

- Labetalol 20mg bolus followed by 20-80mg iv every 10 minutes to a total dose of 300mg/

OR

- Nicardipine 5mg/hour OR
- Captopril 25mg sublingual immediately repeated in 1 -2 hours depending on response

  OR
- Nifedipine 10mg PO immediately repeated in 1 -2 hours depending on
- response

  OR
- Hydralazine slow IV injection slow IV push (5-10mg diluted in 10ml sodium chloride 0.9% and repeat after 30 minutes (beware of reflex tachycardia/fast heart rate)
- In hemorrhagic stroke, if there is raised intracranial pressure (vomiting, papilla-edema, headache), add mannitol 20% 250mls over 30 mins.
- Once stable, manage according to hypertension treatment guidelines.

If there are no symptoms and/or signs of end-organ damage, **hypertensive urgency** is diagnosed.

Admission is recommended.

- Treat with amlodipine 5mg – 10mg PO daily
- Aim to reduce BP over 24 – 48 hours.
- Once stable, manage according to hypertension treatment guidelines,
- Sublingual nifedipine is no longer used to treat severe hypertension as it can worsen
- heart failure. (rapid, uncontrolled BP drop, stroke, Heart attacks, Acute kidney injury and syncope).
- Avoid loop diuretics such as furosemide to manage severe hypertension as it can cause too much fluid loss leading to hypovolemia and dehydration and worsen the hypertension.
- Furosemide can be used only if heart failure is present.

4.12. cardiovascular disease (CVD) presentations

- Further cardiac events must be prevented in people with established CVD.
- This is secondary prevention. The management of specific CVD conditions are expanded in detail below.

4.13. Secondary prevention involves a 3 - 6 monthly review and ensuring that:

- Recommended lifestyle advice offered.
- Aspirin 75 - 100mg daily and/or another antiplatelet agent like clopidogrel as appropriate.
- Atorvastatin 80mg PO 1 x a day (or simvastatin).
- Monitor for CVD related symptoms of angina, heart failure and peripheral arterial disease and end organ damage affecting the eyes with regular ophthalmological review

- Measure BP and aim for target SBP<130mmHg.
- Check pulse. If fast >100bpm, check for causes and manage appropriately. If slow <50bpm may be secondary to beta-blocker overtreatment. If not, check for causes and manage appropriately.
- Ensure taking all medication as prescribed.
- Check renal function annually unless the dose of ACEi/ARB has increased then check within 2 - 4 weeks of change.
- Check blood glucose/HbA1c annually.
- Check for anemia and thyroid disease every 2 years as can worsen CVD.
- Suspect angina if chest pain brought on by activity, which is like a tight band on the chest and may radiate to jaw of left arm. Pain resolves on resting.
- Check for ischemic changes on an EKG. If EKG is not available, do treatment trial.

4.14. Treatment of non-pharmacological

- for symptomatic relief: give nitroglycerin 0.5mg sublingual on or before onset of chest pain.
- Add beta-blocker:
- Start with bisoprolol 2.5mg PO 1 x a day and increase to maximum of 10mg 1 x a day.
- Carvedilol 6.25mg PO 1 x a day and increase to maximum of 25 mg 1 x a day.
- Titrate dose of beta-blocker to pulse rate. Aim for between 50 and 60bpm.
- Avoid in asthma.
- Add calcium channel blocker if still getting pain: amlodipine 10mg PO 1 x a day and titrate to SBP <130mmHg. Avoid verapamil or diltiazem which can cause heart failure.
- Add long-acting nitrate if still getting pain: isosorbide dinitrate 5mg PO 2 x a day, increasing to a maximum of 40mg 3 x a day.
- Consider adding ACEi/ARB especially if hypertensive or diabetic to protect the heart, titrate to SBP <130mmHg.

4.15. Secondary prevention of CVD as above: Acute Coronary Syndrome (ACS)

This is a CVD emergency. ACS is a spectrum consisting of Unstable Angina (UA), non-ST Segment elevation myocardial infarction (NSTEMI), and STEMI

- Consider when sudden onset of chest pain that becomes prolonged does not resolve on resting.
- Pain may be localized to the central part or left of the chest; ranging from mild to severe and can radiate to the left arm, neck and back.
- It may be associated with sweating, dyspnea, vomiting, anxiety, low BP and tachycardia.
- If ACS suspected, admit the patient.

4.16. Treatment

- 300mg aspirin PO immediately.

- Perform an EKG if available and do serial EKGs hourly for 6 hours.
- Measure cardiac enzymes serially if available.
- If not available or EKG negative for ischemia, have a high index of suspicion in patients with risk factors for CVD: hypertension, DM. smoker, hyperlipidemia, chronic kidney disease and female.
- Glyceryl trinitrate 500 micrograms sublingually. Repeat after 5 min if no response.
- Oxygen therapy if oxygen saturation < 91%. Aim for saturation ≥95%
- Morphine 2.5 - 5mg IV if persisting pain with an antiemetic like metoclopramide, 10mg IM.
- Atorvastatin 20-40 mg PO (or another statin) 1 x a day
- Enoxaparin 1 mg/kg SC every 12 hours
- Treat complications such as pulmonary oedema and arrhythmias.
- Check for risk factors such as diabetes and hypertension.

4.17. Non-pharmacological treatment

- Start on ACEi/ARB. Titrate to SBP<130mmHg.
- Start on beta blocker:
- Bisoprolol, start with 2.5mg PO 1 x a day and increase every month to maximum of 10mg 1 x a day.
- Carvedilol start with 6.25mg PO 1 x a day and increase monthly to a maximum of 25mg PO 1 x a day.
- Titrate to heart rate of between 50 and 60bpm.
- Avoid in asthma.
- Continue aspirin 75 – 100mg 1 x a day lifelong with clopidogrel 75mg 1 x a day for 12 months if available.
- Continue atorvastatin 40-80mg (or another statin) PO 1 x a day.
- Secondary prevention of CVD as above

4.18. Hypertension In children

The management of hypertension in children is different from adults and it requires age-appropriate evaluation and treatment. The key principles involve confirming the diagnosis, identifying secondary causes and implementing lifestyle changes and medication when necessary.

DEFINITION OF HYPERTENSION IN CHILDREN

Normal BP: <90 percentile for age, sex and height

Elevated BP: ≥90th percentile to <95th percentile,120/80 to < 95th percentile (whichever is lower)

Stage 1 HTN: ≥95th to <95th percentile +12mmHg, or 130/80 to 139/89 mmHg

Stage 2 HTN: ≥ 95th percentile +12 mmHg, or ≥ 140/90 mmHg

4.19. Initial Evaluation

Confirm BP: measure BP on at least 3 separate occasions

History & physical exam: look for signs of:

- Renal disease
- Coarctation of the aorta
- Endocrine abnormalities

Labs & Imaging

- Urinalysis, BUN, Creatinine
- Electrolytes
- Lipid profile, fasting glucose
- Renal Ultrasound
- Echocardiogram

4.20. Identify Underlying Cause

Most pediatric hypertension is secondary (especially in children<6 years). Common causes:

- Renal disease (most common)
- Coarctation of the aorta
- Endocrine disorders (e.g. hyperthyroidism, Cushing's)
- Medications (e.g., steroids, ADHD meds)
- Obesity-related primary hypertension in children

4.21. Non-pharmacological Management (for elevated BP or Stage 1 HTN without target

organ damage)

Lifestyle changes:

- Weight loss (if overweight/ obese)
- Healthy Diet (DASH diet)
- Reduced salt intake
- Increased guided physical activity(30-60min/day)
- Limit screen time

- **Monitor BP** every 3-6 months

Pharmacological Management

Indication:

- Stage HTN
- Symptomatic hypertension
- Target organ damage (e.g., Left Ventricular Hypertrophy)
- Secondary HTN

Failed lifestyle modification therapy

- First line drugs
- ACE inhibitor (enalapril, Lisinopril)
- ARBs (Losartan) – especially in diabetic or proteinuria nephropathy
- Calcium channel blockers (amlodipine)
- Thiazide diuretics (hydrochlorothiazide)

Targets & follow-up

Target BP: <90th percentile or 130/80 mmHg in adolescents

Monitor:

- Every 1-2 weeks after starting medication
- Every 3-6 months once controlled
- Regular ECG if left ventricular hypertrophy was present

4.22. Peripheral Arterial Disease

- Symptoms include claudication pain on walking, worse going up a hill and relieved on rest. Peripheral foot pulses are absent.
- Advise to walk to the point of pain and a little beyond to encourage new blood supply.
- Secondary prevention of CVD as above.

Hypertension Protocol Diuretic as First-Line Treatment

Step	SCREEN ALL ADULTS
Step	IF ≥140 or ≥90* PRESCRIBE thiazide-
Step	IF still ≥140 or ≥90 ADD starting dose of ACE-I or ARB††
Step	IF still ≥140 or ≥90 INCREASE to full dose of ACE-I or ARB
Step	IF still ≥140 or ≥90 ADD starting dose of CCB
Step	IF still ≥140 or ≥90 INCREASE to full dose of **CCB**
Step 7	IF still ≥140 or ≥90 CHECK that patient has been taking drugs regularly and correctly – IF this is the case, REFER patient to a specialist

LIFESTYLE MANAGEMENT ADVICE FOR ALL PATIENTS

- Stop all tobacco use, avoid secondhand tobacco smoke
- Drink no more than two units of alcohol per day and do not drink on at least two days of the week
- Increase physical activity to equivalent of brisk walk 150 minutes per week
- If overweight, lose weight
- Eat heart-healthy diet: Eat a low-salt diet Eat ≥5 servings of vegetables/fruit per day
- Use healthy oils (e.g. olive oil)
- Eat nuts, legumes, whole grains and foods rich in potassium
- Limit red meat to once or twice a week at most
- Eat fresh or other food rich in omega 3 fatty acids at least twice a week
- Avoid added sugar from cakes, cookies, sweets, drinks and juice

DRUGS AND DOSES

Class	Medication	Starting Dose	Intensification
diuretic‡ thiazide-like	chlorthalidone or indapamide SR	12.5mg	25mg
		1.5mg	stay at 1.5 mg
ACE inhibitor‡ (angiotensin-converting-enzyme inhibitor)	lisinopril	20mg	40mg
	ramipril	5mg	10mg
	perindopril	4-5mg	8-10mg
ARB	losartan	50mg	100mg
CCB (calcium channel blocker)	telmisartan	40mg	80mg
	amlodipine	5mg	10mg

Figure 14: Protocol for Hypertension

4.23. Patients Education

- Adherence to medication
- The diagnosis and the need for life-long medication;
- Difference between medicines for long-term control (as in hypertension) and medicines
- for quick relief (such as for headaches);
- The damage to target organs if blood pressure is uncontrolled (i.e. the possibility of
- stroke, heart attack, or kidney failure);
- How to take medications at home. Show the patient the appropriate dose;
- Medication should be consumed every day at a fixed time when the patient can remember
- Keeping enough supply of medications at home till the next visit to the health facility;
- Taking the medicines regularly as advised, even if there are no symptoms;
- Potential adverse effects of the medications and what to do
- Most importantly check the patient's understanding before the patient leaves the health center

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