Healthy Mothers, Healthy Babies

Ways that a baby can get HIV

During Pregnancy

During Labour and Delivery

From Breastfeeding

Preventing Mother-to-Child Transmission (MTCT) of HIV

Antiretroviral therapy during pregnancy

Safe delivery practices and antiretroviral therapy to mother and newborn

Counselling and support for safer infant feeding practices

EITHER / OR

Mom or baby antiretrovirals decrease risk of HIV infection

Based on DoH guidelines

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ANTENATAL CARE PMTCT

ANC FIRST VISIT

- Group pre-test HIV counseling
- HIV counseling and testing
- Booking blood including on site haemoglobin (Hb)
- Dispense Iron and Folate

HIV NEGATIVE

Repeat test at around 32 weeks gestation

HIV Positive

- If HIV positive do a CD4 cell count
- Stage HIV clinically
- Screen for TB clinically

If Hb < 8g/dL
Refer for management of anaemia
Take FBC

If Hb ≥ 8g/dL
From 14 weeks onwards
start AZT 300mg BD

REFUSED TESTING

Refusing is VERY unusual if offered carefully and respectfully
Re-offer at every visit

ANC SECOND VISIT

CD4 Count ≤ 350cells/mm³ and or WHO stage 3 or 4

Initiate ART urgently
If ≥14 weeks gestation ensure on AZT until ART started

Continue ART life long including during labour
Ensure ongoing care

CD4 Count > 350cells/mm³ WHO stage 1 or 2

Ensure on AZT from 14 weeks gestation until delivery

Subsequent Visits
Problem based visit schedule
Haemoglobin monitoring
Haematinics
Ensure continuous supply of AZT
Ensure ongoing staging and care

LABOUR & DELIVERY

Only if the mother is not on ART

Onset of Labour
Nevirapine 200mg stat
AZT 300mg 3hourly until delivery
Stat dose Truvada

INFANT

6 Weeks
Test infant for HIV
Start infant on cotrimoxazole

Infant exclusive breast fed

- Mother not on ART
  - Continue infant NVP until 1 week after breast feeding stopped
  - Repeat infant HIV test 6 weeks after feeding stopped
- Mother on ART
  - Stop infant NVP
  - Repeat infant HIV test 6 weeks after feeding stopped

Infant exclusive formula fed

- Stop infant NVP

2nd visit

Infant HIV Positive

- Refer urgently for ART
- Stop infant NVP
- Continue breast feeding for 2 years
- Continue cotrimoxazole

Infant HIV Negative

- Stop cotrimoxazole unless infant breast fed
- Repeat HIV test at 18 months

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PMTCT Guidelines for HIV-infected Pregnant Woman With a CD4 cell count GREATER THAN 350 cells/mm^3, & WHO stage 1 or 2 Disease

ANTENATAL MANAGEMENT

- Zidovudine **(AZT) from 14 weeks** of pregnancy started at the local antenatal clinic if the haemoglobin (Hb) is greater than 8 g/dl
- Check **Hb** every **4 weeks**
- **Haematinics** – $FeSO_4$ 200mg tds or Pregamal 1 tablet tds, plus vitamin C 100mg tds – **routinely** to all pregnant women on AZT
- If the Hb is less than 8 g/dl, start haematinics as above AND **refer** for management of anaemia

INTRAPARTUM MANAGEMENT

At the onset of labour,

- AZT 300mg 3 hourly PO
- Give single dose (200mg) **nevirapine** tablet **PLUS** single dose **truvada** (FTC/TDF) tablet

Truvada is a combination of 200mg of emtricitabine and 300mg of tenofovir

POSTPARTUM MANAGEMENT

- No further treatment for the mother
- Repeat **CD4** cell count **every 6 months**
- For lifelong ART when CD4 cell count drops below 350 cells/mm^3, or WHO stage 3 or 4 disease

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PMTCT Guidelines for HIV-infected Pregnant Woman With a CD4 cell count LESS THAN 350 cells/mm^3, or WHO stage 3 or 4 Disease

ANTENATAL MANAGEMENT

Not on antiretroviral treatment (ART), i.e. **ART naïve**, for initiation of lifelong ART

1st line regimen:

- Tenofovir **(TDF)** 300mg daily **PLUS** Lamivudine **(3TC)** 150mg 12 hourly **PLUS** Nevirapine **(NVP)** 200mg 12 hourly

ART naïve,

- Baseline **ALT** before starting **NVP**.
- NVP 200mg daily for the 1st 14 days (lead-in dose), then 12 hourly. Clinical monitoring for NVP toxicity. Laboratory monitoring when indicated
- Determine creatinine clearance before starting TDF

Already on ART,

- On stavudine **(D4T)** and asymptomatic, **do not change** to TDF
- On efavirenz **(EFV)** and less than 12 weeks pregnant, change to NVP. No need for the lead-in dose for the 1st 14 days
- On EFV and more than 12 weeks pregnant, **continue EFV**

INTRAPARTUM MANAGEMENT

- Continue ART as per usual dosing schedule
- No additional treatment necessary

POSTPARTUM MANAGEMENT

- Continue ART and routine follow up

Prophylaxis for HIV-exposed infants

FORMULA-FED INFANTS

- **Daily Nevirapine (NVP) syrup from birth until 6 weeks of age**

  * Birth weight **greater than 2500g – 1.5ml daily** = 15mg per day
  * Birth weight **less than 2500g – 1.0ml daily** = 10mg per day

BREASTFED INFANTS

Mother on ART, i.e. triple therapy,

- Daily NVP syrup from birth until 6 weeks of age. Dosages as above

Mother not on ART,

- Daily NVP syrup from birth until the end of the breastfeeding period
- Dose of NVP syrup increases with the infant's age

Infant's Age	NVP syrup Dose
Birth to 6 weeks	≥ 2500g - 1.5ml Daily < 2500g - 1.0ml Daily
> 6 weeks - 6 months	2ml Daily = 20mg/day
> 6 months - 9 months	3ml Daily = 30mg/day
> 9 months - end of breastfeeding	4ml Daily = 40mg/day

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ARV prophylaxis for HIV exposed infants

ALL HIV exposed infants must receive nevirapine (NVP) ARV prophylaxis from birth daily for at least 6 weeks

Breastfed infants

Mother on HAART: Infant stops NVP at 6 weeks. Do an HIV DNA PCR.
Mother not on HAART: Continue NVP for 1 week after all breastfeeding is ceased. Do an HIV DNA PCR test at 6 weeks.

Commence co-trimoxazole at 6 weeks

If PCR test is negative: Continue co-trimoxazole. Stop when breastfeeding is stopped and HIV test is negative.

If PCR test is positive: Continue co-trimoxazole, stop NVP and refer for treatment within a week.

Formula fed infants

Infant stops NVP at 6 weeks, do an HIV DNA PCR.

If PCR test is negative: Stop co-trimoxazole.

If PCR test is positive: Continue co-trimoxazole and refer for treatment within a week.

Infant nevirapine (NVP) dosing recommendations		
Birth – 6 weeks Birth weight < 2,500 gram Birth weight ≥ 2,500 gram	10mg/daily 15mg/daily	1ml 1,5ml
≥ 6 weeks to 6 months	20mg/daily	2ml
≥ 6 to 9 months	30mg/daily	3ml
≥ 9 months to end of breastfeeding	40mg/daily	4ml

Co-trimoxazole prophylaxis	
< 6 months or < 5kg	2,5mls daily
6 months - 5 years 5kg - 15kg	5mls daily

WHO CLINICAL STAGING OF HIV AND AIDS FOR INFANTS AND CHILDREN

(INTERIM AFRICAN REGION VERSION FOR PERSONS AGED UNDER 15 YE ARS WITH CONFIRMED LABORATORY EVIDENCE OF HIV INFECTION: HIV ANTIBODY IF AGED 18 MONTHS AND ABOVE; VIROLOGICAL OR P24 ANTIGEN TESTING IF AGED UNDER 18 MONTHS)

Clinical Stage 1

- Asymptomatic
- PGL

Clinical Stage 2

- Hepatosplenomegaly
- Papular pruritic eruptions
- Seborrhoeic dermatitis
- Extensive human papilloma virus infection
- Extensive molluscum contagiosum
- Fungal nail infections
- Recurrent oral ulcerations
- Lineal gingival erythema (LGE)
- Angular cheilitis
- Parotid enlargement
- Herpes zoster
- Recurrent or chronic RTIs (otitis media, otorrhoea, sinusitis)

Clinical Stage 3

Conditions where a presumptive diagnosis can be made on the basis of clinical signs or simple investigations

- Moderate unexplained malnutrition not adequately responding to standard therapy
- Unexplained persistent diarrhoea (14 days or more)
- Unexplained persistent fever (intermittent or constant, for longer than one month)
- Oral candidiasis (outside neonatal period)
- Oral hairy leukoplakia
- Acute necrotizing ulcerative gingivitis/periodontitis
- Pulmonary TB
- Severe recurrent presumed bacterial pneumonia

Conditions where confirmatory diagnostic testing is necessary

- Chronic HIV-associated lung disease including brochiectasis
- Lymphoid interstitial pneumonitis (LIP)
- Unexplained anaemia (<8g/dl), and or neutropenia (<1000/mm3) and or thrombocytopenia (<50 000/ mm3) for more than one month

Clinical Stage 4

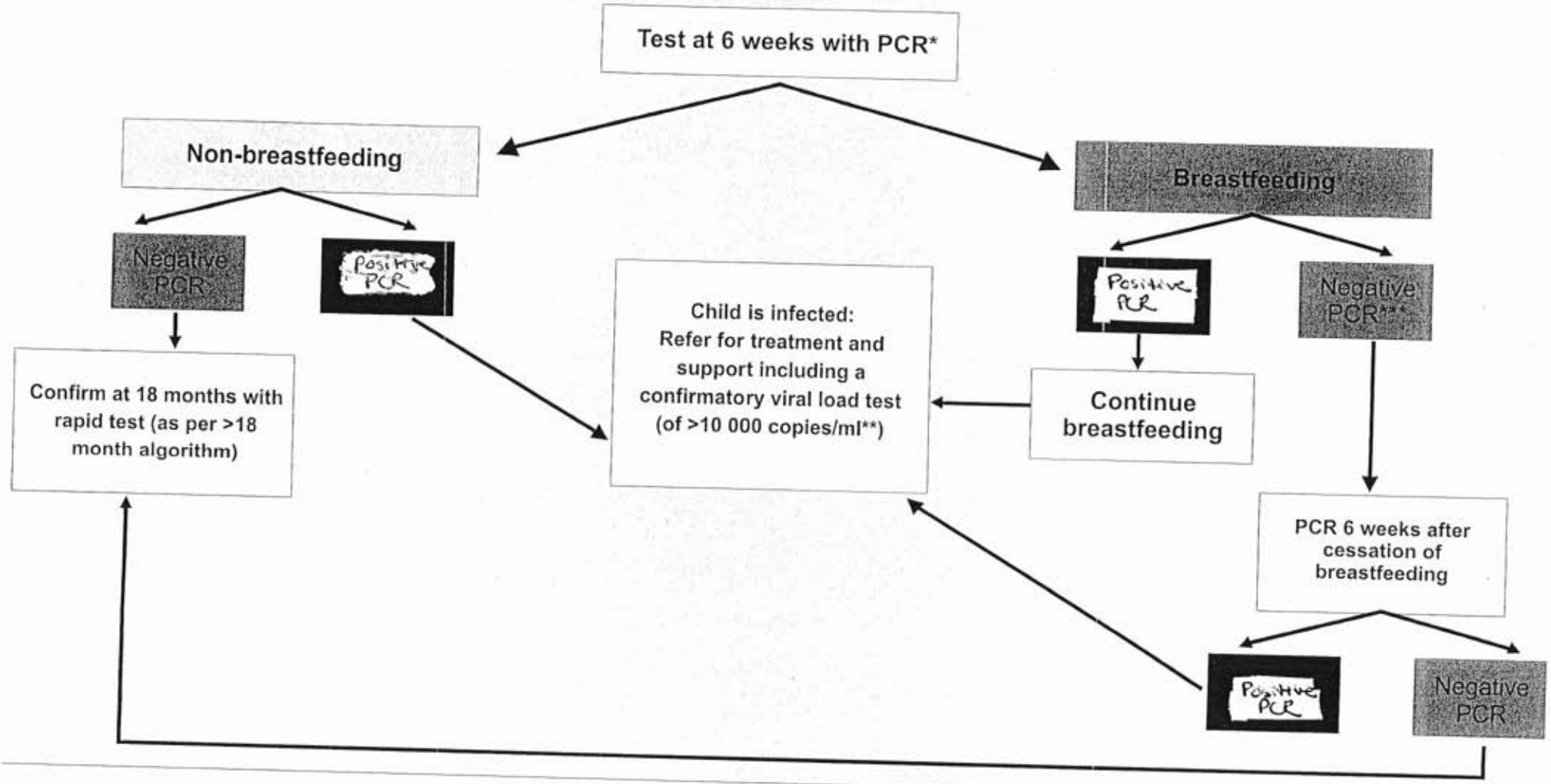
Conditions where a presumptive diagnosis can be made on the basis of clinical signs or simple investigations

- Unexplained severe wasting or severe malnutrition not adequately responding to standard therapy
- Pneumocystis pneumonia
- Recurrent severe presumed bacterial infections (eg empyema, pyomyositis, bone or joint infection, meningitis, but excluding pneumonia)
- Chronic herpes simplex infection; (orolabial or cutaneous of more than one month's duration)
- Extrapulmonary TB
- Kaposi's sarcoma
- Oesophageal candidiasis
- CNS toxoplasmosis (outside the neonatal period)
- HIV encephalopathy

Conditions where confirmatory diagnostic testing is necessary

- CMV infection (CMV retinitis or infection of organs other than liver, spleen or lymph nodes; onset at age one month or more)
- Extrapulmonary cryptococcosis including meningitis
- Any disseminated endemic mycosis (eg extrapulmonary histoplasmosis, coccidiomycosis,
- penicilliosis)
- Cryptosporidiosis
- Isosporiasis
- Disseminated non-tuberculous mycobacteria infection
- Candida of trachea, bronchi or lungs
- Visceral herpes simplex infection
- Acquired HIV associated rectal fistula
- Cerebral or B cell non-Hodgkin lymphoma
- Progressive multifocal leukoencephalopathy (PML)
- HIV-associated cardiomyopathy or HIV-associated nephropathy

HIV testing algorithm for infants less than 18 months



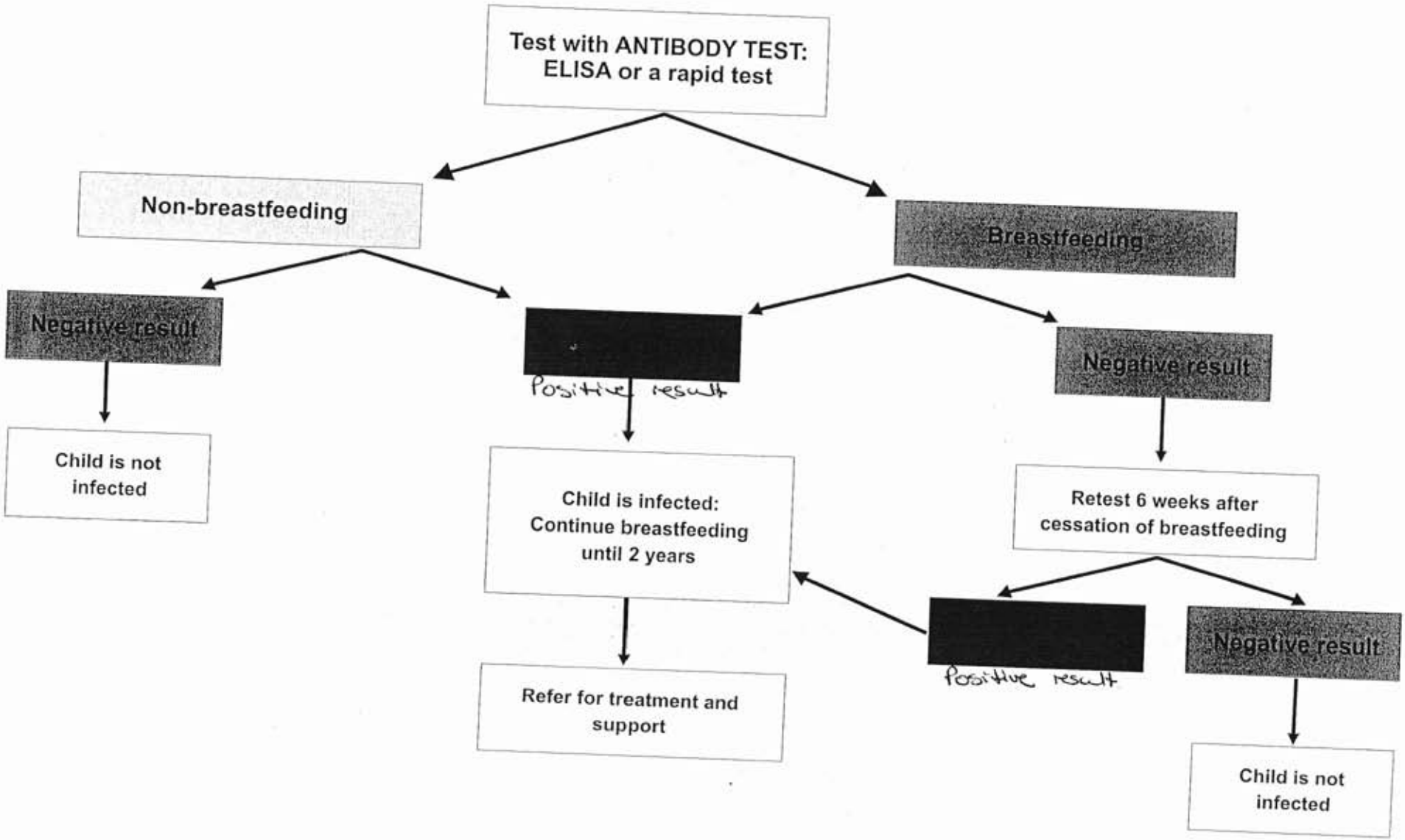
* Symptomatic HIV-exposed infants younger than 6 weeks should be tested immediately. If the PCR is negative, it should be repeated at 6 weeks. A positive PCR requires urgent referral for treatment and a confirmatory viral load test.

** Do not delay initiation of antiretrovirals for viral load test result. If VL test result <10 000 copies/ml, repeat HIV DNA PCR test and consult your laboratory for assistance.

***If a breastfed infant develops clinical symptoms suggestive of HIV infection, an HIV DNA PCR test is indicated.

Version 1 May 2010

HIV antibody testing algorithm for children over 18 months



Growth indicators and nutritional classifications

	Percentile	Z scores	Percentage of the median	classifications
Weight for age	< 3rd percentile underweight	<-2 underweight <-3 severe underweight	Underweight (60-80%) Marasmus (<60%)	WHO IMCI Welcome
Height for Age	< 3rd percentile Stunted	<-2 Stunting <-3 severe stunting	<90% stunting	WHO Waterlow
Weight for height		<-2 Wasting <-3 severe wasting	< 80% wasting <70% severe wasting	WHO waterlow
BMI for Age	➢95th overweight ➢85 risk of overweight	>+1 risk overweight >+2 overweight >+3 obese		WHO
MAUC (Age 1-5 yrs)				<115mm WHO-SAM
oedema				WHO Welcome

Hold arms horizontally: wing beating tremor (Wilson disease)

Knee and ankle reflexes
- Diminished (vitamin E deficiency)
- Delayed return (hypothyroidism)

Sensation: diminished (vitamin E deficiency)

OTHER

Request inspection of:
- Urine: dark (cholestasis)
- Stool: acholic (cholestasis); blood (portal hypertension)

Urinalysis
- Bilirubin (hepatobiliary disease; its absence implies unconjugated hyperbilirubinaemia)
- Urobilinogen (increased in haemolysis, and hepatic dysfunction)
- Blood (UTI)
- Nitrites (UTI)

Temperature chart (hepatitis, UTI, chronic active hepatitis)

CLD = chronic liver disease; IBD = inflammatory bowel disease; UTI = urinary tract infection.

Nutritional Assessment

The simplest method of approach to this case comprises 3 successive components.

1. Assessment of growth parameters.
2. Assessment of fat and protein stores.
3. Assessment of other nutrients, systematically.

First, introduce yourself to the child and the parent. Ensure the child is fully undressed, then stand back and inspect the child carefully. Visually scan for subcutaneous tissue and muscle bulk. Comment on the child's height and weight, request the pèrcentile charts, and interpret these. If only one measurement is given, request previous measurements to observe their progression. Work out the weight age and height age; compare these and comment. Next, if the child is underweight, work out the weight for height, to quantitate the difference in kilograms between this value and the child's actual weight.

On interpretation of percentiles, the common finding is poor weight gain, but height can also be significantly decreased by chronic disease, protein calorie malnutrition (PCM), zinc deficiency, and rickets. Head circumference can be decreased in PCM, but increased in vitamin D deficiency rickets.

After interpreting the percentile charts, demonstrate the amount of subcutaneous fat tissue by examining the skin fold thickness, between your thumb and index finger, at the midarm over biceps and triceps, at the axillae, the subscapular and suprailiac regions. Demonstrate muscle bulk at the arms, thighs and buttocks, muscle wasting being best demonstrated over these areas, particularly the buttocks (glutei). In infants, poor muscle bulk can be reflected by hypotonia on picking the child up.

The next step is a systematic general examination directed at detection of various deficiencies; it commences at the hands, then continues up to the head, and then essentially head to toe. Figure 16 outlines the order of examination, and the list at the end of this section gives additional information. Each deficiency sought is given in parentheses after the relevant physical sign.

Figure 16. Nutritional assessment.

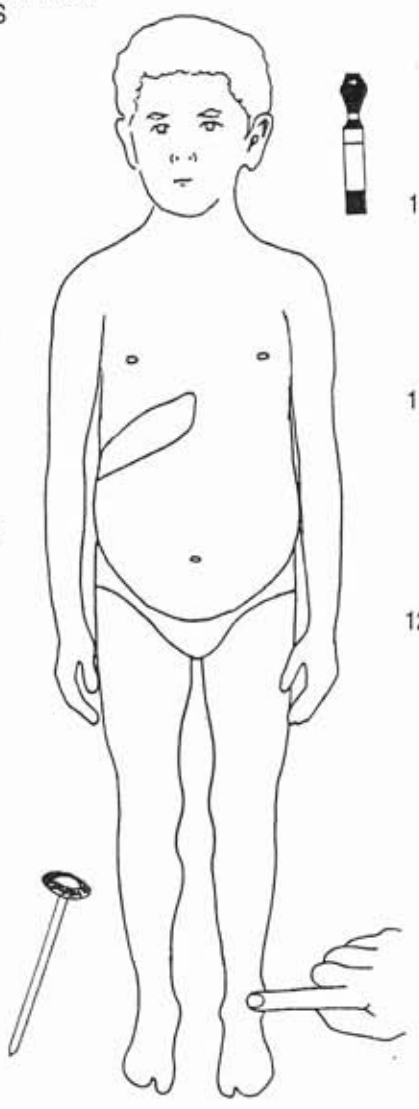
1. INTRODUCE SELF

2. GENERAL INSPECTION
   - Position patient: standing, fully undressed, then lying
   - Parameters
     - Weight
     - Height
     - Head circumference
     - Percentiles
     - Weight age versus height age
     - Weight for height (quantitate)
   - Sick or well
   - Irritability
   - Nasogastric tube
   - Intravenous access
   - Posture
   - Skeletal deformity
   - Potbelly

3. DEMONSTRATE FAT AND PROTEIN STORES
   - Subcutaneous fat
     - Mid-arm
     - Axillae
     - Subscapular
     - Suprailiac
   - Muscle bulk
     - Biceps
     - Triceps
     - Quadriceps,
     - Glutei

4. SKIN
   - Pallor
   - Jaundice
   - Bruising
   - Dermatitis
   - Erythema nodosum

5. HEAD AND NECK
   - Head
   - Hair
   - Eyes: detailed examination
   - Mouth
   - Teeth
   - Tongue
   - Gums
   - Neck



6. UPPER LIMBS
   - Palms, nails
   - Pulse
   - Wrists, forearms
   - Blood pressure

7. CHEST WALL
   - Rib rosary (vitamins C, D)
   - Sternal deformity (vitamins C, D)
   - Harrison's sulcus (vitamin D)
   - Sacral oedema (PCM, CLD)

8. ABDOMEN
   - Distension
     - Ascites (PCM, CLD)
     - Weak abdominal muscles (PCM, vitamin D)
   - Hepatomegaly (fatty infiltration with PCM, linoleic acid)
   - Hepatosplenomegaly (CLD, zinc)
   - Pubertal delay (zinc)

9. GAIT
   - Full gait examination (vitamins B_1, B_6, B_{12}, E)
   - Examine back (vitamin D)

10. LOWER LIMBS
    - Palpation
      - Muscle bulk
      - Ankle oedema
      - Tenderness
    - Neurological examination

11. CARDIOVASCULAR SYSTEM
    - Full praecordial examination, looking for
      - Cardiomegaly (vitamin B_1, phosphate, selenium)
      - Cardiac failure (vitamin B_1, phosphate, anaemias)

12. OTHER
    - Urinalysis
      - Low specific gravity (CRF)
      - High specific gravity (dehydration)
      - Glucose (diabetes)
    - Stool analysis
      - Malabsorption
      - Giardiasis
    - Temperature chart (hypothermia with PCM)

Examine the skin thoroughly before laying hands on the patient. There are numerous dermatological manifestations of many deficiencies. Some of the relevant deficiencies include marked flakiness (PCM), dryness (linoleic acid, vitamin A), bruising (vitamin C, K), pellagra (niacin) or hyperpigmented hyperkeratosis (zinc deficiency).

Examine the child's hands next. Look at the palms for crease pallor (anaemia associated with several deficiencies), or palmar erythema (chronic liver disease, CLD), and the nails for koilonychia (iron), brittleness (iron, protein), leuconychia (CLD), or clubbing (cystic fibrosis, CLD, Crohn disease).

Feel the radial pulse for bradycardia (PCM, iodine) or tachycardia (vitamin B_1, dehydration). Check the wrists for palpable epiphyseal enlargement (vitamin D), forearms for tenderness (vitamin C), and joints for swelling (vitamin C). Take, or request, the blood pressure, supine and standing (sodium, dehydration) and offer to look for Trousseau's sign (cuff inflated to greater than systolic pressure for 3 minutes) at the end of the examination (calcium).

Next, examine the head and neck. Look for thinning of hair or areas of alopecia (linoleic acid, zinc), dyspigmentation of hair (PCM), and feel the hair for dryness (iodine) or excessive pluckability (PCM).

The eyes are the next area on which to focus, and there are many signs possible here (see list). In particular, look at the conjunctivae for pallor (iron, copper, B group vitamins, folate), or dryness and wrinkling (vitamin A), or Bitot's spots (silver plaques of desquamated epithelial cells and mucus) on the bulbar aspect (vitamin A). Look for scleral icterus (vitamin B_{12}, CLD), corneal dryness, wrinkling or clouding (vitamin A), or opacification (vitamin A, zinc). Quickly assess the external ocular movement (vitamin E), and check for photophobia (riboflavin, zinc). Offer fundoscopy for optic nerve inflammation (vitamin B_{12}), or atrophy (vitamin B_1); this will usually not be required.

Next, percuss over the facial nerve, for Chvostek's sign (calcium). Then, inspect the mouth for angular cheilosis (iron, riboflavin), gums for swelling or bleeding (vitamin C), teeth for caries (fluoride), enamel defects (vitamin D), or looseness (vitamin C), tongue for moistness (hydration), glossitis (B group vitamins), buccal mucosa for reddening or ulceration (B group vitamins) or petechiae (vitamin C). Examine the neck for goitre (iodine).

Examine the chest for sternal deformity (vitamin C, D), or any 'rib rosary' (vitamin C, D).

Next examine the abdomen for evidence of pot belly (weak abdominal musculature, coeliac disease), hepatomegaly (PCM, linoleic acid), hepatosplenomegaly (CLD), or ascites (PCM, CLD). Assess Tanner staging for pubertal delay (zinc).

Now, walk the child, looking for evidence of cerebellar ataxia (vitamin E, zinc), or peripheral neuropathy (vitamins B_1, B_6, B_{12}). Check for Romberg's sign (vitamins E, B_{12}). While the child is up, check the back for scoliosis, lordosis or kyphosis (vitamins D, C) and look again for any evidence of bow legs or knock knees (vitamin D). Proceed with a lower limb examination, feel for ankle oedema (PCM, CLD), test muscle tone (decreased in PCM). Check muscle power for weakness (PCM, sodium, potassium), tap out the knee and ankle jerks, which may be decreased (vitamins, B_1, B_6, B_{12}, E), increased (vitamin B_{12}), or have slowed return (iodine). Examine sensation for peripheral neuropathy (vitamins B_1, B_6, B_{12}, E), or posterior column dysfunction (vitamins B_{12}, E).

Examine the heart for cardiomegaly (vitamin B_1, phosphate, selenium) or congestive cardiac failure (vitamin B_1, phosphate, anaemia).

Finally, request the urinalysis for specific gravity (high with dehydration, low with chronic renal failure) and glucose (diabetes), and the stool analysis for evidence of malabsorption or giardiasis.

Additional Information

Details of possible findings on nutritional assessment

INSPECTION

Activity, awareness (PCM)

Irritability (vitamin C, iron, coeliac)

Nasogastric tube

Intravenous access for total parenteral nutrition

Posture

- 'Frog leg' (vitamin C)
- Bow legs (vitamin D)

Prominent wrists, ankles (vitamin D)

Rib rosary (vitamin C, D)

Harrison's groove (vitamin D)

Potbelly (PCM, coeliac, vitamin D)

SKIN

Pallor (vitamins A, B_1, B_2, B_6, B_{12}, C, E, folate, iron, copper)

Jaundice (CLD, vitamin B_{12})

Bruising (vitamins C, K)

Poor wound healing (vitamin C, PCM, zinc)

'Flaky paint' dermatitis (PCM)

Desquamation (linoleic acid, biotin)

Dry (vitamin A, linoleic acid)

Rough scaly skin in sun-exposed areas [pellagra] (niacin)

Seborrheic dermatitis (vitamin B_2)

Eczematous scaling around mouth, elbows, knees, genitals, anus (zinc)

Waxy (vitamin B_1, in wet beri beri)

Dermatitis herpetiformis (coeliac)

Erythema nodosum (Crohn disease, ulcerative colitis)

UPPER LIMBS

Palms: crease pallor (anaemias); erythema (CLD)

Nails: leuconychia (CLD); koilonychia (iron); brittle (iron, PCM)

Pulse: bradycardia (iodine, PCM); tachycardia (vitamin B_{12}, hydration)

Wrists: palpable epiphyseal enlargement (vitamin D)

Forearms: tender (vitamin C)

Joints: swollen (vitamin C)

Blood pressure: hypotension (sodium, hydration)

Troussseau's sign (calcium)

HEAD AND NECK

Frontal and parietal prominence (vitamin D)

Increased head circumference (vitamins A, D)

Soft skull [craniotabes] (vitamin D)

Fontanelle
- Large (vitamin D)
- Bulging (vitamin A)
- Depressed (hydration)

Sutures separated (vitamin A)

Hair
- Alopecia (zinc, linoleic acid)
- Dyspigmented (PCM)
- Thinning (PCM)
- Pluckable (PCM)
- Dry (iodine)

Eyes: sunken (hydration)

Lids
- Ptosis (vitamin B_1)
- Blepharitis (vitamin B_2, zinc)

Conjunctivae
- Pallor (anaemias)
- Xerosis (vitamin A)
- Conjunctivitis (vitamin B_2, C)
- Bitot spots (vitamin A)

Scleral icterus (vitamin B_{12}, CLD)

Cornea:
- Xerosis (vitamin A)
- Cloudy (vitamin A)
- Keratomalacia (vitamin A)
- Opacification (vitamin A, zinc)
- Vascularization (vitamin B_2)

Retina
- Optic neuritis (vitamin B_{12})
- Optic atrophy (vitamin B_1)

Eye movements: ophthalmoplegia (vitamin E)

Photophobia (vitamin B_2, zinc)

Facial nerve: percuss for Chvostek's sign (calcium)

Mouth: angular cheilosis and stomatitis (iron, vitamin B_2, niacin)

Teeth
- Caries (fluoride)
- Loose (vitamin C)
- Enamel defects (vitamin D)

Tongue
- Glossitis, reddening and ulceration (vitamin B group)
- Moisture (hydration)
- Cyanosis (CHD, vitamin B)

Buccal mucosa
- Reddened and ulcerated (vitamin B group)
- Petechiae (vitamin C)

Gums: swollen, bleeding (vitamin C)

Contour of lower face
- Prominent salivary glands (vitamin C)
- Pendulous cheeks (PCM)

Neck: goitre (iodine)

GAIT AND BACK

Full gait examination, looking for:
- Cerebellar ataxia (vitamin E, zinc)
- Peripheral neuropathy (vitamins B_1, B_6, B_{12})
- Romberg's sign (vitamins E, B_{12})

Examine back for scoliosis, kyphosis and lordosis (vitamin D)

LOWER LIMBS

Palpate
- Muscle bulk (PCM)
- Ankle oedema (PCM, CLD)
- Long bone tenderness (vitamin C, phosphate)
- Calf tenderness (vitamin B_1, selenium)

Power: decreased (PCM, vitamin C, sodium, potassium, phosphate)

Tone: decreased (PCM)

Reflexes
- Decreased (vitamins B_1, B_6, B_{12}, E)
- Increased (vitamin B_{12}) [note that B_{12} deficiency can cause either]
- Slowed return (iodine)

Sensation
- Peripheral neuropathy (vitamins B_1, B_6, B_{12}, E)
- Posterior column dysfunction (vitamins B_{12}, E)

CHD = congenital heart disease; CLD = chronic liver disease; PCM = protein calorie malnutrition.

Failure to Thrive

This is a very complicated short case and fortunately uncommon. The approach outlined is essentially a nutritional assessment modified to include relevant examination for chronic diseases of the main organ systems. To prevent unnecessary duplication, only aspects not mentioned in the nutritional short case are outlined in detail.

Commence with general inspection for obvious abnormalities, such as recognizable dysmorphic syndromes, central nervous system disease (e.g. cerebral palsy), neuromuscular disease (congenital myopathies, spinal muscular atrophy), tachypnoea (cardiac, respiratory, or renal — metabolic acidosis — in origin), cyanosis (congenital heart disease), and any findings related to nutritional status. Next, request the child's parameters. Failure to thrive as a term is used to describe failure of weight gain in particular, but, particularly if long standing, may include lack of linear growth as well. If the head circumference is significantly affected, this suggests an intrauterine onset.

The percentile charts should be examined; the pattern of the height, weight and head circumference curves relative to each other may well give a valuable indication of the underlying pathology.

1. If all percentiles are equally affected, the possibilities include intrauterine TORCH infections, or chromosomal abnormalities.

2. If height is most affected, possibilities include endocrinopathies and skeletal dysplasias.
3. The common pattern for malnutrition is that the weight is most affected, the height less affected, and the head circumference relatively normal.

Demonstrate fat and protein stores, and then examine the skin fully, in particular for dermatitis herpetiformis (coeliac disease), erythema nodosum (inflammatory bowel disease), pyoderma gangrenosum (inflammatory bowel disease) and note any ichthyosis (Shwachman).

Look next at the hands, noting any clubbing (chronic lung disease, chronic liver disease, inflammatory bowel disease, congenital heart disease), and other nutrition-related signs. Examine the structure of the hands (dysmorphic syndromes), take the radial and femoral pulses (congenital heart disease, coarctation). Check the blood pressure (renal disease, coarctation).

Proceed to the head and neck. As well as nutrition-related signs, look for dysmorphic features, macrocephaly, scars and shunts. In the eyes, look for cataracts or chorioretinitis (TORCH), retinitis pigmentosa (abetalipoproteinaemia, Shwachman syndrome), papilloedema (intracranial tumours, hydrocephalus) and check the extraocular movements (neurological disease). At the mouth, check for thrush (can occur in cell-mediated immunity defects), check the palate for a cleft, note the quality of sucking and test the gag reflex. If a bottle or breast is available, the method of feeding should be observed.

Now, move to examination of the chest. Look for sternal deformity (syndromes), hyperinflation, Harrison's sulcus, use of accessory muscles, intercostal recession (chronic lung disease), scars of cardiac or pulmonary surgery. Palpate tracheal position, apex beat, praecordium for thrills and heaves, percuss the chest and auscultate heart and lungs thoroughly, to assess for chronic respiratory or cardiac disease.

Then, move on to the abdomen. Perform a full abdominal examination (see page 104). The findings sought include abdominal distension (ascites with chronic liver disease, coeliac disease, protein calorie malnutrition), prominent veins (chronic liver disease), scars of previous surgery (e.g. bowel resection with necrotizing enterocolitis, Kasai procedure for biliary atresia), hepatosplenomegaly (chronic liver disease, TORCH, metabolic and haematological diseases), enlarged kidneys (polycystic kidneys, hydronephrosis), anal anomalies (syndromes), rectal prolapse (cystic fibrosis), excoriated buttocks (carbohydrate intolerance).

Next, stand the child, walk him or her, checking the gait for primary neurological disease, as well as nutritional deficiencies. Examine the back for midline defects or skeletal abnormalities such as kyphoscoliosis (syndromes, cerebral palsy) and then return the child to the bed and examine the lower limbs, again predominantly to detect primary neurological disease, as well as nutritional parameters. Note that if the patient is an infant, a gross motor developmental assessment is more appropriate at this point, and this may be combined with checking the primitive reflexes.

Request the urinalysis for specific gravity (low with chronic renal failure, diabetes insipidus), glucose (diabetes), pH (renal tubular acidosis), protein (structural kidney disease, proximal tubular disease), blood (structural kidney disease, urinary tract infection), nitrites (urinary tract infection), and bilirubin (chronic liver disease). Also, request stool analysis, for evidence of steatorrhoea,

fat crystals (coeliac disease) or globules (cystic fibrosis), low pH and reducing substances (carbohydrate intolerance), or giardia (cysts or vegetative forms). It is also worth mentioning inspection of any vomitus for bile (obstructive bowel lesions) or blood (portal hypertension); temperature chart for infection; and watching the mother feeding the child, noting their interaction, feeding technique and any maternal anxiety.

The examiners may ask how you would investigate the problem. If undernutrition seems possible, then a common approach would be to admit the child to hospital and document whether the child can gain weight with adequate calories, which confirms undernutrition. If the child does not gain weight despite adequate calories, then investigation for malabsorption would be appropriate (see page 98).

Poor Feeding

This is a very similar case to failure to thrive, but may be less long standing, such that poor somatic growth has yet to occur. The approach is essentially the same in content, with some additions, but the order is changed.

Commence with general inspection, as outlined in the previous section, and comment on parameters and percentiles. The resting respiratory rate is a guide to a cardiac or respiratory cause, and obviously abnormal posturing and movements may indicate a neurological cause (e.g. cerebral palsy, spinal muscular atrophy).

Next, watch the child feed; this will help to clarify the nature of the feeding problem, whether it is local or general, and if general, which system is affected.

Start the examination with the head, looking for local causes first, if no initial clues are apparent after inspection. If there are suggestions of specific problems, such as an infant with an alert face but paucity of movement, then 'go for the money', and 'chase' all the relevant clinical signs for the diagnosis that you suspect (in this example, demonstrate all the findings recognized in Werdnig-Hoffmann spinal muscular atrophy).

Note if there is any regurgitation of food through the nose, or any vomiting associated with feeding. Look for local structural problems, such as cleft palate; check the gag reflex and note the quality of the suck. If the infant is breathless, check for nostril patency by holding a shiny metal object, such as one arm of a stethoscope, immediately below the nostrils, and inspect for condensation at the point underneath. The remainder of the head examination procedure suggested for failure to thrive is appropriate here.

The remainder of the general examination can also follow the failure to thrive pattern, that is, assessing the cardiorespiratory system, abdomen, and neurological system, as well as checking the blood pressure (renal disease), urinalysis and the temperature chart.