

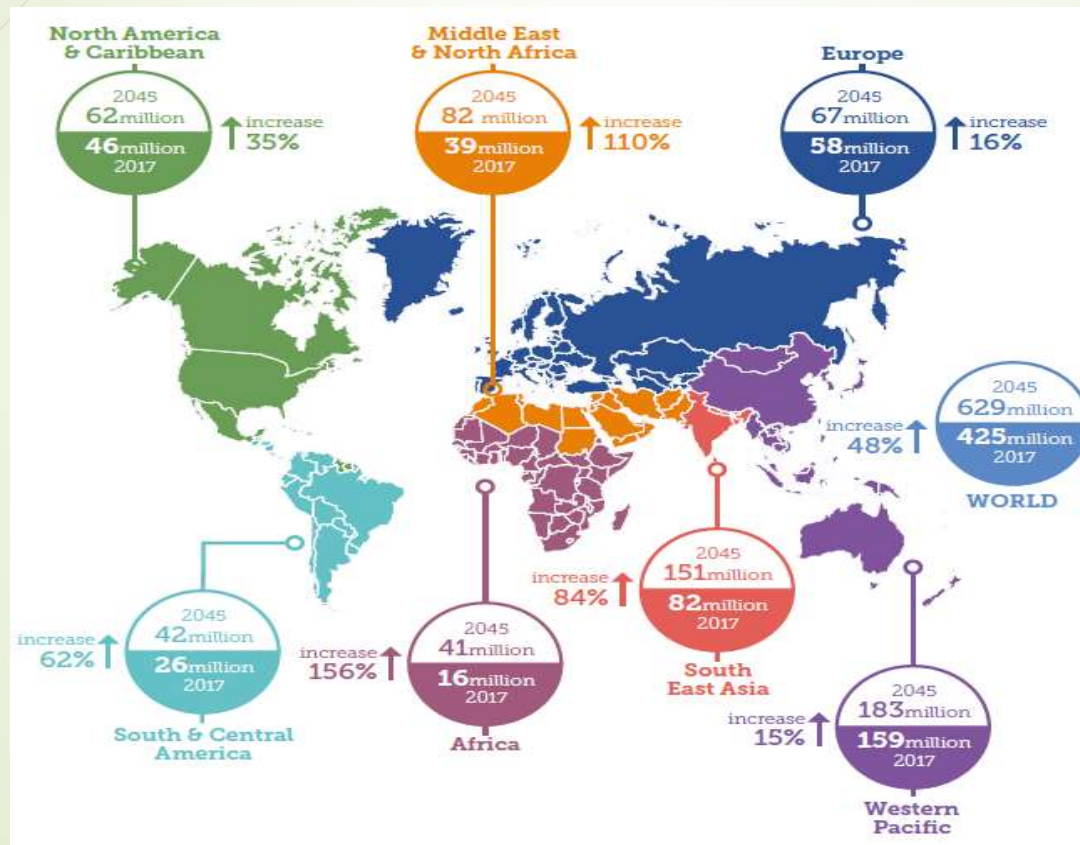


DKA in pregnancy

Dr AMY WISE

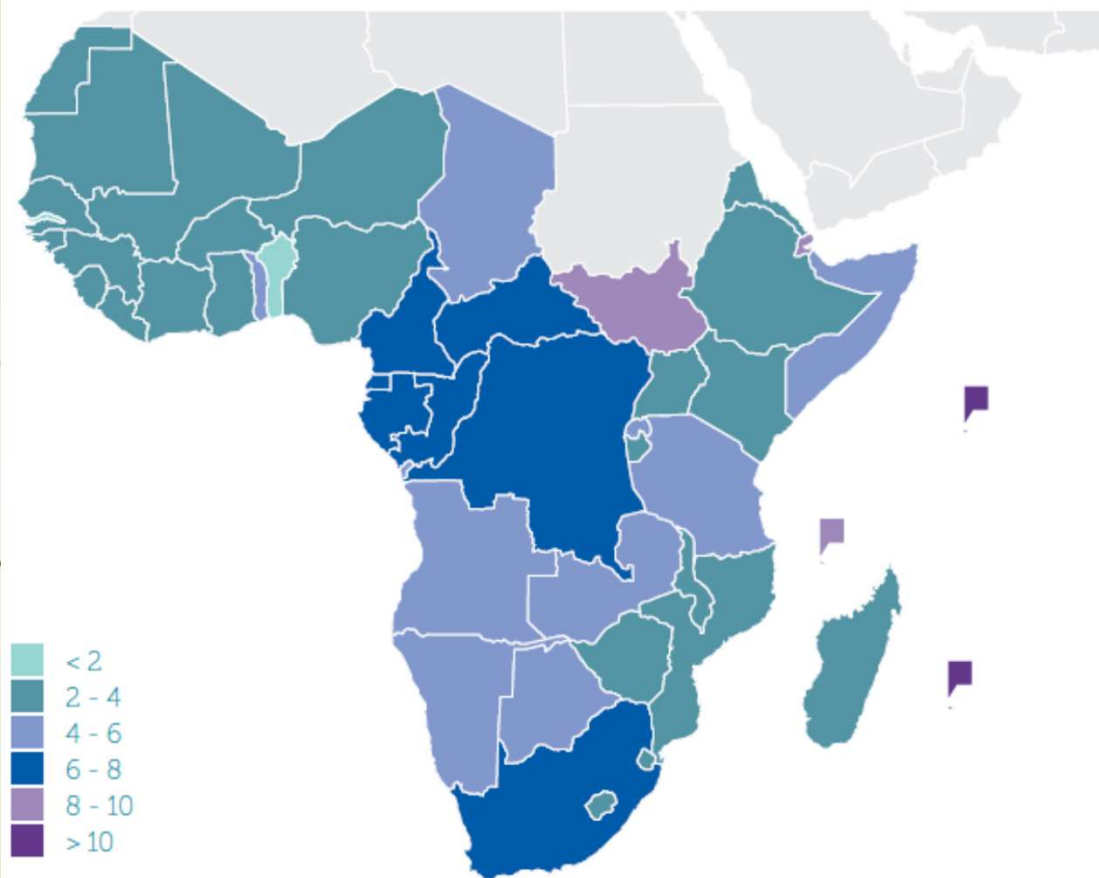
Diabetes: A global emergency

Number of people with diabetes worldwide and per region in 2017 and 2045 (20-79 years)



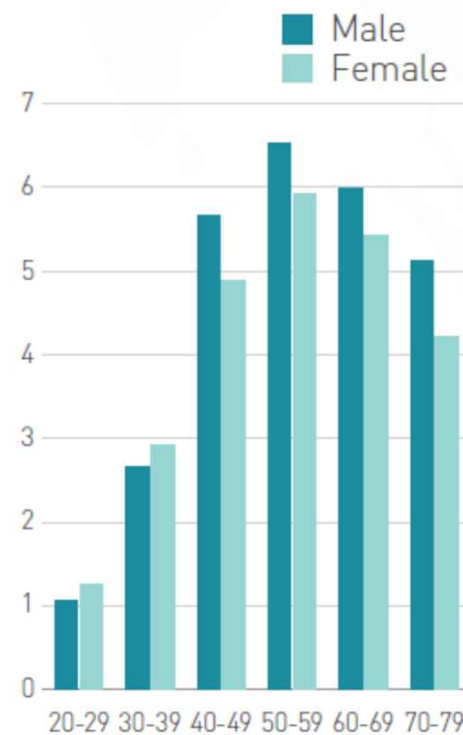
<https://diabetesatlas.org/resources/2017-atlas.html>

Map 4.1 Prevalence* (%) estimates of diabetes (20-79 years), 2015



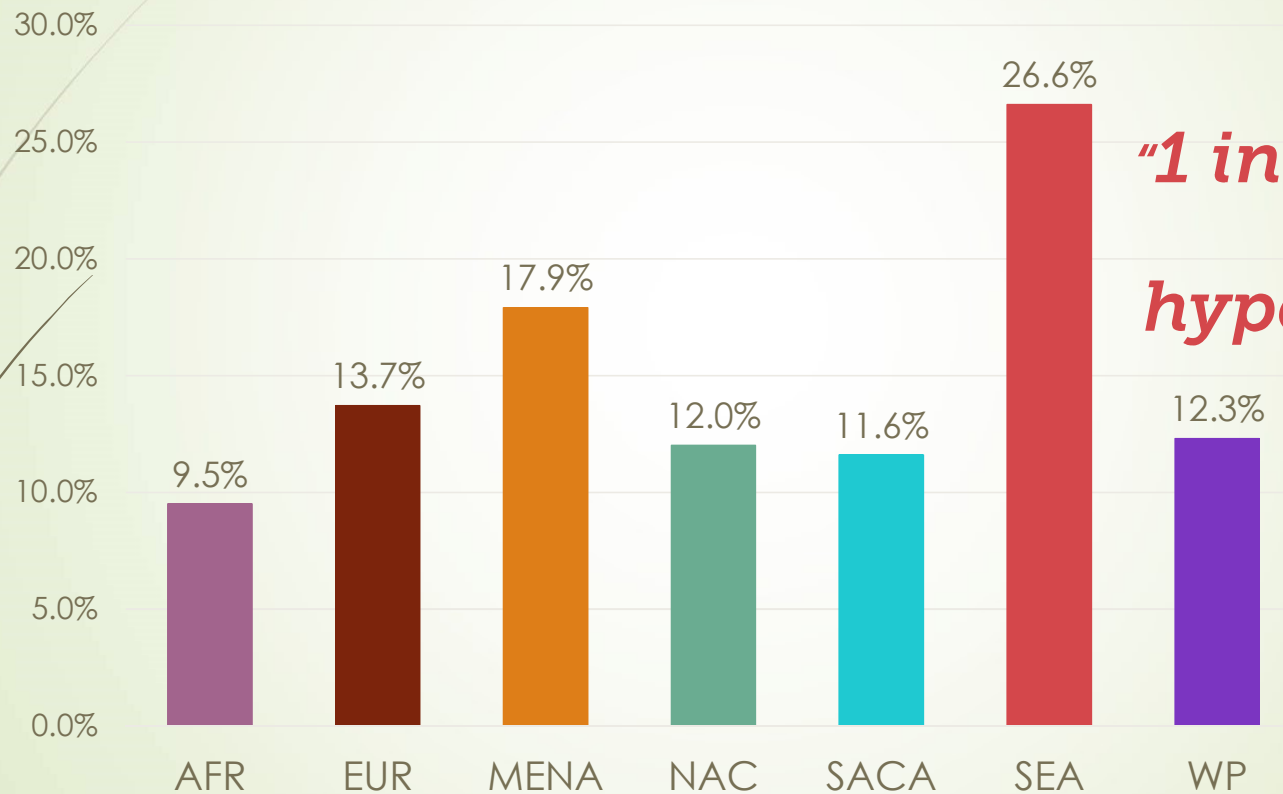
* comparative prevalence

Prevalence (%) estimates of diabetes by age (20-79 years) and sex




Hyperglycaemia in pregnancy

Hyperglycemia in pregnancy in women aged 20-49 years by IDF region, 2017



***"1 in 6 live births
is affected by
hyperglycaemia
in pregnancy"***

<https://diabetesatlas.org/resources/2017-atlas.html>



Approach to ketoacidosis in pregnancy

History

- Diet, last meal – vomiting
- Glucose intolerance
- Alcohol use
- Headache
- Blurred vision

Examination

- Vitals, GCS
- Systems review – look for possible infection



Investigations

- ▶ Urine dipstick: WCC, nitrates, ketones, protein
- ▶ Urine MC&S
- ▶ Blood: glucose, urea & electrolytes (calculate the anion gap), full blood count, ketones, CRP, procalcitonin, ABG, beta hydroxybutyrate, TSH, HbA1c, cultures

Differential diagnosis

- ▶ Diabetic ketoacidosis
- ▶ Euglycaemic diabetic ketoacidosis
- ▶ Starvation ketoacidosis
- ▶ Alcohol induced euglycaemic diabetic ketoacidosis
- ▶ Gene defects



Diagnosis of diabetic ketoacidosis

- ▶ Hyperglycaemia - $>13.9\text{mmol/l}$
- ▶ Acidosis – $\text{pH} < 7.3$
OR $\text{HCO}_3 < 18\text{mmol/l}$
- ▶ Ketonaemia - $> 3\text{mmol/l}$ **blood** betahydroxybutyrate (BOHB)




Management

- ▶ High-care setting
- ▶ Investigations as before as well as CXR, ECG

Principals

- ▶ Fluid resuscitation
- ▶ Correct/ avoid hypokalaemia
- ▶ Insulin
- ▶ Prevent rapid decrease in serum osmolality
- ▶ Search for precipitant – infections, compliance issues, pump-failure, beta-mimetics and steroids

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- ▶ Continue insulin in fusion till DKA has resolved
 - ▶ IV fluid with dextrose once $<14\text{mmol/l}$ to avoid hypoglycaemia
 - ▶ Do not use sodium bicarbonate if $\text{pH} >6.9$
 - ▶ Confirm ketonaemia resolution biochemically and clinically
 - ▶ Start subcut insulin while on insulin infusion

Intravenous fluids

- ▶ 5-10l fluid deficit
- ▶ Average deficit is 100ml/kg
- ▶ Replace half in first 12h: 1l in first hour, then 250-500ml/h; then rest over 12-16h
- ▶ Normal saline otherwise Ringers lactate
- ▶ Change to dextrose saline once glucose < 1.4mmol/l
- ▶ If hyperchloraemic use dextrose saline or 0.45% saline

90kg woman = 9000ml (90 x 100)

- ▶ 1l in first hour; ~440ml/h (2nd to 12th hours); 280-375ml/h (13th to 24th/28th hour)



Insulin

Hourly finger – prick glucose is the standard

- ▶ ICU/ HCA – insulin infusion 0.14u/kg/h eg. 11.2u/h in an 80kg person
- ▶ General ward – hourly IV or sc 10u bolus

- ▶ Subcut insulin
- ▶ Eating, GCS 15/15
- ▶ AG normal, normal pH, bicarb >18mmol/l
- ▶ Glucose ,15mmol/l
- ▶ BOHB <1mmol/l



Potassium K⁺

4 hourly monitoring

- ▶ If <3.5mmol/l, replace BEFORE start insulin (otherwise can cause arrhythmias, muscle weakness)
- ▶ ≤3.0mmol/l 40mmol KCl/l
- ▶ 3.0 – 3.9mmol/l 30mmol KCl/l
- ▶ 4.0 – 5.5mmol/l 20mmol KCl/l
- ▶ >5.5mmol/l omit KCl

Converting to sc insulin

- Basal bolus is better than a sliding scale – better glycaemic control
- Estimate the total daily dose (TDD) (0.2-0.5u/kg) initially, obese may require 0.8-1.2u/kg
- 50% as basal (intermediate-acting)dose AND 50% (short-acting) divided between 3 meals
- Hyperglycaemia in this setting is controlled with a 'Correction dose' (short-acting) in addition to the scheduled insulin
- Suggested formula using premeal reading (>4h apart):

Bedside BG (mmol/l)*	LEVEL 2
8.0-10.0	2
10.1-12.0	4
12.1-14.0	6
14.1-16.0	8
16.1-20.0	10
> 20	12

80% of the additional insulin can be added to the following day's total, divided equally between the basal dose (50%) and the other half equally between the three meals





Fetal considerations

Fetal distress

- ▶ ↓ uteroplacental blood flow from volume depletion/ osmotic diuresis
- ▶ maternal acidosis causing fetal electrolyte abn and acidosis
- ▶ maternal hypokalaemia causing fetal hypokalaemia – arrhythmias, myocardial suppression
- ▶ reduced 2,3 diphosphoglycerate leading to reduced O₂ delivery to fetus
- ▶ Hyperglycaemia and hyperinsulinaemia - ↑ oxidative metabolism - ↑ fetal hypoxaemia


- ▶ Heart rate abnormalities may take 4-8 hours to normalize
- ▶ Correct the cause, delivery depends on gestational age and the clinical picture of the fetus once the mother is stable. Documentation of the fetal heart beat during resuscitation should be done, fetal distress reflects the maternal pathology.

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- ▶ Ketones and the metabolic acidosis contribute to cerebral oedema and ensuing endothelial damage
 - ▶ Autoantibodies and inflammatory mediators can cause vasculopathy and encephalopathy resulting in long-term neurocognitive deficits
 - ▶ Encephalomalacia resulting from impaired brain perfusion from vascular insults usually occurs in the 20th to 30th week GA and can be caused by maternal DKA
 - ▶ The acute insult from the hypoxia as well as the delayed neuronal damage from free radicals inducing apoptosis result in global brain damage
 - ▶ Ultrasound and MRI can be used to detect this following recovery
 - ▶ The fetal neurodevelopmental effects of DKA need to be included in the counselling post-DKA to allow the patient an opportunity to consider their options



Euglycaemic ketoacidosis

- ▶ Associated with pregnancy – other causes include SGLT2i used for type 2DM, sepsis, chronic liver disease, decreased calory intake
- ▶ Glucose levels are lower – pregnancy is ketosis prone
- ▶ Glucose is major source of energy in 2nd and 3rd trimesters for placenta and fetus
- ▶ Maternal fasting glucose is decreased, insulin production is decreased thus more free fatty acid release is increased and the liver converts them to ketones
- ▶ Respiratory alkalosis of pregnancy and excretion of bicarbonate hampers buffering of the dropping pH

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- ▶ Late pregnancy
 - ▶ Type 1 >> type 2
 - ▶ Impaired glucose tolerance – 1-3% have DKA
 - ▶ May be missed – dehydration less common
 - ▶ Nausea, vomiting and decreased caloric intake – exclude DKA irrespective of glucose level
 - ▶ Malaise, anorexia, pyrexia, tachycardia, tachypnoea
 - ▶ Severe metabolic acidosis
 - ▶ Glucose \leq 11.1mmol/l usually



Point of care

- ▶ WHO compiled a list of in vitro diagnostic tests which should be available at varying levels of care
- ▶ Primary health care: Glucose should be detected on urine dipstix and glucometer with capillary whole blood. HbA1c and lactate with handheld analyzers. Larger health facilities should have automated machines.
- ▶ POC has been evaluated in Kenya as a screening option for GDM however against a low prevalence the sensitivity was only 33% and a fasting blood glucose had the best sensitivity of 77.8% when compared to the standard IADSPG 75gOGTT testing.
- ▶ Conversely a South African study showed a 100% sensitivity and 89% specificity for the detection of beta-hydroxybutyrate >3mmol/l – making it an attractive option for a lower resource setting

World Health Organization Model List of Essential In Vitro Diagnostics First edition (2018) Report of the first Strategic Advisory Group on In Vitro Diagnostics (SAGE-IVD) WHO headquarters, Geneva, 16–20 April 2018

Pastakia et al. BMC Pregnancy and Childbirth (2017) 17:226 DOI

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Barriers and facilitators in the management of hyperglcaemia in LMIC

Despite calls from FIGO to standardize care of diabetes in pregnant women in 2015, and a recognition that protocols may need adaption in certain areas there remain stumbling blocks to care

- Health systems – lack of region specific guidelines, international guidelines often not appropriate or feasible. Time and lab requirements not appropriate
- Health personnel – inconsistent application of guidelines when do exist, poor training
- Cost of consumables/ laboratory services, unable to monitor adequately once diagnosed
- Poor counselling regarding importance, inadequate knowledge of medications leading to incorrect use
- Patients while being concerned, are unable to follow the diet, family pressure to conform, little exercise



What if ?

- ▶ No monitoring
- ▶ No laboratories
- ▶ No POC

- ▶ A case discussed on a forum recently from a central hospital in Africa explained the lack of glucometers, infusion sets, nursing staff, testing strips, delayed potassium results, limited insulin options, patients run 'high' due to lack of testing and fear of hypoglycaemia – they had had a number of deaths and were asking for suggestions....



World Health
Organization



Diabetes Care



www.figo.org

Thank
you



International
Diabetes
Federation



East African Diabetes Study Group

To Empower healthcare professionals and persons with and affected by diabetes to effectively manage diabetes mellitus.



The International Association
of the Diabetes and Pregnancy Study Groups [IADPSG]