Diabetes and COVID-19

Western Cape

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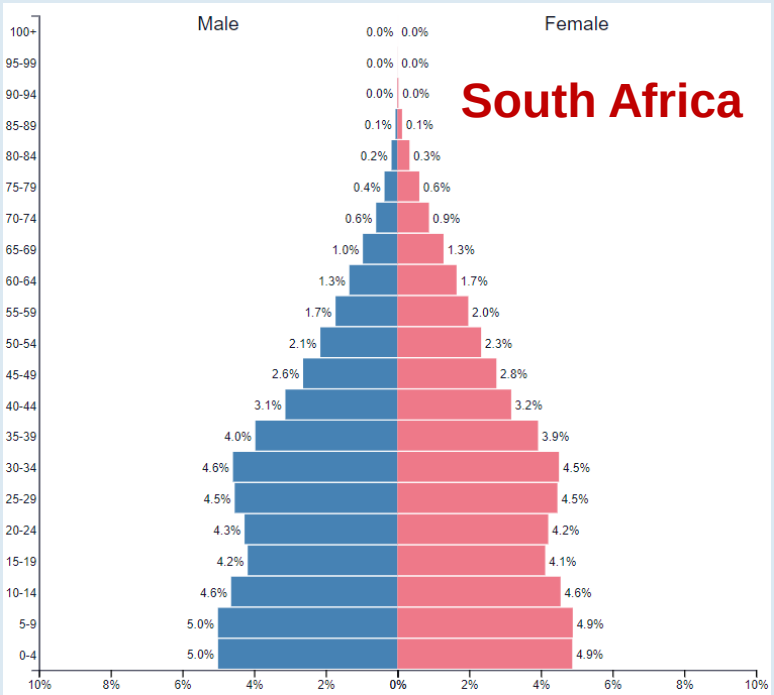
BURDEN OF DIABETES

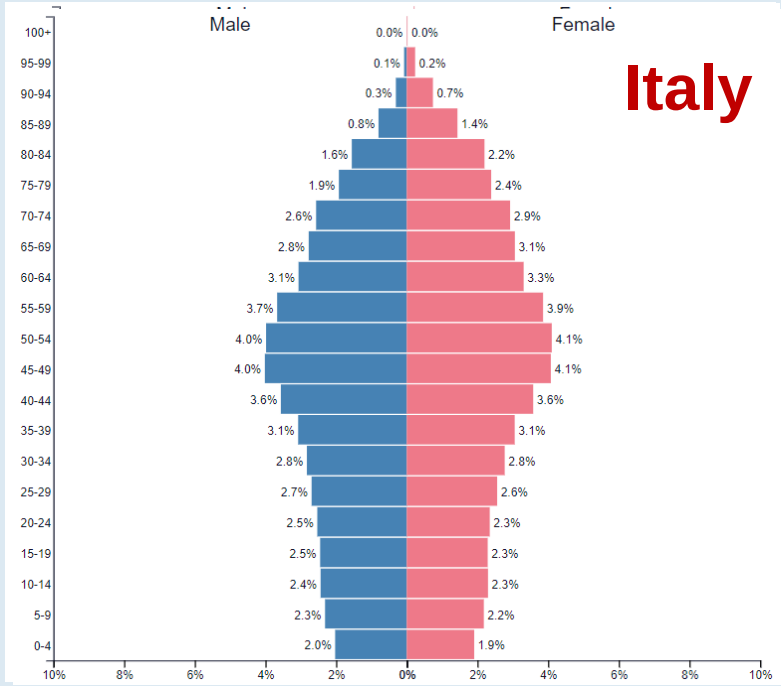
Diabetes in Africa

Top five countries for number of people with diabetes (20–79 years), 2019

	Millions
South Africa	4.6
Nigeria	2.7
Democratic Republic of the Congo[i]	1.8
Ethiopia	1.7
United Republic of Tanzania	1.0

i Data were extrapolated from similar countries.



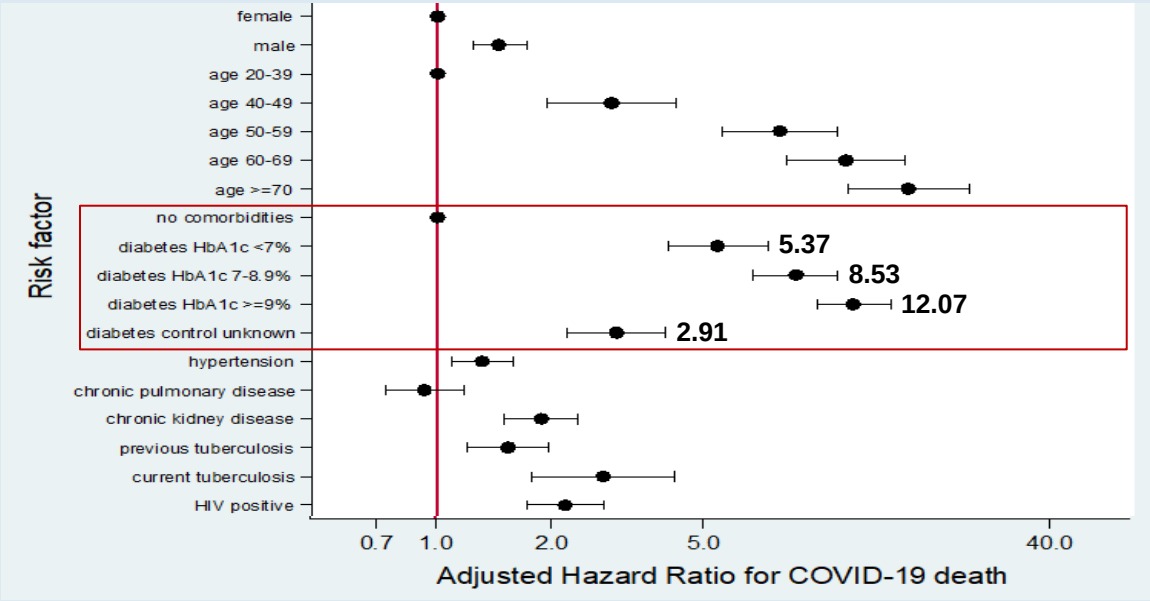


Diabetes and COVID-19 WC
Increased mortality

WC comorbidity report 1 June 2020

Associations with COVID-19 death in all Western Cape public sector patients ≥20 years with a public sector health visit in the previous 3 years

3.46 million



Davies *et al* (2020) submitted for publication

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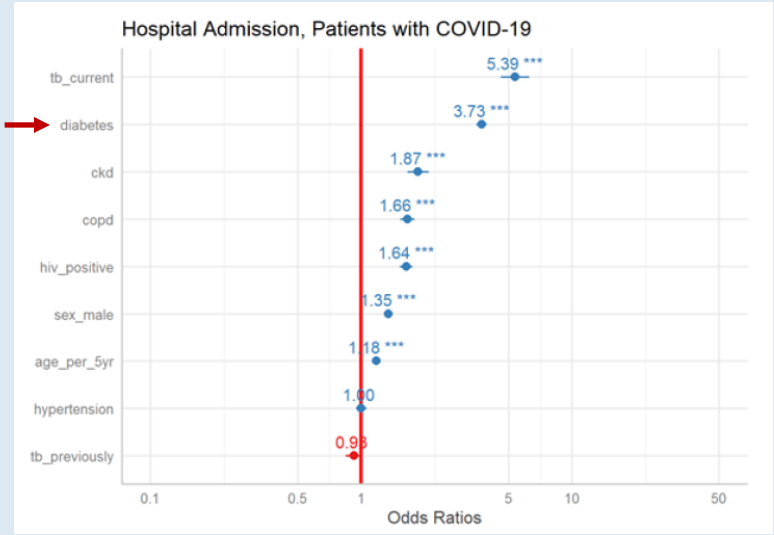
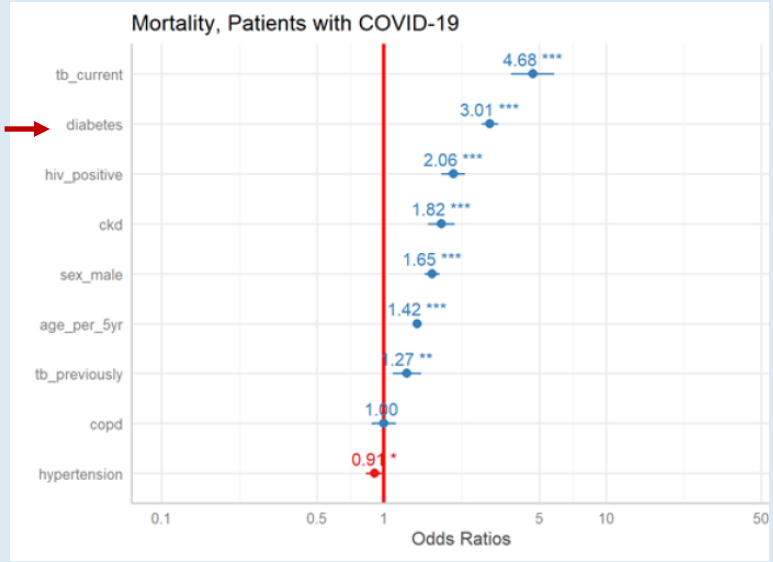
Up to 31 July 2020

Diabetes is a significant risk factor for hospitalisation and mortality





Dave *et al* (2021) submitted for publication

Diabetes and COVID-19
Western Cape

	All n=64 476	No diabetes n=55 171	Diabetes n=9 305
Admitted	10 887 (16.9%)	6 706 (12.2%)	**4 181 (44.9%)**
Outcome			
Active	11(<0.1%)	10 (<0.1%)	1(<0.1%)
Died	2 993 (4.6%)	1 559 (2.8%)	**1 434 (15.4%)**
Recovered	61374 (95.3%)	53518 (97.2%)	7856 (84.6%)
ICU	917 (1.4%	544 (1.0%)	**373 (4.0%)**

Dave *et al* (2021) submitted for publication

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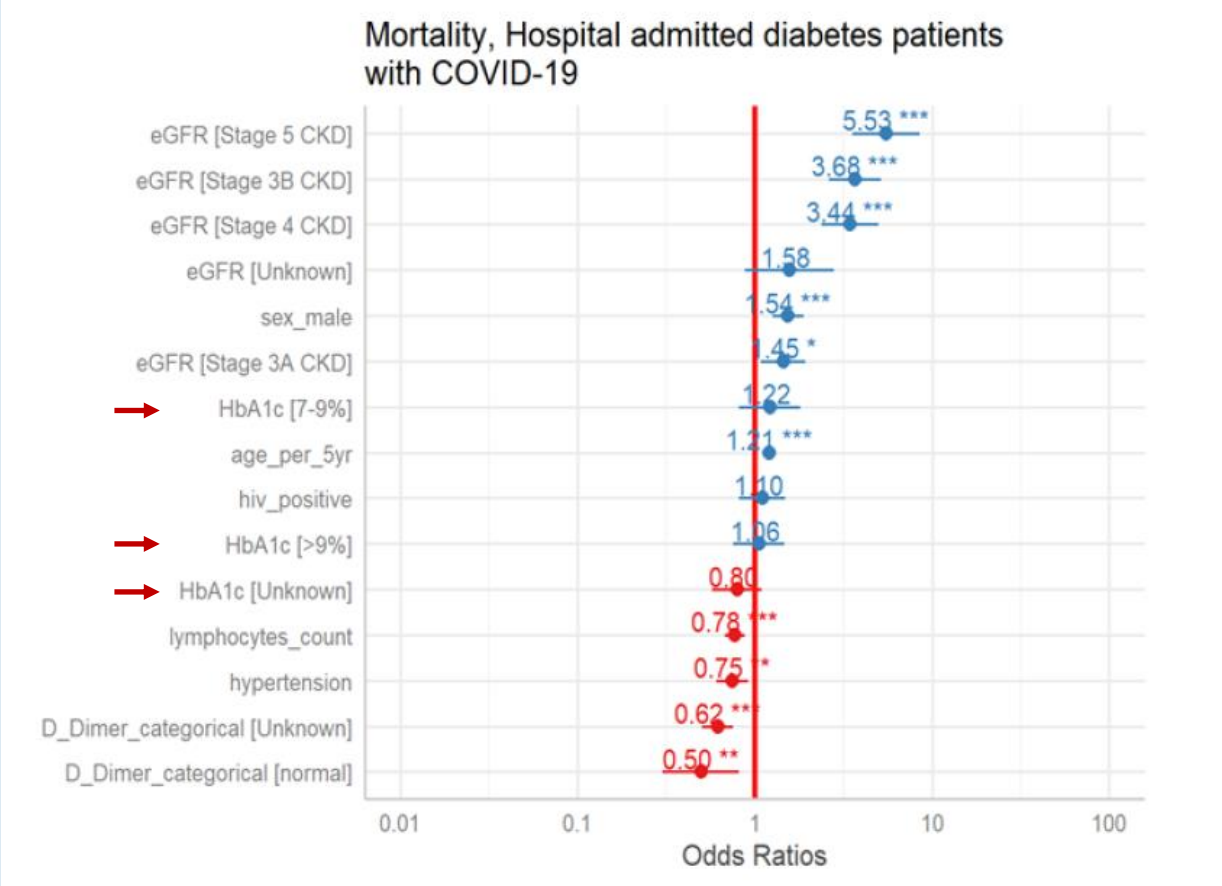
Western Cape

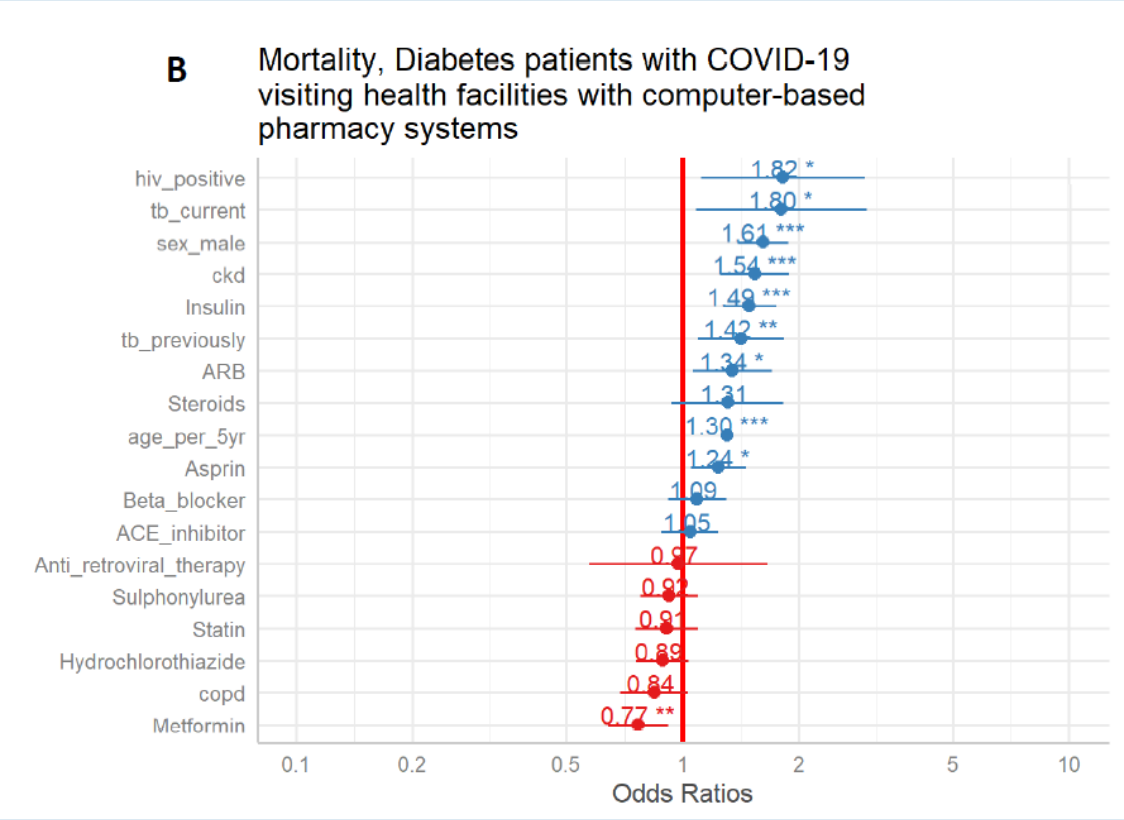
HbA1c is not a risk factor for mortality in PLWD hospitalised for COVID-19



Dave *et al* (2021) submitted for publication

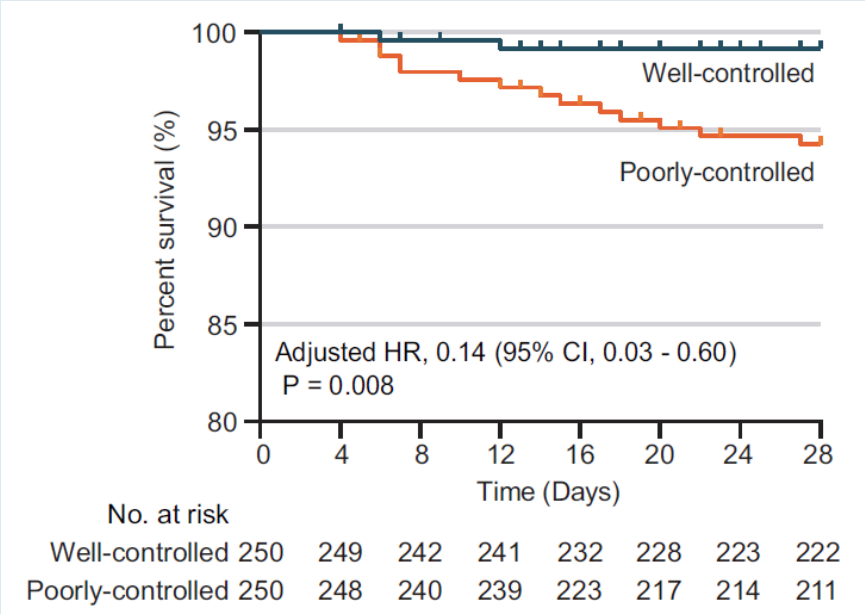
Diabetes and COVID-19
Benefit of using metformin

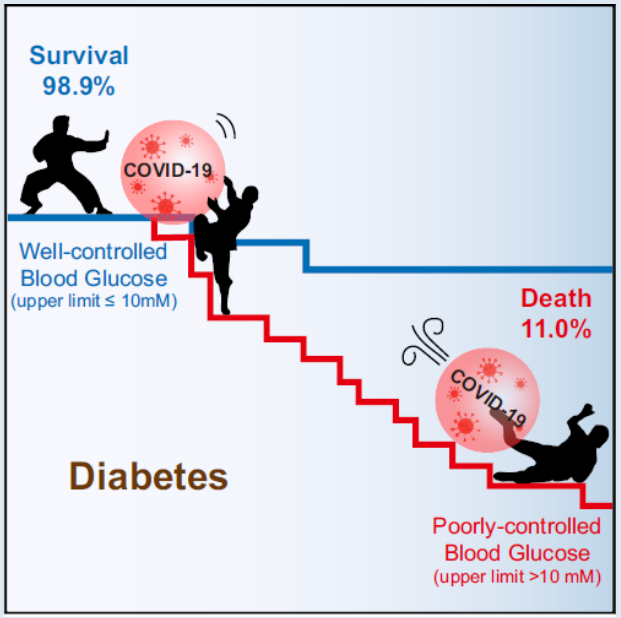
- Conflicting data BUT most observational studies showing a reduction in mortality



Dave *et al* (2021) submitted for publication

Diabetes and COVID-19
Good control vs Poor control





- No robust data
- No regimens
- No targets

Zhu *et al*., 2020, Cell Metabolism 31, 1–10

DIABETES AND COVID-19
Challenges

- Healthcare workers from a variety of disciplines
- Staff shortages
- Clinical status – fever, sepsis, dehydration, vomiting, confusion, acute kidney injury
- Steroids
- Irregular meals
- New diabetes
- Isolation
- Poor access to Diabetes Educators

DIABETES
Principles of in-hospital treatment

- Clearly defined simple protocols for consistency of care

INITIAL In-hospital management of Diabetes and COVID-19

COVID-19 severity

Mild

RR < 30/min

O_2 sats ≥ 94%

Moderate

Severe

RR > 30/min

O_2 sats ≤ 94%

HbA1c or glucose

HbA1c ≤ 9%

or

glucose ≤ 12 mmol/L

HbA1c > 9%

or

glucose > 12 mmol/L

Diabetes management

- Continue pre-admission diabetes treatment
- Monitor fingerprick glucose
  - Fasting and before supper if on oral medication
  - Before each meal and 22h00 if on insulin
- Adjust treatment if glucose readings > 10 mmol/L
  - If on oral meds - stop oral meds and start insulin if average glucose is > 10 mmol/L
  - If on insulin - increase preceding insulin dose by 2 units every 24 hours if the glucose reading is above 10mmol/L
- Use insulin correction doses as below in **B**
- Use the simplest regimen possible to achieve glucose targets (see # below)
- Review diabetes control daily

- Stop pre-admission oral diabetes treatment
- Continue or start insulin
- #Insulin regimen to be determined by expertise and staff availability
  - Long-acting insulin bd (NOT eating or on dexamethasone/prednisone)
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Give 2/3 TDD before breakfast and 1/3 TDD before supper
    - Use rapid-acting insulin correction doses ONLY at meal times and ONLY for blood glucose > 10 mmol/L (as below in **A**)
  - Pre-mix insulin before breakfast and supper
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Give 2/3 TDD before breakfast and 1/3 TDD before supper
    - Use correction doses as below in **B**
  - Basal bolus
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Amount basal long-acting insulin (units)=50% of TDD, given as a single injection at 22h00
    - Amount short-acting insulin (units)=50% of TDD given as 3 divided doses before each meal
    - Use correction doses as below in **B**
- Monitor fingerprick glucose before each meal and 22h00
- Increase preceding insulin dose by 2 units every 24 hours if the glucose reading is above 10mmol/L
- Review diabetes control daily

A Rapid-acting insulin correction doses for a patient NOT EATING or on bd long-acting insulin

Previously on insulin use TOTAL daily dose		Less than 25 units	25 to 50 units	Greater than 50 units
Not previously on insulin use weight		Less than 50 kg	50 kg to 75 kg	Greater than 75 kg
Blood glucose level (mmol/L)	10.1-12.0	2 units	4 units	6 units
	12.1-14.0	3 units	6 units	9 units
	14.1-16.0	4 units	8 units	12 units
	More than 16.1	5 units	10 units	15 units

B Meal-time insulin correction doses for a patient EATING

Blood glucose level (mmol/L)	Less than 4.0	See Block B
	4.1 to 4.9	Decrease the prescribed dose of insulin by 4 units
	5.0 to 8.5	Give the prescribed dose of insulin
	8.6 -12.0	Increase the prescribed dose of insulin by 2 units
	Greater than 12.1	Increase the prescribed dose of insulin by 4 units

INITIAL In-hospital management of NEW Diabetes and COVID-19

COVID-19 severity

Mild

RR < 30/min

O_2 sats ≥ 94%

Moderate

Severe

RR > 30/min

O_2 sats ≤ 94%

HbA1c or glucose

HbA1c ≤ 9%

or

glucose ≤ 12 mmol/L

HbA1c > 9%

or

glucose > 12 mmol/L

Diabetes management

- Monitor fingerprick glucose
  - Before each meal and 22h00
- Add glimepiride if average glucose reading is 10-12 mmol/L
- Increase dose of glimepiride by 1 mg every 24 hours if the average glucose reading is 10-12 mmol/l
- Start insulin if average glucose level is still 10-12 mmol/L despite glimepiride 4 mg daily OR at any time if the average glucose is > 12 mmol/L
- Use the simplest insulin regimen possible to achieve glucose targets (see # below)
- Review diabetes control daily

- Continue or start insulin
- #Insulin regimen to be determined by expertise and staff availability
  - Long-acting insulin bd (NOT eating or on dexamethasone/prednisone)
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
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    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Amount basal long-acting insulin (units)=50% of TDD, given as a single injection at 22h00
    - Amount short-acting insulin (units)=50% of TDD given as 3 divided doses before each meal
    - Use correction doses as below in **B**
- Monitor fingerprick glucose before each meal and 22h00
- Increase preceding insulin dose by 2 units every 24 hours if the glucose reading is above 10mmol/L
- Review diabetes control daily

A Rapid-acting insulin correction doses for a patient NOT EATING or on bd long-acting insulin

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B Meal-time insulin correction doses for a patient EATING

Blood glucose level (mmol/L)	
Less than 4.0	**See Block B**
4.1 to 4.9	Decrease the prescribed dose of insulin by 4 units
5.0 to 8.5	Give the prescribed dose of insulin
8.6 -12.0	Increase the prescribed dose of insulin by 2 units
Greater than 12.1	Increase the prescribed dose of insulin by 4 units

Patients with COVID-19 and Diabetic Ketoacidosis (DKA)

Guidance on management of DKA

CLINICAL
• *Diagnosis:* Blood glucose > 11.1 mmol/L, pH<7.30, serum HCO_3 <18 mmol/L, ≥ moderate ketonuria/ketonemia
• Start fluid resuscitation immediately whilst examining the patient and doing blood tests
• *Urgent blood tests:* venous blood gas, fingerprick blood glucose, serum/fingerprick ketones, white cell count and differential, CRP, ALT, sodium, potassium, creatinine
• Other tests as clinically indicated. Consider blood culture, urine culture, chest X-ray, ECG
• STOP all oral diabetes medication, especially metformin and SGLT2 inhibitors

FLUIDS		
• 1 litre 0.9% Normal Saline stat then 1 litre 0.9% Normal Saline over 1 hour		
• From this point the type of fluid used is determined by the serum sodium		
Serum sodium* *(measure every 2 hours)*	Low	Continue with 0.9% Normal Saline
	Normal or high	Continue with 0.45% Normal Saline
• 1 litre fluid over 2 hours		
• 1 litre fluid every 4-6 hours depending on hydration status and urine output		
When the fingerprick blood glucose is <12.0 mmol/L change to Rehydration Solution		

POTASSIUM		
• Measure potassium every 2 hours		
• Ensure that the renal function is normal		
Potassium level	Less than 3.3 mmol/L	• Don't start insulin, continue giving fluids • 20 mmol/L KCL iv hourly
	3.3 mmol/L to 5.2 mol/L	• Start insulin • 20 mmol/L in every litre of iv fluid
	Greater than 5.2 mmol/L	• Start insulin • Re-check potassium in 2 hours

INSULIN			
	Severe DKA	***Moderate DKA***	***Mild DKA***
Criteria	• Stupor/Coma • pH<7.00 • HCO_3 <10 mmol/L	• Drowsy • pH7.00-7.24 • HCO_3 10-15 mmol/L	• Alert • pH>7.24 • HCO_3 >15 mmol/L
Insulin administration	IV insulin infusion (50 units of actrapid in 200 ml 0.9% Normal Saline)		subcutaneous (sc) insulin
Initial insulin dose	0.1 units/kg iv bolus		0.2 units/kg sc bolus
Fingerprick glucose	Measure every 1 hr		Measure every 2 hrs

• Titrate insulin according to fingerprick blood glucose readings

		Insulin Infusion rate	***Insulin sc dose***
Glucose reading	*< 5.0 mmol/L*	STOP infusion	No insulin given
	5.0 -12.0 mmol/L	12 ml/hr (or 0.05u/kg/hr)	6 u every 2 hrs
	> 12.0 mmol/L	24 ml/hr (or 0.1u/kg/hr)	12 u every 2 hrs

• Measure venous blood gas and serum/fingerprick ketones every 2-4 hours
• When the fingerprick blood glucose is <12.0 mmol/L then change fluid to Rehydration Solution
• Continue with this insulin regimen until the blood (serum or fingerprick) ketones are negative
• Initiate subcutaneous insulin when the patient is eating and blood ketones are negative
• Continue the intravenous insulin infusion for 1-2 hours after starting subcutaneous insulin

BICARBONATE
Only give bicarbonate if the pH is < 6.9
100 mmol $NaHCO_3$ in 400 ml H_20 plus 20 mmol/L KCL and infuse over 2 hours
Repeat every 2 hours until pH is >7.0
Monitor the potassium every 2 hours

*Correct sodium for hyperglycaemia; add 2 mmol/L to the serum sodium for every 5 mmol/L the glucose is elevated above 5 mmol/L

Division of Endocrinology, Groote Schuur Hospital, June 2020

DIABETES
Principles of in-hospital treatment

- Clearly defined simple protocols for consistency of care
- Individualised glycaemic targets
- Simplest treatment regimen to achieve glycaemic targets (and realistic for the facility) BUT probably best to use insulin if possible
- Regular monitoring of fingerprick glucose readings and adjustment of insulin doses
- If no contra-indication perhaps try to keep on metformin

DIABETES
Specifics of IDEAL in-hospital treatment

- Type 1 DM – basal bolus regimen with monitoring of glucose before each meal and adjustment of insulin doses

- Type 2 DM
  - ❑ **Steroids**
    bd protaphane with correction doses of actrapid at meals
  - ❑ **Not on steroids mild disease**
    simplest oral OR insulin regimen to achieve glycaemic target
  - ❑ **Not on steroids severe disease**
    simplest insulin regimen to achieve glycaemic target

- **Glycaemic target: 8 mmol/L**

Thank you for listening