



COVID-19 and Obesity: Lessons From Around The World AND The South African Perspective

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OBESITY: Background

Overweight and Obesity is the accumulation of excess fat, which can increase risk of development of metabolic syndrome and NCDs

Classification:

- Overweight BMI = 25 – 29.9
- Obesity BMI \geq 30

Fundamentally: Obesity = positive balance between energy intake and expenditure

However, the disease is complex and causes are multifactorial (biological, environmental, socio-economic and lifestyle behavioural factors)

OBESITY: Background

Determinants of Obesity:

- Downstream - individual behaviour, genetic and physiological components
- Mid-stream - population feeding and physical activity behaviour
- Upstream - social and economic elements

Obesity management – to target all the levels

SA strategy – Upstream, and some mid-stream components. No downstream management

- Many people struggle with weight management
- All deserve support and treatment
- Causes of Obesity are multifactorial, but also often linked to nutritional illiteracy, financial limitations, or psychological trauma and psychiatric issues
- It is a widespread issue that deserves attention

OBESITY: Understanding the trends

Globally, Overweight and Obesity tripled to 39% and 13% respectively in 2016, compared to 1975

In South Africa:

- Women - 67.6% overweight and obese
- Men - 31.3%
- Average BMI is 29.9 amongst women and 23.6 kg/m² men
- Urban women of African and Coloured decent - highest prevalence severe Obesity amongst women
- Rising rates amongst African women in non-urban areas
- Highest BMIs amongst women – in the 45-54 and 55-64 age groups, highest incidence of Overweight and Obesity amongst women is in the 25-34 and 45-54 age groups respectively.

SOUTH AFRICA: The challenge

Obesity is a significant risk factor for NCDs

- An increase in mortality from NCDs (Statistics SA, 2014)
- Secondary to issues of access to adequate chronic disease management, deaths from NCDs are more common in the lower to middle income countries compared to the more affluent countries

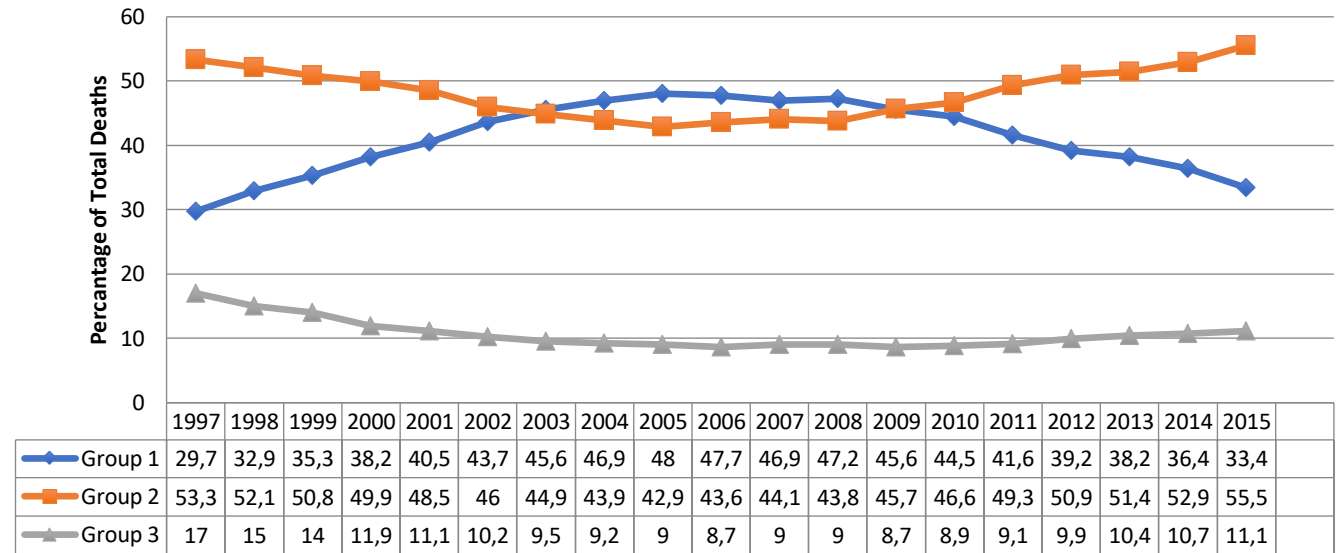
The underlying upstream determinants of health present a particular challenge in South Africa

- South Africa has a Gini index of 0.63 (World Bank, 2011)
- Socio-economic inequalities are incessant twenty years into the democratic era (HSRC, 2014)
 - Occur principally along racial lines
 - Inform decreased employment opportunities, and poor access to quality healthcare and education observed in the previously disadvantaged African majority (HSRC, 2014).
- The impact of socio-economic disparities on health is evident in morbidity and mortality patterns in the country
 - Communicable diseases, HIV/AIDS, and TB - mostly in the African population
 - Now compounded by an increasing prevalence of NCDs (Stats SA, 2014).

SOUTH AFRICA: The challenge

GROUP 1	GROUP 2	GROUP 3
1a <ul style="list-style-type: none"> All communicable diseases except HIV/AIDS, and Tuberculosis Maternal and perinatal causes Nutritional causes of death 	Non-communicable diseases	Intentional and accidental external causes of death (Injuries)
1b <ul style="list-style-type: none"> HIV and AIDS, Tuberculosis 		

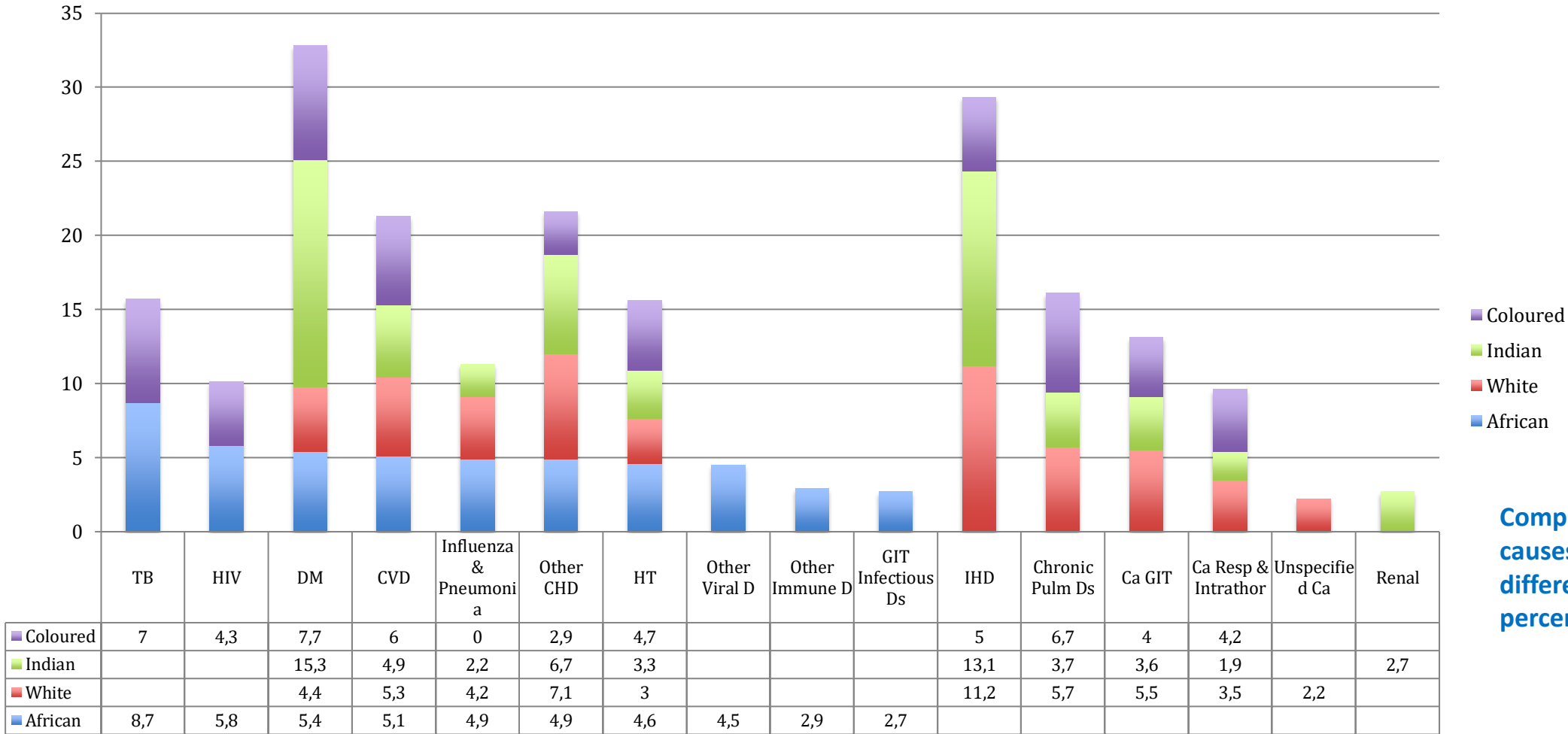
Group classification of the causes of death in South Africa (Stats SA, 2015; MRC, 2012)



Percentage of deaths due to Communicable Diseases, Non-communicable Diseases, and Injuries (Group I, II, and III causes respectively). (Adapted from Statistics SA, 2015)

In 2015, 55.5% of annual deaths were secondary to group 2 causes, 33.4% to group 1 and 11.1% to group 3 (Statistics SA, 2015). These figures demonstrate a continuous annual progression in deaths from NCDs from 2009 to 2015, with a decline in deaths from communicable diseases during the same period (Statistics SA, 2015). Figure 1.2 illustrates changing mortality in South Africa from 1998 to 2015.

SOUTH AFRICA: The challenge



Comparing the leading natural causes of death between the different population groups (in percentages)(Stats SA, 2015)

SOUTH AFRICA: The challenge

Population group	Male		Female		Total	
	Number	% of total population	Number	% of total population	Number	% of total population
African	21 653 500	80,6	22 574 500	80,4	44 228 000	80,5
Coloured	2 334 800	8,7	2 498 100	8,9	4 832 900	8,8
White	2 201 900	8,2	2 332 200	8,3	4 534 000	8,3
Indian/Asian	688 100	2,6	673 900	2,4	1 362 000	2,5
Total	26 878 300	100,0	28 078 700	100,0	54 956 900	100,0

Mid-year South African population estimates by population group and sex (Statistics SA, 2015)

SOUTH AFRICA: The challenge

- Population ≥60years
 - 8.0% (4,42 million)
- Population <60 years of age
 - 30,2% is under the age of 15years,
 - 61,8% is between the ages of 15 and 60 years – employable age, but high unemployment rate
- A GINI Index of 0.63 renders South Africa one the most unequal societies in the world
- A distinct dual economy exists in the country
 - The first is developed and comparable to any Western country; it is characterised by access to world-class financial and technical services, affordability, access to health insurance and quality healthcare, private school education and better employment opportunities
 - Conversely, the second is a cash-based economy, marred with poverty, unemployment and state dependence for health, education, and other services
 - NB – inequality along racial lines

SOUTH AFRICA: The challenge

The WHO recommends that at least 5% of GDP should be spent on health

- Total healthcare expenditure in South Africa is 8,3% of the GDP - more than the minimum recommendation of 5%,
- Health outcomes are not reflective of this extent of expenditure when compared with similar middle income countries (NHI Green Paper, 2011).

Further, there is incongruous and inverse expenditure on healthcare between the public and the private sector (Ataguba, JE, 2016).

- As of 2011, public healthcare expenditure for 84% of the population (42 million people) was 50,6% of the total healthcare expenditure,
- Whilst 49.4% was private healthcare expenditure on only 16,2% of the population (8,2 million) (NHI Green Paper, 2011);
- 59% of doctors are in the private sector serving 16% of the population,
- 41% are in the public sector serving 84% of the population (Ataguba, JE, 2016).

SOUTH AFRICA: The challenge

Our challenge: Affecting the African majority

- Inequality and poverty
- Poor access to healthcare, education, economic activities, good nutrition...
- Poor housing – overcrowding, sanitation...
- Obesity

So:

- Poverty and inequality pandemic
- Obesity pandemic

And now, enters the COVID-19 pandemic

COVID-19: Background

December 31, 2019

The World Health Organization (WHO) was informed of an outbreak of “pneumonia of unknown cause” detected in Wuhan City, Hubei Province, China

- May 5
 - Cases globally > 3,5 million
 - Deaths > 252k
 - Recoveries > 1,17 million

South Africa

- March 5 – 1st case was diagnosed
- May 5 - 7 220 cases, evidence of positive infections in the townships
 - 138 deaths
 - 2746 recoveries

COVID-19: Background

WHO statement on NCDs and COVID-19:

- People of all ages can be infected by the new coronavirus (COVID-19)
- The risk of becoming severely ill with the virus appears to increase if you are 60 years and older
- People with pre-existing NCDs appear to be more vulnerable to becoming severely ill with the virus
 - These NCDs include: Cardiovascular disease (e.g. hypertension, persons who have had, or are at risk for, a heart attack or stroke), Chronic respiratory disease (e.g. COPD), Diabetes and Cancer

OBESITY: Risk for COVID-19

Obesity and severity of COVID-19 disease symptoms

- Since the announcement, some centers are gathering more data
- Literature suggests Obesity-related conditions seem to worsen the effect of COVID-19
- The Centers for Disease Control and Prevention (CDC) report that people with heart disease and diabetes are at higher risk of COVID-19 complications
- The CDC has now listed Obesity, BMI >40 as an independent risk factor to severe COVID-19 illness
- The risk is thought to be associated with excess fat, even in the absence of metabolic disease
 - Increased expression of the ACE 2
- The risk of serious illness increases even more
 - In the presence of comorbidities, particularly pre-existing adiposity-based chronic disease (CAD, DM, Sleep apnoea, CMO)
 - Older age

OBESITY: Risk for COVID-19

- By virtue of increased risk to chronic NCDs
- Existing in a state of chronic inflammation
- Possible relative hypoxia – restrictive lung function, sleep apnoea
- Increased risk of coagulopathy
- Risk of malnutrition – poor healing

Increased risk from mechanistic challenges

- Bariatric hospital beds
- Challenging intubations, central lines
- Imaging diagnostic difficulties (there are weight limits on imaging machines)
- Difficult to position, mobilise, transport by nursing staff
- Assuming prone position to improve oxygenation in severe COVID-19 disease may prove difficult

Demonstrated increased risk from previous pandemics

- Independent risk factor for complications from H1N1
- Likely to be an independent risk factor for COVID-19 – The CDC in the US has already called it
- Decreased efficacy of influenza immunization - a study showing that adult recipients of IIV3 with Obesity have 2X greater incidence of influenza and/or ILI despite being vaccinated (linked to CD8+ memory T-cells)

OBESITY: Risk for COVID-19

Adipose tissue

- Functions to store energy fat
- Not only adipocytes, but also, fibroblasts, mast cells, macrophages, endothelial cells, granulocytes, lymphocytes
- Active vs inert tissue
- Produces a variety of adipocytokines
- These influence different physiological processes
 - Control of food intake, energy balance, insulin action, lipid and glucose metabolism, angiogenesis and vascular remodelling, blood pressure, and coagulation
 - Therefore play a role in body homeostasis

Obesity is associated with:

- A chronic low grade inflammatory state
 - Excess nutrients in adipocytes induces intracellular, oxidative stress, resulting in the activation of inflammatory cascades
 - Overloading of adipocytes with fat - increased infiltration of macrophages - subsequent differentiation and activation of cytotoxic T cells – promotes inflammatory cascades
 - As adipose tissues hypertrophies – relative tissue hypoxia – possible activation of inflammatory pathway

OBESITY: Risk for COVID-19

Example	Function	Response to obesity
Leptin	Regulates food intake and energy expenditure	↑
Adiponectin	Regulates glucose and lipid metabolism, insulin sensitivity, food intake	↓
Visfatin	Insulin-mimetic effects	↑
Resistin	Regulation of inflammation	↑
Adipsin	Enhance fat storage	↑
Tumor necrosis factor (TNF- α)	Pro-inflammatory inflammation, antagonism of insulin signaling	↑
Interlukin (IL)-1	Pro-inflammatory, early mediator of inflammation	↑
IL-4	Anti-inflammatory, inhibition of pro-inflammatory cytokines	↓
IL-6	Pro-inflammatory, regulates energy homeostasis and inflammation	↑
IL-10	Anti-inflammatory cytokine, host responses to systemic inflammation	↓
Vascular endothelial growth factor (VEGF)	Stimulates vasculogenesis, angiogenesis, and T-cell cytokine production	↑
Transforming growth factor (TGF- β)	Regulate of cell growth, cell proliferation, cell differentiation and apoptosis	↑
Plasminogen activator inhibitor-1 (PAI-1)	Inhibit endothelial plasminogen activator, elevated in inflammatory and obese states	↑
Serum amyloid A (SAA)	Family of acute-phase proteins, elevated with inflammation	↑
C-reactive protein (CRP)	Family of acute-phase proteins, increased during inflammatory condition	↑

OBESITY and COVID-19 – Possible link

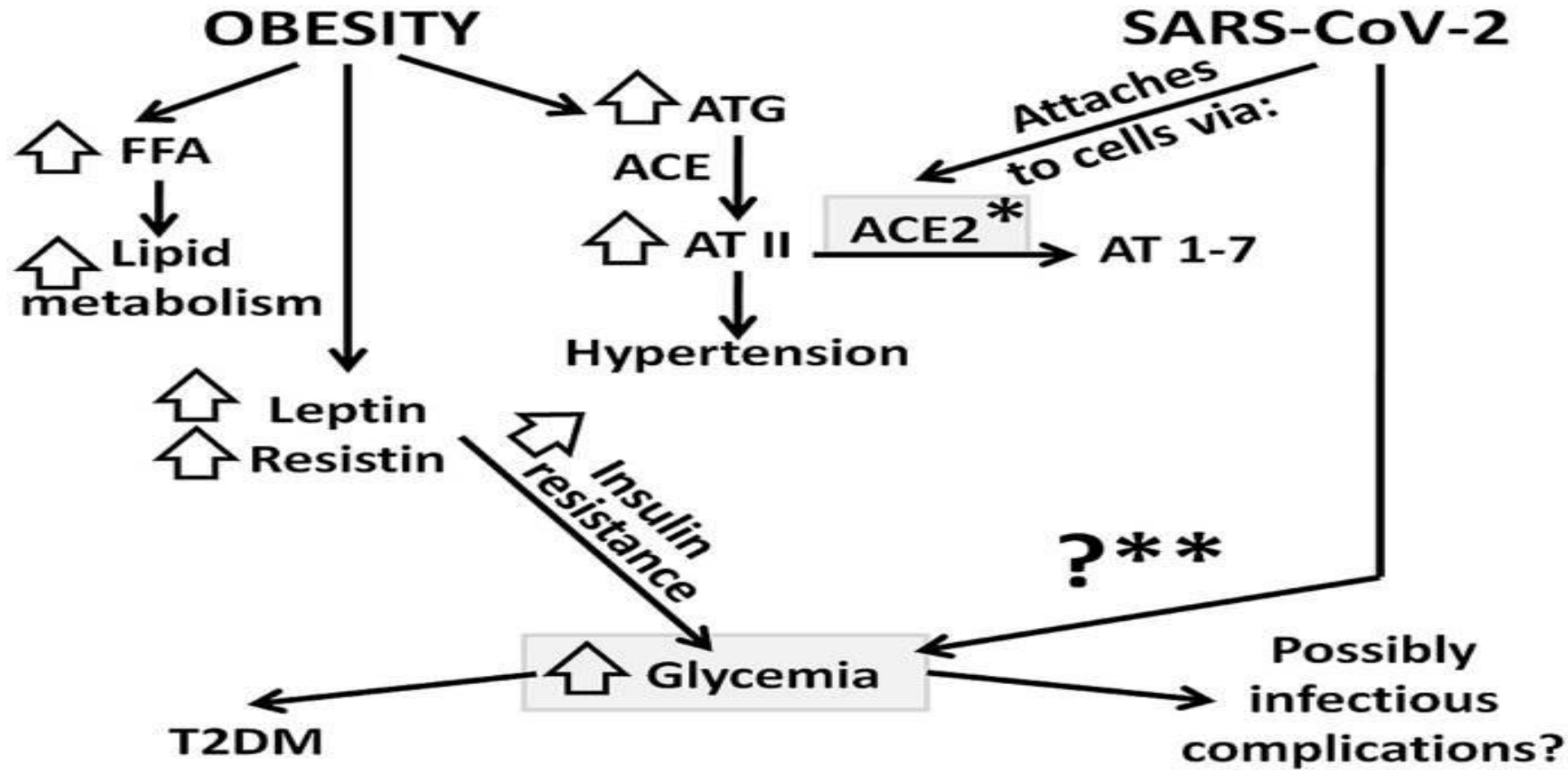
COVID-19 complications - Reports from the wards

- Cytokine storm
- ARDS
- Coagulopathy
- Hyperglycaemia
- Kidney failure
- Multi-organ failure

Obesity complications

- Chronic inflammatory state
- Pulmonary dysfunction
- Coagulopathy
- Insulin resistance, metabolic dysfunction, DM

OBESITY and COVID-19 – Possible link



COVID-19 STATISTICS IN RSA

04-05-2020

Unknown: 0

Confirmed cases: 7 220

Tests conducted: 257 541

Deaths: 138

Recoveries: 2 746

Province	Deaths	Recoveries
Eastern Cape	17	341
Free State	6	96
Gauteng	14	979
KwaZulu-Natal	35	415
Limpopo	2	27
Mpumalanga	0	22
North West	0	20
Northern Cape	0	13
Western Cape	64	833



COVID-19: Practical implications

South Africa – Weekly epidemiology report

- Median age of cases - 39 years (interquartile range [IQR], 29-52 years)
- Largest proportion of cases - 30-34-year age group (526/4202, 13%)
- Followed by the 35-39-year age group (524/4202, 12%)

- Highest incidence risk - 50-54-year age group (16.2 cases per 100 000 persons)
- Followed by those in the 55-59-year age group (15.2 cases per 100 000 persons)
- Lowest incidence risk in the 5-9-year age group (1.1 cases per 100 000 persons)

- Fifty-six per cent (2795/4947) (95% CI, 55-58%) of the cases were female
- The overall incidence risk was higher among females than males (9.3 cases per 100 000 persons [95%CI 8.9-9.6] versus 7.5 cases per 100 000 persons [95% CI 7.1-7.8])
- However, this varied by age group with the peak incidence risk among females aged 35-39 years and males aged 75-79 years

COVID-19: South Africa

Reported risk for severe illness

- Hypertension, Diabetes and Cardiac disease
- Age >60

Other co-morbidities associated with increased chances for admission

- Chronic pulmonary disease, Asthma, Chronic renal disease, Malignancy, HIV, active and past Tuberculosis

Incidence of death by age

20-29: **1 (0.8%)**

30-39: **6 (4.9%)**

40-49: **19 (15.5%)**

50-59: **23 (18.7%)**

60-69: **30 (24.4%)**

70-79: **28 (22.7%)**

80-89: **14 (11.4%)**

90-99: **2 (1.6%)**

Published data by age, sex, location. No published data on race, weight parameters

COVID-19: New York, USA

3,615 individuals who tested positive for Covid-19 in a New York Hospital (Lighter, J. et al., 2020)

- 775 (21%) had a BMI of 30-34
- 595 (16%) had a BMI >35
 - 1,853 (51%) - discharged from the ED
 - 1,331 (37%) - admitted in acute care
 - 431 (12%) were either directly admitted or transferred to the ICU during admission

Analysis showed that compared to individuals with a BMI <30, patients <60 years with:

- BMI 30-34 were 2.0 (95% CI 1.6-2.6, $p < 0.0001$) and 1.8 (95% CI 1.2-2.7, $p = 0.006$) times more likely to be admitted to acute and critical care, respectively
- BMI >35 were 2.2 (95% CI 1.7-2.9, $p < .0001$) and 3.6 (95% CI 2.5-5.3, $p < .0001$) times more likely to be admitted to acute and critical care compared to patients in the same age category with BMI <30

Though patients aged <60 years are generally considered a lower risk group for severe Covid-19 illness, conclusion from analysis - significant difference in admission and ICU care in patients <60yrs with varying BMIs

Based on this data, obesity appears to be a previously unrecognized risk factor for hospital admission and need for critical care

COVID-19: Practical implications

This has important and practical implications in SA, where 41.1% of women are obese (BMI > 30),

Obesity in South Africa

- Highest BMIs amongst women – in the 45-54 and 55-64 age groups, highest incidence of Overweight and Obesity amongst women is in the 25-34 and 45-54 age groups respectively
- High prevalence COVID-19 infection in young, middle aged females
- Disease progression into the townships

Our challenge

- Inequality and poverty
- Poor access
- Poor housing
- Poor nutrition
- Obesity

And now COVID-19

OBESITY and COVID-19 - Conclusion

Desirable: conclusive studies on the risk Obesity poses to COVID-19, & other possible future pandemics:

- Infection
- Severe illness
- Death
- Response to vaccination

Required:

Standardised data collection – BMI, preferably biometric assessments

Further:

- Classification of Obesity as a disease in the NCD disease framework
- A paradigm shift from a curative focus to a preventative focus
- An understanding that Obesity is a pandemic, with serious health, economic implications
 - South Africa has the highest rates in Sub-Saharan Africa
 - Obesity exists within an environment of poverty, overcrowding, inequality, undernutrition, a strained healthcare system



THANK YOU

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