# Association between underlying comorbidities and in-hospital mortality among COVID-19 cases in Gauteng Province, South Africa, 2020 – 2021

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# Introduction

- The COVID-19 pandemic exposed vulnerabilities in healthcare systems, especially in LMICs*
- Gauteng Province faced significant challenges
  - Dense, diversity, high prevalence of chronic diseases i.e. hypertension, diabetes, and HIV
- Comorbidities compromise the immune system and increase the risk of poor outcomes in COVID-19 patients
- Understanding these factors was crucial for enhancing public health strategies
  - Preparedness for future health crises

*LMIC: Low- and middle-income country

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# Aim and Objectives

**Aim**

- To determine the association between underlying comorbidities and in-hospital mortality among COVID-19 cases in Gauteng Province, South Africa from 2020 to 2021

**Objectives**

- To describe the demographic and clinical characteristics of hospitalised COVID-19 cases
- To determine the case-fatality ratio for hospitalised COVID-19 cases
- To determine the association between underlying comorbidities and in-hospital mortality

# Methods

**Study design**

- Retrospective cohort study

**Study site**

- Gauteng Province, South Africa (SA)

**Primary study**

- Active surveillance of COVID-19 hospital admissions in SA (DATCOV)
  - Collect data from hospitals in public and private sectors

# Methods

**Study population**

- COVID-19 cases hospitalised in Gauteng Province between 5 March 2020 and 30 November 2021

**Case definition**

- A patient with a positive test (RT-PCR or antigen) for SARS-Cov-2 admitted to a DATCOV hospital for ≥ 1 full day

**Exclusion criteria**

- COVID-19 cases hospitalised for < 1 full day and patients still in hospital beyond study period

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# Data Analysis

| Objectives | Statistical analysis methods |
|---|---|
| 1. To describe the demographic and clinical characteristics among hospitalised COVID-19 cases | Percent (%) for categorical variables and median and IQR for numerical variables. |
| 2. To determine the case-fatality ratio for hospitalised COVID-19 cases | $\frac{\text{In-hospital COVID-19 deaths}}{\text{In-hospital COVID-19 cases}}$ X 100 |
| 3. To determine the association between underlying comorbidities and in-hospital mortality among COVID-19 cases and the survival functions upon admission | Survival analysis:<br>Kaplan-Meier survival curve,<br>Log-rank test comparing survival in cases with and without comorbidities at a 5% significance level,<br>Cox regression hazard ratios with 95% CI |

Data analysis software: STATA version 18

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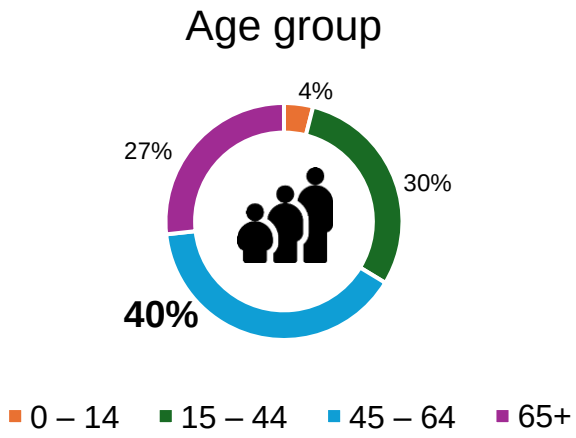
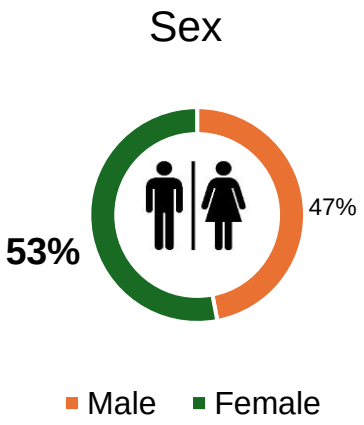
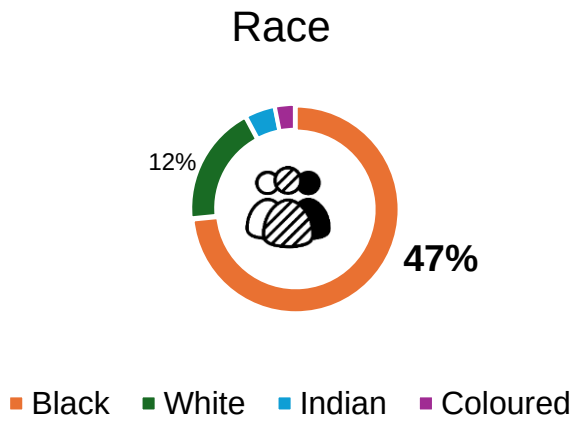
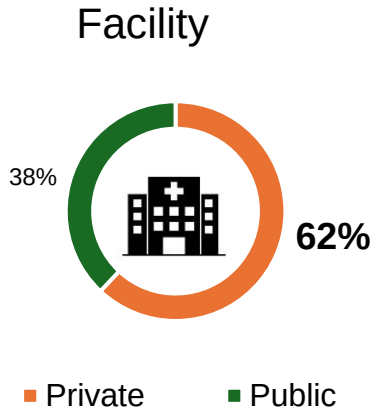
# Demographic characteristics of hospitalised COVID-19 cases in Gauteng Province, South Africa, 2020 – 2021 (n=115 387)

- Median age (years): **53** (IQR: 39–66)



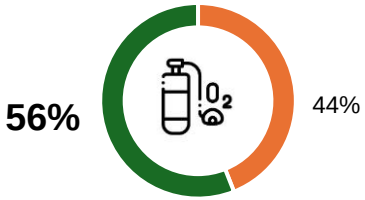



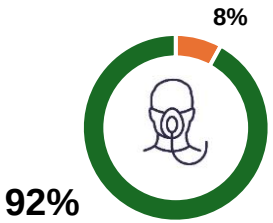
# Clinical characteristics of hospitalised COVID-19 cases in Gauteng Province, South Africa, 2020 – 2021 (n=115 387)

- Median length of hospital stay (days): **7** (IQR: 4–6)

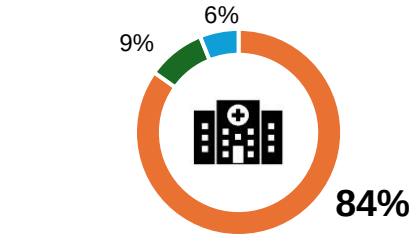
Oxygenated



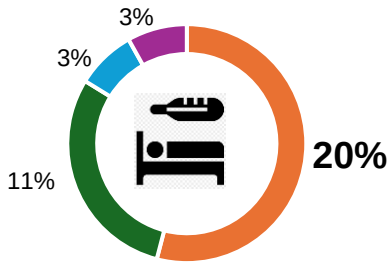

Ventilated



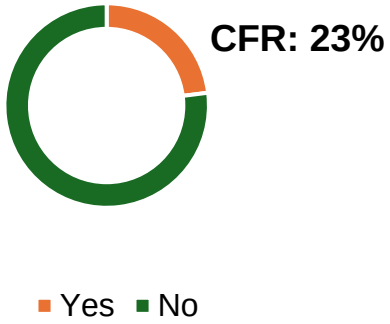

Hospital admission



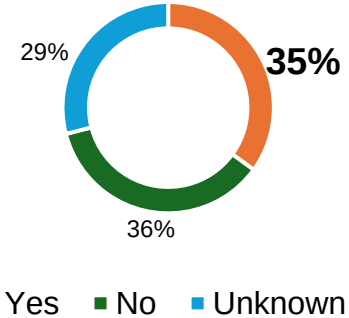

Comorbidities




Died

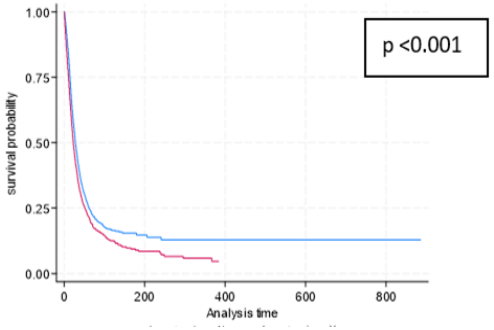



Comorbidity(s) among died

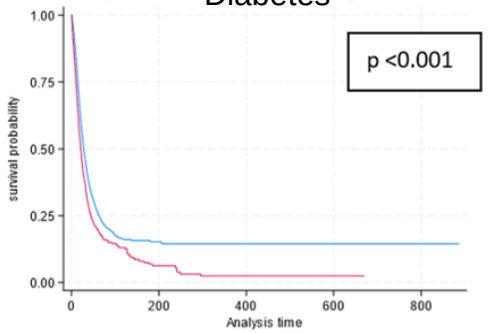


# Survival Analysis of hospitalised COVID-19 cases in Gauteng Province, South Africa, 2020 – 2021: Kaplan-Meier curves and log rank by underlying comorbidities

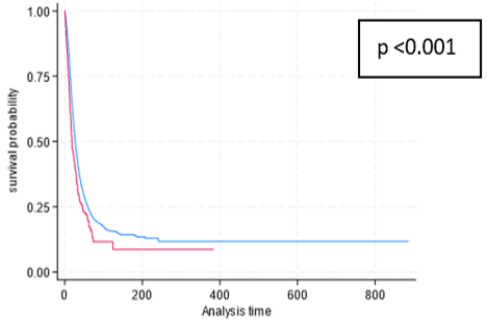
Hypertension



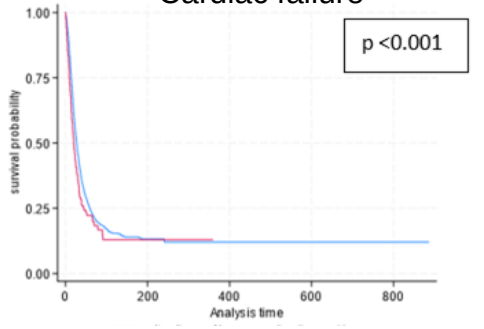

Diabetes



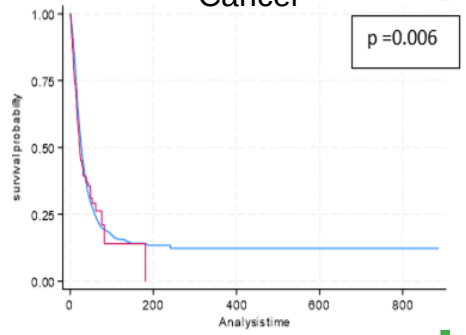

Renal failure



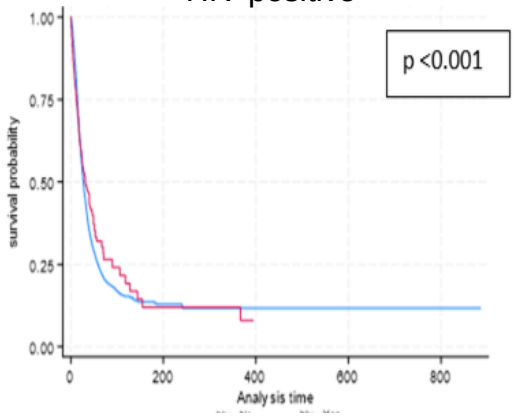

Cardiac failure



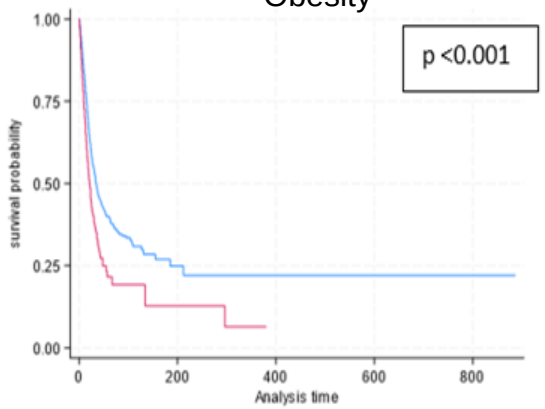

Cancer



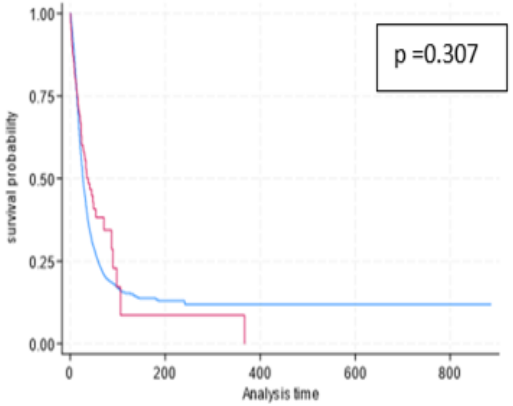

HIV positive



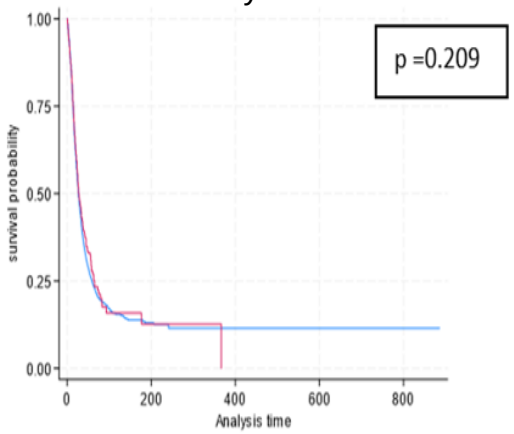

Obesity




Tuberculosis




Pulmonary disease/asthma




Comorbidity present

yes

no

# Survival Analysis of hospitalised COVID-19 cases in Gauteng Province, South Africa, 2020 – 2021: Multivariable Cox Regression

| Variable | Adjusted HR | p-value | 95% CI |
|---|---|---|---|
| Age group | | | |
| 0 – 14 | ref | | |
| 15 – 44 | 2.10 | 0.015 | 1.95 – 2.74 |
| 45 – 64 | 5.00 | <0.001 | 2.83 – 8.85 |
| 65+ | **8.29** | <0.001 | 4.65 – 14.77 |
| Sex | | | |
| Female | ref | | |
| Male | 1.09 | 0.291 | 0.93 – 1.27 |
| Race | | | |
| Black | ref | | |
| White | 0.87 | 0.160 | 0.71 – 1.06 |
| Indian | 1.59 | 0.070 | 0.93 – 2.63 |
| Coloured | 1.04 | 0.831 | 0.69 – 1.56 |
| Other | 0.47 | 0.196 | 0.15 – 1.47 |
| Admission | | | |
| General ward | ref | | |
| Intensive Care Unit | 1.17 | 0.326 | 0.86 – 1.59 |
| High care | 1.07 | 0.634 | 0.80 – 1.44 |
| Isolation ward | 1.24 | 0.128 | 0.94 – 1.65 |
| Ventilated (ref=no) | **1.43** | 0.006 | 1.65 – 1.74 |
| Oxygenated (ref=no) | **1.66** | <0.001 | 1.09 – 1.14 |

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# Survival Analysis of hospitalised COVID-19 cases in Gauteng Province, South Africa, 2020 – 2021: Multivariable Cox Regression

| Variable | Adjusted HR | p-value | 95% CI |
|---|---|---|---|
| Comorbidity (ref=no) | | | |
| Hypertension | 1.18 | 0.075 | 0.98 – 1.25 |
| Diabetes | 1.09 | 0.344 | 0.91 – 1.31 |
| HIV Positive | 1.33 | 0.066 | 0.98 – 1.81 |
| Obesity | 1.03 | 0.794 | 0.84 – 1.26 |
| Cardiac disease | 1.17 | 0.230 | 0.91 – 1.51 |
| Renal failure | 1.08 | 0.704 | 0.73 – 1.59 |
| Cancer | 1.57 | 0.102 | 0.91 – 2.70 |

Test for proportionality of hazards: p-value 0.654 thus assumption not violated

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# Discussion

- Our estimated case fatality ratio consistent with rates reported being between 15 – 24% in SA
  - Globally ~ 2%
- Older age was most prevalent among the cases
  - Suggesting vulnerability to severe outcomes due to weakened immunity
- Ventilation and oxygenation had a significantly higher hazard of in-hospital mortality
  - Indication of advanced stages of disease leading to poor outcomes
- Comorbidities had no significant association with COVID-19 in-hospital mortality
  - Contradicting the findings of studies conducted globally and locally

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# Conclusion and recommendations

**Conclusion**

- No significant association between underlying comorbidities and in-hospital mortality
- Older age, clinical severity (oxygenation and ventilation) significantly increased the hazard of in-hospital mortality

**Recommendations**

- Ongoing research and surveillance:
  - Clinical outcomes in severe cases to improve critical care strategies and treatment protocols
  - Protective factors among clinically severe and older cases
- Optimizing resource allocation for older patients and severe cases

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# THANK YOU

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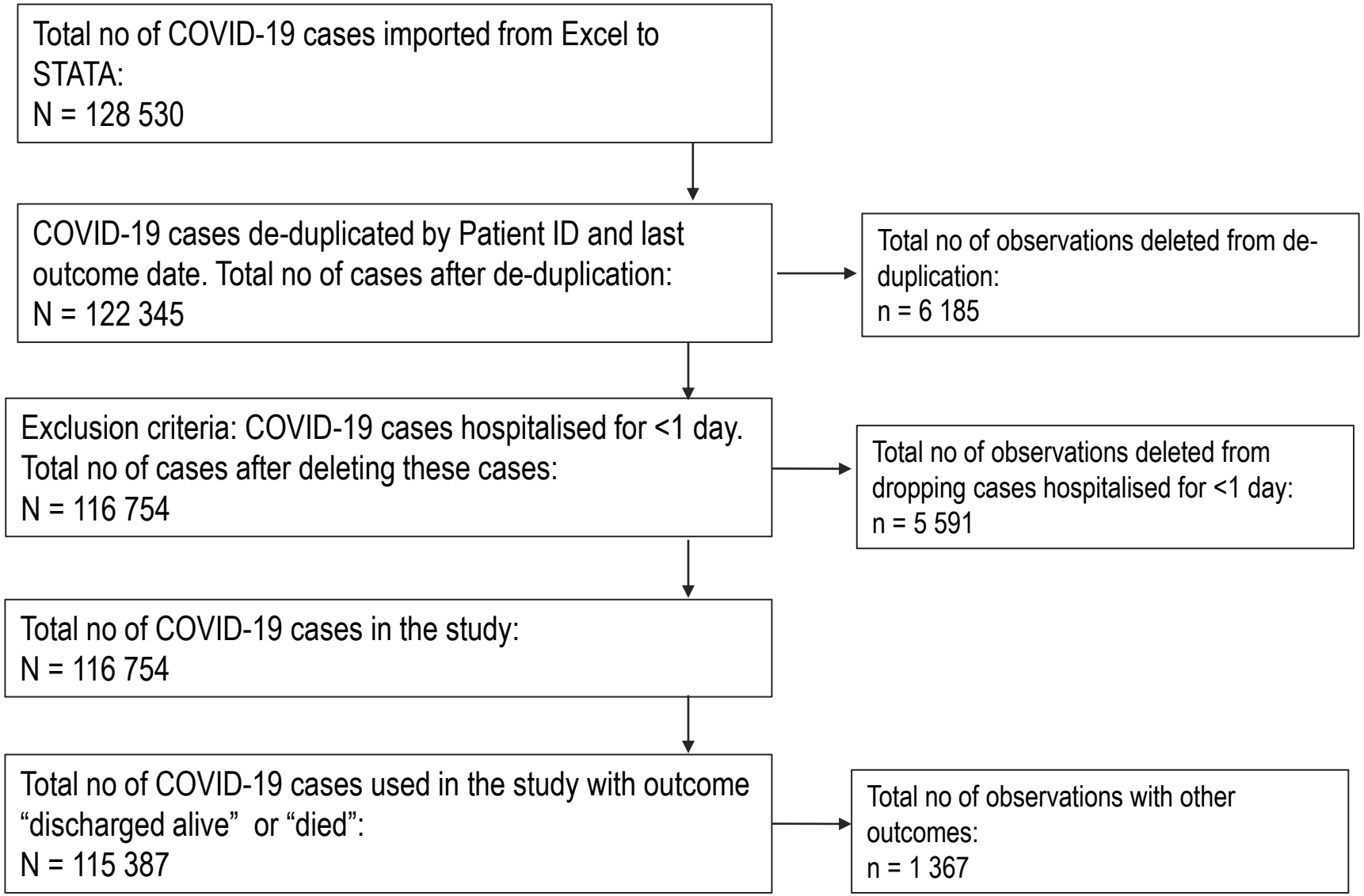
# Pocket slides

# Data Management

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# Limitations

- Only hospital data used
- Missing data on key variables and data entry ambiguity
- No protective factors investigated
- Hospitalised patients represent those with moderate to severe disease
- Socio-economic factors and vaccination not included

# Post-hoc analysis

| Interaction | Adjusted Hazard Ratio | p-value | 95% CI |
|---|---|---|---|
| Obesity#Ventilated (ref=No#No) | . | . | . |
| No#Yes | 1.56 | 0.002 | 1.18 – 2.06 |
| Yes#No | 1.11 | 0.358 | 0.87 – 1.40 |
| Yes#Yes | **1.55** | 0.031 | 1.04 – 2.31 |