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QUALITY OF LIFE OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE ATTENDING TWO ACADEMIC HOSPITALS IN JOHANNESBURG SOUTH AFRICA

By

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WITWATERSRAND,
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A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg in fulfilment of the requirements of the degree of Master of Science in Medicine.

8 July 2024

Declaration

I Mbali Agreement Mbatsana, declare that this dissertation is my own unaided work. It is submitted for the Master of science `(family medicine) degree at the University of the Witwatersrand Johannesburg. It has not been submitted before for any other degree or examination at this or any other university.

Signed: ……

8th of July 2024

TABLE OF CONTENTS

1.1 Background **1**

1.2 Problem statement **1**

1.3 Research Aim **2**

1.4 Research questions **2**

1.5 Rationale **2**

2.1 Chronic obstructive pulmonary disease **4**

2.1.1Diagnostic criteria for COPD 5

2.2 Prevalence of COPD **5**

2.3 Risk factors for COPD **7**

2.3.1 Smoking/Tobacco use 7

2.3.2 Occupational Risk Exposure 9

2.4 COPD and Clinical Comorbidities **10**

2.4.1 HIV & AIDS 10

2.4.2 Tuberculosis 11

2.5 COPD and patients' quality of life **12**

2.6 Conclusion **14**

3.1 Study design and setting **16**

3.2 Study population **16**

3.2.1 Sampling and sampling strategy 16

3.3 Instruments **17**

3.3.1 Health status and quality of life measurement 17

3.3.1.2 non-health-related Quality of Life 18

3.4 Data analysis **19**

3.4.1 Data Entry 19

3.4.2 Descriptive statistics. 19

3.4.3 Analytical statistics 19

3.4.4 Quantile regression analysis 20

3.6 Ethical considerations **20**

4.1 Sociodemographic factors among COPD patients **20**

4.1.1 Number of patients per hospital 20

4.1.2 Age range 22

4.1.2 Education 24

4.1.3 Employment status 25

4.3.3 Smoking status 26

4.2 Distribution of clinical risk factors among COPD patients **28**

4.2.1.1 Gender-related differences in the distribution of comorbid communicable diseases. 28

4.2.1.2 Age-related differences in the distribution of comorbid communicable diseases. 29
4.2.1.3 The distribution of Comorbid communicable diseases by smoking status 31
4.2.2 Gold stage 32
4.3 Health-related quality of life results 34
4.3.1 Gender-related differences in the health-related quality of life of COPD patients. 34
4.3.2 Ethnic-related differences in HRQL: An analysis of SGRQ....35
4.3.3 Age-related differences in the health-related quality of life of patients....37
4.3.4 Smoking-related Differences in SGRQ Scores 38
4.3.5 GOLD stage variations in SGRQ....39
4.3.6 Impact of education on the health-related quality of life of patients. 40
4.3.7 Health-related quality of life: an analysis of CAT and patient demographic factors. 41
4.4 Non-health related quality of life: an analysis of the WHOQOL-BREF tool. 42
4.4.1 Gender-related differences in non-health-related quality of life 42
4.4.2 Age-related differences in non-health-related quality of life. 44
4.4.3 Ethnic variation in non-health-related quality of life....47
4.4.4 Smoking-related differences in non-health-related quality of life. 50
4.4.5 The impact of education on patients' non-health-related quality of life 52
4.4.6 non-health-related quality of life stratified by GOLD COPD stages....54
4.5 Quantile linear regression. 55
5.1 Participant Characteristics....58
5.3 Quality of life of patients with COPD Health-related and non-health-related quality of life. 60
5.4.2 Ethnicity and QOL....62
5.4.3 Age and QOL....63
5.4.4 Smoking status and QOL....64
5.4.5 GOLD stage and QOL. 65
5.4.6 Education Attainment and QOL 67
6.1 Limitations....68
6.2 Recommendations 68
6.3 Conclusion 69

Abstract

There has been an increase in non-communicable diseases (NCDs) research over the past decade, which indicates that NCDs are slowly reaching epidemic levels. Amongst the NCDs, chronic obstructive pulmonary disease (COPD) has been identified as a major medical and social problem worldwide. NCDs are associated with an increased burden on healthcare manifested in patients' poor quality of life(QOL). It is a culmination of NCDs and in particular, COPD on the physical and social effects of the disease on patients with COPD. Studies have established that measuring QOL is an effective and reliable means of quantifying the impact of COPD on patients' livelihoods and the subsequent effects on the healthcare system. The study aimed to assess the QOL of COPD patients in two academic hospitals in Johannesburg, South Africa. The study employed a sequential exploratory mixed methods design that comprised quantitative and qualitative methods. The Saint George Respiratory Questionnaire (SGRQ), COPD assessment tool, and the World Health Organization quality of life scale (WHOQOL-BREF 26)tool were used to assess the health-related and non-health-related quality of life. Non-parametric tests were employed to test for differences in the sample and post hoc analysis. The HRQL of patients in our study was, on average, 59%, while the non-health-related quality of life was 53.65%. The majority of patients resided in the South of Johannesburg, constituting the largest proportion (27.51). About 43% of the patients in our sample were within the elderly age group, mostly male and African (49%). COVID-19, TB, and HIV/AIDS were some of the diseases comorbid with COPD in the study sample and were noted as risk factors for COPD. In addition, demographic factors such as older age, ethnicity, and education level were also reported as risk factors for patients in this study. There were significant differences in patients' non-health-related quality of life in the different age groups and education levels. it is recommended that non-clinical personnel, such as administrative staff, be incorporated into dedicated COPD clinics in academic hospitals to alleviate the burden on clinical staff. Future research should focus on studying the relationship between COPD and communicable diseases and how they affect each other to help tailor treatment regimens for patients grappling with comorbidity.

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Nomenclature

1. **AIDS:** Acquired immune deficiency syndrome
2. **ART:** Antiretroviral therapy
3. **ARV:** Antiretroviral
4. **BOLD:** Burden of obstructive lung disease
5. **COPD:** Chronic obstructive pulmonary disease
6. **CAT:** COPD Assessment tool
7. **COVID**-19: Coronavirus disease
8. **CMJAH:** Charlotte Maxeke Johannesburg Academic Hospital
9. **FEV:** Forced expiratory volume
10. **GOLD:** Global initiative for obstructive lung disease
11. **HICS:** High-income countries
12. **HJAH:** Helen Joseph Academic Hospital
13. **HIV:** Human immunodeficiency virus
14. **HRQL:** Health-related quality of life
15. **LMICS:** Low and middle-income countries
16. **LLN:** Lower limit than normal
17. **NCD:** Non-communicable disease
18. **Non-HRQL:** Non-health related quality of life
19. **QOL:** Quality of life
20. **SES:** Socioeconomic status
21. **SGRQ:** Saint George Respiratory Questionnaire
22. **SA:** South Africa
23. **TB:** Tuberculosis
24. **WHOQOL-BREF:** World Health Organization Quality of life scale

List of Figures

1. **FIGURE 4.1:** Summary of the distribution of patients across Johannesburg.

List of tables

1. Number of participants per hospital per gender
2. Table 4.1: Age distribution stratified by gender.
3. Table 4.2: Age distribution stratified ethnicity.
4. Table 4.3: Summary of participants' highest qualification per gender distribution
5. Table 4.4: Summary of participants' highest qualification by ethnic distribution
6. Table 4.5: A representation of participants' employment status summarized by gender.
7. Table 4.6: A representation of participants' smoking status stratified by gender.
8. Table 4.7: A representation of participants' smoking status stratified by age group.
9. Table 4.8: A representation of participants' smoking status stratified by ethnic group.
10. Table 4.9: Gender differences in the distribution of comorbid communicable diseases.
11. Table 4.10: Summary of communicable comorbid diseases across age groups.
12. Table 4.11: Summary of communicable comorbid diseases stratified by smoking status.
13. Table 4.12: Summary of the stratification GOLD stage COPD by gender.
14. Table 4.13: Summary of the stratification of GOLD stage COPD by age group.
15. Table 4.14: Summary of the stratification of GOLD stage COPD by ethnic group.
16. Table 4.15: Gender differences in health-related quality of life scores.
17. Table 4.16: Summary of ethnic-related variations in SGRQ.
18. Table 4.17: Summary of health-related quality of life analysis stratified by Age.
19. Table 4.18: Summary of smoking-related differences in SGRQ scores.
20. Table 4.19: Summary of the impact of GOLD stage on participants' health related quality of life.
21. Table 4.20: Summary of health-related quality of life analysis by SGRQ stratified by education.
22. Table 4.21: Summary of CAT scores in the different demographic categories.
23. Table 4.22: Gender differences in non-health-related quality of life.
24. Table 4.23: Age-related differences in patients' non-health-related quality of life.
25. Table 4.24: Ethnic variations in non-health-related quality of life.
26. Table 4.26: A representation of WHOQOL-BREF scores stratified by smoking status.
27. Table 4.27: Summary of WHOQOL-BREF HHRQL scores by education level.
28. Table 4.28: GOLD stage variations in the non-health-related quality of life: an analysis of WHOQOL-BREF.
29. Table 4.29: Summary of quantile regression model of HRQL and Non-HRQL.

Chapter 1:Introduction

1.1 Background

Non-communicable diseases (NCDs) are at epidemic levels and have become a key area of interest in public health research over the past decade. A primary concern of this increase in NCDs research is associated with estimates that NCDs will be the leading cause of death in sub-Saharan Africa by 2025(1). Amongst the NCDs, chronic obstructive pulmonary disease (COPD) has been identified as a major medical and social problem worldwide. This is due to the adverse effects COPD has on the quality of life(2). The wealth of COPD quality-of-life studies have established that measuring QOL is an effective and reliable means of quantifying the impact of the disease on affected people. However, the literature on QOL among patients with COPD in South Africa is scant. Moreover, the prevalence of COPD and the distribution of risk factors in the SA context is not well grounded, particularly in the light of the HIV and TB epidemics. This study aimed to assess the QOL and characterize the distribution of the risk factors among patients with COPD at two of the three academic hospitals in Johannesburg, namely: Charlotte Maxeke and Helen Joseph hospitals.

1.2 Problem statement

The existing body of literature has highlighted that the QOL of COPD patients declines in tandem with both the worsening severity of the disease and advancing age. Despite these well-documented trends, a glaring gap exists in the knowledge base within the South African COPD patient population. The evidence regarding this phenomenon in the SA context is limited, and our understanding remains fragmented and poorly documented.

Furthermore, the intricate interplay between risk factors, disease manifestation, and their collective impact on QOL remains unclear. This is more so considering that South Africa is at the epicentre of the HIV/ TB epidemic, and these factors and others, like marijuana smoking, have not been fully explored in the South African context. We chose to conduct the study in academic hospitals because of the availability of diverse patient populations, which would aid in recruiting a broad range of COPD patients in different stages of the disease, thereby enhancing the generalizability and applicability of research findings. This study aimed to investigate the effect of COPD on the health-related and non-health-related quality of life in COPD patients and the distribution of risk factors for COPD in patients attending the two academic hospitals in Johannesburg, SA.

1.3 Research Aim

This study aimed to assess the quality of life of COPD patients attending the two academic hospitals in Johannesburg, South Africa.

1.4 Research questions

- What are the sociodemographic and clinical risk factors among patients with COPD in academic hospitals in Johannesburg?
- What is the health-related and non-health-related quality of life of patients with COPD attending academic hospitals in Johannesburg?
- What are the relationships between sociodemographic and clinical risk factors and quality of life among COPD patients?

1.5 Rationale

HRQL is a pivotal metric that can effectively translate into an individual's overall health status. This translation is particularly valuable as HRQL offers a comprehensive assessment of the holistic impact of a disease, encompassing manifestations beyond the confines of airway obstruction. For instance, the quantification of QOL serves as a crucial means to ascertain the degree to which airway obstruction hampers a patient's ability to engage in essential daily activities, ranging from routine activities like bathing to more physically demanding pursuits like exercising.

Moreover, delving into the specific dimensions of a patient's life that bear the brunt of the burden imposed by COPD may yield actionable insights. This understanding of the precise areas affected by the disease could equip healthcare providers with the knowledge needed to triage treatment strategies effectively and assess the impact of the disease on the patient. Optimising patient care within a healthcare system plagued by unique sociodemographic and financial constraints might be possible by strategically allocating limited healthcare resources. Such judicious resource allocation, driven by a comprehensive grasp of the impact of COPD on HRQL, ultimately translates into tangible benefits for patients, enhancing their overall well-being and health outcomes. Especially in the SA context, where the healthcare system is overburdened with patients and understaffed, the emerging burden of NCDs is in addition to the already existing burden of communicable diseases such as AIDS and TB. Ultimately, by prioritizing interventions based on a comprehensive understanding of the impact of COPD on

HRQL, healthcare providers in SA can enhance patient outcomes and improve overall well-being. This approach aligns with the broader goal of optimizing healthcare delivery within the constraints of the healthcare system, leading to tangible benefits for COPD patients and society as a whole.

Chapter 2: Literature Review

For the literature review, I comprehensively searched Medline, PubMed, Research Gate, and Google Scholar for population-based studies, outcome measures studies, meta-analyses, and systematic reviews published between 2011 and 2023. I did not apply any language or geographical restrictions in the search. I utilized various combinations of medical subject terms and headings related to COPD, including quality of life, prevalence of COPD, risk factors for COPD, and management of COPD. I also examined the reference lists of included papers to identify additional studies not found in the initial search. I excluded studies that did not employ the conventional or globally accepted diagnosis and definition of COPD, such as the global initiative for obstructive lung disease (GOLD), the burden of obstructive lung disease (BOLD), and the lower limit than normal (LLN). I carefully reviewed each article's abstracts and full texts to extract critical information, including study design, findings, participant characteristics, quality of life assessment methods, and main results. The literature was then presented conceptually, in line with the aim of the study.

2.1 Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) falls under the family of chronic respiratory diseases (CRDs). There are problems with defining COPD both in research and in clinical practice. The main problem pertains to the standard used to define COPD. This is attributable to several standards used to define and diagnose COPD. The standards include the burden of obstructive lung disease (BOLD) standard and the global initiative of obstructive lung disease (GOLD) guidelines. The differences between the two standards contribute to the variation in prevalence estimates, mostly resulting from different rules for defining COPD. For instance, the BOLD guidelines use a fixed ratio criterion to define and diagnose COPD, while GOLD employs a spirometry-based definition (3,4). For this study, the GOLD standard was used to define COPD. According to the Global Initiative for Lung Disease (GOLD), COPD is defined as a common, preventable, and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to abnormalities in the airway and/alveolar, is caused by significant exposure to noxious particles/gases. Symptoms include cough, sputum, dyspnoea, and wheezing (4).

Gold outlines four stages of COPD (I-IV), varying severity in terms of forced expiratory volume in one second (FEV1). Stage I, also called mild COPD, is characterized by a forced expiratory volume of <80% of the predicted value. Cough and sputum production are

symptoms usually experienced in this stage; however, they often occur intermittently. Furthermore, patients in this stage often do not experience shortness of breath when performing daily activities. Stage II: moderate COPD is seen in individuals who present with FEV1 50–80% predicted value. Patients in stage II often experience an increased frequency of symptom presentations, such as cough and getting tired easily (during physical activity and at rest). Stage III is characterized by a significant impact on patients' daily lives and quality of life. This occurs as a result of persistent chronic cough, sputum production, and exacerbations leading to hospitalization. COPD's fourth and most severe stage entails FEV1 30% predicted value on lung function test results. In this stage, symptoms are extremely severe and ongoing; exacerbations are frequent and may be life-threatening, often leading to repeated (4).

2.1.1Diagnostic criteria for COPD

Gold recommends that a COPD diagnosis should be considered for anyone who presents with dyspnoea, phlegm, sputum production, and a history of exposure to the risk factors for COPD (4,5). Different diagnostic criteria/guidelines are used in epidemiological research and clinical settings. These include the burden of obstructive lung disease (BOLD), the global initiative for obstructive lung disease (GOLD), and the lower limit of normal (LLN) guidelines (6). The use of these guidelines differs according to country region. For example, data indicates that low and middle-income countries (LMICS) use either one of these methods at the primary healthcare level. In contrast, high-income countries (HICS) use a combination of the methods (7). This is a result of a lack of resources emanating from a lack of funding for primary healthcare for COPD in LMICs. This subsequently contributes to either the misdiagnosis, underdiagnosis, or both of the COPD diseases in these countries. Another ramification of using one method of diagnosis is the poor health-seeking behaviour of patients. For example, Criner and Kim established that COPD patients tend to ignore chronic cough and sputum production as 'significant' symptoms of COPD until they present with more severe symptoms such as dyspnoea (8). This health-seeking behaviour may also be attributable to the prioritization of more severe stages of COPD in primary healthcare(9,10). Considering that the two academic hospitals in which the study was conducted used the GOLD standard of diagnosis, the GOLD guideline was also the preferred definition for COPD in this study.

2.2 Prevalence of COPD

To date, no study has estimated the global prevalence of COPD using a single diagnostic method. It is a challenging task to estimate the prevalence and impact of COPD due to the use of different diagnostic criteria and definitions in different parts of the world. Meta-analyses and systematic reviews can provide estimates of COPD prevalence by region. Even these estimated prevalence statistics are but a fraction due to the many undiagnosed COPD cases discovered in epidemiological studies. BOLD asserts that COPD prevalence varies by country and region, probably due to a combination of varying risk factors and diagnostic criteria used in each country (3). Studies reporting on the prevalence of COPD in SA and the greater sub-Saharan Africa are scant. In SA, the only data we have is from the 2007 BOLD study conducted in Cape Town. This study showed that the prevalence of COPD was 22.6% and 16.7% in men and women, respectively (11).

A 2015 meta-analysis of data from 27 countries revealed that more than 80% of the COPD cases identified using spirometry in epidemiological studies were undiagnosed. Undiagnosed cases were especially prevalent in sub-Saharan Africa (SSA) and among men and young adults who have never smoked. This highlights the overemphasis on smoking-related COPD and the insufficient attention given to COPD cases of other aetiology (6).

The 2019 systematic review by Adeloye et al. revealed that the prevalence of COPD identified using the GOLD guidelines was 10.3% globally at the time of the study. This prevalence figure was higher in LMICs compared to HICS, even after considering demographic characteristics (6). Regionally, the prevalence was high in the African and Mediterranean regions (6). This is consistent with data from some countries in Sub-Saharan Africa, such as Ethiopia, where the prevalence was reported to be 17.8% (9,12).

Considering demographic characteristics such as age, the prevalence of COPD using the GOLD criteria increased with increasing age in Adeloye et al.'s systematic review(6). It is worth noting that the age range was limited to 30-79 in this review, indicating that COPD cases of individuals younger than 30 were not accounted for. However, a similar trend was observed in Ethiopia, wherein COPD prevalence was higher in individuals 50 years and older (12). The general COPD prevalence (considering all or a combination of risk factors) was high in HICS and lower in women in urban settings. This can be explained by data indicating that women generally smoke less than men, and in HICS, they are generally not exposed to biomass smoke, unlike their counterparts in LMICS, who reside in rural settings(6). Moreover, the generally high prevalence of HICS can be explained by using a combination of diagnostic methods that

improve the diagnostic yield. Also, it is more culturally acceptable for both men and women to smoke in HICS compared to LMICS (13).

2.3 Risk factors for COPD

The plenitude of data on COPD emphasizes smoking or tobacco use as the leading behavioral risk factor. However, GOLD guidelines emphasize an interplay of risk factors such as genetics, environmental and occupational factors such as biomass smoke; as well as the comorbidity of COPD with other diseases (4). Diseases often found comorbidity with COPD include but are not limited to Human immune deficiency virus and acquired immune deficiency syndrome(HIV & AIDS), Tuberculosis (TB), Coronavirus (COVID-19), and mental disorders such as anxiety and depression. Furthermore, evidence indicates that other risk factors, such as environmental exposure to particles and fuels, are equally and independently implicated in the aetiology of COPD. Demographic risk factors such as age (older age), gender, lower level of education, and living in a rural area have also been implicated specifically for developing countries (14).

2.3.1 Smoking/Tobacco use

For decades, COPD research predominantly implicated smoking as the principal causal factor for all cases. While there has been a recent shift in this perspective, smoking continues to be recognized as a prominent global risk factor for COPD (7). Smoking is classified as both an environmental and behavioral risk factor. For instance, it is environmental in the sense that an individual can be exposed to it through second-hand smoking, as well as direct smoking, which would be classified as behavioural (7).

There are assumptions that the clinical presentation of COPD patients who are current or ex-smokers is different from that due to exposure to other factors. Moreover, this also differs according to exposure to the type of smoke(i.e., tobacco smoke or biomass smoke). For instance, in the study by Postolache et al. (15), COPD patients with a prior history of biomass exposure exhibited a comparatively mild degree of airflow obstruction in contrast to patients with a history of tobacco smoking. Additional distinguishing clinical features of these patients encompassed anthracosis, pulmonary fibroids, and little to no emphysema (15). However, there is little data on this, and it has not been established in the South African and African contexts at large. Furthermore, various factors determine the clinical presentation of smoking-related COPD, as GOLD highlighted an interplay of multiple factors in the development of COPD(4). In the context of smoking, such factors would include age of onset of smoking and number of years of smoking calculated in pack years.

The prevalence of smoking-related COPD is relatively higher in the Western region compared to the Sub-Saharan African region, as evidenced in the literature. Adeloye et al.'s systematic review established that a substantial proportion of COPD cases in Western regions (70%) were linked to smoking, while in LMICs, environmental exposures such as dust and fumes accounted for 60% of the cases(6). Similarly, the prevalence of spirometry-defined COPD in 2019 was higher in Europe than in other regions and significantly increased with the level of income(6). In this study, the authors did not account for why the prevalence of COPD increased with the level of income. However, this could mean either two or both of the following: with an increase in income, people can afford more tobacco products and thus smoke more than low-income earners. An alternative hypothesis could be that low-income earners are exposed to high levels of occupational environmental exposures such as dust and fumes.

Consistent with data implicating tobacco use in COPD, the prevalence was higher in HIV+ patients who were current smokers than in ex and never-smokers (6). There were also no differences in sex, which might be a result of high levels of tobacco consumption in women in HICS such as Europe, and high levels of indoor air pollution and biomass smoke for women in LMICs. Despite a high COPD prevalence of 17.5%, a rural Tanzanian COPD prevalence study found that the prevalence of ever-smokers and current-smokers was 25.2% and 5.4%, respectively. This reiterates the significant contribution of risk factors other than smoking. (16). Data from African countries such as Uganda report different results from those from Western countries regarding smoking-related COPD. The correlation study in rural Uganda did not record associations between respiratory symptoms and smoking status(13). The prevalence of smoking risk factors for current smokers was 17.02%, and 14.92% of those that had COPD. The general prevalence of smoking in this study was 5.4%. However, smoking was among the common risk factors for COPD in this study's population(17).1.4.2 Indoor air pollution and biomass smoke exposure

Indoor air pollution and biomass smoke have been highlighted as a top risk factor for women in LMICs, specifically those who reside in rural areas(12,18). Indoor air pollution refers to the burning of fires inside the house as means of heat and energy(i.e, cooking). Biomass smoke includes wood, charcoal, cocaine, crop residues, and dung that are used as a means of heat and energy source (14). In a study by Germet and colleagues(2016), Ghanaian men and women who had developed COPD had never smoked but had a long history of reliance on heat from biomass as the primary source of energy. Moreover, the risk attributable to biomass fuels was similar to that due to the risk of tobacco smoking(19). This differs from findings in a Tanzanian study, where no substantial associations were observed between the prevalence of COPD and

biomass smoke exposure(16). The association was not explored, but 99% of participants used biomass fuel as an energy source. Seeing this prevalent use of biomass fuel, the authors recommended further studies into this association in rural Tanzania.

In China, living in a rural area was one of the highest risk factors for the development of COPD(14). It is plausible that this was due to the heavy reliance on wood and open fires as a heat and energy source that characterizes the style of living in similar areas in SA and Africa at large. A similar trend was established in rural Ethiopia, where 91.9% of women reported previous exposure to biomass compared to 75.3% of their male counterparts (12). This is important data to consider as most of the poor and poor working class in rural SA also rely on biomass heat as a means of energy (20). Moreover, the current state of the electricity supply in SA can contribute to the increased exposure to biomass smoke through cooking. Loadshedding exacerbates the likelihood of heightened exposure to biomass smoke during cooking activities, underscoring the relevance of this information for comprehensive analysis and intervention strategies in the context of energy accessibility and public health.

The low rates of tobacco smoke-related COPD and high prevalence of biomass smoke in sub-Saharan Africa suggest that exposure to other non-tobacco smokes might surpass tobacco exposure, or the consequences of the former might be dire. It is also worth noting that smoking among women in Africa is not as common practice as it is in HICS. For example, HIV+ females had a higher frequency of biomass exposure than their male counterparts, with household cooking being the main activity associated with biomass exposure.

2.3.2 Occupational Risk Exposure

Occupational risk exposure in COPD is classified as secondary to tobacco and biomass smoke exposure(21). It is currently estimated to be responsible for 31% of COPD cases in non-smokers (19). Occupational exposures include organic and inorganic dust, chemical agents, and fumes. The main population affected by occupational risk exposure are mine workers and those who work in related fields, wherein they are exposed to inhalants. Additionally, compared to their white counterparts, black South African men are the population most vulnerable to occupational risk exposures. This is because over 90% of people in the mining sector and related fields in SA are black men(22). A similar sex trend was established in Tanzania in a prevalence study wherein about 49.1% of men with COPD were either ex-or current mine workers.

2.4 COPD and Clinical Comorbidities

The co-existence of communicable diseases, mental disorders and other risk factors have been found to interact to drive the development of NCDs. HIV & AIDS, COVID-19, and TB are some of the diseases that have been implicated in the development and exacerbation of COPD.

2.4.1 HIV & AIDS

Epidemiological studies have established that respiratory and lung diseases are generally common in patients with HIV/AIDS. The adaptation of the WHO "test and treat" policy in the management of HIV has resulted in the worldwide availability of HIV treatment, such as antiretroviral therapy. This has subsequently decreased the mortality of HIV, which can also be translated into increased life expectancy of HIV+ persons. While this is encouraging in the context of HIV & AIDS management, it is associated with increments in the diagnosis of comorbidities such as COPD in this population; in prevalence of and disease burden for COPD, as well as poor QOL (23). For instance, ARVs are hypothesized to cause at least one respiratory symptom (i.e., airway obstruction) common in the clinical presentation of COPD (18,23).

In a correlational study of HIV and COPD, about 23% of HIV-positive patients who were non-smokers presented with emphysema and airway trapping, which are significant symptoms of COPD (9). Similarly, a study on 234 outpatients established that 31% of that population suffered at least one respiratory symptom (23). Consistent with this, the prevalence of severe dyspnoea in people living with HIV in rural Uganda was 70% (by self-report) (17)

The data on HIV-associated COPD in Africa is scant. This is concerning as the Sub-Saharan African region is heavily burdened with HIV, with the highest prevalence being in this region. Nigeria, Malawi and Uganda are amongst the few countries that have conducted prevalence studies of HIV-associated COPD in this region. In 2018, Ankabi and colleagues conducted a study in Nigeria in a population of 356 participants. According to GOLD guidelines, the prevalence of COPD was 15.4% and 12.1% using the LLN definition. In addition, all COPD cases recorded in this study were of mild and or moderate severity (18). However, we will only focus on the GOLD COPD results that align with the definition used in this study. A similar study in Uganda recorded a drastically low 4% prevalence of COPD but was higher in HIV patients (17).

Similarly, a Malawian study did not report any HIV-associated COPD cases in their study(24). This is inconsistent with data from the veteran's comparative study of HIV+ and HIV- patients, wherein those who had contracted HIV were 50% more likely to receive a COPD diagnosis by

ICD-9 guidelines and 68% self-reported COPD (25). In summary, the prevalence of COPD in the HIV population reported from sub-Saharan African studies is inconsistent with the higher rates from American and European studies. The systematic review of Ankbi and Asangbe revealed that the prevalence of COPD in the HIV& AIDS population was higher in the European region and among current smokers(18). Reasons for this were not stated in the systemic review. However, the results are not surprising, owing to the high HIV & AIDS prevalence in the African region.

Conclusively, the relationship between HIV and COPD is not entirely clear. Moreover, data from different world regions presents conflicting data. For example, the Ugandan study did not record significant associations between ART and the risk of developing COPD. This is similar to the 55% probability of receiving a COPD diagnosis in the veterans study, which was conducted in a period when the availability of HIV treatment was limited (25). Interestingly, in Nigeria, most COPD cases within the HIV population were recorded during a period when ART was highly available in the country. Some studies have cited viral load and pulmonary macrophages as significant risk factors for HIV-associated COPD. To conclude, longitudinal studies on COPD and HIV patients might help shed more light on the relationship between the two.

2.4.2 Tuberculosis

TB has also been implicated in the pathogenesis of COPD in both HICS and LMICs due to the prevalence being higher in the latter. Considering the clinical characteristics of TB-associated COPD, such as bronchiectasis, some researchers have coined the term TOPD to describe TB-associated COPD, moreover, with the argument that it manifests differently from COPD with a different aetiology (24). Early diagnosis and the faster progression of TOPD are some of the other clinically differentiating factors of TOPD observed in other studies. Another contributing factor to this controversy is the fact that COPD may develop during or after the treatment of TB. TOPD tends to be diagnosed earlier and then progresses faster than smoking-related COPD.

One of the symptoms of COPD that is observed in TOPD is airflow obstruction. A study conducted between 1964 and 1966 with 1403 TB patients revealed that 23% experienced airflow obstruction. Consistent with this, a study conducted in the same period established clinical evidence of airflow obstruction in 61% of 1533 adult TB patients (26).

Smoking, sex and age have been found to interact with TB to cause the development of airflow obstruction. Smoking is an established risk factor for both TB and COPD. In individuals with

TB, smoking can exacerbate lung inflammation and impair the lungs' ability to clear the infection. In addition, chronic smoking can lead to the development of COPD, which involves airflow limitation and persistent respiratory symptoms. In certain populations, males are more likely to develop TB and COPD compared to females. This may be attributed to biological and behavioural factors such as hormonal differences, genetic predispositions, and exposure to environmental pollutants (27). These sex-specific factors can interact with TB infection, exacerbating airflow obstruction and respiratory symptoms in susceptible individuals (24,26).

Another significant risk factor for both TB and COPD is age (28). Older individuals are more likely to develop TB and COPD due to age-related changes in the immune system, reduced lung function, and cumulative exposure to environmental risk factors over time. Furthermore, ageing-related lung damage, such as emphysema and fibrosis, can contribute to airflow obstruction and respiratory impairment in individuals with TB, especially when combined with concurrent smoking and other risk factors (24,28).

A Korean study with 244 patients reported that TB is an independent risk factor for the development of airflow obstruction. In that study, 75% of those who presented with airflow obstruction had a history of TB (1). Similarly, a PLATINO comparative study of 5 countries revealed that 30.7% of the population with a history of TB suffered from airflow limitation, while 13.9% of those without a history of TB did not experience airflow limitation (29). Moreover, the association was stronger in participants who did not have a history of smoking.

Studies from Africa report similar results; a 2015 COPD prevalence study among HIV-positive patients in Cameroon observed that COPD was high in HIV+ patients with a history of pulmonary tuberculosis (10). Consistent with this, in the 2012 BOLD study, Cape Town ranked 3rd as the city with the highest prevalence of COPD, and about a quarter of the prevalence was associated with prior tuberculosis (self-reported) (3).

Overall, there is rich research evidence confirming the independent role of TB in the development of airflow obstruction. This includes observations in clinical longitudinal studies indicating that airflow obstruction in COPD patients is a consequence of active TB. BOLD has also highlighted TB as an independent risk for developing COPD later in life(3,24,26).

2.5 COPD and patients' quality of life

Since COPD is generally irreversible, meaning that while treatments and interventions can help manage symptoms and improve quality of life, they cannot restore lung function to normal or

fully reverse the underlying damage caused by the disease (4). It is important to understand its implications on patients' daily lives in the context of QOL and HRQL. Quality of life is understood as a subjective phenomenon that is influenced by personal value systems and self-imposed and selective standards. It refers to one's perception of position in life in the context of culture and value systems in which one lives and about goals, expectations, standards, and concerns (1,30). In SA, quality of life is defined in light of three factors: overall life satisfaction, happiness, and optimism (31). Considering this, HRQL can be thought of as the patient's subjective experience of the disease, consisting of treatment, need for healthcare or health-seeking behaviour, and subsequent health outcomes.

Respiratory impairment, physical impairment, social factors such as socio-economic status, age, education, and support, psychological factors such as health locus of control, and health-seeking behaviour have been identified as determinants of HRQL (32).

Understanding HRQL determinants can provide valuable insights such as functional status beyond descriptions of physiological impairment. HRQL measures provide a holistic assessment of the impact of the disease and the benefits of treatment for patients. Moreover, employing QOL measures in disease management can be useful in struggling health systems such as the one in SA, where access to spirometry and lung function tests is limited. Hence, knowing which aspects of the patient's life are impacted will help triage (i.e., which aspects of the affected areas are of priority in terms of treatment).

There is data intended to understand how each of the above factors interact to drive HRQL in patients. An Australian study of 126 severe COPD patients conducted between 1992 and 1994, found that patients reported severe impairment in their well-being, presumably because of respiratory impairment. In addition, a significant correlation was found between the activity component of the SGRQ and HRQL. It is, however, interesting to note that no relationship was found between symptomatology and HRQL, albeit that COPD is said to worsen with increasing age, and the mean age for that study was 65 years. This lack of a relationship reported between the demographic factors such as age and HRQL in that study contradicts the many COPD HRQL studies that have found that increasing age is associated with poor HRQL. Similarly, age-related differences in HRQL in COPD studies established an association between increasing age and lower SGRQ scores, which is indicative of poorer HRQL. Furthermore, in that study, dyspnoea, a symptom of COPD, was associated with worse HRQL in terms of increasing age, and its impact was higher in middle-aged adults.

There is only one QOL study in Africa that has used the SGRQ. In this study, women reported worse HRQL scores compared to their male counterparts. Almost as expected, ex-smokers had a total higher score in the symptom component compared to non-smokers. A significant relationship was found between the SGRQ activity sub-scale and total score, as well as FEV1; however, the correlation with FEV1 was weak (33). Consistent with results from studies in other parts of the world, in this study, patients who reported dyspnoea (self-reported) had a higher total score, indicative of worse HRQL. Lastly, factors such as GOLD stage, and demographic factors such as age, sex, and SES did not predict HRQL (16).

In the symptoms component, symptoms such as cough, wheeze, and sputum production did not significantly influence the HRQL. The authors explained that breathlessness has an overriding influence on HRQL over the other symptoms. This was interesting, as overall, patients with COPD in Nigeria reported worse scores in the symptom and activity subscales (18).

Concerning race, an American comparative study established differences between QOL scores using the SGRQ and the WHOQOL-Bref, as well as smoking behaviour in African-American and Caucasian COPD patients. Essentially, a significant proportion of African Americans were current smokers and experienced more hospitalizations than their white counterparts(34). This study reported a significant correlation between younger age and dyspnoea; which is inconsistent with other QOL studies. However, there was no relationship between race and HRQL, i.e. race did not influence patients' HRQL. Interestingly, despite race, African Americans had a higher HRQL score than their counterparts.

2.6 Conclusion

COPD presents challenges in defining and diagnosing the condition due to various standards employed in research and clinical practice. COPD severity is classified into four stages (I-IV) based on forced expiratory volume in one second. Different guidelines, such as BOLD and GOLD, are utilized to diagnose COPD globally, particularly LMICs.

The prevalence of COPD varies due to differing diagnostic criteria and regional factors. Studies from HICs show a higher prevalence among smokers, while LMICs report a significant COPD burden unrelated to smoking, often attributed to biomass smoke exposure. Additionally, occupational risk factors, such as mine work, contribute to COPD prevalence, especially in certain demographics.

Comorbidities like HIV/AIDS, TB, and COVID-19 exacerbate COPD. HIV/AIDS patients, due to improved treatment resulting in patients living longer, exhibit increased COPD diagnoses, impacting their quality of life. In LMICs, TB is a significant risk factor for COPD development, and TB-associated COPD progresses faster and presents differently from smoking-related COPD.

COPD profoundly impacts patients' quality of life (QOL) and health-related quality of life (HRQL), influenced by respiratory and physical impairment, social factors, and health-seeking behaviour. Although limited data is available from Africa, studies show worse HRQL among women and ex-smokers, with breathlessness significantly affecting QOL.

In conclusion, effective COPD management should consider diverse risk factors and comorbidities and their implications for patients' QOL. Addressing regional disparities in COPD diagnosis, understanding unique risk factors, and assessing HRQL determinants are crucial for providing effective COPD care in diverse contexts.

Chapter 3: Methods and Materials

This chapter delineates the study's methodological approach. First, the study design will be presented, followed by ethical considerations, the study population, and the instruments used to collect data. The chapter will conclude with a focus on the data analysis method employed in the study.

3.1 Study design and setting

This study employed a sequential explanatory mixed methods design and was conducted in two of the three academic hospitals (Charlotte Maxeke and Helen Joseph academic hospitals) in Johannesburg, South Africa. The hospitals were selected due to their affiliation with the University of the Witwatersrand. They serve as major teaching hospitals for medical students, interns, and other healthcare professionals. This academic partnership allows for integrating education, research, and clinical practice, contributing to advancements in medical knowledge and patient care. There are dedicated respiratory clinics in both hospitals on specific days a week(Mondays and Wednesdays at CMJAH and Wednesdays at HJAH). During the clinic days, the clinic staff consists of 2 nurses, an administrator, and about 5 Drs to attend to the patients. The patients attend the hospital for respiratory care through referrals from local clinics or other hospital departments.

3.2 Study population

3.2.1 Sampling and sampling strategy

According to information from the Department of Internal Medicine's pulmonology unit, the clinic attends roughly 2600 patients yearly in each hospital.

The sample size was calculated using Rao-soft software. A 95% confidence interval was selected together with a 5% sampling error, and a P value of 0.05 was considered. Taken together, the sample size totalled (n=367) in the three hospitals, that is (n=122 in each hospital). Consecutive patients diagnosed with COPD were approached on their follow-up clinic visit days at the academic hospitals between September 2022 and April 2023. The prospective participants were given a participant information document, and clarity was provided on any concerns. Patients who showed interest were asked to sign a written consent form. The

inclusion criteria included being an outpatient at the academic hospital with a valid COPD diagnosis on the respective patient file. Patients who presented with clinically unstable COPD and those living with severe mental disorders that would impair their ability to consent to the study were excluded. Recruitment continued until a total of 367 diagnosed outpatient COPD patients (238 in HJAH and 123 at CMJAH) were sampled. The unequal number of sampled patients in each academic hospital resulted from delays in approval for research at CMJAH. However, the sampling was proportionate to the sampling size for the study and the size of the two respiratory clinics.

3.3 Instruments

3.3.1 Health status and quality of life measurement

HRQL was assessed using the Saint George Respiratory Questionnaire (SGRQ) developed by PW Jones of the Saint George's Hospital Medical School(35). Permission to use the tool was received from the developers (Appendix H). The SGRQ is a sensitive disease-specific instrument used worldwide in previous COPD and other lung disease studies (including in African populations). Furthermore, it has adequate inter-rater reliability and reproducibility that can quantify change over time (r= 0.70 to 0.90). It has 50 items spread across three components that measure symptoms, activities of daily living, and impact, with a total of 76 responses. The symptoms component measures the level of clinical presentation in the context of frequency and severity of symptoms (i.e., cough). The activity component focuses on daily activities associated with the patient's routine living, such as bathing/dressing, that are either limited by or cause breathlessness when performed. The impact component relates to factors such as employment, control of health (e.g., need for treatment or hospitalization), side effects of COPD, and disruptions in the patient's daily living because of the disease.

It has a total score and domain score for the three domains (symptoms, activity, and impact), ranging between zero and hundred, where zero represents the best HRQL and hundred represents the worst possible HRQL. In sum, a higher score indicates a worse HRQL (35).

3.3.1.1 COPD Assessment Tool (CAT)

The COPD Assessment Tool (CAT) is a widely used self-administered questionnaire designed to assess the health status and impact of COPD on patient's lives. It was also developed by Jones et al. and has become a valuable tool for healthcare professionals in evaluating the severity of COPD symptoms and their effects on a patient's overall well-being. It has a

Cronbach alpha of 0.70 or higher, depending on the study population. Permission to use the tool was received from the developers from their website (see Appendix H for permission to use the tool).

It consists of 8 items that address common symptoms experienced by individuals with COPD, including cough, phlegm production, chest tightness, breathlessness, and limitations in physical activities. Each item is rated on a scale from 0 to 5, with higher scores indicating more severe symptoms or greater impairment. The total CAT score can range from 0 to 40. Higher scores indicate the significant impact of COPD on a patient's quality of life (36).

3.3.1.2 non-health-related Quality of Life

In this study, general QOL was measured with the World Health Organization Quality of life scale (WHOQOL-Bref) with 26 questions. Permission to use the tool was received from WHO (Appendix I). The first two questions are concerned with the patient's perception of their health status and general QOL. The remainder of the questions fall under the following aspects: Psychological, physical, social relationships, and environment. It is a positively scored instrument, with scores of the negatively worded questions reversed for total score calculation. In this instrument, a higher score indicates better QOL, and a lower score suggests poor QOL (37). For this study, perception of health, physical health, and psychological health were classified under HRQL. In the same vein, the Perception of QOL, social relationships, environmental health, and the total of the tool were assessed as non-HRQL.

One of the primary strengths of the WHOQOL-BREF is its cross-cultural applicability. The questionnaire was developed with input from individuals from diverse cultural backgrounds, ensuring that it can capture aspects of quality of life that are relevant across different societies and cultures. The questionnaire has been shown to produce consistent results and effectively measure quality of life in different contexts.

Demographic data, such as gender, age, race, ethnicity, location, and occupation, were collected from the patient's file. The age range for this study was defined according to the WHO 2022 age range definition. Four categories were outlined: young age ranging from 25 to 44, Middle age from 44 to 60, Elderly age from 60 to 75, Senior age from 75 to 90, and lastly, long-livers, patients over 90 years old.

Additional clinical information, such as the GOLD stage of COPD, medication, and duration of COPD diagnosis, were also obtained from the patient's file.

Both the SGRQ and WHO-QOL100 were administered to the patients during their clinic or follow-up visits during the waiting period to be attended by the doctor. Some patients who

were too sickly or verbally expressed disinterest in completing the questionnaire by themselves had the questionnaires completed on their behalf by family members accompanying them or the researcher without bias or undue emphasis. Lastly, permission to use both questionnaires was obtained from the developers.

3.3.3 Focus groups.

Due to patients' reluctance to stay behind after their appointments for focus groups, we could not conduct focus group interviews.

3.4 Data analysis

We employed STATA version 17 software for descriptive statistics analysis. Initial data was captured on an Excel spreadsheet, which underwent data cleaning, including the removal of missing values before being imported into STATA.

3.4.1 Data Entry

Data from the SGRQ instrument was analyzed and scored using the Excel-based scoring template from the developer of the SGRQ tool. Scores for the three components of the tool were derived, as well as the additional total scores. The WHQOL scores were calculated using the WHOQOL calculator on the `WHO website. Similar to the SGRQ scoring method, component and total scores were derived. The same was true for the CAT score and the WHOQOL-BREF tool.

3.4.2 Descriptive statistics.

Kolmogorov-Sminorv and Shapiro-Wilk normality tests were conducted for all three quantitative tools employed in the study. The Kolmogorov-Smirnov test and the Shapiro-Wilk test are both statistical tests used to assess the normality of a dataset (38,39). The normality tests were conducted for the total scores of each tool and component scores in each tool. We established that some of the total and component domains were not normally distributed, so we employed non-parametric statistical tests for the analysis.

3.4.3 Analytical statistics

To evaluate potential gender and hospital differences between the QOL of COPD participants, Mann-Whitney U tests were performed for all three measurement tools. Mann-Whitney U test

is a non-parametric test used to compare two sample means from the same population and test whether the two means are equal(38,39).

Furthermore, post hoc Kruskal-Wallis tests were employed to examine differences between various participants' subgroups' exposure variables regarding age, ethnicity, smoking status, and the GOLD stages. The Kruskal-Wallis test is a rank-based non-parametric test used to determine if there are significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable (39).

3.4.4 Quantile Regression Analysis

Since the data in our study was not normally distributed, we employed quantile regression. Quantile regression is a statistical method used to model the relationship between variables, specifically focusing on various quantiles or percentiles of the dependent variable. Its primary purpose is to analyze the conditional distribution of the response variable rather than just the conditional mean, which is the focus of ordinary least squares (OLS) regression (38).

3.6 Ethical considerations

Ethical clearance to conduct the study was obtained from the human research committee of the University of the Witwatersrand (Appendix A & B). Permission to conduct the research and access the medical records of patients was also obtained from the management of the academic hospitals and their pulmonology units(Appendix C&D). Lastly, the study was also registered on the Gauteng provincial research directorate and the National Health Research Depository (NHRD).

Considering the 2020 POPIA act, three consent forms were distributed to patients who participated in the study to provide their written consent: consent to participate in the study (Appendix E), consent to access the medical records(Appendix F), and consent to audio record the focus group interviews(Appendix G).

Chapter 4: Results

4.1 Sociodemographic factors among COPD patients

4.1.1 Number of patients per hospital

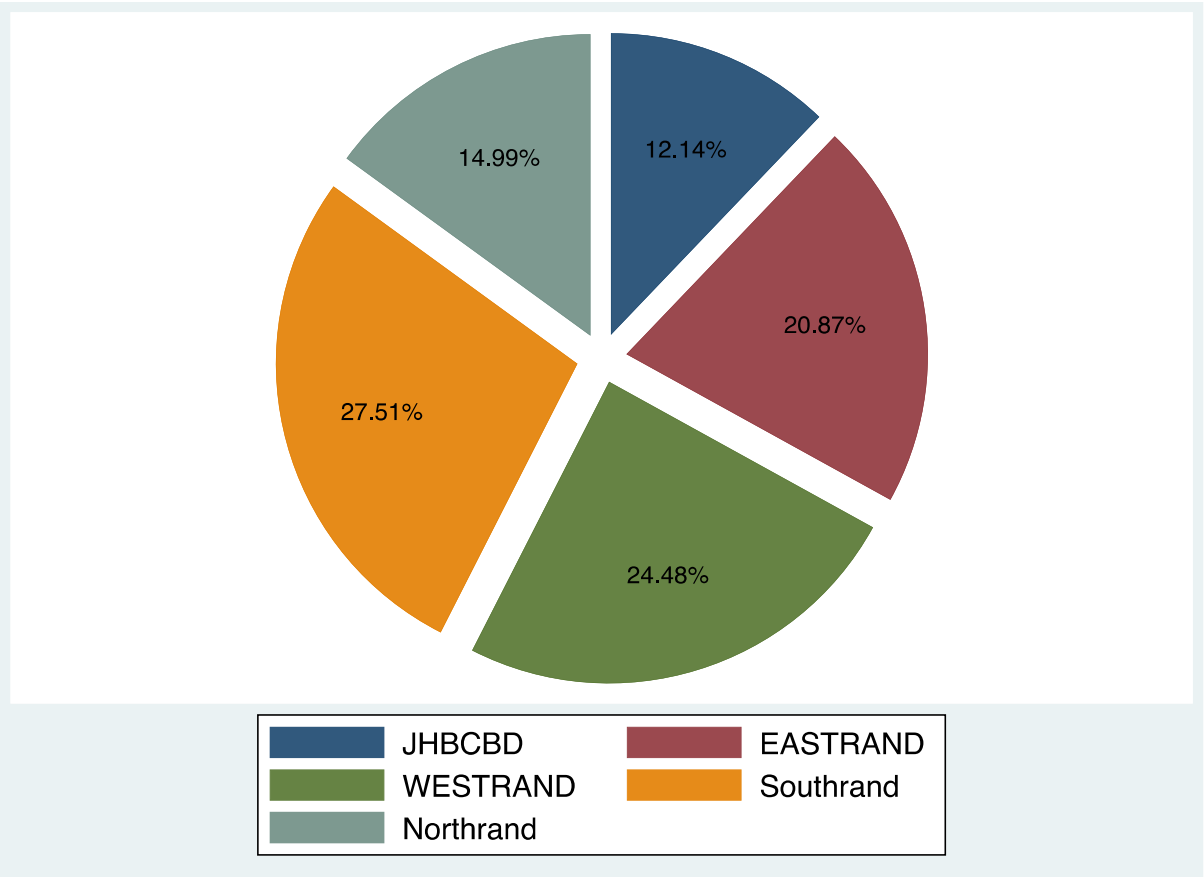
Table 4.1: Number of participants per hospital per gender.

Referring hospital/clinic	Male	Female	Total	Percentage
HJAH	123	115	238	65%
CMJAH	72	51	123	34,87%
Total	**195**	**166**	**361**	**100%**

Our sample comprised 361 COPD participants from Charlotte Maxeke and Helen Joseph academic hospitals. A large fraction of the sample (65%) was from HJAH (N=238).) The remainder of the patients attended CMJAH (N=123).

In terms of gender distribution, the sample consisted of 46% female and 54% male COPD patients (N=166; N=195, respectively). Table 4.1 above summarizes the distribution of patients per gender per hospital.

Figure 4.1: Summary of the distribution of participants across Johannesburg.



Regarding the patient's area of residence, the study's population was evenly distributed among the four Johannesburg districts and the central business district (CBD) (Figure 1). This includes the Eastrand, Northrand, Southrand and Westrand. The majority of patients resided in the South of Johannesburg, constituting the largest proportion (27.51), followed by 24.48% of patients from the West Rand. Patients from the JHB CBD were the least represented at 12.14% of the overall study population.

4.1.2 Age range

Table 4.2: Age distribution stratified by gender.

Age group	Gender					
	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Young Age	4	1.10%	8	2.21%	12	3.32%
Middle Age	72	19.94%	62	17.17%	134	37.11%
Elderly Age	88	24.38%	68	18.83%	156	43.21%
Senile Age	29	8.03%	27	7.48%	56	15.51%
Long livers	2	0.55%	1	0.28%	3	0.83%
Total	195	54%	166	45,98%	361	100%

The sample comprised of a large fraction of elderly age patients (43.21%; n=156), while young aged and long-lived patients were least represented. For gender distribution, the majority of middle-aged patients were males (19.94%; N=72), while in the elderly age group, both genders were evenly distributed. In the senile age group, there were slightly more males (8.03%; N=29) than females (7.48%; N=27). In the young age group, there were more females (2.21%, N=8) than males.

Table 4.3: Age distribution stratified ethnicity.

	Ethnicity									
Age group	African	Percentage	Coloured	Percentage	Indian	Percentage	White	Percentage	T patient	T percentage
Young Age	7	1.94%	0	0.00%	3	0.83%	2	0.55%	12	3.32%
Middle Age	71	19.67%	23	6.37%	15	4.16%	25	6.92%	134	37.11%
Elderly Age	72	19.94%	21	5.82%	24	6.65%	39	10.80%	156	43.21%
Senile Age	29	8.03%	4	1.11%	3	0.83%	19	5.26%	56	15.51%
Long livers	1	0.28%	1	0.28%	0	0.00%	1	0.28%	3	0.83%
Total	180	49.86%	49	13.57%	45	12.47	87	23.81%	361	100%

The distribution of ethnicity varied across age groups. 49% of our sample were inherently African participants (N=180). In the senile age group, African patients were the majority (8.03%), and in the long-lived age group, the distribution was relatively balanced among different ethnicities. Lastly, there were no “long-livers” in the Indian population.

4.1.2 Education

Table 4.4: Summary of participants' highest qualification per gender distribution

	Gender					
Education	Male	Percentage	Female	Percentage	Total patients	Total Percentage
University	83	22.99	86	23.82	169	46.81%
Matric	93	25.76	62	17.17	155	42.94%
Primary school	19	5.26	18	4.99	37	10.25%
Total	195	54.01	166	45.98	361	100%

The patients' educational background and gender were also assessed to understand the education level of our sample. A significant proportion of the 361 patients held a university-level education, comprising 46.81% of the total sample. Among them, 22,99% (83) were male and 23.82% (86) were female. Patients with matric level education accounted for 42.94%; in this category, the number of males who had matric education was 8,59% higher than that of females (17.17%). (Table 4.4)

Table 4.5: Summary of participants' highest qualification by ethnic distribution

Education	Ethnicity									
	African	%	Coloured	%	Indian	%	White	%	Total patients	Total Percentage
University	68	37.78	12	24.49	32	71.11	57	65.52		
Matric	91	50.56	28	57.14	12	26.67	24	27.59		
Primary school	21	11.67	9	18.37	1	2.2	6	6.9		
Total	180	100%	49	100%	45	100%	87	100%	361	100%

The patients' education level was also stratified by ethnicity. The dataset showed that most African (50.56%) and Coloured (57.14%) patients had a matriculation-level education. This can be contrasted with the majority of Indian (71.11%) and White patients (65.52%) possessing a university-level education. Table 3.2

4.1.3 Employment status

Table 4.6: A representation of participants' employment status summarized by gender.

Employment status	Gender					
	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Employed	55	28.21%	43	25.90%	98	27.14%%
Unemployed	27	13.85%	27	16.27%	54	14.95%
Pensioner	113	57.95%	96	57.83%	209	57.89%
Total	195	100%	166	100%	361	100%

Employment status can significantly affect an individual's QOL. On the other hand, COPD impairs lung function and limits physical abilities, which may affect patients' ability to work. To understand the employment background of our sample, we analyzed the employment status of the patients by gender, age group, and ethnicity. Most participants were pensioners, representing 57.89% of the sample (N=209), and only 27.14% were employed. Table 4.1 below shows that among male patients, 28.21% were employed, while 57.95% were pensioners. The percentage of females who were pensioners was not that distinct from their male counterparts (57.83%).

4.3.3 Smoking status

Table 4.7: A representation of participants' smoking status stratified by gender.

Smoking status	Gender					
	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Current smoker	119	61.03	84	50.60%	203	56.23%%
Ex-smoker	47	24.10	39	23.49%	86	23.82%%
Never smoker	29	14.87	43	25.90%	72	19.94%%
Total	195	100%	166	100%	361	100%

From the table above, we can see that 56.23% (N=203) were current smokers, while those without a smoking history represented 19.94% of the participants in our study. The distribution of smoking status among patients was stratified by gender, age group, and ethnicity. Table 4.8 below shows that among males, 61.03% were current smokers, while the percentage of female current smokers was approximately 10% less than that of males (50.60%). Conversely, the percentage of female patients who had never smoked was higher than that of male patients (25.90% vs 14.87%). In summary, among all participants, 56.23% were current smokers, 23.82% were ex-smokers, and 19.94% were never smokers.

Table 4.8: A representation of participants' smoking status stratified by age group

Smoking status	Age group									
	Young age	Percentage	Middle age	percentage	Elderly age	Percentage	Senile age	percentage	Long livers	percentage
Current smoker	7	1.94%	75	20.78%	92	25.48%	27	7.48%	2	0.55%
Ex-smoker	1	0.28%	34	9.42%	34	9.42%	16	4.43%	1	0.28%
Never smoker	4	1.11	25	6.93%	30	8.31%	13	3.60%	0	0.00%
Total	12	3.32%	134	37.12%	156	43.21%	56	15.51%	3	0.83%

In terms of age groups, the majority of current smokers were in the elderly age group (25.48%; N=92), whereas ex-smokers were evenly distributed among the age groups. Similarly, patients who had never smoked were most prevalent in the elderly age group (8.31%; N=30).

Table 4.9: A representation of participants' smoking status stratified by ethnic group.

Smoking status	Ethnicity									
	African	Percentage	Coloured	Percentage	Indian	Percentage	White	Percentage	T patient	T percentage
Current smoker	69	19.11	41	11.36	33	9.14	60	16.62%	203	56.23%
Ex-smoker	51	14.13	7	1.94	10	2.77%	18	4.98%	86	23.82%
Never smoker	60	16.62%	1	0.28%	2	0.55%	9	2.49%	72	19.94%
Total	180	49.86%	49	13.57%	45	12.47%	87	24.1%	361	100%

Regarding ethnicity, African patients had the highest percentage of current smokers (19.11%; N=69), followed by White patients with 16.62%(N=60). Of the 45 Indian patients, 73% were current smokers (N=33). Similarly, 91% of Coloured patients were current smokers (N=41),

which is the highest in all the ethnic groups. 28% of the African patients were ex-smokers, followed by 19% white patients. Lastly, only one Coloured patient was classified as a never-smoker.

4.2 Distribution of clinical risk factors among COPD patients.

4.2.1.1 Gender-related differences in the distribution of comorbid communicable diseases.

Table 4.10: Gender differences in the distribution of comorbid communicable diseases

	Gender					
COVID-19 history	Male	Percentage	Female	Percentage	Total patients	Total Percentage
YES	85	23.54%	75	20.77%	160	44.31%
NO	110	30.47%	91	25.20%	201	55.67%
	Gender					
TB History	Male	Percentage	Female	Percentage	Total patients	Total Percentage
YES	69	19.11%	72	19.94%	141	39.05%
NO	126	34.90%	94	26.03%	220	60.93%
	Gender					
HIV status	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Negative	125	34.62%	108	29.91%	233	64.53%

Positive	70	19.39%	58	16.06%	128	35.45%

In terms of COVID-19 history, 44.31% of the total patients had a history of COVID-19, with the percentage of male patients with a history of COVID-19 being slightly higher than that of their female counterparts. Regarding TB history, 39.05% of the total patient population had a history of TB, with 19.94% being female. The proportion of participants without TB history was higher among males than females (34.90% vs 26.03% respectively). Shifting to HIV status, a large fraction of the patients were HIV-negative (64.53%). Participants who reported being HIV-positive accounted for 35.45%(n=128 of the study sample.

4.2.1.2 Age-related differences in the distribution of comorbid communicable diseases.

Table 4.11: Summary of the distribution of comorbid communicable diseases across the age groups.

COVID-19 history	Age group									
	Young age	Percentage	Middle age	Percentage	Elderly age	Percentage	Senior age	Percentage	Long-livers	Percentage
YES	7	1.93%	57	15.23%	71	19.66%	23	6.37%	2	0.55%

NO	5	1.38%	77	21.32%	85	23.54%	33	9.14%	1	0.27%
TB History	Young age	Percentage	Middle age	Percentage	Elderly age	Percentage	Senior age	Percentage	Long-livers	Percentage
YES	5	1.38%	48	13.29%	62	17.17%	24	6.64%	2	0.55%
NO	7	1.93%	86	23.82%	94	26.03%	32	8.86%	1	0.27%
HIV status	Young age	Percentage	Middle age	Percentage	Elderly age	Percentage	Senior age	Percentage	Long-livers	Percentage
Negative	9	2.49%	84	23.26%	104	28.80%	33	9.14%	3	0.83%
Positive	3	0.83%	50	13.85%	52	14.40%	23	6.37%	0	0.00%

Table 4.11 is a summary of the distribution of comorbid diseases across the different age groups. The distribution of COVID-19 history among different age groups revealed that middle-aged patients constituted the highest percentage of 15.23% who had a history of COVID-19, while elderly patients were most of the patients without a history of COVID-19 at 23.54%. In terms of TB history, elderly participants represented 17.17% of the total sample with a history of TB and 26.03% without a history of TB among all the age groups. A similar trend was observed in elderly patients concerning HIV status, where the highest percentage of HIV-positive patients was in this age group at 14.4%. Notably, none of the long-lived individuals were HIV positive.

4.2.1.3 The distribution of Comorbid communicable diseases by smoking status

Table 4.12: Summary of the distribution of comorbid communicable diseases stratified by smoking status.

COVID-19 history	Smoking status					
	Current Smoker	%	Ex-smoker	%	Never smoker	%
YES	91	25.20%	44	12.18%	25	6.92%
NO	112	31.02%	42	11.63%	47	13.01%
TB History	Current Smoker	%	Ex-smoker	%	Never smoker	%
YES	78	21.60%	30	8.31%	33	9.14%
NO	125	34.62%	56	15.51%	39	10.80%
HIV status	Current Smoker	%	Ex-smoker	%	Never smoker	%
Negative	129	35.73%	56	15.51%	48	13.29%
Positive	74	20.49%	30	8.31%	24	6.64%

In the analysis of COVID-19 history by smoking status, it was found that among current smokers, 25.20% had a history of COVID-19, while among ex-smokers, 12.18% had a COVID-19 history (Table 5). Only 6.92% of patients who had never smoked reported a history of COVID-19. Again, current smokers represented the majority of patients without a history of COVID-19 at 19.31%, followed by 13.01% of patients who had never smoked. This finding aligns with general health recommendations that avoiding smoking can reduce the risk of respiratory infections, including COVID-19.

When examining TB history by smoking status, it was observed that current smokers represent an equally large fraction of those with and without a history of TB (21.60%; and 34.62% respectively). Among HIV-positive individuals, 20.49% were current smokers, and 6.64% were never smokers.

4.2.2 Gold stage

Table 4.13: Summary of the stratification of GOLD stage COPD by gender

GOLD stage	Gender					
	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Stage 1	2	0.56%	0	0.00%	2	0.56
Stage 2	60	16.67%	59	16.34%	118	32.78%
Stage 3	98	27.22%	72	20.0%	170	47.22%
Stage 4	35	9.72%	35	9.72%	70	19.44
Total	195	54.17%	166	46.06%	361	100%

The results in Table 4.13 above, provide insights into the distribution of patients across different GOLD stages, highlighting variations based on gender, age group, and ethnicity. The table is revealing in several ways: firstly, it depicts the predominance of GOLD stage 3 patients in our study (47%; N= 170). Secondly, the distribution of patients with GOLD stage 2 COPD, was 13% higher than that of patients with stage 4 diagnosis (N=118; N=70; respectively). Among males, the majority were in stage 2 (16.67; N=60) and stage 3 (27.22%; N=98), while among female patients, stage 3 was the most common(N=72).

Table 4.14: Summary of the stratification of GOLD stage COPD by age group

GOLD stage	Age group									
	Young age	Percentage	Middle age	Percentage	Elderly age	Percentage	Senior age	percentage	Long livers	percentage
Stage 1	0	0.00%	1	0.28%	1	0.28%	0	0.00%	0	0.00%
Stage 2	9	2.49%	67	18.55%	38	10.52%	4	1.10%	0	0.00%
Stage 3	3	0.83%	60	16.62%	90	24.93%	18	4.98%	0	0.00%
Stage 4	0	0.00%	6	1.67%	27	7.48%	34	9.41%	3	0.83%
Total	12	3.32%	134	37,12%	156	43.21%	56	15.49%	3	0.83%

Table 4.15: Summary of the stratification of GOLD stage COPD by ethnic group

GOLD stage	Ethnicity									
	African	Percentage	Coloured	Percentage	Indian	Percentage	White	Percentage	T patient	T percentage
Stage 1	2	0.56%	0	0.00%	0	0.00%	0	0.00%	2	0.56%
Stage 2	69	19.17%	16	4.44%	12	3.32%	22	6.09%	119	32.96%
Stage 3	83	23.06%	25	6.94%	23	6.39%	39	10.80%	170	47.22%
Stage 4	26	7.22%	8	2.22%	10	2.78	26	7.20%	70	19.44%
Total	180	50.00%	49	13.61%	45	12.49%	87	24.09%	361	100%

When considering age groups, the elderly age group had the highest percentage in stage 3 (24.93%N=90), while the middle age group had the highest percentage in stage 2(18.55%; N=67). All three patients in the long-livers category had a GOLD stage 4 diagnosis. Table 9.2. When comparing the COPD stage, we can see that the only two patients with GOLD stage 1 were African. Table 9.3.

4.3 Health-related quality of life results

4.3.1 Gender-related differences in the health-related quality of life of COPD patients.

Table 4.16: Gender differences in health-related quality of life scores

SGRQ scores	Gender				
	Male	IQR	Female	IQR	P value
Total score	60.51	53.39-65.56	57.40	51.94-65.52	0.13
Symptoms score	77.9	63.83- 88.09	74.1	58.89-85.78	0.10
Activity score	54.4	42.5- 64.82	50.76	37.53- 62.85	0.49

Impact score	60.57	51.59- 67.81	58.25	49.82- 65.66	0.14
CAT score	23	16-29	21.5	15-29	0.22

Table 4.16 illustrates the HRQL results of our study's COPD participants using the two HRQL assessment tools outlined in Chapter 2. The Mann-Whitney test results indicate that there were no statistically significant differences in SGRQ and CAT scores between male and female participants, as evidenced by the p-values, which were greater than the typical significance level of 0.05.

When comparing the SGRQ total score, male patients reported higher scores of 60.51(IQR=53.39-65.56) than their female counterparts, who reported a total score of 57.40(IQR=51.94-65.2). A similar pattern was observed for the component scores wherein the male patients tended to have slightly higher scores than their female counterparts, but these differences did not reach statistical significance. Lastly, the different CAT scores reported by the two genders were not too distinct; however, male patients again scored higher at 23(IQR=16-29) than their female counterparts at 21.5(IQR=15-29).

4.3.2 Ethnic-related differences in HRQL: An analysis of SGRQ

Table 4.17 presents an overview of SGRQ scores among different ethnic groups. Indian patients demonstrated the highest median total score at 63.53 (IQR=53.5-71.98), followed by African patients with a median score of 59.66 (IQR=52.99-64.97). In contrast, Coloured patients displayed the lowest total score of 56.27 (IQR=51.62-63.82) within the ethnic groups. However, it's important to note that these ethnic variations in SGRQ total scores did not achieve statistical significance, as indicated by a p-value of 0.06.

This trend of Indian patients scoring higher than their counterparts extended to the symptom, activity, and impact domains. Conversely, Coloured patients consistently scored lower in the component scores than the other three ethnic groups.

Table 4.17: Summary of ethnic-related variations in SGRQ

SGRQ Scores						
Ethicity	**Symptoms**	**IQR**	**P value**	**Activity**	**IQR**	**P value**
African	74.72	61.43-86.09		54.42	42.52;63.08	
Coloured	70.7	58.33-88.18		47.5	38.22-63.29	
Indian	81.06	67.69-90.88		57.34	48.76-67.77	
White	76.07	63.55-87.7	0.26	50.74	37.3-64.21	0.88
SGRQ Scores						
Ethicity	**Impact**	**IQR**	**P value**	**Total**	**IQR**	**P value**
African	58.84	51.46-67.35		59.66	52.99-64.97	
Coloured	56.79	50.23-63.22		56.27	51.63-63.82	
Indian	61.71	50.71-67.83		63.53	53.50-71.98	
White	60.04	47.22-66.59	0.66	58.82	52.12-67.30	0.06

Remarkably, all ethnic groups exhibited elevated scores in the symptoms domain, exceeding 60 (African=74.72; Coloured=70.7; Indian=81.06; White=76.07). In contrast, they displayed low scores in the activity domain (African=54.42; Coloured=47.5; Indian=57.34; White=50.74). Analyzing the significance levels of variations in the total and SGRQ component scores among patients from diverse ethnic backgrounds revealed that none of these differences reached statistical significance. Table 4.17.

4.3.3 Age-related differences in the health-related quality of life of patients.

Table 4.18: Summary of health-related quality of life analysis stratified by Age

SGRQ Scores						
Age group	**Symptoms**	**IQR**	**P value**	**Activity**	**IQR**	**P value**
Young Age	77.9	64.41-96.63		64.46	56.24-73.87	
Middle Age	74.27	57.38-85.92		53.60	38.19-63.25	
Eledery Age	77.99	63.55-89.57		50.86	43.06-62.76	
Senile Age	73.41	64.01-84.50		49.62	36.64-68.0	
Long lived	81.12	58.33-86.65	0.30	54.69	43.51-67.88	0.13
SGRQ Scores						
Age group	**Impact**	**IQR**	**P value**	**Total**	**IQR**	**P value**
Young Age	57.70	46.89-65.75		63.85	55.23-71.93	
Middle Age	58.06	50.23-66.3		58.05	51.63-64.75	
Eledery Age	60.35	50.45-68.67		59.61	52.58-66.11	
Senile Age	59.36	53.18-65.62		59.66	53.71-65.18	
Long lived	62.45	37.54-62.52	0.77	59.47	52.68-60.10	0.37

Table 4.18 above summarises HRQL results stratified by patients' age. Young age patients reported the highest total score of 63.85 (IQR: 55.23-71.93), followed by elderly and senior age patients who reported closely resembling scores of 59.61 (IQR: 52.58-66.11), and 59.66 (IQR: 53.71-65.18) respectively. In the symptoms domain, Long-lived patients reported the highest score of 81.12 (IQR: 58.33-86.65). Notably, young and elderly patients reported closely resembling scores of 77.9 (IQR: 64.41-96.63) and 77.99 (IQR: 63.55-89.57), respectively.

Another notable result was that in the activity domain, young-age patients reported the highest scores across all the age groups at 64.46 (IQR: 56.24-73.87). Lastly, impact domain scores were uniformly distributed across the age groups. This domain's interquartile ranges (IQR) also showed no significant variations.

4.3.4 Smoking-related Differences in SGRQ Scores

Table 4.19: Summary of smoking-related differences in SGRQ scores

SGRQ Scores						
Smoking Status	**Symptoms**	**IQR**	**P value**	**Activity**	**IQR**	**P value**
Current Smoker	77.9	63.83-88.09		50.94	38.22-64.38	
EX smoker	77.50	61-87.7		55.34	43.22-63.25	
Never smoker	70	57.85-85.85	0.24	54.22	40.68-65.57	0.89
SGRQ Scores						
Smoking Status	**Impact**	**IQR**	**P value**	**Total**	**IQR**	**P value**
Current Smoker	58.34	50.39-65.7		58.45	52.47-65.01	
EX smoker	60.57	50.71-67.43		60.25	52.52-65.52	
Never smoker	59.75	51.12-70.63	0.54	57.43	51.77-67.75	0.93

Table 4.19 demonstrates that there were no statistically significant differences between current smokers, ex-smokers, and those who had never smoked. Notably, patients without a history of smoking reported the lowest symptoms score of 70.0 (IQR: 57.85-85.85) compared to their counterparts. Similarly, ex-smokers demonstrated a relatively lowest average impact score of 56.70 (IQR: 46.55-67.05) across the smoking status categories. In the same breath, current smokers exhibited the lowest activity score of 56.70 (IQR: 46.55-67.05).

4.3.5 GOLD stage variations in SGRQ

Table 4.20: Summary of the impact of GOLD stage on participants health-related quality of life using the SGRQ

SGRQ Scores						
GOLD Stage	**Symptoms**	**IQR**	**P value**	**Activity**	**IQR**	**P value**
Stage 1	77.07	66.09-88.05		75.40	69.95-80.86	
Stage 2	75.21	58.33-86.65		54.51	41.74-64.38	
Stage 3	77.37	63.55-88.09		50.78	41.02-63.47	
Stage 4	74.44	63.55-86.19	0.75	50.84	38.24-64.44	0.91
SGRQ Scores						
GOLD Stage	**Impact**	**IQR**	**P value**	**Total**	**IQR**	**P value**
Stage 1	74.27	67.43-81.12	0.88	75.23	71.61-78.84	0.89

Stage 2	58.84	52.24-67.15		60.05	53.02-64.93	
Stage 3	59.35	50.39-66.59		59.03	52.44-65.57	
Stage 4	59.36	47.8-67.93		58.33	52.36-65.52	

Table 4.20 shows that similar to the trend observed concerning smoking status; there were no statistically significant differences in the SGRQ scores in the patients across the 4 COPD GOLD stage categories.

However, there were notable observations. First, there was a pattern of decreased average scores and total scores with an increase in the GOLD stage. Secondly, in the symptoms domain, GOLD stage 1 and stage 3 patients reported closely resembling scores of 77.07 with an (IQR of 66.09-88.05.) and, 77.37 with an (IQR of 63.55-88.09.). Similarly, GOLD stage 3 and stage 4 patients reported similar scores in the activity domain, 50.78 (IQR of 41.02-63.47.) and 50.84 (IQR of 38.24-64.44), respectively. The same was true for stages 3 and 4 patients in the impact score domain. Lastly, GOLD stage 1 patients reported the highest scores in the activity and impact domains, across all the GOLD stage patients, 75.40 with an IQR of 69.95-80.86 and 74.27 with an IQR of 67.43-81.12, respectively.

4.3.6 Impact of education on the health-related quality of life of patients.

Table 4.21: Summary of health-related quality of life analysis by SGRQ stratified by education

SGRQ Scores						
Education	**Symptoms**	**IQR**	**P value**	**Activity**	**IQR**	**P value**
University	77.9	63.55-87.7		54.48	42.67-63.92	
Matric	77.37	63.83-88.56		51.2	38.32-62.89	
Primary	68.48	58.33-76.72	0.03	50.02	42.85-68.89	0.47
SGRQ Scores						
Education	**Impact**	**IQR**	**P value**	**Total**	**IQR**	**P value**
University	58.34	50.39-65.7		58.45	52.47-65.01	
Matric	60.57	50.71-67.43		60.25	52.52-65.52	
Primary	59.75	51.12-70.63	0.54	57.43	51.77-67.75	0.93

Regarding education-related differences in HRQL, using SGRQ analysis, participants with matric level education demonstrated the highest total score of 60.25 (IQR: 52.52-65.52). In contrast, patients with university and primary school education reported closely resembling total scores of 58.45 and 57.43, respectively. However, these differences were not statistically significant. In the symptoms domain, participants with primary school education reported statistically significantly lower scores than other groups (P = 0.03).

4.3.7 Health-related quality of life: an analysis of CAT and patient demographic factors.

Table 4.22: Summary of CAT scores in the different demographic categories

Referring hospital	**CAT Score**			
	N	**Median**	**IQR**	**P value**
CMJAH	123	23	15-29	
HJAH	238	23	15-29	0.91
Age Group	**N**	**Median**	**IQR**	**P value**
Young Age	12	28.5	21-29	
Middle Age	134	24	14-29	
Eledery Age	156	22	15-28	
Senior Age	56	22	16-27.5	
Long lived	3	19	14-27	0.44
Ethnicity	**N**	**Median**	**IQR**	**P value**
African	180	23	15-29	
Coloured	49	24	15-29	
Indian	45	21	15-27	
White	87	22	15-28	0.78

Smoking Status	N	Median	IQR	P value
Current Smoker	203	24	16-29	
EX smoker	86	22	13-29	
Never smoker	72	22	15-28.5	0.48
Education	**N**	**Median**	**IQR**	**P value**
University	169	22	15-27	
Matric	155	24	15-29	
Primary school	37	23	16-29	0.59

Table 4.22 shows the distribution of the CAT scores across various demographic factors, including the referring hospital, age group, ethnicity, and smoking status. There were no significant differences in CAT scores between participants from the two academic hospitals (P=0.91). In terms of age, the young-aged patients exhibited the highest CAT score, while long-lived patients reported the lowest average score across the age groups.
In the ethnic group category, patients from the Coloured ethnic group reported the highest average score of 24 (IQR=15-29), while patients who identified as Indian reported the lowest score of 21 (IQR=15-27). Notably, the IQR was similar in the four ethnic groups, ranging from 15 to 29.
In terms of smoking status, current smokers reported the highest CAT score average of 24 (IQR=16-29), while ex-smokers and never-smokers reported a similar average of 22 with slightly different IQRs of 13-29 and 15-28.5, respectively.
When comparing education levels, patients with university and primary level education reported similar average scores, while those with matric level education scored the highest score of 24 (IQR=15-29) among the education group levels. In summary, none of the above-mentioned demographic differences demonstrated statistically significant differences.

4.4 Non-health related quality of life: an analysis of the WHOQOL-BREF tool.

4.4.1 Gender-related differences in non-health-related quality of life

Table 4.23: Gender differences in non-health-related quality of life

WHOQOL-BREF scores	Gender				
	Male	IQR	Female	IQR	P value
Total score	53.2	49.1-58.1	54.1	48.8-57.7	0.61
Perception of health	4	3;4	4	3;4	0.85
Physical health	9.7	8.6-10.9	9.7	9.1-11.4	0.20
Psychological health	12.7	10.7-14.7	12.7	10.7-14.7	0.40
Social relationships	12	9.3-14.7	12	9.3-14.7	0.51
Environmental health	12	11;13	12	11-12.5	0.07
Overall perception of QOL	3	2;4	3	3;4	0.82

The analysis revealed no significant gender difference in the overall perception of QOL (P=0.82), as both genders reported closely resembling scores of 3, with slightly different IQRs. We did not observe any statistically significant differences in the WHOQOL-BREF scores between male and female patients for any of the assessed domains.

4.4.2 Age-related differences in non-health-related quality of life.

Table 4.24: Age-related differences in patients' non-health-related quality of life

WHOQOL_BREF Score						
Age group	**Total**	**IQR**	**P Value**			
Young Age	49.4	47.25-53.55				
Middle Age	53.05	49.1-56.7				
Eledery Age	53.5	48.8-58.25				
Senile Age	55.25	51.8-60.8				
Long lived	47.9	46.7-56.1	0.01			
WHOQOL_BREF Score						
Age group	**Perception of health**	**IQR**	**P Value**	**Physical health**	**IQR**	**P value**
Young Age	4			10.6	9.1-11.15	
Middle Age	4			9.7	8.6-10.9	
Eledery Age	4			9.7	9.1-10.9	
Senile Age	4	3;4		9.7	8.6-10.9	
Long lived	3	3	0.89	10.9	6.9-12.6	0.95
WHOQOL_BREF Score						
Age group	**Psychological health**	**IQR**	**P value**	**Social relationships**	**IQR**	**P value**
Young Age	10.7	10;13		12	8-13.3	
Middle Age	12.7	10.7-14.7				
Eledery Age	12.7	10.7-14.7		12	9.3-14.7	
Senile Age	13.3	11.65-15.3		14.7	10.7-16	
Long lived	9.3	8-14.7	0.13	12	9.3-12	0.07
WHOQOL_BREF Score						
Age group	**Enviromental health**	**IQR**	**P value**	**Overall perception_QOL**	**IQR**	**P value**

Young Age	11.5	10.25-12.5		4	2.5-4	
Middle Age	12	11;13				
Eledery Age	12	11-12.8				
Senile Age	11.5	11-12.5		3	2.5-4	
Long lived	12.5	12-13.5	0.73	3	2;3	0.09

Table 4.24 above reveals notable variations in Non-HRQL WHOQOL-BREF scores across the different age groups. Starting with physical health, only long-lived patients reported a score of 3, while their counterparts reported a similar score of 4 with a similar IQR of 3-4. Notably, long-lived patients reported the highest physical health score of 10.9 (IQR=6.9-12.6), followed by young aged at 10.6 (IQR=9.1-11.15). Lastly, it is worth noting that while long-lived patients scored the highest in the physical health domain, they scored the lowest in the psychological health domain with an average of 9.3(IQR=8-14.7).

Concerning the patients' perception of QOL, young age patients scored the highest in this domain with an average of 4(IQR=2.5-4), while the remainder of the patients scored a similar score of 3, with a slightly different IQR of (2-3) in long-lived patients. However, there was no significant difference in the perception of QOL (P=0.09) across the age groups. Furthermore, long-lived patients also reported the lowest total score, 47.9(IQR=46.7-56.1), across all the age groups. A significant difference was not found in the social relationship domain(P=0.07). In addition, although the P value is not statistically significant, it is not far from the significance threshold of 0.05.

Lastly, for the WHOQOL total score, a significant difference was observed (P= 0.01) between the different age groups. Senior participants were significantly more likely to report a higher overall WHOQOL total score than their counterparts [55.25 versus 53.5 in the elderly, versus 53.05 in the middle-aged group; p=0.01].

4.4.3 Ethnic variation in non-health-related quality of life

Table 4.25: Ethnic variations in non-health-related quality of life

WHOQOL_BREF Score							
Ethicity	**Total**	**IQR**	**P Value**				
African	54	49.95-58.1					
Coloured	52.9	49-57.7					
Indian	51.9	47.3-55.6					
White	53.9	48.6-58.1	0.16				
WHOQOL_BREF Score							
Ethicity	**Perception of health**		**IQR**	**P Value**	**Physical health**	**IQR**	**P value**
African	4				9.7	8.6-10.9	
Coloured	4				10.3	9.1-11.4	
Indian	3				9.7	9.1-11.4	
White	4		3;4	0.68	9.7	9.1-12	0.24
WHOQOL_BREF Score							
Ethicity	**Psychological health**		**IQR**	**P value**	**Social relationships**	**IQR**	**P value**
African	13.3		11-14.7		13.3	10.7-16	
Coloured	12.7		10-14.7		12	9.3-14.7	
Indian	11.3		9.3-14.7		10.7	9.3-13.3	
White	12.7		10.7-14	0.05	12	9.3-14.7	0.06
WHOQOL_BREF Score							
Ethicity	**Enviromental health**		**IQR**	**P value**	**Overall perception_QOL**	**IQR**	**P value**
African	12		11;13		3		
Coloured	12		11;13		4		
Indian	12		11;13	0.44	3	2;4	0.11

White	12		11;13				

African patients reported the highest average scores in the psychological health domain, 13.3(IQR=11-14.7), while patients belonging to the Indian ethnicity scored the lowest in this domain at 11.3(IQR=9.3-14.7). Table 19. We observed that Coloured and White patients reported a similar score of 12.7 (IQR=10.14.7) in this domain; importantly, the variations in this domain were not far from reaching the significance threshold of ($P<0.05$).

Indian patients reported the lowest scores in the perception of the health and psychological health domains. It is plausible that there could be a direct relationship between the perception of health and psychological well-being such that the two influence each other. Notably, African, Coloured, and white patients showed a similar perception of health score of 4(IQR=3-4). This pattern continued in the physical health domain, wherein African, Indian, and white patients reported a similar score of 9.7 with slightly different IQRs. Moreover, Coloured patients scored the highest in this domain at 10.3(IQR=9.1-11.4). However, the differences in the physical health domain were not statistically significant ($P= 0.24$).

African patients reported the highest average scores in the social relationship domain, 13.13 (IQR10.7-16), and the WHOQOL-total score of 54 (IQR=49.95-58.1). Conversely, Indian patients reported the lowest score of 10.7 (IQR=9.3-13.3) in the social relationship domain, while the Coloured and White ethnic groups reported a similar score of 12 (IQR=9.3-14.7). In addition, while the differences in this domain were not statistically significant, they were not far from the minimum threshold significance of 0.05 ($P=0.06$).

4.4.4 Smoking-related differences in non-health-related quality of life.

Table 4.26: A representation of WHOQOLBREF scores stratified by smoking status.

WHOQOL_BREF Score						
Smoking Status	**Total**	**IQR**	**P Value**			
Current Smoker	52.5	48.5-57.7				
EX smoker	54.1	50.9-58.4				
Never smoker	54.3	48.45-58.25	0.16			
WHOQOL_BREF Score						
Smoking Status	Perception of health	IQR	P Value	Physical health	IQR	P value
Current Smoker				9.7	8.6-10.9	
EX smoker				9.7	8.6-11.4	
Never smoker	4	3;4	0.78	10.3	9.1-11.4	0.34
WHOQOL_BREF Score						
Smoking Status	Psychological health	IQR	P value	**Social relationships**	**IQR**	**P value**
Current Smoker	12.7	10-14.7		12	9.3-14.7	
EX smoker	13	10.7-14.7		13.3	9.3-16	
Never smoker	12.7	10.7-15	0.26	13.3	9.3-16	0.49
WHOQOL_BREF Score						
Smoking Status	**Enviromental health**	**IQR**	**P value**	**Overall perception_QOL**	**IQR**	**P value**
Current Smoker	12	11;13				
EX smoker	12	11;13				
Never smoker	12	11-12.5	0.41	same	same	0.05

There were no statistically significant differences in the non-HRQL of participants who were “current smokers”, “ex-smokers”, and “never smoked". This trend was observed in the perception of health, as well as in the physical and psychological health domains. Overall, “Ex-smokers” and the “never smoked” reported closely resembling total WHOQOL-BREF scores, indicating a relatively similar perception of overall quality of life among the participants. However, The Kruskal-Wallis test indicated that while the difference in the patient’s perception of QOL was not statistically significant, it was not far from the significant threshold of (P=0.05). Similarly, in the social relationship domain, no significant differences were observed (P=0.49) among the smoking status groups. The average scores remained relatively stable across all groups, with current smokers reporting slightly higher scores in this domain. Table 20

4.4.5 The impact of education on patients' non-health-related quality of life

Table 4.27: Summary of WHOQOL_BREF HHRQL scores by education level.

WHOQOL_BREF Score						
Education	**Total**	**IQR**	**P Value**			
University	52.8	48.6-56.7				
Matric	53.4	48.8-57.6				
Primary	56.7	53.8-60.5	0.00			
WHOQOL_BREF Score						
Education	**Perception of health**	**IQR**	**P Value**	**Physical health**	**IQR**	**P value**
University	4	3;4		9.7	9.1-10.9	
Matric	4	3;4		9.7	8.6-10.9	
Primary	4	3;5	0.07	10.3	9.1-11.4	0.34
Education	**Psychological health**	**IQR**	**P value**	**Social relationships**	**IQR**	**P value**
University	12	10.7-14				
Matric	12.7	10-14.7		12	9.3-14.7	
Primary	14	12-15.3	0.07	14.7	12;16	0.02
WHOQOL_BREF Score						
Education	**Enviromental health**	**IQR**	**P value**	**Overall perception_QOL**	**IQR**	**P value**
University	12.5	11;13				
Matric	12	11-12.5				
Primary	11.5	11-12.5	0.09	3	2;4	0.06

Table 21 presents the results of the non-HRQL analysis within the three distinct education-level groups. Notably, no significant differences were observed in the perception of health, physical, and psychological health domains. However, primary school-educated participants tended to report higher scores in the Perception of health and psychological health domains than participants with other educational attainments(P=0.07).

There was a statistically significant difference in the total WHOQOLBREF scores of the patients in the three different education groups(P=0.00), with primary school-educated patients reporting the highest average score of 56.7(IQR=53.8-60.5, while those with matric and university level education reported closely resembling similar average scores of 53.4(IQR=48.8-57.6); and 52.8(IQR=48.5-56.7). Similarly, there were significant differences in the social relationship's domain(P=0.02), with primary school-educated patients reporting marginally higher scores compared to those with higher education levels.

4.4.6 non-health-related quality of life stratified by GOLD COPD stages.

Table 4.28: GOLD stage variations in non-health-related quality of life: an analysis of WHOQOLBREF

GOLD stage	WHOQOL_BREF Scores								
	Perception of health	**IQR**	**P Value**	**Physical health**	**IQR**	**P value**	**Psychological health**	**IQR**	**P value**
Stage 1	4	3;5		9.7	9.1-10.3		13.65	9.3-18	
Stage 2				9.7	9.1-11.4		12.7	10.7-14.7	
Stage 3				9.7	8.6-11.4		12.7	10.7-14.7	
Stage 4	4	3;4	0.97	9.7	9.1-10.9	0.60	13.3	10.7-15.3	0.53

GOLD stage	**Total**	**IQR**	**P Value**	**Social relationships**	**IQR**	**P value**	**Enviromental health**	**IQR**	**P value**	**Overall perception**
Stage 1	53.75	44.9-62.6		12.65	9.3-16		11.25	10.5-12		4
Stage 2	52.4	48.2-57.6		12	9.3-14.7					
Stage 3	53.7	49.7-57.7	0.37	12	10.7-14.7	0.37	12	11;13	0.27	3

Stage 4	54.45	48.3-59.2		13.3	10.7-14.7		11.5	11-12.5		

Table 22 reveals distinct patterns in the non-HRQL of COPD patients across the four GOLD stages. Patients in the four stages reported similar scores in the perception of health and physical health domains, with slightly different IQRs in the latter. Similarly, there were slight differences in the psychological health domain wherein stage 1 and 4 patients reported closely resembling scores, with stage 1 patients exhibiting a slightly higher score of 13.65(IQR=9.3-18). Moreover, stage 2 and 3 patients reported the same score of 12.7(IQR=12-14.7) in this domain.

Overall, there were no statistically significant differences in the non-HRQL of patients in the four stages of COPD, as the differences observed exceeded the minimum statistical significance threshold of 0.05. Notably, patients diagnosed with GOLD stage 4 COPD reported the highest total score of 54.45 (9QR=48.3-59.2). Conversely, GOLD stage 2 patients reported the lowest total score of 52.4(IQR=48.2-57.6) across all four stages.

4.5 Quantile linear regression.

Table 4.29: Summary of the quantile regression model of HRQL and Non-HRQL

CAT score	Co-eeficient	Std Error	T value	P value
Age	-1	.7549995	-1.32	0.186
Sex	2.13	1.23843	0.00	1.000
Ethnicity	-1	.583117	-1.71	0.087
Education	-1	.8988901	-1.11	0.267
Smoking status	-1	.7963048	-1.26	0.210
SGRQ total score	Co-eeficient	Std Error	T value	P value

Age	.3283285	.9670336	0.34	0.734
Sex	.3508264	1.049084	0.33	0.738
Ethnicity	-3.376972	1.473026	-2.29	0.022
Education	1.013111	.6964812	1.45	0.147
Smoking status	-1.608758	1.069076	-1.50	0.133
GOLD stage	-1.019264	1.157073	-0.88	0.379
WHOQOLBREF Total score	Co-eeficient	Std Error	T value	P value
Age	1.29	.7068876	1.82	0.06
Sex	1.11	.992546	1.12	0.26
Ethnicity	-.56	.469299	-1.19	0.23
Education	1.09	.7203588	1.51	0.13
Smoking status	-.095	.6516011	-0.15	0.88
GOLD stage	-.01	.7796526	-0.01	0.99

The quantile regression model results are presented above in Table 4.29, emphasizing the coefficients and their statistical significance. The analysis reveals that an increase of one unit in age, smoking status, or education level is associated with a decrease of one unit in a patient's CAT score. In

summary, the study found that none of the patient demographic factors significantly predicted CAT scores. This means that none of the patient's demographic factors predicted the patient's HRQL.

When examining health-related quality of life (HRQL) stratified by SGRQ, it was observed that patients' ethnicity had a significant but weak negative impact on their HRQL.

Lastly, age appeared to have a positive weak influence on non-health-related quality of life. However, the relationship is not statistically significant(P=0.06). Notably, age was the only factor with an almost significant relationship with non-HRQL across all the factors we hypothesized to predict non-HRQL. This is because the P value was close to the minimum significance level of 0.05.

Chapter 5: Discussion

This study gives insight into the HRQL and non-HRQL of patients with COPD attending two academic hospitals in Johannesburg, South Africa. One of the primary objectives was to understand the distribution of risk factors for the COPD population in Johannesburg, S A. Secondly, we sought to understand how COPD has affected the HRQL and non-HRQL of patients. We achieved this by quantifying the HRQL and non-HRQL using the SGRQ and WHOQOL-BREF. We also sought to understand the lived experiences of the COPD patients in our study, relating to their daily lives and access to healthcare services to help manage the disease.

5.1 Participant Characteristics

5.1.1 Geographic location

The majority of the participants in our study were from HJAH. This may be because HJAH has a dedicated COPD clinic and a significant number of clinical personnel on clinic visit days. The opposite is true for CMJAH, which may be a result of the fire incident at CMJAH in 2020 that affected the space dedicated to the COPD clinic. Concerning the patients's area of residence, a large fraction of the participants resided in the South of JHB, while those in JHB CBD were least represented. This may be because most of the patients in our study were elderly people who were retired and pensioners. Therefore, they would reside in the townships and suburban areas, while employed young patients would live in the CBD closer to work. For those in the township, local clinic referrals may have been the driving force of the influx into academic hospitals. It is also plausible that the longer travel time between patients who resided in the township may have contributed to the move to CBD for younger patients who are employed.

5.1.2 Age range, Ethnicity, Education and Employment

A large fraction of the participants were in the elderly age group (60-71) and male (N=95). In terms of ethnicity, the majority of our patients were African. It is worth noting that the majority of the general population in South Africa are African. We also noted that 46.81% of the sample was educated up to university level, and 23.82% of those participants were female. Of note is that Indian participants were the ethnic group with the highest percentage of university-level educated individuals. Concerning Employment, the majority of our participants were

pensioners; this is in line with the pension policy in South Africa, where individuals over the age of 60 are eligible to receive a pension.

5.1.3 Smoking

The prevalence of smoking in our sample was 56.2% and was higher in the elderly age group. While the results indicated that smoking was more prevalent in the African ethnic group, it is noteworthy that 41/49 Coloured participants were smokers, suggesting that the prevalence of smoking was higher among the Coloured ethnic group. The results may have also been influenced by the higher representation of African participants in the study compared to their counterparts.

Given the high prevalence of smoking among COPD patients, healthcare providers must prioritize smoking cessation interventions as a fundamental component of COPD management. Strategies such as counselling, behavioural therapy, pharmacotherapy, and access to cessation support services should be readily available and tailored to the specific needs of individuals, particularly among elderly patients and those belonging to ethnic groups with higher smoking prevalence. Identifying and addressing barriers to smoking cessation, such as socioeconomic factors, cultural beliefs, and access to healthcare, is essential to effectively support individuals in quitting smoking and preventing further progression of COPD.

5.2 Clinical risk factors

5.2.1 Comorbid communicable diseases

In our study, COVID-19 emerged as the most prevalent communicable disease, with 44.31% of patients reporting a history of infection, compared to 39.05% for tuberculosis (TB) and 35.45% for HIV/AIDS. Notably, all three diseases showed higher prevalence among elderly individuals. Several factors may contribute to this observation: firstly, the elderly constituted the largest demographic group in our study; secondly, advanced age is recognized as a risk factor for COVID-19 and COPD development. This suggests that individuals with a history of COVID-19 and the elderly face a compounded risk of developing COPD. Clinicians should consider these factors when diagnosing COPD, assessing the influence of COVID-19 on disease progression, and evaluating clinical presentations. Screening for underlying communicable diseases among COPD patients is crucial, as it may inform strategies to manage comorbidities' impact on COPD development and progression.

Moreover, our findings highlighted current and previous smoking as significant risk factors for COPD development and COVID-19 contraction. This underscores the heightened risk among smokers and ex-smokers for COPD and its comorbidities, including TB. Healthcare providers should prioritize smoking cessation interventions and promote awareness of the risks associated with smoking in COPD management. Additionally, strategies targeting comorbidities and smoking cessation could potentially reduce the burden of COPD and its complications, improving overall health outcomes in the South African context.

5.2.2 GOLD stage

GOLD stage 3 was the most prevalent in our study, with 47.22% of the participants diagnosed with GOLD stage 3. The prevalence was higher among male participants in stages 1, 2, and 3, while the prevalence of stage 4 COPD was equally distributed among males and females. The prevalence was higher among the elderly age, which is consistent with the progressive nature of COPD. Health policymakers should consider these prevalence rates when planning healthcare services and infrastructure development. Strategies such as increasing the availability of respiratory clinics, training healthcare professionals in COPD management, and investing in public health campaigns for early detection and prevention may be warranted. In addition, Emphasis should be placed on early detection and intervention to slow disease progression and improve outcomes, especially among elderly patients who are more likely to be in advanced stages. This may involve implementing screening programs in primary care settings and promoting smoking cessation initiatives.

Efforts to reduce the burden of COPD should include comprehensive preventive measures targeting modifiable risk factors such as smoking, indoor and outdoor air pollution, and occupational exposures. Public health campaigns aimed at raising awareness about COPD risk factors and promoting healthy behaviours should be tailored to address the specific needs of the South African population. Additionally, strategies to address social determinants of health, such as poverty and inadequate access to healthcare, may help reduce the prevalence and impact of COPD in vulnerable populations.

5.3 Quality of life of patients with COPD Health-related and non-health-related quality of life.

The results indicating that the Health-Related Quality of Life (HRQL) of COPD patients in the study was on average 59% according to the St. George's Respiratory Questionnaire (SGRQ)

scale, with non-health-related quality of life (non-HRQL) at 53.65%, have several implications. First, The findings emphasize the need for adequate resources to address the multifaceted needs of COPD patients, including both health-related and non-health-related aspects. This may involve allocating funds for pulmonary rehabilitation programs, psychosocial support services, and community-based interventions aimed at improving overall quality of life. The healthcare system could also benefit from prioritizing the development and implementation of integrated care models that address the holistic needs of COPD patients. This includes fostering collaboration between primary care providers, pulmonologists, mental health professionals, and social workers to deliver comprehensive care that addresses both physical and psychosocial aspects of COPD management.

5.4 Results of tests and associations.

5.4.1 Gender and QOL.

The findings of the study revealed subtle differences in the HRQL between male and female participants with COPD. Although males tended to score slightly higher than females, the difference was not statistically significant. It is worth noting that men reported a greater impact on their HRQL, experienced more symptoms, and had more restrictions on their daily activities compared to women. This may have been influenced by the duration of the diagnosis, of which the results were not reported in this paper. These findings differ from the Tanzanian study that examined sex-related differences in the HRQL of COPD patients. For instance, in this Tanzanian study, they found that women experienced more symptoms such as dyspnoea and emphysema than men and also had more exacerbations, which can lead to poor quality of life (16).

Additionally, female patients in this study reported better non-HRQL than male patients, consistent with the results observed in the HRQL component. However, their perceptions of health, overall quality of life, and physical and psychological health were similar. This may be due to the subjective interpretation of patients, as individuals may evaluate their overall health and well-being based on factors beyond the specific symptoms or limitations outlined in the HRQL assessment. Personal beliefs, coping mechanisms, and resilience may also affect how patients perceive and report their general health and quality of life. Secondly, male and female patients may employ adaptive strategies to cope with their condition, leading to a convergence in their perceptions (27). This adaptation could involve psychological mechanisms such as acceptance, reframing, or resilience that minimize perceived differences in overall health despite variations in HRQL (41). In summary, psychological mechanisms like acceptance and

resilience can help COPD patients develop effective coping strategies to deal with the challenges posed by their condition. By accepting their illness and reframing their perspective, patients can better manage symptoms and maintain a positive outlook on life.

5.4.2 Ethnicity and QOL.

Concerning ethnicity, some disparities were identified in the SGRQ total score and the activity domain. It was observed that Indian patients experienced the poorest HRQL and faced the most limitations in daily activities. The reasons for this are not entirely apparent. However, given South Africa's history of apartheid, it is plausible to hypothesize that Indian patients may face obstacles in obtaining culturally competent care that conforms to their cultural values, beliefs, and preferences. The absence of culturally sensitive healthcare services, such as culturally appropriate health education materials, language interpretation services, and culturally competent healthcare providers, may contribute to disparities in COPD care and outcomes among Indian patients. This could result in poorer HRQL and more significant limitations in daily activities. This further supports the results of the comparative study of White and African American COPD patients, which revealed a substantial racial difference in the activity component of the SGRQ(34). Although the differences observed did not reach statistical significance, they were close to the minimum significance threshold of 0.05, suggesting that further research is needed to explore the influence of ethnicity on the HRQL of patients in the Indian population and to identify other factors that may affect the HRQL of this ethnic group. In terms of non-HRQL, Indian patients reported the lowest quality of life (QOL), which may be due to their poor HRQL. This also explains the findings in the health perception domain, where Indian patients reported the lowest scores, indicating potential concerns about their self-perceived health status. This is consistent with the study on Indian patients with severe COPD, which established that Indian patients experienced poor quality of life as a result of COPD (42). The variations in the psychological health domain are noteworthy and raise important considerations (Table 11). Importantly, statistical analysis showed that these differences are statistically significant, highlighting the relevance of these variations in psychological health scores among different ethnic groups. It is essential to interpret and contextualize these findings. The higher psychological health scores among African patients may be influenced by various cultural, social, or environmental factors unique to this group (43). Strong familial and community ties in many African communities act as a robust support system for individuals encountering difficulties (44). According to Taylor et al.'s research, perceived social support has been linked to improved mental health outcomes among African populations (45). In

addition, cultural beliefs about illness and healing practices can influence individuals' help-seeking behaviours and compliance with treatment. Research has revealed that African cultures often have traditional healing practices and strong family support networks contributing to their psychological resilience (44,46).

Conversely, the lower scores among Indian patients may indicate specific challenges or stressors within this community that impact their psychological well-being. The Indian national mental health survey conducted in 2016 highlighted that despite efforts to reduce the stigma surrounding mental illness, many Indian communities still view it as a taboo, leading to a reluctance to seek professional help and a delay in initiating treatment (25).

The findings of similar psychological health scores between Coloured and White patients suggest a shared status in their psychological well-being. While variations in scores among different ethnic groups are not unexpected, their similarity warrants further investigation into the common factors contributing to their psychological health. In the domain of social relationships, African patients reported the highest scores, with a median of 13.13 (IQR=10.7-16), while Indian patients reported the lowest scores at 10.7 (IQR=9.3-13.3). Overall, the results imply that psychological health and social relationships are interconnected. It is reasonable to assume that the support provided by friends and family members plays a significant role in the psychological well-being of COPD patients, as they grapple with the disease daily.

5.4.3 Age and QOL

The influence of age on the HRQL of patients in this study was not apparent. This differs from a multitude of COPD studies, which have identified age as a significant predictor of HRQL (28). Despite the lack of a relationship between age and HRQL, noteworthy patterns were observed. In this study, advanced age was related to better HRQL and SGRQ. This contradicts the notion that the severity of COPD worsens with age (48). Moreover, the results of this study confirm that older individuals experience better HRQL, as previously demonstrated by Carloz and colleagues (49). However, the reasons for this phenomenon were not established, and it may have been influenced by the categorization of age in the study.

Additionally, the worst HRQL scores reported by younger patients may have been influenced by the fact that young patients were not adequately represented in the sample (only 12 patients were in the young-age category). The results of the activity component in this study are at odds with those of previous studies. For example, a comparative study of middle-aged versus older COPD patients found that dyspnoea, a symptom of COPD that affects physical activity, had a

greater impact on middle-aged patients (28). The significant impact of the activity domain among younger patients in this study may be attributed to their inherent preference for higher activity levels, which are constrained by respiratory impairments. Conversely, older patients may not prioritize physical activity as much and may not report a substantial impact in the activity domain (28,50).

Results observed in the impact domain are consistent with other research, which showed that long-lived and senior-aged patients reported the highest overall impact compared to other age groups (28). However, it was not clear why elderly-aged patients reported the highest impact than their senior-aged counterparts.

5.4.4 Smoking status and QOL

This study did not find any substantial associations between smoking and patients' HRQL. Although no significant relationships were established between smoking status and HRQL, our findings make a significant contribution to the field of COPD research. Specifically, within the Johannesburg COPD population, smoking status did not appear to have a discernible impact on HRQL. Our results further support the argument that while smoking is a primary risk factor, there could be other risk factors unique to the African population (7,18,51). Nevertheless, while it appears that smoking status does not significantly influence the overall HRQL of patients, our results indicate that smoking does influence the clinical presentation of the disease, leading to similar effects on symptomatology in both current and former smokers. One plausible explanation for this pattern could be the irreversible nature of the effects of smoking on COPD, resulting in no substantial disparity in symptom scores between current and former smokers (52).

In this study, patients who were former smokers and those who had never smoked exhibited the greatest degree of impact within the impact domain of the SGRQ. This observation can be attributed to the fact that compared to current smokers, ex-smokers might be more health-conscious and upon diagnosis of COPD, begin to perceive their condition with greater concern, resulting in heightened awareness of its impact on their daily activities. This increased awareness could contribute to a perceived higher impact within the activity and impact domains for ex-smokers compared with current smokers. Moreover, Former smokers and non-smokers might employ different coping strategies or have varying psychological responses to COPD compared with current smokers, manifesting as a higher reported impact in these groups within the activity and impact domains.

Ex-smokers and patients who had never smoked showed similar effects in the impact domain, suggesting that other factors independently affect the HRQL of COPD patients outside of smoking (17). This corroborates results from studies conducted in other parts of Africa that did not establish a relationship between smoking and HRQL of COPD patients (16,17). Furthermore, this suggests that other factors, such as indoor air pollution, concurrent marijuana use, and exposure to deep mining, might be at play within the current study population. Especially in the time of heightened load shedding, with citizens opting for gas and coal stoves as alternatives to using electric stoves.

Concerning non-HRQL, ex-smokers and never-smokers reported similar scores for overall non-HRQL, which was slightly higher than that of the current smokers. This is consistent with observations from previous studies that have shown that smoking cessation is recommended for COPD patients to improve their QOL (15). Concerning physical health, non-smokers and ex-smokers reported similar scores, which may be attributed to the residual effects of smoking cessation.

5.4.5 GOLD stage and QOL.

In this study, the `GOLD stage did not significantly impact patients' HRQL and non-HRQL to a considerable extent. This is consistent with the findings by Smith et al. (2021) that physical exercise capacity in COPD patients is independent of disease severity (53). However, our study revealed interesting patterns in the various aspects of HRQL and non-HRQL: Firstly, there was a pattern of better HRQL with increasing GOLD stages, which contrasts with previous studies that showed that the HRQL of patients deteriorates as the severity of the disease worsens (48). Moreover, we observed that GOLD stage 4 patients reported the best non-HRQL compared to their peers, mostly GOLD stage 2 patients. Several factors can explain this - patients with GOLD stage 4 may have developed coping strategies and adaptive mechanisms to manage advanced COPD, adjusting their lifestyles, learning effective symptom management techniques, and developing resilience in dealing with the challenges posed by severe COPD (48,51).

Other factors to consider include psychosocial factors and selection bias. Concerning psychosocial factors, it is plausible that patients with severe COPD may have different perspectives on life and priorities, leading to a shift in focus from certain aspects affecting non-HRQL. They may place greater value on different domains of life, finding contentment and satisfaction in alternative activities (5,8,52).

From a different perspective, there could be a survivorship effect wherein individuals who have progressed to GOLD stage 4 might inherently possess stronger resilience or certain inherent characteristics that positively influence their non-HRQL. This effect could stem from their ability to adapt, withstand, and manage challenges associated with disease progression.

Considering the patient's perception of the disease and subsequent expectations, patients in different disease stages may perceive and set varying expectations regarding their quality of life. Those in GOLD stage 4 may have adjusted their expectations over time and could be experiencing a level of contentment or acceptance that positively impacts their non-HRQL, in contrast with those in earlier stages, who might still be coming to terms with their condition.

The observation that patients in GOLD stages 1 and 4 reported better psychological health than those in stages 2 and 3 in the context of COPD contradicts results from previous studies. In the study by Barcells and colleagues (43), it was established that the effect of anxiety and depression supersedes the severity of the disease. Nevertheless, our results may be attributed to several plausible reasons. One is that patients in GOLD stage 1, despite being diagnosed with COPD, might not yet experience significant respiratory symptoms or limitations, allowing them to maintain a more positive outlook with fewer disruptions to their daily activities and, thus, better psychological health. Conversely, stage 2 and 3 patients might have begun to experience more noticeable symptoms, which can negatively impact their psychological well-being as they adjust to changes in their health status (4).

Furthermore, patients in GOLD stage 4 might have developed advanced coping strategies over time. Despite severe respiratory limitations, they may have learned to adapt and cope more effectively with their condition. This adaptation could positively influence their psychological health, enabling them to manage and mitigate the psychological impact of their illness better than those in the intermediate stages (GOLD 2 and 3).

Lastly, individuals categorized within GOLD stages 2 and 3 may find themselves in a transitional phase characterized by a pronounced impact of their COPD on their daily lives, particularly since they may still be in the productive stage of life, ultimately leading to heightened psychological distress. Conversely, patients classified in stage 1 may not have yet reached this juncture, while those in stage 4 may have achieved a greater sense of psychological well-being through either acceptance or adaptation to their condition, despite the severe limitations it imposes.

5.4.6 Education Attainment and QOL

Education level was the sole demographic risk factor that had an impact on non-HRQL. Our observations revealed that individuals who had only completed primary education reported better HRQL than their highly educated counterparts (Table 21). According to the findings, the ethnicity and education level of the patients played a significant role in determining their non-HRQL. It was observed that Indian patients reported the lowest HRQL compared to other ethnic groups. In our study, out of the 45 Indian patients, 32 had completed their education up to the university level. This suggests that being Indian and possessing a higher level of education was associated with a poor HRQL in our study. Our results corroborate the results from the Spanish study of determinants of HRQL in COPD patients, which established a relationship between FEV1 and lower education (54). The Potential reasons for these findings may include socioeconomic disparities linked to educational backgrounds, differing cultural perceptions, and varying levels of social support and interactions among these educational groups. In the context of different educational backgrounds, it is important to consider historical barriers to accessing education for African people in SA as a result of apartheid. This is because 91 out of 240 African patients in our study were elderly. Due to barriers in accessing education in the past, African patients with primary-level education may have grown to prioritize other aspects that affect their QOL while their counterparts prioritized education. As such, the benefit for those with lower levels of education is better QOL, while for others, it may be higher socio-economic status and career affiliations. Additionally, Primary school-educated individuals might possess more robust social networks or hold distinct perceptions of their relationships compared to those with higher education. This could influence their overall well-being and social interactions, ultimately contributing to higher scores in the WHOQOL-BREF domains. Moreover, additional nuanced factors, such as community integration, access to resources, and personal satisfaction derived from relationships, may further distinguish these differences across various education levels.

Chapter 6

6.1 Limitations

Some limitations of this study include the sample size. The intended sample size was 400 patients across three academic hospitals in Johannesburg, but only 367 patients from two of the three hospitals, namely Helen Joseph and Charlotte Maxeke, were included due to access and ethical issues. However, it is worth mentioning that the two hospitals included in the study are home to respiratory patients from communities close to Chris Hani Baragwanath Academic Hospital, which may have contributed to the representativeness of the sample. In addition, HJAH drains a significant percentage of the Coloured population over the general SA population. Moreover, the proportions of White and African populations in the study are discordant to the Gauteng and national population proportions. The second limitation concerns GOLD staging; the COPD diagnosis was not confirmed using spirometry but relied on the diagnosis documented in the patient file.

Furthermore, the risk to the patient's future health predicted by the patient's GOLD category was not included in this study. For this study, the objectively measurable parameters were included for analysis only. The reason for not including exacerbation history is that often, these events cannot be conclusively verified, and their aetiology is sometimes non-respiratory.

Regarding reliability, we did not conduct the 6-minute walk test to confirm physical activity impairment. Thus, our data was based solely on patient self-reports, which can be influenced by the patient's mood, recall, and limited insight into their disease experience. Secondly, this was a cross-sectional study, implying that we were not able to establish causal effects on patients' HRQL; we were also unable to provide information about the incidence (rate of new cases) of exacerbations and/or hospitalization of patients.

6.2 Recommendations

Based on the findings of this study, several recommendations can be derived from the study. Firstly, it is recommended that non-clinical personnel, such as administrative staff, be incorporated into dedicated COPD clinics in academic hospitals to alleviate the burden on clinical staff. This would allow them to focus on the clinical needs of COPD patients and provide more specialized care to those in advanced stages of the disease, including comprehensive medical interventions, multidisciplinary support, and advanced therapies, which may lead to improved health-related quality of life. Additionally, community healthcare workers, peer educators, psychologists, and counsellors should educate outpatients on effective strategies for managing and coping with the disease as it progresses. Psychologists can also

assist patients in regulating their emotions as they experience disease burden. Overall, these recommendations aim to improve the quality of care and support for patients with COPD, regardless of the stage of the disease.

The sampling method used in the study is a major source of bias and limits the generalizability of this study's findings. Since our study was cross-sectional, future research should consider using a larger sample size in conjunction with COPD longitudinal studies. This will help the study's reliability, as COPD is progressive. Moreover, since this study's results and previous studies are discordant concerning the relationship between HRQL and disease severity, a longitudinal study might help shed light on this relationship.

Our study included the comorbidity of COPD with non-communicable diseases. However, it did not measure or analyse how COPD interacts with communicable diseases. Future research should focus on studying the relationship between COPD and communicable diseases and how they affect each other to help tailor treatment regimens for patients grappling with comorbidity. This is extremely important when developing healthcare policies regarding preventative strategies, including introducing vaccines to adult population groups.

6.3 Conclusion

In this study, I investigated the distribution of demographic and clinical factors in the COPD patient population in Johannesburg. Furthermore, I conducted an extensive analysis of the disparities in HRQL and non-HRQL among COPD patients based on various demographic factors, including sex, ethnicity, age, smoking status, and education level. The findings showed subtle differences between male and female patients in terms of HRQL and non-HRQL, with men generally experiencing greater symptom burden and limitations than women. These findings emphasize the significance of sex-specific factors in COPD management and treatment. Tailoring interventions to account for these differences can lead to more personalized and effective care for both male and female patients.

The findings about age suggest that older patients experience better HRQL. Recognizing this age-related trend in HRQL among patients with COPD can inform healthcare professionals and policymakers about the specific needs of different age groups within the COPD population. From a healthcare perspective, understanding that older patients tend to have better HRQL indicates the importance of tailoring interventions and support programs to address the unique challenges faced by younger patients with COPD. This may involve implementing age-

appropriate management strategies, providing targeted education and resources, and offering specialized care to address the distinct needs of younger individuals living with COPD.

Notably, patients with advanced GOLD stages reported better HRQL and non-HRQL scores, contrasting with previous studies suggesting a decline in HRQL with disease severity. This finding has significant implications for healthcare, QOL, and disease management in SA.

First, from a healthcare perspective, this finding challenges the conventional understanding of disease progression. It highlights the importance of nuanced assessment and tailored interventions for patients with COPD in SA. Healthcare providers must re-evaluate their approaches to disease management, considering the potential for improved HRQL among patients in advanced stages. This may involve reassessing treatment strategies, optimizing symptom management, and providing targeted support to address the unique needs of patients in different disease stages.

Second, in terms of QOL, the mixed results highlight the intricacy of the factors that affect HRQL among COPD patients. It is crucial to understand why patients with advanced stages, according to the GOLD standard, report better HRQL, as this may enhance their overall well-being and functional status. This might involve investigating potential protective factors, such as access to healthcare services, social support networks, or psychological resilience, which could contribute to improved HRQL despite disease severity.

Educational level influenced non-HRQL, with educated patients reporting a better QOL, potentially reflecting socioeconomic and cultural factors. This finding underscores the importance of addressing socioeconomic disparities in access to healthcare services and resources. Healthcare providers in SA must acknowledge that patients with lower educational levels may encounter barriers to obtaining adequate care, including limited health literacy, financial constraints, and reduced awareness of available support services. Addressing these disparities requires implementing targeted interventions to improve health literacy, expand access to healthcare resources, and promote equitable healthcare delivery for all COPD patients, regardless of their educational level.

In conclusion, this study provides insights into the distribution of demographic and clinical factors among COPD patients in Johannesburg. The comprehensive analysis of differences in HRQL and non-HRQL based on various demographic factors identified nuanced disparities between male and female patients and among different ethnic groups. The findings emphasize the importance of taking into account sociocultural and environmental influences on patient

well-being, particularly among diverse demographic groups. Further research is needed to explore the underlying factors contributing to these disparities and to develop targeted interventions to improve the quality of life of COPD patients.

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Appendices

Appendix A: Charlotte Maxeke Ethical Clearance Certificate

Annex 1

Protocol No. M220426 **Miss Mbali Mbatsana**

Study sites approved under this Clearance Certificate

Study site	Date of HREC (Med) Approval
Helen Jospeh Hospital	19/08/2022
Charlotte Maxeke Johannesburg Academic Hospital	21/11/2022

Dr CB Penny
Chair: HREC (Medical)
University of the Witwatersrand, Johannesburg

Date: 21/11/2022

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix B: Helen Joseph Academic hospital Clearence certificate.

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Miss Mbali Mbatsana

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M220426

NAME: (Principal Investigator)	Miss Mbali Mbatsana
DEPARTMENT:	Family Medicine
PROJECT TITLE:	*The quality of life of patients with chronic obstructive pulmonary diseases in three academic hospitals in Johannesburg*
DATE CONSIDERED:	29/04/2022
DECISION:	Approved unconditionally
CONDITIONS:	This approval applies only to the study sites listed in Annex 1 attached. Further sites may be added on presentation of evidence of management approval to the HREC (Medical)
SUPERVISOR:	Dr K Pather, Prof I Kalla and Prof O Omole
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	19/08/2022

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions.Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. I **agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **April** and will therefore be due in the month of **April** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

Appendix C: Charlotte Maxeke Academic hospital permission to conduct research



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Prof R Morar
Department of Medicine
Division of Pulmonology
Area 552
5 Jubilee
Road
Parktown
2193
Tel: 011 488 3614
Email: rajen.morar@wits.ac.za

21 June 2022

Dear Mbali Mbatsana

Re: COPD research

Please note that your above request is provisionally approved. Your study can only commence once ethics approval has been obtained.

Sincerely



_____
Prof R Morar
PhD, MMed, FCP (SA) MBChB

CLINICAL HEAD: Division of Pulmonology
Department of Medicine, Charlotte Maxeke Johannesburg Academic Hospital

Appendix D: Helen Joseph Academic Hospital permission to conduct research and access medical records.

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA
Department of Health and Social Development

Dr A K Graham
Department of Pulmonology
Internal Medicine
Helen Joseph Hospital
Perth Road
Auckland Park
011489 1011/0473
dranitagraham@gmail.com

12/08/2022

RE: CONSENT TO USE CLINICAL DATA AND RECORDS FROM DEPARTMENT OF PULMONOLOGY HELEN JOSEPH HOSPITAL

Dear Dr Mbali Mbatsana

This letter serves to inform you that I consent to allow you access to and use of clinical information and records from the department of pulmonology at Helen Joseph Hospital for your MSC research entitled "*Quality of life of patients with chronic obstructive pulmonary diseases in three academic hospitals in Johannesburg."*

Wishing you the best of luck with your research project.

Regards



DR A K Graham
HOD Pulmonology
Helen Joseph Hospital
MBBch(WITS), FCP (SA), Cert Pulm
MP0609684

Appendix E: Patient's consent form to participate in the study.



Quality of life of patients with chronic obstructive pulmonary diseases in three academic hospitals in Johannesburg, South Africa

Participant consent form: Consent to participate in the study

I (Name and Surname) give the permission to be part of the COPD study that will be conducted at the hospital I am attending. The reason of the study and the information that will be required from me as a COPD patient in the study has been explained to me in writing. I therefore state that I have fully understood the reason for the study, process and activities that will take place during the study. I understand that any of my personal information that will be accessed or revealed during the study will be protected from people outside the study and that it will not be used to identify / be linked with me. I also understand that information given to the researcher may be used/quoted in the reporting of the results of this study in the form of a thesis, presentation in a conference and/in publication. I understand that signed consent forms will be retained for the duration of the study and 5 years post completion of the study at the university's research data base. I understand that all the information from the study will be shared with the researcher's supervisors for the study.

I understand that and I can withdraw my consent to participate in the study and the use of my original information in the reporting of the study at any point after my participation in the study before it is published/submitted for examination.

Signature of Patient _____ Date: _____

I believe the patient is giving informed consent to access hospital patient file.

Signature of researcher_____ Date: _____

1

Quality of life of patients with chronic obstructive pulmonary diseases in three academic hospitals in Johannesburg, South Africa

Participant consent form: Consent to access hospital records

I (Name and Surname) grant the researcher permission to access my patient file for the study that will be conducted at the hospital I am attending. The purpose of the study and use of patient files has been explained to me verbally and in writing. I therefore state that I have fully understood the reason for the need to access and use my file in the study. I understand that information from my patient file will be protected and that it will not be used to identify / be linked with me. I also understand that information obtained from my patient file may be used/quoted in the reporting of the results of this study in the form of a thesis, presentation in a conference and/in publication. I understand that signed consent forms will be retained for the duration of the study and 5 years post completion of the study at the university's research data base. I understand that raw data from my patient file will be shared with the researcher's supervisors for the study.

I understand that and I can withdraw my consent to use the original information from my file in reporting the study at any point after my participation in the study before it is published/submitted for examination.

Signature of patient _____ Date: _____

I believe the patient is giving informed consent to access hospital patient file.

Signature of researcher_____ Date: _____

1

Appendix G: Patient's consent to audio record focus group conversations.

Quality of life of patients with chronic obstructive pulmonary diseases in three academic hospitals in Johannesburg, South Africa

Participant Consent form: Consent to audio record focus group interviews.

I (Name and Surname) grant the researcher permission to audio record the focus group interviews that I will be a part of, as part of my participation in this study. The reason of audio recording my interview has been explained to me verbally and in writing. I therefore state thatI have fully understood the reason for, and I understand that information from my interview will be protected from people outside the study and will not be used to identify/linked with me. I also understand that protection of my information outside the study is not guaranteed as there will be other people in the focus group interviews. I understand that information from my interview may be used/quoted in the reporting of the results of this study in the form of a thesis, presentation in a conference and/in publication. I understand that signed consent forms and audio recordings will be retained for the duration of the study and 5 years post completion of the study at the university's research data base. I understand that original audio recordings and transcripts will be shared with the researcher's supervisors for the study.

I understand that I am entitled to request access to original audio recordings and transcripts while they are still in storage, and I can withdraw my consent to use the original data in reporting the study at any point after the interview.

Signature of patient_____Date: _____

I believe the participant is giving informed consent to audio record their interview

Signature of researcher_____ Date: _____

Appendix G: Permission to the Saint George's respiratory questionnaire

Mbali Mbatsana <1063646@students.wits.ac.za>

Request for permission to use the SGRQ tool for COPD academic research

St' George's Respiratory Questionnaire <sgrq@sgul.ac.uk> 21 June 2022 at 11:58
To: Mbali Mbatsana <1063646@students.wits.ac.za>
Cc: Kyrtania Pather <kyrtania.pather@wits.ac.za>, Olufemi Omole <olufemi.omole@wits.ac.za>, Ismail Kalla <Ismail.Kalla@wits.ac.za>

Dear Mbali

Thank you for your email regarding the SGRQ.

The SGRQ Office at St George's, University of London gives permission for use of the SGRQ in your research study as outlined in your email.

Please let me know if you require any SGRQ translations for your academic research.

Kind regards

Yvonne

Yvonne Forde

Administrative Officer (events, communication and GAT)

Research Operations

St George's University of London

yforde@sgul.ac.uk

Find advice and tools to support you in your research on our Research Operations webpages

[Quoted text hidden]

List of 3 month SGRQ translations.pdf
50K

Appendix H: Permission to use the COPD Assessment tool questionnaire

WITS UNIVERSITY

Mbali Mbatsana <1063646@students.wits.ac.za>

ePROVIDE™: You received a message related to Request 2208082

noreply@mapi-trust.org <noreply@mapi-trust.org> 7 June 2022 at 00:39
To: 1063646@students.wits.ac.za

Please find below new message(s) regarding your request.

To make sure we'll receive your answer(s), please login to ePROVIDE platform and access the details of your request to reply.

Date	From	Message
2022-06-06 10:39:03	Brittany Heard	Hello, Thank you for your interest in CAT. The CAT is distributed by Mapi. As you have indicated your study is not funded, you can download the scales directly from our website. You will just need to fill out the User Agreement online. I have included instructions for your convenience. We do not currently have access to English specifically for Africa. We do have a generic English. If this does not work, please let me know and I will provide the steps needed in order to have this

Appendix I: Permission to use the WHO Quality of life Bref Questionnnaire.

WITS UNIVERSITY

Mbali Mbatsana <1063646@students.wits.ac.za>

GRANTED: 389591 Permission request for WHO copyrighted material

permissions <permissions@who.int> 12 June 2022 at 12:59
To: "1063646@students.wits.ac.za" <1063646@students.wits.ac.za>

Dear Ms Mbatsana,

Thank you for submitting the online form and for your interest in World Health Organization (WHO) Quality of Life materials.

On behalf of WHO, we are pleased to authorize your request to reproduce, reprint and/or translate WHOQOL tools and instruments as detailed in the form below, subject to the terms and conditions of the non-exclusive licence below.

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We thank you for your interest in WHO published materials.

Kind regards,

Dolores

WHO Permissions Team

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Appendix J: Saint George Respiratory Questionnaire



ST. GEORGE'S RESPIRATORY QUESTIONNAIRE

ID NUMBER:									FORM CODE: **SGR** VERSION: 3.0 10/24/2017	Event: _____

0a) Date of Collection ☐☐ / ☐☐ / ☐☐☐☐ 0b) Staff Code ☐☐☐

Instructions: *This form should be completed during the participant's clinic visit. Please read the script exactly as written.*

This questionnaire is designed to help us learn much more about how your breathing is troubling you and how it affects your life. We are using it to find out which aspects of your illness cause you most problems, rather than what the doctors and nurses think your problems are.

Please ask if you have difficulty understanding the questions. Do not spend too long deciding about your answers.

0c) Please pick one response to show how you describe your current health:

Very good$_1$	Good$_2$	Fair$_3$	Poor$_4$	Very Poor$_5$
☐	☐	☐	☐	☐

The following questions ask about your chest trouble. Please answer as it applies to you.

PART 1

1) I cough:
- ☐ Most days a week$_1$
- ☐ Several days a week$_2$
- ☐ Only with respiratory infections$_4$
- ☐ Not at all$_5$

2) I bring up phlegm (sputum):
- ☐ Most days a week$_1$
- ☐ Several days a week$_2$
- ☐ Only with respiratory infections$_4$
- ☐ Not at all$_5$

St. George's Respiratory Questionnaire for COPD Patients (SGRQ-C) © Version No. 1.2 April 2012. P.W. Jones, PhD FRCP, Y. Forde, St. George's University of London, London SW17 ORE, UK. All rights reserved.

Appendix K: COPD Assessment Tool

Your name:_____

Today's date:_____

How is your COPD? Take the COPD Assessment Test™ (CAT)

This questionnaire will help you and your healthcare professional to measure the impact that COPD (Chronic Obstructive Pulmonary Disease) is having on your wellbeing and daily life. Your answers and test score can be used by you and your healthcare professional to help improve the management of your COPD and gain the greatest benefit from the treatment.

For each item below, place a mark (X) in the box that best describes your current situation. Please ensure that you only select one response for each question.

Example: I am very happy | 0 | X | 2 | 3 | 4 | 5 | I am very sad

			SCORE
I never cough	0 1 2 3 4 5	I cough all the time	
I have no phlegm (mucus) on my chest at all	0 1 2 3 4 5	My chest is full of phlegm (mucus)	
My chest does not feel tight at all	0 1 2 3 4 5	My chest feels very tight	
When I walk up a hill or a flight of stairs I am not out of breath	0 1 2 3 4 5	When I walk up a hill or a flight of stairs I am completely out of breath	
I am not limited to doing any activities at home	0 1 2 3 4 5	I am completely limited to doing all activities at home	
I am confident leaving my home despite my lung condition	0 1 2 3 4 5	I am not confident leaving my home at all because of my lung condition	
I sleep soundly	0 1 2 3 4 5	I do not sleep soundly because of my lung condition	
I have lots of energy	0 1 2 3 4 5	I have no energy at all	
		TOTAL SCORE	

A COPD assessment test was developed by an interdisciplinary group of international COPD experts with support from GSK. GSK's activities in connection with the COPD assessment test are monitored by a supervisory council that includes external, independent experts, one of which is chair of the council.

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Appendix L: WHOQOL BREF-26

WHO/HIS/HSI Rev.2012.01
English only

Field Trial

WHOQOL-100

February 1995

THE 100 QUESTIONS WITH RESPONSE SCALES

DIVISION OF MENTAL HEALTH

WORLD HEALTH ORGANIZATION

GENEVA

Appendix K: Consolidated participant characteristics table

	Sex			
Referring hospital/clinic	Male	Female	Total	Percentange
HJAH	123	115	238	65%
CMJAH	72	51	123	34.87%
Total	195	83	361	100%

	Gender					
Age group	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Young Age	4	1.10%	8	2.21%	12	3.32%
Middle Age	72	19.94%	62	17.17%	134	37.11%
Eldery Age	88	24.38%	68	18.83%	156	43.21%
Senile Age	29	8.03%	27	7.48%	56	15.51%
Long livers	2	0.55%	1	0.28%	3	0.83%
Total	195	54%	166	45.98%	361	100%

	Gender					
Smoking status	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Current smoker	119	61.03	84	50.60%	203	56.23%%
Ex smoker	47	24.10	39	23.49%	86	23.82%%
Never smoker	29	14.87	43	25.90%	72	19.94%%
Total	195	100%	166	100%	361	100%

	Gender					
Employment status	Male	Percentage	Female	Percentage	Total patients	Total Percentage
Employed	55	28.21%	43	25.90%	98	27.14%%
Unemployed	27	13.85%	27	16.27%	54	14.95%
Pensioner	113	57.95%	96	57.83%	209	57.89%
Total	195	100%	166	100%	361	100%

	Gender					
Education	Male	Percentage	Female	Percentage	Total patients	Total Percentage