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Medication Adherence, Self-care Behaviour and Knowledge on Heart Failure in Urban South Africa

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Referat

Non-Compliance ist unter herzinsuffizienten Patienten ein weltweites Problem, welches bisher in Südafrika noch nicht untersucht wurde. Gerade bei dieser Erkrankung können Patienten einen Krankenhausaufenthalt verzögern, indem sie ärztlichen Rat befolgen, also einen gesundheitsfördernden Lebensstil führen und die Medikamente entsprechend der Verordnung einnehmen. In dieser Studie sollte die Compliance für verschiedene Aspekte wie Medikamenteneinnahme und gesundheitsfördernder Lebensstil bei herzinsuffizienten Patienten erfasst und Gründe für Non-Compliance beschrieben werden. Außerdem wurde eine Bestandsaufnahme vorgenommen, inwieweit Patienten von Ärzten im Baragwanath Hospital über ihre Erkrankung aufgeklärt und sich infolgedessen Wissen über ihre Krankheit aneignen konnten. Die Untersuchung verfolgte einen dualen Ansatz, indem sowohl das Patientenverhalten, als auch die medizinische Versorgung untersucht wurde. Die Studie ist integrierter Bestandteil der „Heart of Soweto Study“, welche die Entstehung von „westlichen“ Herzkrankheiten in der Population von Soweto beschreibt und unter der Leitung von Professor Karen Sliwa durchgeführt wird.

Zur Erfassung der Sachverhalte wurde ein Fragebogen entwickelt, der in einem Interview mit 200 Patienten angewandt wurde. Das mittlere Alter der Patienten betrug 56 ± 14 Jahre, 79% der Patienten waren Schwarzafrikaner und 55% waren männlich. Im zeitlichen Abstand von 1 Monat ließ sich bei 41% der Studienteilnehmer eine Medikamentenzählung durchführen. Die Herzinsuffizienztherapie bestand aus einem Diuretikum (93%), einem Betablocker (84%), einem ACE-Hemmer (74%), dem Aldosteronrezeptorantagonisten Spironolacton (64%) und dem Herzglykosid Digoxin (24%); durchschnittlich wurden 6 ± 2 Medikamente eingenommen. Insgesamt wurden 71% der verordneten Medikamente korrekt eingenommen, wobei die Compliance für die einzelnen Medikamente zwischen 64% und 79% variierte. Eine große Bandbreite fand sich in der Compliance bezüglich des empfohlenen Lebensstils (2,5%-98%). Insgesamt herrschte nur geringes Wissen über die Herzinsuffizienztherapie: 56% der Patienten konnten weder Wirkungsweise noch unerwünschten Wirkungen der Medikamente benennen. Dem hingegen konnten 69% der Fragen über das Management der Herzinsuffizienz richtig beantwortet werden.

Diese Ergebnisse zeigen, dass ähnlich wie in anderen Regionen der Welt, Non-Compliance bezüglich Medikamente und einer gesundheitsfördernde Lebensweise ein wesentliches Problem darstellt. Sie sollen als Ausgangspunkt für die Entwicklung eines „Heart Failure Management Programs“ dienen, um die Behandlung von herzinsuffizienten Patienten unter Berücksichtigung ihrer besonderen Lebensumstände in Südafrika entscheidend zu verbessern.

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Content

Abbreviations and symbols

ACE-inhibitors = Angiotensin-converting enzyme inhibitors

AF = Atrial fibrillations

ARBs = Angiotensin receptor blockers

Beta-blockers = Beta-adrenoceptor antagonists

BMI = Body mass index

CHF = Chronic heart failure

CI = Confidence interval

CMO = Cardiomyopathy

ESC = European Society of Cardiology

HF = Heart failure

LVEF = Left ventricular ejection fraction

MEMS = Medication Event Monitoring System

NYHA = New York Heart Association

OR = Odds ratio

UK = United Kingdom

USA = United States of America

WHO = World Health Organisation

χ^2 = Chi square

1. Introduction

1.1 Background

Although the population burden and individual impact of chronic heart failure (CHF) has been well described in the Western World **[1]**, it has been less well described on the African continent **[2-5]**. Significantly, CHF represents an emerging problem in low to middle income countries in sub-Saharan Africa undergoing epidemiologic transition **[3]**. For example, CHF is already an important cause for morbidity and mortality in black South Africans and it is conceivable that the incidence of CHF will increase over time **[6]**. In addition to the need for a series of studies in Africa that parallel the detailed documentation of an epidemic of CHF in the Western World **[7]**, there is a need to better understand the individual experiences of those affected by CHF in African communities. In this context, one of the key issues that determines individual outcomes is patient knowledge and adherence to prescribed gold-standard non-pharmacologic and pharmacologic treatments **[8]**.

Results from high income countries have shown that poor adherence with medical recommendations remains a substantial problem among people with CHF who must follow a multi-component treatment regimen that includes medications, dietary restrictions and exercise recommendations **[9]**. Overall, it has been estimated that between one third and one half of all patients with chronic heart conditions have difficulties adhering to their prescribed medication regimen in the Western World contributing to impaired quality of life, high health care costs linked to increasing rates of hospital readmissions and outpatient hospital care in addition to premature mortality **[10]**. Importantly, greater CHF-related knowledge is associated with better treatment adherence **[11]**. However, despite its potential clinical importance (there is no reason to suspect African patients are immune to this problem) there is a paucity of data on treatment adherence in patients with cardiovascular disease in the African context **[12-15]**.

1.2 Chronic heart failure

Chronic heart failure (CHF) is a syndrome in which patients should have symptoms of heart failure, typically shortness of breath at rest or during exertion, and/or fatigue; signs of fluid retention such as pulmonary congestion or ankle swelling; and objective evidence of an abnormality of the structure or function of the heart at rest **[8]**. Altogether, treatment for CHF includes non-pharmacological management, pharmacological therapy, mechanical devices and surgery. The aim of CHF therapy is first of all prevention of the disease, but also maintenance or improvement in quality of life and improvement in survival. There has been several changes in the treatment of CHF over the past 15 years with a change of focus from not just improving the symptoms of CHF but also to prevent the heart transcending from asymptomatic cardiac dysfunction to symptomatic CHF.

Non-pharmacological management plays an important part in the treatment of a CHF patient. A patient who adheres to this non-pharmacological management promotes a behaviour that can be referred to as self-care behaviour. This behaviour maintains physical stability, avoidance of behaviour that can worsen the condition, and detection of the early symptoms of deterioration **[16]**. Appropriate self-care behaviour can significantly impact on symptoms, functional capacity, well-being, morbidity, and prognosis **[8]**. According to the European Society of cardiology (ESC) guidelines, non-pharmacological management approaches several issues and a patient needs to be educated on each topic. In this context, adherence to treatment is a key issue as it decreases morbidity and mortality and improves overall well-being **[17]**. A patient should also be able to recognise symptoms that indicate a deterioration of CHF, and react accordingly or inform a healthcare provider. Moreover, regular weight monitoring (preferably daily) is important self-care behaviour, in order to recognize a weight gain of 2 kg in 3 days, which would require an adjustment in the diuretic dose or a consultation with a healthcare provider.

Furthermore, there are several dietary recommendations for CHF patients. In advanced CHF, sodium restriction seems to be important, and also a fluid control of 1.5-2 litres per day needs to be addressed in these patients. However, the later is only a general recommendation rather than scientifically proved self-care behaviour (Class of recommendation IIb, level of evidence C). A moderate alcohol intake (one beer, 1-2 glasses of wine per day) and weight reduction in obese patients are other important dietary aspects in CHF patients. In the USA, recommendations for diet and lifestyle for cardiovascular disease risk reduction have already been established **[18]**. South Africa, however, has to deal with two contrasts: the high prevalence with under-nutrition, coexisting with an emerging, even higher prevalence of nutrition related chronic disease of lifestyle. Several studies have already looked at the emerging health and nutrition transition in South Africa **[19-22]**, and there are general South African Food-based Dietary guidelines **[23]**, but so far there are no dietary guidelines for specific diseases.

However, nutritional advice should always be accompanied by advice on smoking cessation and exercise training programs in patients with compensated CHF. As smoking seems to be a predictor of hospital readmission in patients with heart failure, it is recommended to support patients to stop smoking **[24]**. Regular physical activity is associated with improvement in peripheral vascular, muscular and metabolic function, which is beneficial for a heart failure patient **[25]**. Another study indicated that mortality might even be reduced through exercise training in CHF patients **[26]**. According to the ESC guidelines, exercise training is only recommended in patients with stable CHF. Regular, moderate daily activity, however, is recommended for all CHF patients **[8]**. As mentioned above, these self-care behaviours are important for CHF management, however, to our knowledge there are yet no studies on CHF related self-care behaviour in South Africa.

The pharmacological therapy for CHF includes a combination of several drugs. The ESC has developed a treatment algorithm, which is shown in Figure 1:

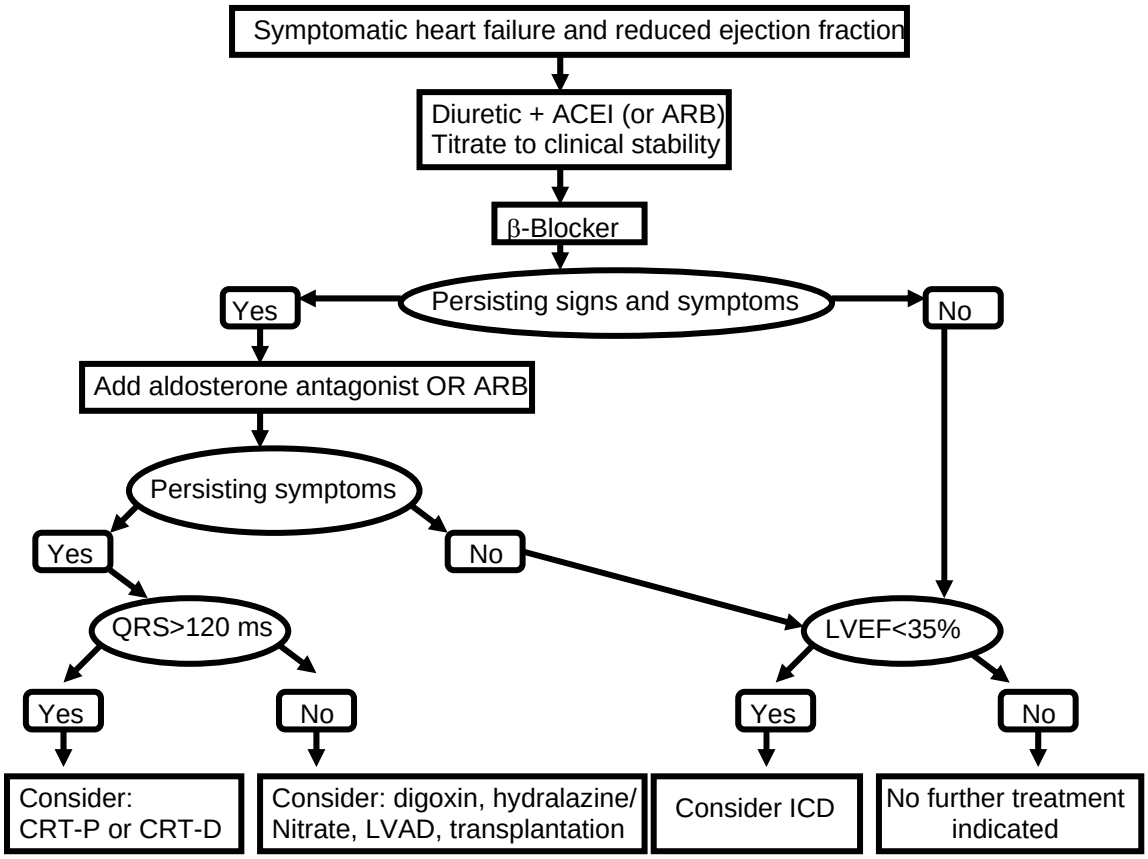

Fig. 1 A Treatment algorithm for patients with symptomatic heart failure and reduced ejection fraction (from [8]). ACEI = Angiotensin-converting enzyme inhibitors, ARB = Angiotensin receptor blockers, β-blockers = Beta-adrenoceptor antagonists, QRS = QRS-time, LVEF = Left ventricular ejection fraction, CRT-P = Cardiac resynchronization therapy with pacemaker function, CRT-D = Cardiac resynchronization therapy with defibrillator function, LVAD = Left ventricular assist devices, ICD = Implatable cardioverter defibrillator.

- Angiotensin-converting enzyme inhibitors (ACE-inhibitors) are recommended as first line therapy in patients with a reduced left ventricular systolic function (ejection fraction < 40-45%) with heart failure symptoms. ACE-inhibitors improve survival, left ventricular function, symptoms, and reduce hospitalizations in patients with moderate and severe heart failure **[8, 27, 28]**.
- Diuretics are essential in symptomatic patients with fluid overload expressed either in pulmonary congestion or peripheral oedema. However, significant effects on symptoms or survival have not yet been proved **[8, 29]**.

- Beta-adrenoceptor antagonists (Beta-blockers) are indicated for all symptomatic patients (New York Heart Association [NYHA] class II-IV) with a left ventricular ejection fraction (LVEF) ≤ 40, unless there is a contraindication. Beta-blockers reduce hospitalization, improve ventricular function and well-being and increase survival **[8, 30-32]**.
- Aldosterone receptor antagonists are recommended in patients with an LVEF < 35% and advanced CHF (NYHA III-IV), as they reduce hospitalization and improve survival in combination with an ACE-inhibitor **[8, 33]**.
- Angiotensin receptor blockers (ARBs) are indicated when a CHF patient is symptomatic and has a LVEF < 40%, in spite of taking an ACE-inhibitor and a beta-blocker, unless aldosterone antagonists are also taken. However, ARBs are also often implemented when side effects of ACE-inhibitors occur. ARBs improve ventricular function and the patient's well-being and reduce hospitalization **[8, 34, 35]**.
- Cardiac glycosides are indicated in patients with symptomatic CHF and atrial fibrillation (AF) to slow the heart rate. In patients with AF and a LVEF < 40%, cardiac glycosides should be used in addition to beta-blockers. In patients with CHF and sinus rhythm, they improve ventricular function and symptoms and reduce hospitalization **[8, 36]**.

Apart from the standard drugs for the treatment of CHF, many patients take additional drugs for concomitant diseases. For example, nitrates can be given to patients presenting with concomitant angina, but also to relieve acute dyspnoea. However, evidence is lacking that oral nitrates improve symptoms of CHF or an acute exacerbation of CHF **[37]**. Calcium antagonists (e.g. amlodipine) are a safe alternative to treat concomitant hypertension and angina, if hypertension is resistant to beta-blockers and nitrates as they have a neutral effect on survival **[37]**. Anticoagulation is firmly indicated in patients with CHF and AF, as it reduces the risk of thromboembolic complications **[38]**. Contrarily, anti-platelet therapy is not effective in reducing thromboembolic events **[37]**. Anti-arrhythmic therapy, other than beta-blockers, is only indicated in patients with CHF when concomitant diseases, such as AF or ventricular tachycardia occur. Potassium supplements are indicated when hypokalaemia persists. Other diseases such as diabetes and high blood cholesterol need an anti-diabetic or a lipid lowering therapy, respectively. Although there is an evidence for a difference in the heart failure phenotype between black and white patients, chronic heart failure therapy in black patients remains largely the same as in white chronic heart failure cohorts, with the notable exception of the added benefits provided by combination of hydralazine and isosorbide dinitrate **[39, 40]**.

Surgery and mechanical devices cover revascularization procedures, valvular and ventricular surgery, pacemakers, cardiac resynchronisation therapy, implantable cardioverter defibrillators and heart replacement therapy.

1.3 Treatment adherence

Adherence with medication is a complex area of human behaviour. The World Health Organisation (WHO) defines adherence as "the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider" **[41]**. It is a multidimensional phenomenon determined by the interplay of five sets of factors: patient-related, condition related, therapy-related, health system factors and social/economic factors **[41]**. A synonym for adherence is compliance; this term has however, a negative connotation because of the one-way-direction from the describing health care provider to the obeying patient. Other terms to describe the same phenomenon are therapeutic alliance and concordance **[42]**.

Poor adherence to treatment to long-term therapies is a world wide problem of striking magnitude. As mentioned above, approximately only 50% of all patients in developed countries adhere to their prescribed regimen and the WHO estimates that in undeveloped countries the number of treatment adherence may be even less **[10, 41]**.

In order to assess adherence to medications, there are several methods available, but there is however no gold-standard. Patient interviews, interviews of the health care provider or self-report questionnaires are easy to realize, but adherence is often described inaccurately **[43]**. Pill counts seem to be more objective, but overestimate adherence as well **[44]**. Chart reviews and patients' diaries represent other options which are easy to realize. Medication Event Monitoring System (MEMS) and biochemical measurement, on the other hand, are more complex, but are also more objective methods to assess treatment adherence. Nevertheless, there are also several drawbacks to these options such as costs or influences by diet, absorption and rate of excretion **[41]**.

Consequences of non-adherence with medication in CHF patients are severe, such as clinical destabilisation and lower LVEF with impaired quality of life, high health care costs linked to increasing rates of hospital readmissions and outpatient hospital care in addition to premature mortality **[10, 17, 45, 46]**.

Because of these consequences, it is crucial to intervene and improve medication adherence. Haynes *et al.* supposed that increasing the effectiveness of adherence interventions might even have a far greater impact on the health of the population than any improvement in specific medical treatments **[47]**. There is a variety of possible interventions to enhance medication adherence. For short-term drug treatments, patient education in terms of written information, counselling and personal phone calls are effective interventions **[48]**. For long-term treatments, no simple interventions, and only some complex ones, lead to improvements in health outcomes **[48]**. These include combinations of education, counselling, reminders, home visits, follow-up at a clinic, social service consultation, psychological therapy, computer based education and

home telemonitoring. Unfortunately, in spite of increasing efforts, even the effective interventions, did not lead to large improvements in adherence and treatment outcomes. However, as the most effective intervention seems to be those that promote sustained behaviour change, future studies should concentrate on this field **[49]**. Additionally, interventions should also be directed towards the healthcare provider in terms of training providers in patient-centred methods of care **[41]**.

There are several factors that affect adherence. An important reason for non-compliance is forgetfulness, but in this case one can refer to unintentional non-compliance. However, there seem to be "risk-factors" that enhance intentional non-adherence. Studies suggest that adherence to medication seem to be related to education and social support, and may be affected by age, sex, ethnic subset, previous admission to hospital due to CHF and knowledge on CHF and its management **[11, 50-53]**.

1.4 Knowledge on CHF

A key issue to promote heart failure self-care behaviour, and thus prevent frequent hospitalization, is to increase a patient's knowledge on CHF symptoms, CHF treatment and its non-pharmacological management through education **[54]**.Patient education can be defined as the process of improving knowledge and skills in order to influence the attitudes and behaviour required to maintain or improve health **[55]**. Even though increased knowledge does not necessarily improve adherence, it is fundamental for the decision-making process of behaviour choice by helping people weigh the costs and benefits **[56]**, and knowledge does increase at least the chance for adequate self-care behaviour **[55]**. As a result, education is an important part of all management programs in CHF patients. Knowledge is however, difficult to measure, but most studies used questionnaires as a tool to assess knowledge **[11, 57, 58]**. Ni *et al.* suggest that higher knowledge seems to be related to previous hospitalization, higher NYHA class, gender and the presence of received information through a health care provider **[11]**. Although knowledge on CHF is now more frequently promoted in CHF patients, public awareness of CHF in Europe is still low **[59]**. In the same way, little is known about knowledge on CHF in patients in South Africa.

2 Aims

Due to the increasing burden of heart failure in South Africa and the associated cost for an already strained health care system, it is crucial to exploit all possibilities and elicit the maximum effect of heart failure therapies that have already been established. In this context, improvement of adherence to heart failure treatment and heart failure self-care behaviour might be as important on the health of the population as any improvement in specific medical treatment. As knowledge on the disease and its management seems to improve self-care behaviour, it is important to educate heart failure patients in these areas. The aim of our study was consequently,

1) To examine the pattern of treatment adherence, self-care behaviour and knowledge on CHF in 200 consecutive CHF patients attending the Chris Hani Baragwanath Hospital, Soweto, South Africa via a combination of questionnaire and pill count
2) To determine variables predicting medication adherence
3) To create a basis for a heart failure management program in Soweto

3 Material and Methods

3.1 Study setting

This study represents a key sub-study of the previously described *Heart of Soweto Study* **[3, 4]**, which is currently mapping the emergence and spectrum of heart disease in a black, urban population. The study benefits from the unique setting that is found at the Chris Hani Baragwanath Hospital representing the only tertiary-care centre for the population of Soweto and surrounding communities. Soweto, a township situated in the South West of Johannesburg, South Africa, has a population of 1.1 million which has undergone an economic development enabling a large proportion of its population to a more affluent lifestyle. The township is comprised of people from different ethnic backgrounds; however the Black African population is predominant. As the Chris Hani Baragwanath Hospital is the only point of specialist cardiac care for the population in Soweto, the Cardiology Clinic will most likely attend to nearly every patient presenting with symptoms evolving from a cardiac condition. The cardiology outpatient department population consists of patients seen and referred by 12 local Soweto primary-care clinics with a suspected cardiac disorder, patients initially seen at the general medicine outpatient facilities, the specialist medical registrar clinic, the diabetic clinic or inpatients admitted to any other ward of the Chris Hani Baragwanath hospital that need a cardiac consultation.

3.2 Study participants

During November 2006 and April 2007, we recruited 200 consecutive patients with a confirmed diagnosis of CHF presenting to the cardiology clinic. Naturally, in this way, patients with a NYHA class IV were hardly included in the study, as most patients at this stage of the disease are not able to attend an outpatient clinic. However, in this study the resources for home visits were not available. For the purpose of this study, patients were included if they had a confirmed diagnosis of CHF by an attending cardiologist based on typical clinical symptoms (shortness of breath, oedema, fatigue) and a documented left ventricular ejection fraction (LVEF) of $\leq 45\%$ using echocardiography. Patients with concomitant valve diseases were excluded, as they often need heart surgery and thus are not available for follow-up appointments. Non-English speaking patients were only excluded if a translator was unavailable. Patients were approached in the outpatient cardiology clinic and invited to participate. Data were collected after an informed consent form was signed. There were no duplicate registrations.

Prior to study commencement, the study was approved by the relevant local Ethics of Human Research Committee. The study conforms to the standard statements on ethics outlined by the Declaration of Helsinki.

3.3 Study instrument

During a pilot study consisting of 20 participants a *"Medication adherence and knowledge on Heart failure Survey"* specific to this predominantly Black African community was developed in October 2006. The questionnaire was then applied to the above study population on a one-to-one basis in an interview of approximately 20 min. All interviews were executed by the same investigator (VR) and if needed a translator assisted its application. A pill count of prescribed CHF treatment was conducted in those 82 patients (41%) who returned for a scheduled 1 month post interview appointment. If appropriate, a telephone reminder was made two days prior to this appointment; however, contact details were available for few patients.

The *"Medication Adherence and knowledge on HF Survey"* addresses the following sections: Demographic and clinical data, medication adherence, self-care behaviour (adherence to follow-up appointments, weighing behaviour, dietary restriction, regular physical activity, smoking abstinence and alcohol intake), knowledge concerning CHF medication and overall CHF management. Questionnaires in other studies included the same sections **[9, 11, 60]**, however the answer possibilities in our questionnaire were mostly dichotomous ("yes" or "no") instead of offering a range of answers ("no", "a little", "some" or "a lot"). In accordance with previous studies of this type **[9, 60]**, we defined treatment adherence as ≥75% of prescribed pills taken. However, recent studies suggested a level of adherence > 80% is needed to achieve optimal clinical outcomes **[61, 62]**. This needs to be considered in future studies. Similarly, we defined appointment adherence as being present at ≥75% of assigned appointments consisting of quarterly check-ups and monthly medication refills at the hospital pharmacy. In accordance with the ESC Guidelines **[8]**, we defined behavioural adherence as daily weight monitoring, daily intake of 5 servings of fruit and vegetables, drinking less than 2 litres of fluids per day, being physically active with compensated CHF 2-3 times per week, refraining from smoking and keeping a moderate alcohol intake (1 beer, 1-2 glasses of wine/day).

The demographic and clinical section records:

- Age in years
- Height and weight and thus BMI
- Sex
- Ethnic subset (Black African, Indian, Coloured or White African)
- Education (None, Standard 1-5, Standard 6-10, Matriculation and Post Matriculation)
- NYHA class at the point of being diagnosed with Heart failure (HF)
- Left ventricular ejection fraction at diagnosis in percent (%)
- Aetiology (Ischemic Cardiomyopathy [CMO], hypertensive HF, inflammable CMO, valvular CMO, Post partum CMO, arrhythmia, idiopathic CMO and others)
- Living status ("alone" or "with somebody")

- Practical and emotional support classified in “none”, “a little”, “some” and “a lot”
- Employment status (employed, unemployed, retired)
- Duration of CHF divided into “longer than 5 years”, “between 1 and 5 years” and “newly diagnosed”
- Previous admission to hospital due to CHF

In the following sections the patient was asked to report on adherence to follow-up appointments at the cardiology out-patient department, on reasons for missing appointments if applicable and on adherence to their CHF medication. The latter was supported through a pill count if the patient returned for the designated appointment. If relevant, reasons for skipping medications were questioned. Additionally, adherence on various aspects on CHF management were being questioned such as daily weight monitoring, daily fluid and fruit intake, diet, regular physical activity, smoking abstinence and alcohol intake.

In order to gain insight on education given on CHF and CHF management at the cardiology outpatient department, patients were asked if they were educated by a doctor or a nurse concerning the recommended standards for various aspects on CHF management. Health education on “salt intake” was given when the patient was informed of the benefits of a low salt intake and similarly health education on “fat intake” was given when information of the benefits of a low fat intake was given. Furthermore, health education given on a “healthy diet” was accomplished when a patient was informed on the positive effect of a diet rich in vegetables and fruits. Health education on “fluid intake” was given if a patient knew that there is a limitation to less than 2 litres of fluids per day. Moreover, health education on “alcohol restriction” meant informing about a moderate alcohol intake (1 beer or 1-2 glasses of wine per day). Health education on “physical activity” was given when a patient was aware that regular physical activity has a positive effect on CHF as long as the patient has a compensated HF. “Information on HF” was given if the nature of the disease was explained to the patient.

The last section of the questionnaire was concerned with the patient’s knowledge on CHF, CHF medication and CHF management. Firstly, the study participants were asked to name the effects and side-effects of each of their medication. Afterwards they should quantify how much they knew about the nature of their disease categorized in “a lot”, “some”, “a little” or “nothing”.

The second part of the knowledge section consisted of 10 statements on CHF management (Tab. 1). Patients had to decide whether they think the statement is “correct”, “false” or if they “do not know”. The correct answers are indicated in table 1. If a patient chose 10 correct answers he received 100% on this knowledge section.

3.4 Statistics

Descriptive statistics and measures of frequency were conducted in Microsoft EXCEL® and were used to describe the study population and various adherences. Data are presented by means ± standard deviation or with percentages. To compare groups we used χ^2 analysis for discrete variables and Students t-test or Mann-Whitney-U test for continuous variables in SPSS 11.5. Univariate and multivariate binary logistic regression models were performed in SPSS 11.5 to determine variables predicting adherence. Determinants for medication adherence were presented by odds ratio (OR) and 95% confidence intervals (CI) whereas an OR=1 indicates no influence on medication adherence. Significance was accepted at the two-sided level of 0.05.

4. Results

4.1 Demographic profile

The demographic profile of the study cohort is presented in table 2. Overall, Black Africans predominated (n=157 [79%]) and there were more men (n=109 [55%]) than women (n=91 [45%]). The average age of the study population is shown in table 2. Between the genders were no difference in age profile (average age 56±13 vs. 56±15), however Black African patients were in average younger than the other ethnic subsets combined (average age 55±15 vs. 60±8, p=0.066). Figure 2 visualizes the distribution of the patients onto different age groups. Looking at the body mass index (BMI), women had an average BMI of 1st degree obesity whereas men were only slightly overweight (p=0.001). (Tab. 2 and Fig.3) No significant difference was found between Black Africans and the other ethnic subsets combined. Almost half of the patients were retired, and apart from a few exceptions nearly all lived in a shared household. Black Africans were significantly more likely to have no or standard education than other ethnic subsets combined (128 [82%] vs. 24 [56%], p=0.001). In the same way, women were significantly more likely to have no or standard education than men (76 [84%] vs. 76 [70%], p=0.014). When questioned about their self-perceived level of social support, Black Africans were less likely to report having "a lot of" practical support than other ethnic subsets combined (91 [58%] vs. 33 [77%], p=0.038), however there was no major difference found between the ethnic subsets in respect to reported emotional support. Women on the other side were significantly more likely to feel emotionally supported than men (71 [78%] vs. 66 [61%], p=0.008).

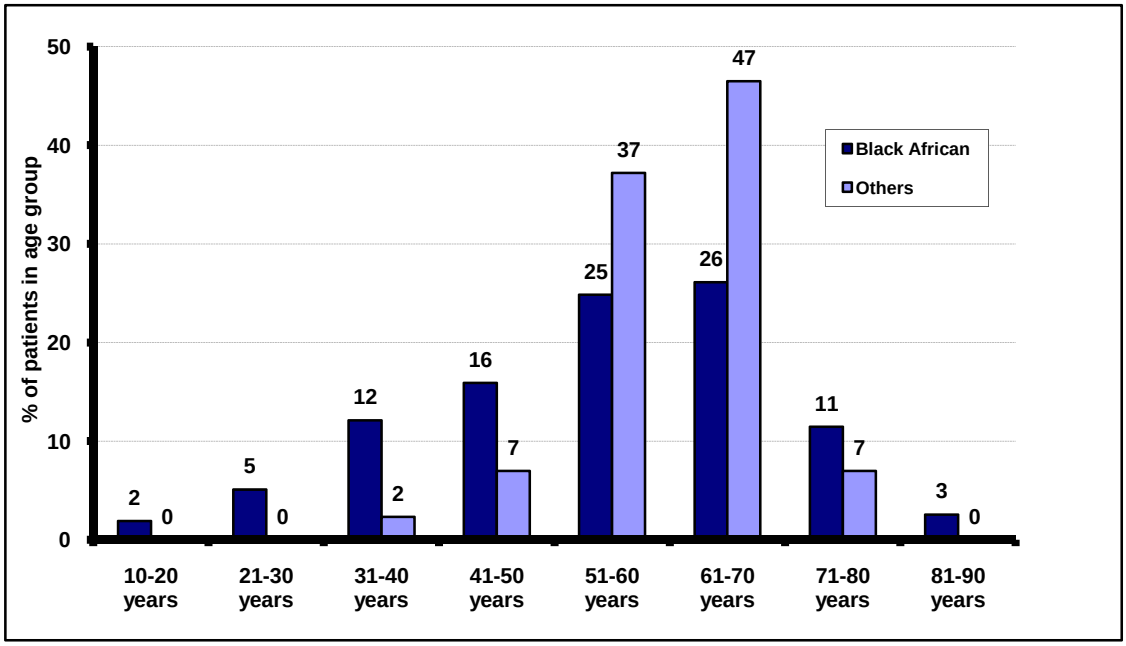

Fig. 2 Distribution of study patients onto age groups

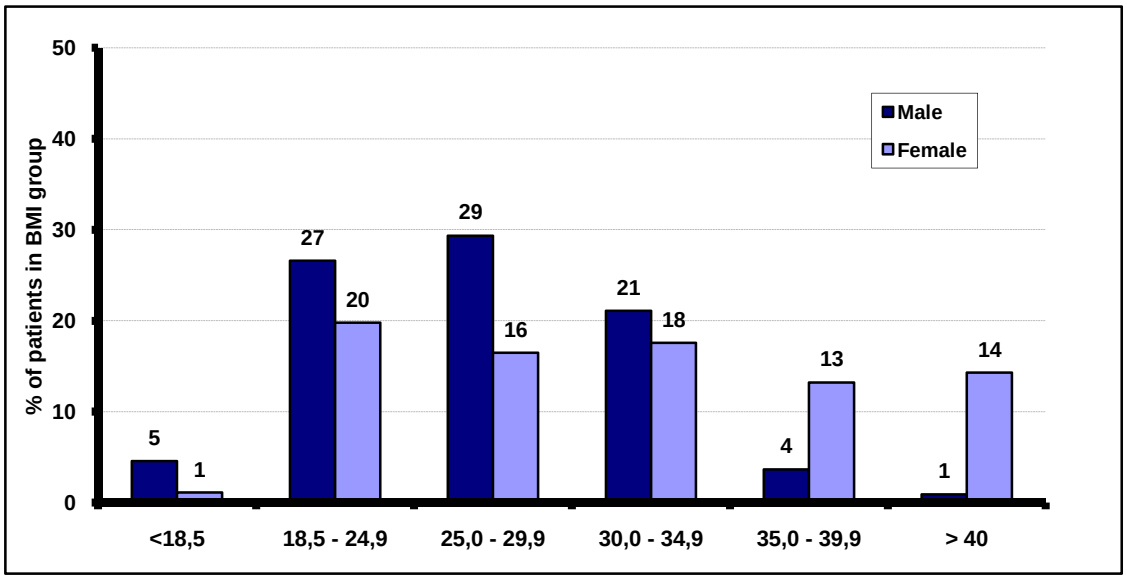

Fig.3 Distribution of male and female patients onto different BMI groups (kg/m²)

4.2 Clinical profile

The clinical profile of the study cohort is presented in table 3. Overall, 90% of our study patients were classified into New York Heart Association functional Class (NYHA) II and III at the point of being diagnosed with heart failure. The mean left ventricular ejection fraction (LVEF) was 32% ± 8. Differences between men and women are shown in figure 4. Black Africans were less likely to live longer than 5 years with CHF than other ethnic substes combined (61 [39%] vs. 23 [53%], p=0.085) and additionally they were more likely to have been admitted to hospital before the point of investigation due to their CHF (135 [86%] vs. 34 [79%], p=0.188). However, that did not reach statistical significance. Standard treatment included beta-blockers, ACE-inhibitors, loop diuretics, spironolactone and cardiac glycosides.

As represented in figure 5, the three most common underlying aetiologies for CHF in our study population were idiopathic cardiomyopathy (CMO), ischemic CMO and hypertensive HF. A striking difference between Black Africans and the other ethnic subsets combined, was that ischemia was only in 14% the underlying aetiology for CHF vs. 63% respectively (p<0.001). These results are supported by Stewart *et al.* **[5]**. Similarly, among women ischemia was only in 9% the underlying aetiology for CHF vs. 38% among men (p<0.001). Other causes of CHF included Post Partum CMO (5% of patients); a condition more commonly found in Africa **[2]**.

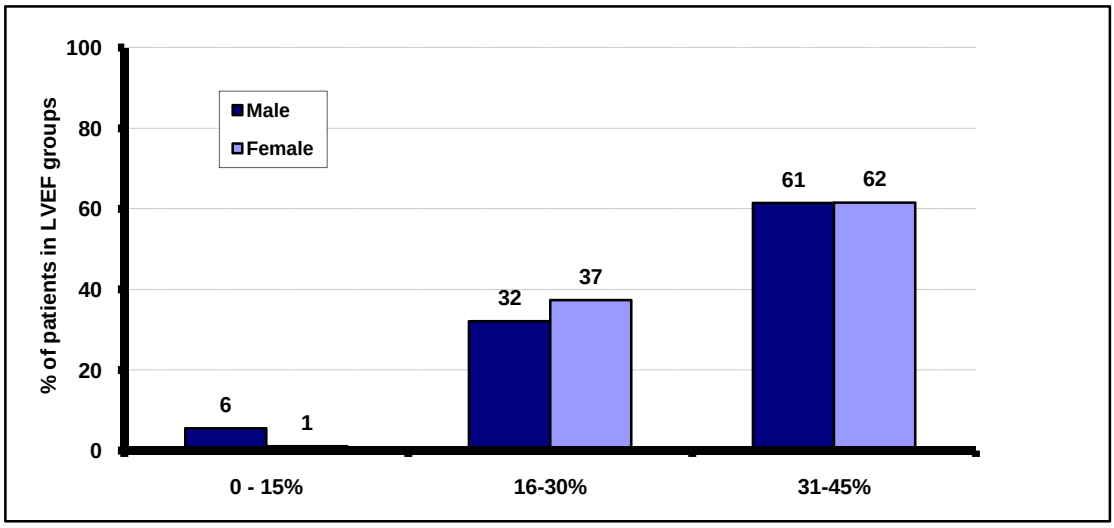

Fig. 4 Distribution of patients on different LVEF groups

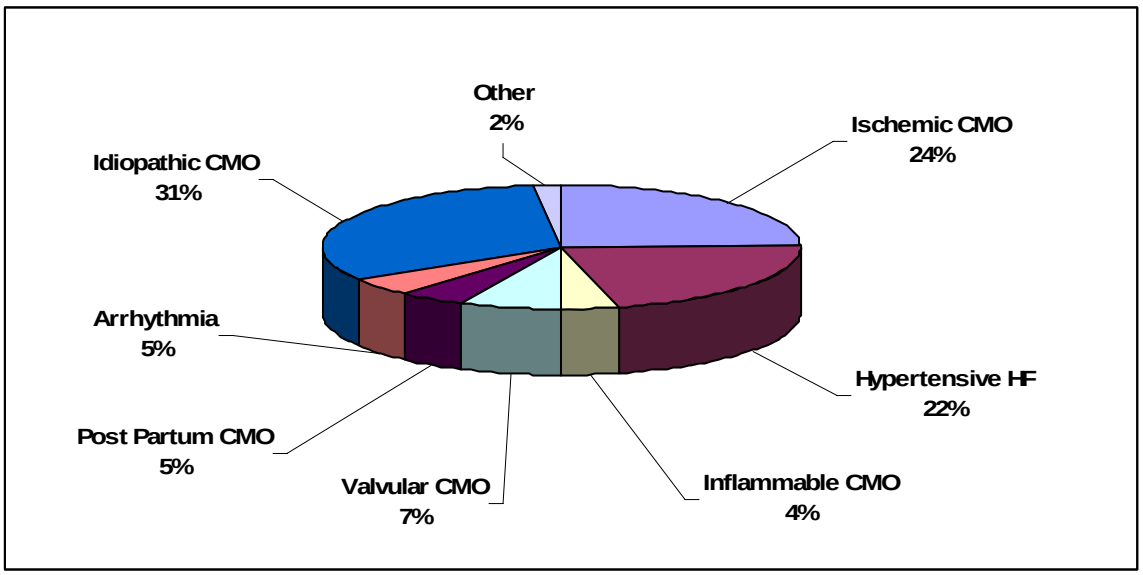

Fig. 5 Aetiology of CHF (total study population)

4.3 Treatment adherence

Standard treatment included beta-blockers (84%), ACE-inhibitors (74%), loop diuretics (93%), spironolactone (64%) and cardiac glycosides (24%). (Table 3) Other medications commonly prescribed in patients with CHF included potassium supplements (54%), aspirin (47%), lipid lowering agents (33%), warfarin (19%), nitrates (24%), hypoglycaemic agents, thiamine supplements and calcium antagonists (14%) and the anti-arrhythmic agent amiodarone (7%). A mean of 6 ± 2 pills were taken, whereas overall 70% of all patients took between 5 and 8 different pills (Fig.6). 91% of the study patients had to take tablets twice a day.

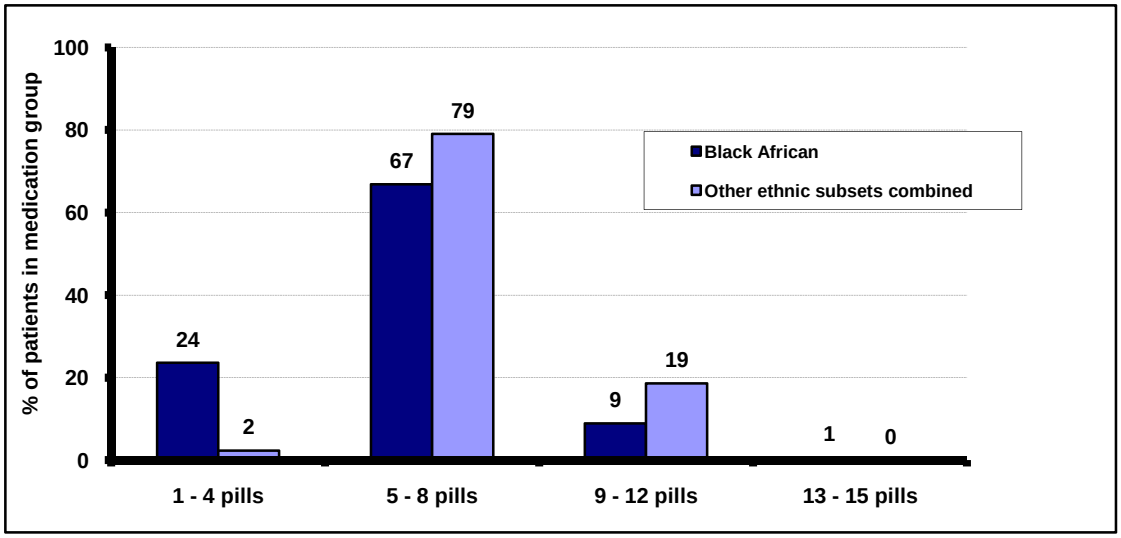

Fig. 6 Distribution of patients onto medication groups

4.3.1 Self-reported medication adherence

Overall, 82% of the study participants reported that they were compliant with their prescribed medication (Fig. 10). There was a difference between men and women with 84% versus 78% of participants, respectively, rating themselves as compliant with their medication (p=0.474). 81% of Black Africans said they adhered to their medication regimen vs. 84% of other ethnic subsets combined (p=0.866)

4.3.2 Pill count

Although adherence to follow-up appointments given by the attending cardiologist was good, there was a poor adherence to the appointment given for the pill count with only 82 of 200 patients returning (41%). Out of these 82 patients, 63 were Black Africans and 19 were patients of other ethnic subsets combined. Putting this into percentages, 40% of the Black Africans returned for the pill count vs. 44% of the other ethnic subsets combined. Between the genders

were no differences in returning for the pill count (41%). These pill counts (n=82) revealed that 71% were clearly compliant and 22% non-compliant with their overall prescribed CHF regimen (a pill count was not possible in 7% of this sub-group of participants). Looking at differences between Black Africans and other ethnic subsets combined, it is striking that only 72% of Black Africans were compliant vs. 89% of the other ethnic subsets combined (p=0.119). Similarly, only 71% of all females returning were compliant with their medication vs. 81% of male patients (p=0.291). As mentioned above, we defined patients being compliant when taking ≥ 75% of their prescribed medication; the average adherence to treatment, determined by the distinct pill counts is however 86%.

Figure 7 shows that the highest adherence rates were found for ACE-inhibitors and spironolactone compared to the lowest for loop diuretics. Participants reported skipping their loop diuretics (furosemide) with forgetfulness and avoidance of side effects being the most common reasons for non-adherence overall. Figure 8 illustrates adherence to concomitant pills taken by the study population, showing the highest adherence for Amiodaron and the lowest for coumarone derivates, however only 5 pill counts were conducted in each case.

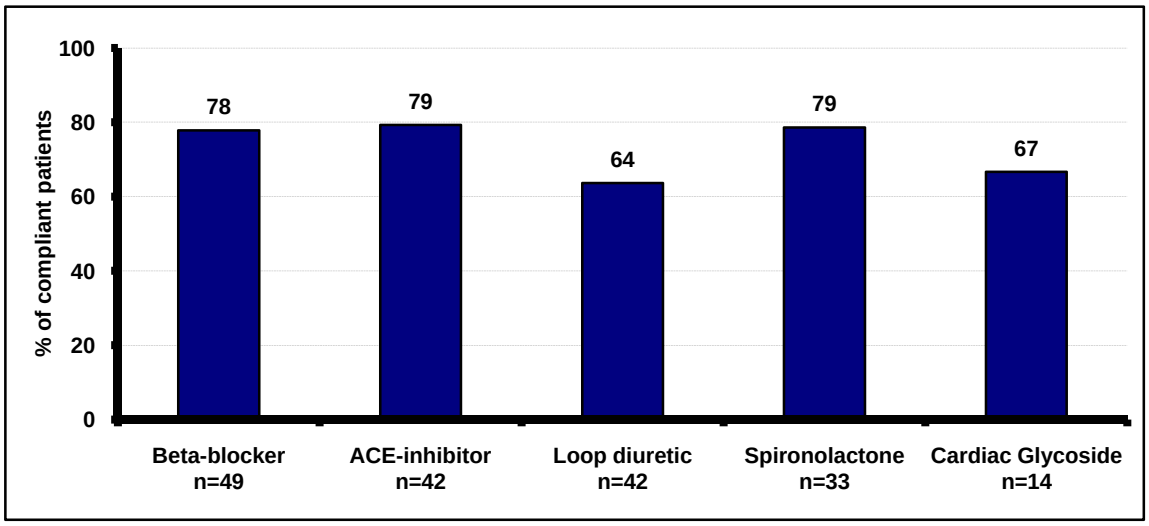

Fig. 7 Adherence to CHF medication (≥75%). n = number of realized pill counts

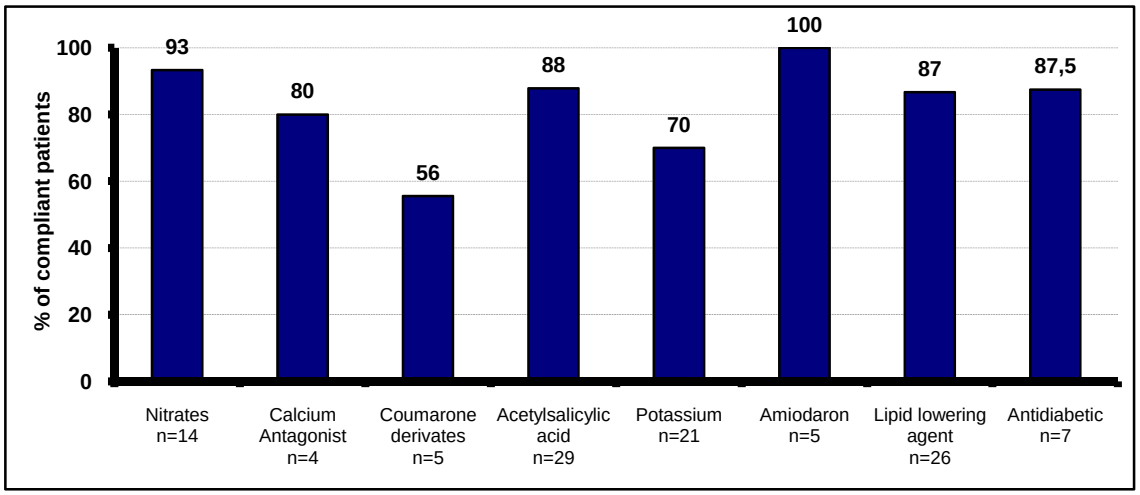

Fig. 8 Adherence to concomitant medication (≥75%). n = number of realized pill counts

4.3.3 Determinants for treatment adherence

There were no statistically significant factors linked to treatment adherence on the basis of univariate binary logistic regression analysis. However, those participants reporting less than 3 symptoms commonly found in patients with CHF, were 4.5- fold (95% CI 0.95; 21.7; p=0.058) much more likely to be designated as compliant, demonstrating the importance of treatment for symptom control and likely clinical benefit of prescribed treatment (Tab.4). At the same time, Non-Black Africans and patients being younger than 65 years in age were 3.3-fold and 2.5-fold more likely to be compliant than Black Africans and elderly patients. Other predicting factors for treatment adherence in our study group were male gender, patients living in a single household, and a previous admission to hospital due to CHF. Negative predictors were a low educational level and no knowledge on CHF medication. Looking at social support, little practical support seemed to increase treatment adherence in our study group, whereas little emotional support had a negative effect on medication compliance. (Tab.4)

When including certain variables in a multivariate binary logistic regression, chances for medication adherence changes as follows. (Tab. 5) If we only look at an OR effect modification of ≥ 0.5, study patients with less than 3 symptoms have a significantly 5-fold higher chance for medication adherence when adjusted by living status (single household vs. non-single household) (95% CI 1.051; 24.567; p=0.043). Similarly, patients living in a single household have a 3 –fold higher chance for medication adherence adjusted by the number of present symptoms (95% CI 0.320; 26.331; p=0.343). When adjusted by ethnic subset, those patients with little practical support had a 2-fold higher chance for adherence than patients with a lot of practical support (95% CI 0.675; 7.398; p=0.188).

4.4. Symptoms

Figure 9 indicates the symptoms occurring in the study population with fatigue being the most common symptom and pedal oedema arising in less than a third of the study population. Out of these 8 possible symptoms the study population had a mean of 4 ± 2 symptoms and 66% of all patients had more than 3 symptoms. Significant differences in symptoms were found neither between Black African and other ethnic subsets combined, nor between genders.

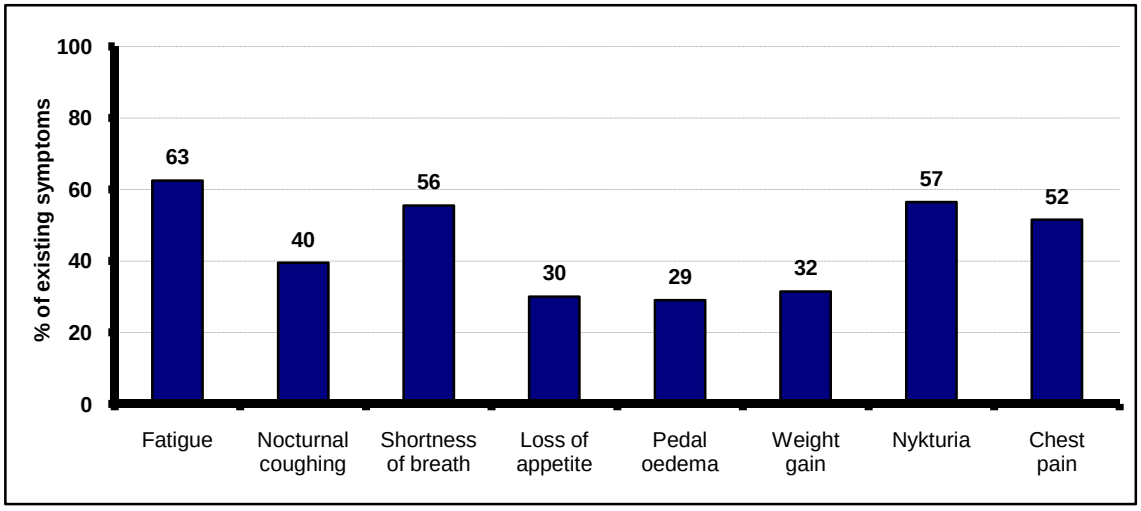

Fig. 9 Occurrence of symptoms

4.5 Self-care behavioural adherence

Figure 10 demonstrates adherence to different self-care behaviours. Daily weight monitoring was associated with the lowest rate of adherence. However, this low figure is to a great extent due to only 19% of participants having a weigh scale at home. When looking at only the group of patients having a scale at home, 14% adhered to daily weight monitoring. Avoiding alcohol intake was associated with the highest adherence rate. Overall, adherence to follow-up appointments (either a check-up appointment or an appointment at the hospital pharmacy for a medication refill) was very high (95%), in fact, 81% of all patients adhered to 100% of their follow-up appointment schedule. From a dietary behaviour perspective, 87% of participating patients were non-compliant concerning daily intake of fruit. However, 64% of participants reported having difficulty affording fresh fruit. Again, if looking only at those patients who could afford 5 servings of fruit per day, "only" 70% were non-adherent concerning fruit intake. Well over a third of the study patients were regularly physically active with the predominant type of exercise being walking over a distance longer than 1km. From a smoking perspective, there were 31 (16%) current smokers and 59 (30%) former smokers.

Analysing self-care behaviour between the genders and the ethnic subsets the only significant difference is found in adherence to smoking restriction: 89% Black Africans were non-smokers vs. 67% of the other ethnic subsets combined (p=0.001). Similarly, 91% of all females refrained from smoking vs. 78% of all men (p=0.015).

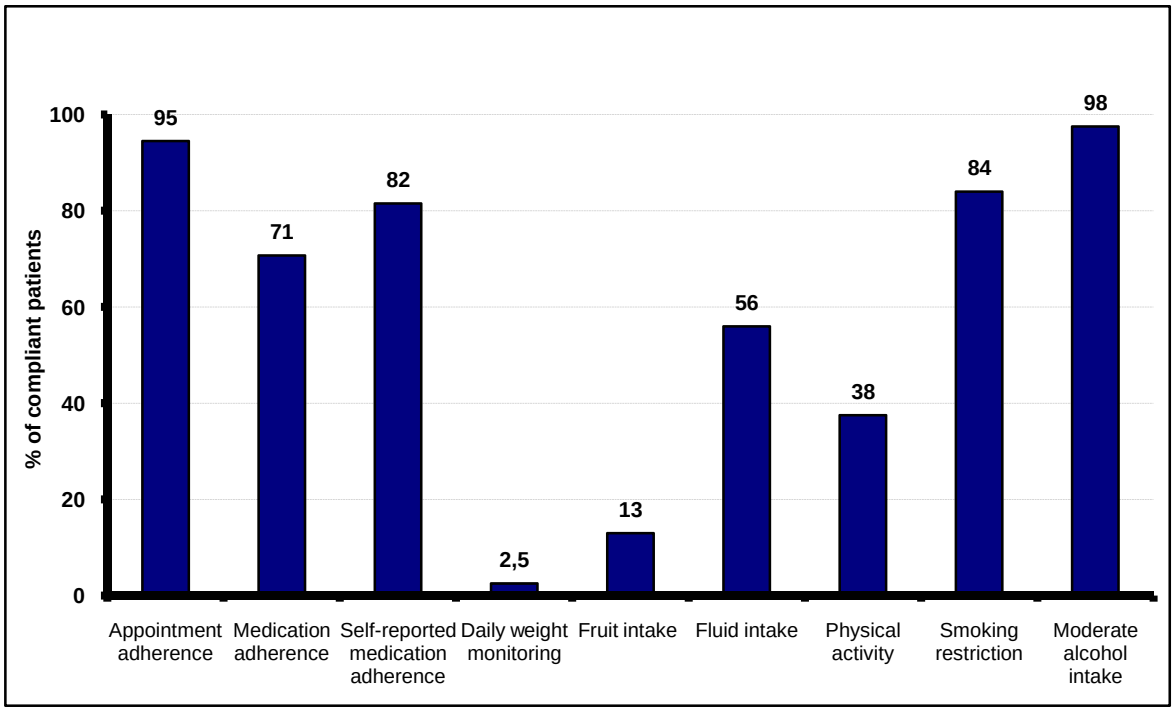

Fig. 10 Adherence to self-care behaviour. Appointment adherence was achieved when being present at ≥75% of assigned appointments consisting of quarterly check-ups and monthly medication refills at the hospital pharmacy. Medication adherence represents the number of patients who took ≥75% of their medication determined through pill counts. Adhering to fruit intake meant 5 servings of fruit per day and adherence in fluid intake was accomplished when drinking less than 2 litres per day. Regular physical activity was achieved when study participants walked moderately 20-30/min three to four times a week. A moderate alcohol intake meant 1 beer or 1-2 glasses of wine per day.

4.6 Health education

The *"Medication Adherence and Knowledge on Heart Failure Survey"* contained questions in several sections on health education given by a doctor or a nurse. According to the patient's responses, the least amount of education was provided in relation to daily weight monitoring with only 8% of participants remembering this component of education. Dietary management was also less memorable, than education focussing on alcohol, smoking and CHF in general (Fig. 11).

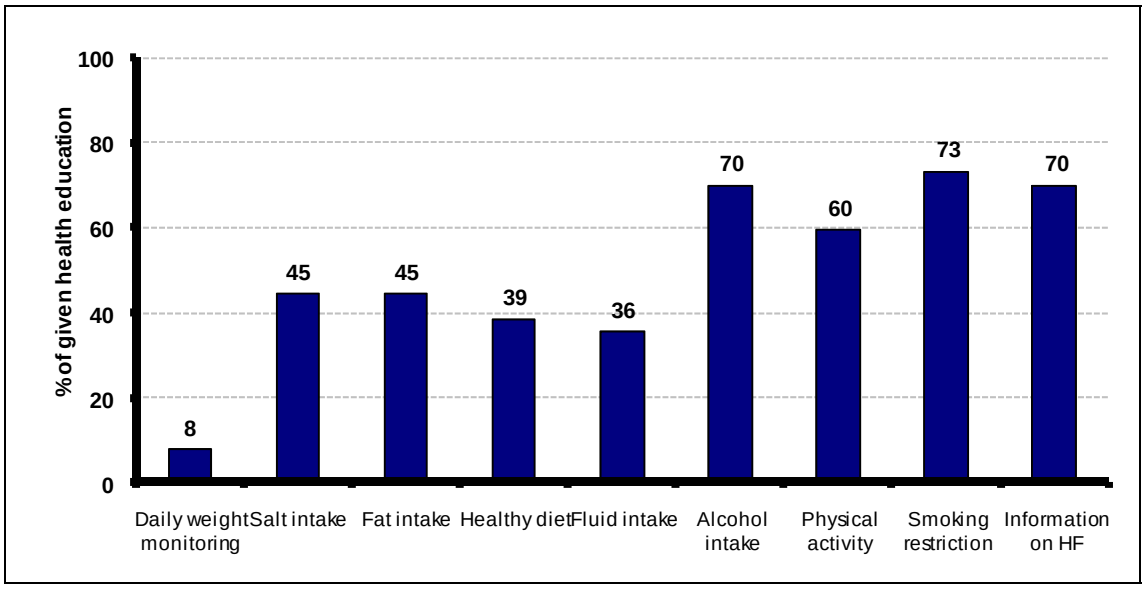

Fig. 11 Percentage of health education given on various aspects of self-care behaviour and heart failure

4.7 Knowledge on CHF, CHF medication and CHF management

By self-report 68% of all patients said they knew only "a little" or "nothing" about their disease CHF. Looking at gender differences, 73% of females reported having "a little" or "no" knowledge on CHF vs. 65% of male patients, however this did not reach statistical significance ($p=0.164$). Among Black Africans 75% reported to know only "a little" or "nothing" about CHF vs. only 42% of the other ethnic subsets combined ($p<0.001$).

Overall, patient knowledge concerning their prescribed CHF medication was poor: 56% could not name the effect or any side effects of their medication. Similarly, none of the 200 study participants knew all effects and side effects of the taken pills. There was no significant difference found between the genders, however among Black Africans 68% could not explain their medication whereas among the other ethnic subsets combined only 12% had no knowledge on their medication ($p<0.001$).

An average score of 69% was achieved on 10 questions concerning CHF management. Percentages on correct answers for each of the 10 questions varied between 29% and 89% (Fig. 12+13). Again, there was no significant difference between the genders and between Black Africans and other ethnic subsets combined. Patients who received education on CHF management had a higher average knowledge (70%) than patients who have not received information on CHF management (65%) ($p=0.119$).

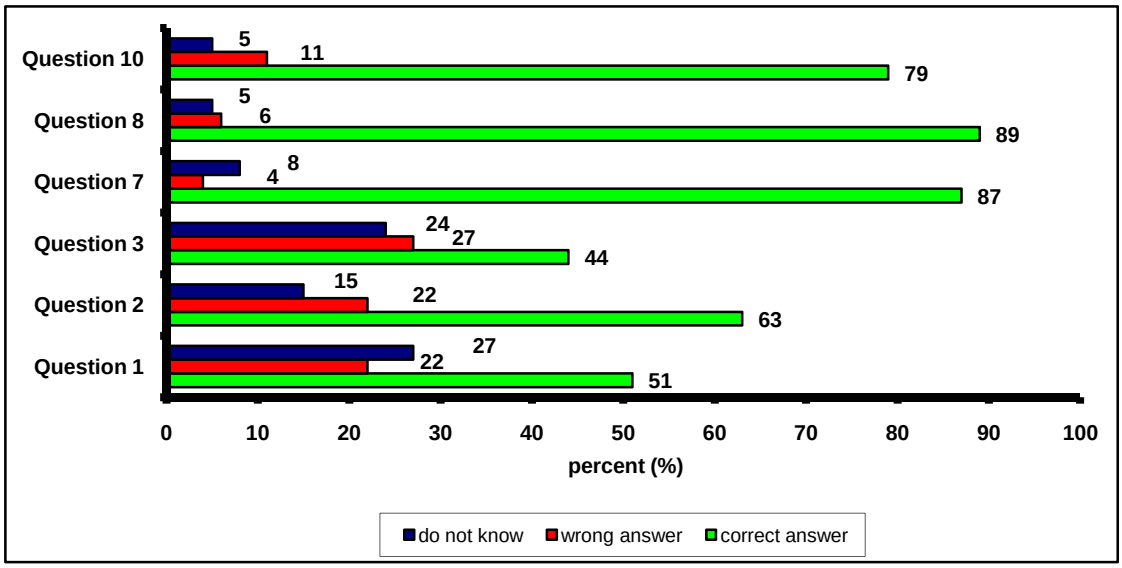

Fig. 12 Percentages of correct answers on questions asked on CHF management (self-care behaviour).

Question 1: Weighing yourself everyday is important

Question 2: You should weigh yourself before you go to bed

Question 3: Weight changes are not related to your heart condition

Question 7: Smoking is bad for your heart

Question 8: Even a little exercise is bad for my heart

Question 10: You can skip your medication once in a while

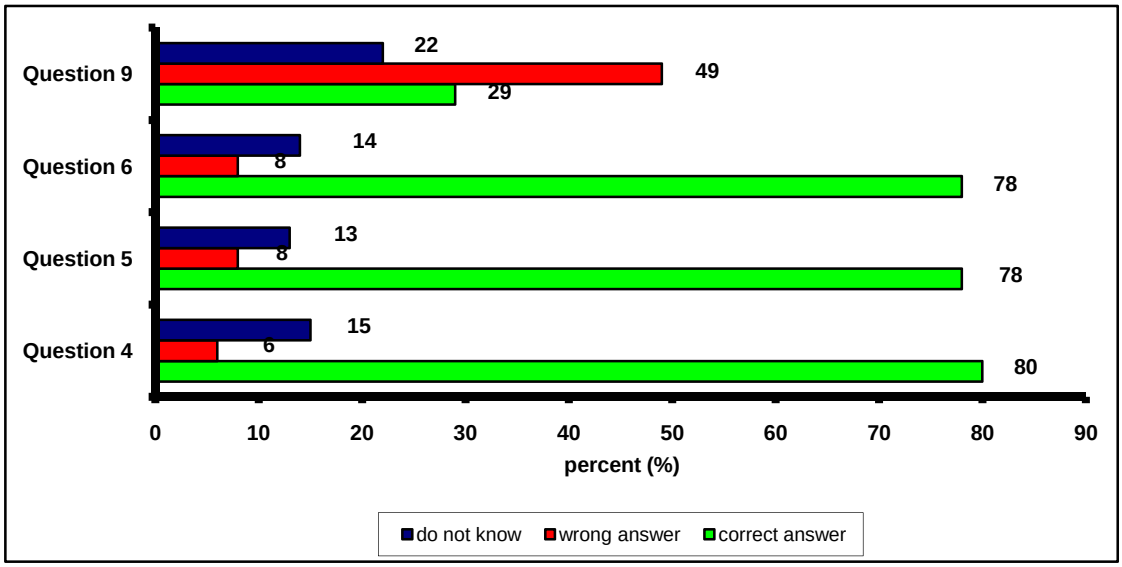

Fig. 13 Percentages of correct answers on questions asked on CHF management (diet)

Question 4: A low salt diet is good for your heart

Question 5: A low fat diet is good for your heart

Question 6: Alcohol is bad for your heart

Question 9: You should drink more than 2 litres of fluid with your heart condition

5. Discussion

To our knowledge this represents the largest report to date on the pattern of treatment adherence and knowledge in predominantly Black African patients with CHF emanating from South Africa. Indeed it is one of the largest overall reports relating to CHF from the continent **[13]**. This is particularly significant given our recent reports of a higher than expected burden of CHF in the urban South African community of Soweto **[4]** and the likelihood of an increase in both traditional and affluent forms of the syndrome due to epidemiologic transition **[4]**. How do our data compare to data derived from Africa and Western cohorts?

5.1 Demographic and clinical data

One striking difference in demographical data of our study population is the fact that Black African patients were in average younger than the other patients combined. Although this was not a significant finding, it can be supported by a study led in the USA **[63]**. This is an important feature for future intervention programs. When looking at education in our study population, Black Africans and women were significantly more likely to have no or standard education than the other ethnic subsets combined or men. This finding can be supported by Sliwa *et al.* **[4]**. Although this is probably one of the remnants from Apartheid in South Africa **[64]**, there seem to be similar developments in the USA **[65]**. Another difference in our study population was that women had a significantly higher BMI than men. Similar findings appeared in a study led by Stewart *et al.* **[5]**. Furthermore, Black Africans felt less socially supported than the other ethnic subsets combined. Women on the other hand, felt better emotionally supported than men. This is both supported and refuted in the literature **[66-69]**. Looking at differences in clinical data it is striking that there is a significant difference in aetiology for CHF between the ethnic subsets. Ischemia accounted for less CHF in Black patients than in the other ethnic subsets. Again, this can be supported by Stewart *et al.* **[5]**. Further studies are needed to examine this finding. Similarly, significantly fewer women had ischemia as aetiology for CHF. This finding is in accord with results from the Western World **[70, 71]**. Another cause for CHF was Post Partum CMO, a condition commonly found in Africa **[2]**.

5.2 Treatment adherence

5.2.1 Adherence through self-report

As mentioned above, our overall self-reported adherence rate of prescribed medication was 82%. (Fig. 10) Comparing this with other studies from Africa, there was one study with a considerably lower adherence rate with only 7% of 128 patients taking more than 80% of their prescribed tablets as assessed through self-report **[12]**. In this case, unaffordable drug prices were the underlying reason for bad medication adherence. Another study with bad medication adherence (12.5%) was also due to poverty **[15]**. As patients in South Africa get their

medication free of charge, this might be a reason for our better adherence rates. Another study conducted in Zimbabwe had a self-reported compliance rate of 73%, which is slightly more in accord with our findings **[13]**. These patients however do no get their medication free of charge, so this is an encouraging result. However, the situation in Zimbabwe has deteriorated leading to an unavailability of numerous medications. When comparing our findings on medication adherence via self-reports with studies from the Western World, there is one big meta-analysis attaining an average percent of medication adherence via self-report of only 72 % **[51]**. A reason for this considerably lower adherence rate might be due to the size of the studies included in the meta-analysis. DiMatteo himself found in his meta-analysis that larger studies had a lower compliance rate than smaller studies. In addition, DiMatteo did not only assess medication adherence rates in patients with CHF, but also patients with numerous other diseases. In this case, a comparison is questionable. Similarly, there is another study with a considerably lower adherence rate compared with our findings: Cline *et al.* had an adherence rate of only 73% determined trough an in-depth interview. The sample size however comprised only 22 patients **[72]**. When comparing our findings with further studies from the Western World (some having a similar sample size), adherence rates through self-report vary from 84% to 99% **[60, 61, 73-75]**. This is a slightly higher adherence rate compared with our findings.

Similarly, in our study population the other ethnic subsets combined quoted a higher medication adherence rate than the Black Africans (84% vs. 81%). Although this was not a significant finding ($p=0.866$), there might be a trend to that effect that Black Africans rate themselves less compliant as for example most Europeans. This might be supported by the two other studies from Africa with lower rates on medication adherence as mentioned above. A retrospective study conducted in America found out that African Americans were less likely to be adherent to medications than White American. **[76]** In this case, it is also possible that Black Africans give a lower adherence rate on self-report. However, other studies found no differences in medication adherence between Black and White heart failure patients **[77]**.

Looking at differences between the genders, it is striking that 84% of participating men in our study rated themselves as compliant as compared to only 78% of participating women. Unfortunately, there is only one study from Africa that comments on a difference in adherence rates between the genders **[15]**. Our finding that men tend to be more compliant with prescribed medication is both supported **[15, 78, 79]** and refuted **[77, 80]** by other studies from the Western World with no clear pattern in the literature.

5.2.2 Adherence through pill count

(In the following we will always refer to our adherence rate derived from the cut-off point of taking ≥75% of prescribed medication, not the average adherence rate from all distinct pill counts.) As shown in Figure 10, adherence to medication determined through pill count was

71%. Unfortunately, there were no studies from Africa that determined medication adherence via pill count for comparison. However, compared with studies from the Western World, which used pill counts or prescription refill records to determine medication adherence, our findings are rather in accord with those results. The study population of a study conducted by Roe *et al.* also had a medication adherence of 71% **[79]**. Rather in the same range are findings of a study conducted by Struthers *et al.* in which 66% of all study participants had an adherence above 85% **[81]**. A much higher adherence rate was found by Hansen *et al.* with 91% being compliant as determined by prescription refill records **[61]**. In this study however, two randomized control trials were compared in which a pharmacist's intervention was assessed. Therefore, a reason for this higher adherence rate might be due to the intervention that took place beforehand. Another reason for slightly higher medication adherence rates in the Western World might be due to the fact that many Black Africans still rely on traditional healers and their remedies in addition to the orthodox school of medicine **[82]**.

In our study, there was an obvious difference between medication adherence via pill count, and medication adherence via self-report. This implies that there is a big discrepancy between the actual medication adherence and the self-perceived medication adherence in our study population. This is especially the case for women: via self-report women reported in 84% to be compliant with their medication. Determined through the pill count however, only 71% of the women who returned were in fact compliant. Men on the other hand, had a self-perceived medication adherence of 78%, but were in fact compliant in 81% as determined through the pill count. Hansen *et al.* who also determined medication adherence through various methods (self-report, prescription refill records and electronic lids on medication containers) also had this discrepancy between the adherence rates (84%, 91% and 86% respectively), however, in this case, medication adherence as determined through self-report was lower than the adherence rate determined by the other methods. This is rather unusual considering the fact that adherence tends to be over-reported in interview reports **[42, 83]**. Our findings on the other hand support this statement.

When looking at differences in ethnic subsets concerning the outcomes on medication adherence via pill counts, only 72% Black Africans were compliant versus 89% of the other ethnic subsets combined. Therefore, our results on medication adherence via pill counts and self-report support the assumption, that Black Africans are less compliant than the other ethnic subsets represented in our study population **[76, 84]**. The reason for this is not obvious but needs to be further investigated.

5.2.3 Adherence to individual tablets

When looking at individual medication adherence to the five basic medications prescribed for CHF our results range from 64% to 79% (Fig. 7). Again, there is only limited data out of Africa

with only one study reporting on adherence to digoxin **[85]**. Comparing our data with data derived from the Western World, there is a wide range of adherence rates to beta-blockers. In one case, our adherence rate is much lower (78% vs. 88%), in another our adherence rate is much higher (78% vs. 67%) **[86, 87]**. One study conducted in Canada even assessed an adherence rate to beta-blockers of 97% **[88]**. Few of our patients reported non-adherence to beta-blockers due to erectile dysfunction and dizziness. Further studies concentrating on the reason for non-adherence are needed to fully understand the motivation behind non-adherence. Adherence to ACE-inhibitors was on the other hand in our study group always better than in the international comparison: 79% of our study participants adhered to ACE-inhibitors versus 72% in a study conducted in the UK and 71 % and 74% in studies conducted in the USA and Canada, respectively **[87, 89, 90]**. In another UK study, Struthers *et al.* found that 82% of their patients had an adherence rate of ≥ 70% to prescribed ACE-inhibitors **[81]**.

Looking at adherence to loop diuretics, this was the medicine with the worst adherence in our study group. This might be due to the impact of diuretics especially on social life. For example patients stated on the day of the interview that they did not take their diuretics, as they had to wait for hours to be seen by a doctor, so they could not afford to miss the appointment because of being absent on the toilet when being called up. Similarly, people living in Soweto mostly have to travel far distances to get to work and as there is a little number of public toilets in Soweto this might be another reason for poor adherence. A study in the Netherlands had a considerably higher adherence to loop diuretics with 95% **[91]**, whereas a study led in the UK had a much lower furosemide adherence rate with 56% of their patients showing failure of adherence at some point during their visits for follow-up **[92]**.

In contrast, our patients had a fairly good adherence to aldosterone antagonist. Considering that their diuretic effect is not as strong compared to the diuretic effect achieved by loop diuretics, this might be the crucial difference leading to a better medication adherence. Unfortunately, there were no studies found to compare our data on adherence to spironolactone.

However, comparing our findings on adherence to digoxin with a study from Africa, the results are similar with 67% of our patients vs. 60% of patients in the other study being compliant **[85]**. In contrast, Monane *et al.* found that only 10% of their study patients were fully compliant with prescribed digoxin therapy during one year follow-up **[77]**. Similarly, Miura *et al.* found an adherence rate to digoxin of only 51% **[93]**. Wiseman *et al.* suggested that patients who experienced communication problems and who lacked a meaningful relationship with their doctor showed a marked deterioration in compliance to digoxin **[85]**. However, this is probably not specific for digoxin adherence but rather applicable for all medications.

5.2.4 Determinants for treatment adherence

In our study group a significant determinant for treatment adherence as determined through multivariate binary logistic regression models was the presence of ≤ 3 symptoms adjusted by living status (Tab.5). Other determinants were patients living in a single household adjusted by presence of symptoms and little practical support adjusted by ethnic subset (Tab. 5). This implies the importance of treatment for symptom control and likely clinical benefit of prescribed treatment. Although it seems logical to suggest that those with greater symptoms are more likely to be non-compliant, this association is not a regular feature in the literature. These results also suggest that patients who can not rely on anyone's help are more compliant than others. This is a rather controversial finding, considering that studies from the Western World suggest for example that being married and social support increase medication adherence **[11, 60, 94, 95]**. Maybe there is a contrary effect in the African community that living alone and having no practical support leads to more adherence in health care. A study might support this consideration in which more healthy dietary habits in South Africans was associated with being unmarried **[96]**. Although being unmarried does not necessarily imply living alone, people living alone are most probably unmarried.

These data suggest that having experienced the seriousness of CHF leads to a better adherence in CHF medication.

5.3 Self-care behaviour

Unfortunately, there are no studies from Africa on adherence to self-care behaviour specific to heart failure patients to compare our data with; however, there are numerous studies from the Western world. In respect to adherence to appointment schedules, patients' behaviour in this study is similar to most reports from the Western World (i.e. > 90% appointment adherence) (Fig. 10) **[9, 60]**. Alternatively, our data on daily weight monitoring are generally lower than that of other reports (ranging from 12 to 75%) **[97, 98]**. This might be due to the fact that only 19% of our study patients have a scale at home. In this case, weight monitoring as an indicator of the success of a diuretic therapy is not feasible in this study population. When looking at adherence rates in only those patients having a scale at home, there is a better compliance with 14% adhering to daily weight monitoring. Comparing this to the studies mentioned above, the result is more in accord with those findings, however, still on the lower range **[97, 98]**. In respect to fluid management, 56% of our study patients reported adhering to the recommended fluid intake of < 2 l/day. In comparison, Artinian *et al.* and Jaarsma *et al.* reported lower adherence rates (23% and 37% respectively), while van der Wal *et al.* reported higher adherence rates to fluid restriction (73%) **[53, 74, 75]**. With 38% of our participating patients performing some form of regular exercise (especially walking 20 to 30 min per day), our results are slightly lower than results from other studies (equivalent range 39% to 67%) **[9, 60, 75, 99]**. As there is

a good infrastructure via mini busses in Soweto, most people do not have to walk far to the next bus stop and consequently they can cover long distances without having to walk long distances. Additionally, those people coming to Baragwanath for medical aid, most probably do not have the money for workouts at the gym, so there might be a bias in this adherence rate due to our patients collective. Concerning smoking abstinence, 16% of our participating patients persisted in smoking tobacco. In comparison, Evangelista *et al.* and Carlson *et al.* found less than 10% of their study patients to be non-compliant in this regard **[9, 60, 99]**, while higher smoking rates have been reported by Artinian *et al.* (46%) and also by Evangelista *et al.* in a study on veterans with CHF (55%) **[24, 74]**. Overall, 98% of all study participants were compliant in respect to reduced alcohol intake. This result is higher than in studies lead by Evangelista *et al.* where adherence to alcohol limitation varied between 64% and 94%, compared to 56% in a cohort studied by Artinian *et al.* **[9, 24, 60, 74]**.

When searching the literature there seem to be racial differences towards self-care behaviour. In our study population, however the only significant difference that was found was in regard to smoking: Black Africans had a significant lower number of smokers than the other ethnic subsets combined (p=0.001). This finding can be supported by studies led in South Africa and in the UK, where smoking was less common in black patients as opposed to white patients **[100-103]**. Further studies in this field could be useful for primary prevention. In all the other areas of self-care behaviour our study participants did not show racial differences. In the literature however there are ambiguous results for example for racial differences in treatment seeking delays for HF symptoms: while Artinian *et al.* found out that African Americans were more consistent in seeking medical assistance when HF symptoms occur, Evangelista *et al.* noted a longer mean delay time for African Americans **[74, 104]**. In another area of self-care behaviour, studies stated that Blacks had lower physical activity levels than Whites **[102, 105]**. Furthermore, other studies stated that Black Africans had a lower drinking rate than White Africans **[101, 102]**.

In our study population there is no evidence for differences between the genders concerning self-care behaviour except of smoking habits with women having a significantly higher proportion of non-smokers than men (p=0.015). However, Peltzer and Heo *et al.* demonstrated that there are gender differences in factors affecting self-care **[102, 103, 106]**.

5.4 Health education and knowledge on CHF and its management

It is now largely accepted that greater CHF-related knowledge has a positive impact on adherence behaviours **[11, 53]**. Unfortunately, our data imply that patient education at the cardiology outpatient department of the Chris Hani Baragwanath Hospital is sub-optimal in respect to a number of key educational areas. Similar results were found in another study from South Africa focussing on patients with hypertension and a study lead in the USA **[14, 107]**.

There were some encouraging results in respect to the provision of CHF information, but 70% of all patients receiving health education on the nature of the disease are not satisfactory. The poor numbers on health education given is probably due to the high numbers of patients (n=25-30/d) needed to be seen by the doctors at the outpatients department of Baragwanath hospital.

In respect to knowledge on CHF management there were as well encouraging results, but this may be due to the fact that study participants only had to decide whether a statement on CHF management was "correct" or "incorrect". In a study lead by Ni *et al.* the percentage of choosing the correct answer on 8 questions concerning CHF management varied between 43% and 90% versus a range of 29 % to 89 % in our study **[11]**. By self-report 68% of our patients said they knew only "a little" or "nothing" about CHF. Ni *et al.* found that only 38% of their study participants reported that they knew only "a little" or "nothing" about CHF **[11]**. This is a rather alarming result, implying that given health education on the nature of the disease does not necessarily consequently lead to a better knowledge **[108]**. Other alarming low results were found on the knowledge on CHF medication. This finding can be supported by a study led in the USA **[54]**. It seems as though patients accept or are indifferent about their low level of knowledge in CHF, its management and its medication.

Looking at differences between the genders there were no discrepancies in our study population. Between the ethnic subsets however there was a significant difference to that effect that Black Africans knew less about their CHF medication than the other ethnic subsets combined. This might be one of the relicts from Apartheid where health services and education for Black Africans was neglected **[109]**. For example, during the year 1982-1983 there was a big difference in finances spent for education for the different ethnics groups: For Whites 1.385 Rand were spent per capita in contrast to 192 Rand for Black Africans **[64]**. Even today there are not only disparities in education, but also in health, income, and basic public health infrastructures **[110]**. For example, even after Apartheid districts where household incomes are low tend to have fewer public health services than districts where household incomes are high **[111]**. As a result, there might be less emphasis on health awareness in Black Africans than in White Africans, leading to less interest in health education.

5.5 Implications of poor treatment adherence

It is clear from studies from the Western World that poor adherence to treatment and CHF-related self-care behaviour exposes the patient to an increased risk of clinical instability, increased symptoms and a lower ejection fraction (EF) with impaired quality of life and premature mortality **[10, 17, 42, 45, 46, 93]**. This can result in higher than expected hospital admission rates and more hospitalisation days which places a substantial (cost) burden on the health care system **[42, 93, 112]**. In order to prevent the deterioration of the patient's condition, adherence to medication and other self-care behaviour need to be ameliorated. In the Western

World, CHF disease management programs have had a positive effect on outcomes of adherence through various strategies as describe above **[75, 95, 113-115]**. These data certainly support the potential for CHF management programs to improve health behaviours and outcomes in South Africa. We plan to use these data to undertake one of the first randomized controlled trials of CHF management in Africa with interventions suited to the local culture and environment (for example a computer based intervention might not be suitable for Soweto, as most households do not have a computer).

5.6 Limitations

There are a number of study limitations that require comment. First of all it is difficult to compare results from treatment adherence as there are different ways of measurement. Some articles refer to an average adherence rate whereas others used a percentage of adherences above a certain cut-off point. Evangelista *et al.* had a cut-off point of adherence of ≥ 75%, Granger, Ohene and Hansen *et al.* used a cut-off point of 80 % and Monane *et al.* referred to 100% medication adherence during 12 months of follow up. All the others studies merely asked a "yes"/"no" question and took an average percent of the adhering patients (e.g. "Do you adhere to your medication prescription?").

The comparability between the different studies is anyhow questionable, as the study participants evolved from different cultures. Additionally, there might be side effects of heart failure medication specific to different ethnic subsets of which we do not know yet, leading to a bias in medication adherence.

Although, pill counts are a fairly objective method to measure medication adherence, it is still prone to errors such as the assumption that a pill was truly taken if it is not in the medication box. Serum bioassays or electric monitoring advices may be even more objective and thus more accurate **[60]**. However, in our settings, pill counts and interviews were the only options for measuring adherence. As we also based our adherence figures on the results from the pill counts, the findings may be biased given that those patients who returned for the pill count are already more likely to be compliant in following instructions and are therefore more prone to follow advice concerning medication adherence. Similarly, as the interview took place before the pill count, patients might have paid more attention to taking their medication regularly during the following month. As a result, medication adherence may be overestimated in our study. In future studies, pill counts could be conducted at 1, 3 and 6 months after the interview to obtain more accurate results.

As self-reporting is always subjective and biased, adherence rates to self-care behaviour and the measured knowledge on CHF and CHF management may have been affected. We measured knowledge on CHF management through questions in which the patient should judge if a

statement is correct or incorrect. Of course this method always allows a chance of guessing right, but it establishes the comparison between the study participants.

Overall, an important limitation to our study was that the questionnaire we used was not tested on validity and reliability. Another short-coming of our questionnaire was the absence of a question recording co-morbidities and a question concerning a patient's income, as the financial situation might also have an effect on medication adherence (in our study population, patients with a higher income might afford a taxi ride to the hospital pharmacy to refill the medication more easily than a patient with a lower income).

Furthermore, we defined behavioural adherence in accordance with the ESC guidelines even though they might not be applicable to our study population considering their different disease profiles, cultural, socio-economic profile and financial backgrounds.

Another limitation to our study is the diversity of languages in South Africa (11 official languages); a translator was used in various interviews.

Also, the way we recruited our study population implied a certain bias, as patients with CHF in stage NYHA IV and who might have different medication adherence behaviour, for the most part did not attend the outpatient department.

Finally, it is difficult to ascertain how representative these data are in relation to other African centres. For example, there was a relatively high number of patients with ischaemic CMO; a generally uncommon cause of CHF in Africa. However, we have recently reported a rise in such cases **[5]** and the other common causes of CHF in Africa (idiopathic CMO and hypertensive heart failure) were well represented. Given that this was a relatively small group of patients (although large for Africa), we were most probably under-powered to fully explore significant predictors of non-adherence.

5.7 Conclusion

Despite these limitations, our study is the first study of this dimension on medication adherence in South Africa. These data indicate the need for interventions that already have been established in the Western World and improved health outcomes. As such, these data support the need for culturally sensitive and affordable CHF management programs that can improve treatment adherence and optimise self-care behaviours and knowledge in order to improve CHF-related health outcomes overall in South Africa.

5.8 Zusammenfassung

Trotz der erwähnten Einschränkungen, ist unsere Studie die erste dieser Größe über Medikamenten-Compliance im südlichen Afrika. Diese Daten unterstreichen die Notwendigkeit für Interventionen, welche in anderen Regionen der Welt (Europa, Nordamerika, u.a.) schon längst etabliert sind und nachweislich die Gesundheitsversorgung positiv beeinflusst haben. Allerdings sollten diese speziell auf die kulturellen Bedürfnisse in Soweto abgestimmt und zugleich finanziell zu ermöglichen sein, um die Medikamenten-Compliance, einen gesundheitsfördernden Lebensstil und die herzinsuffizienzspezifische Gesundheitsversorgung insgesamt in Südafrika zu verbessern.

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7. Tables

Table 1 Correct answer for questions on CHF management

Q35. The following is a list of statements about non-medical ways of taking care of heart failure - please indicate whether you think it is true or false or if you do not know.	TRUE	FALSE	DON'T KNOW
a) Weighing yourself everyday is important	■	□	□
b) You should weigh yourself before you go to bed	□	■	□
c) Weight changes are not related to your heart condition	□	■	□
d) A low salt diet is good for your heart	■	□	□
e) A low fat diet is good for your heart	■	□	□
f) Alcohol is bad for your heart	■	□	□
g) Smoking is bad for your heart	■	□	□
h) Even a little exercise is bad for my heart	□	■	□
i) You should drink more than 2 litres of fluid with your heart condition	□	■	□
j) You can skip your medication once in a while	□	■	□

Table 2 Demographic profile

	Total n=200	**Male n=109**	**Female n=91**	**Black African n=157**	**Others n=43**
Mean age (yrs) ±SD	56±14	56±13	56±15	55±15	60±8
Mean BMI ±SD	29±7	26±7	31±8	29±7	28±5
Missing	31	15	16	27	3
Education profile in numbers (%)					
None	16 (8.0%)	9 (8.3%)	7 (7.7%)	14 (8.9%)	2 (4.6%)
Standard 1-5	43 (22%)	18 (17%)	25 (28%)	42 (27%)	1 (2.3%)
Standard 6-10	93 (47%)	49 (45%)	44 (48%)	72 (46%)	21 (49%)
Matriculation/Post Matriculation	42 (21%)	30 (28%)	12 (13%)	25 (16%)	17 (40%)
Missing	6 (3.0%)	3 (2.7%)	3 (3.2%)	4 (2.5%)	2 (4.6%)
Employment status in numbers (%)					
Employed	54 (27%)	37 (34%)	17 (19%)	39 (25%)	15 (35%)
Unemployed	57 (29%)	30 (27%)	27 (30%)	49 (31%)	8 (19%)
Retired	89 (45%)	42 (39%)	47 (51%)	69 (44%)	20 (47%)
Living environment in numbers (%)					
Alone	18 (9.0%)	12 (11%)	6 (7%)	13 (8.3%)	5 (12%)
Missing	2 (1.0%)	1 (0.9%)	1 (1.1%)	1 (0.6%)	1 (2.3%)
Perceived practical support in numbers (%)					
Not at all	36 (18%)	21 (19%)	15 (17%)	28 (18%)	8 (19%)
A little or some	36 (18%)	17 (16%)	19 (21%)	34 (22%)	2 (4.6%)
A lot	124 (62%)	68 (62%)	56 (62%)	91 (58%)	33 (77%)
Missing	4 (2.0%)	3 (2.8%)	1 (1.1%)	4 (2.5%)	0
Perceived emotional support in numbers (%)					
Not at all	16 (8.0%)	14 (13%)	2 (2.2%)	12 (7.6%)	4 (9.3%)
A little or some	41 (21%)	23 (21%)	18 (20%)	32 (20%)	9 (21%)
A lot	137 (69%)	66 (61%)	71 (78%)	108 (69%)	29 (67%)
Missing	6 (3.0%)	6 (5.5%)	0	5 (3.2%)	1 (2.3%)

Table 3 Clinical profile

	Total n=200	**Male n=109**	**Female n=91**	**Black African n=157**	**Others n=43**
Mean LVEF (%) ± SD	32±8	32±8	33±8	32±8	34±7
missing	1	1	0	1	0
NYHA Class in numbers (%)					
II/III	180 (90%)	97 (89%)	83 (91%)	141 (90%)	39 (91%)
IV	5 (2.5%)	2 (1.8%)	3 (3.2%)	4 (2.5%)	1 (2.3%)
Duration in numbers(%)					
> 5 yrs	84 (42%)	47 (43%)	37 (41%)	61 (39%)	23 (53%)
Between 1 & 5 yrs	89 (45%)	46 (42%)	43 (47%)	75 (48%)	14 (33%)
Newly diagnosed	27 (13%)	16 (15%)	11 (12%)	21 (13%)	6 (14%)
Prior admission for HF in numbers (%)	169 (85%)	92 (84%)	77 (85%)	135 (86%)	34 (79%)
Missing	2 (1.0%)	2 (1.8%)	0	2 (1.3%)	0
Prescribed CHF treatment in numbers (%)					
Beta-blocker	168 (84%)	93 (85%)	75 (82%)	129 (82%)	39 (91%)
ACE-inhibitor	148 (74%)	79 (72%)	69 (76%)	117 (75%)	31 (72%)
Loop diuretic	185 (93%)	97 (89%)	88 (97%)	150 (96%)	35 (81%)
Spironolactone	127 (64%)	68 (62%)	59 (65%)	103 (66%)	24 (56%)
Cardiac glycoside	47 (24%)	25 (23%)	22 (24%)	41 (26%)	6 (14%)

Table 4 Factors predicting the chance for medication adherence in a univariate binary logistic regression model

Factors	Odds Ratio	p-value	95% Confidence interval
< 3 symptoms (vs. ≥ 3 symptoms)	4.541	0.058	[0.950; 21.704]
Other ethnic subsets combined (vs. Black Africans)	3.317	0.136	[0.687; 16.023]
Younger than 65 years (vs. ≥ 65 years)	2.514	0.103	[0.831; 7.608]
Men (vs. women)	1,77	0.294	[0.610; 5.144]
Single household	1.962	0.546	[0.220; 17.469]
Previous admission (vs. no previous admission)	1.702	0.520	[0.337; 8.607]
Low educational level (vs. high educational level)	0.448	0.326	[0.090; 2.226]
No knowledge on CHF medication (vs.knowledge on CHF medication)	0.554	0.284	[0.188; 1.630]
Little practical support (vs. a lot of practical support)	1.709	0.365	[0.537; 5.438]
Little emotional support (vs. a lot of emotional support)	0.707	0.537	[0.236; 2.122]

Table 5 Factors predicting the chance for medication adherence in a multivariate binary logistic regression.

Factors	Odds Ratio	p-value	95% Confidence interval
< 3 symptoms adjusted by single household	5.081	0.043	[1.051; 24.567]
< 3 symptoms adjusted by sex, ethnic subset and age	3.981	0.09	[0.805; 19.694]
Single household adjusted by < 3 symptoms	2.903	0.343	[0.320; 26.331]
Single household adjusted by education, sex and ethnic subset	1.760	0.622	[0.186; 16;645]
Previous admission adjusted by < 3 symptoms and employment status	1.689	0.536	[0.322; 8.868]
Low educational level adjusted by sex, ethnic subset&single household	0.796	0.805	[0.130; 4.861]
No knowledge on CHF medication adjusted by ethnic subset, sex and education	0.827	0.765	[0.237; 2.886]
Little practical support adjusted by ethnic subset	2.234	0.188	[0.675; 7.398]
Little practical support adjusted by single household and sex	1.602	0.45	[0.471; 5.443]
Little emotional support adjusted by ethnic subset, sex and single household	0.649	0.468	[0.202; 2.087]

Table 6 Medication Adherence and Knowledge on Heart Failure Survey

Demographic and Clinical Data	
Surname:	
First name:	Date of Interview ___/___/___ (dd/mm/yy)
Date of birth ___/___/___ (dd/mm/yy) *OR* Age (yrs):	Study Number: _____
Height _____ (cm) Weight _____ (kg) Sex:	Tel:
Race: ☐ Black ☐ Asian ☐ Coloured ☐ Caucasian	
Education: ☐ None ☐ Standard 1-5 ☐ Standard 6-10 ☐ Matric ☐ Post Matric	
NYHA classification: ☐ I ☐ II ☐ III ☐ IV (at diagnosis)	
LVEF at diagnosis (in %):	
Heart failure etiology: ☐ Ischaemia ☐ Hypertension ☐ Inflammable ☐ Valvular ☐ Restrictive ☐ HIV Cardiomyopathy ☐ Peripartal ☐ Arrhythmia ☐ Hypertrophic ☐ idiopathic ☐ congenital	
Q1. Are you living with somebody or alone? ☐ Alone ☐ With somebody	
Q2. Have you had practical support during your heart failure diagnosis? ☐ not at all ☐ a little ☐ some ☐ a lot	
Q3. Have you had emotional support during your heart failure diagnosis? ☐ not at all ☐ a little ☐ some ☐ a lot	
Q4. If you have, who? ☐ family ☐ friends ☐ healthworkers	
Q5. What is your employment status? ☐ Employed ☐ Unemployed ☐ Retired	
Q6. Since when have you had your heart problems? ☐ More than 5 years ☐ Between 1 and 5 years ☐ less than 1 yr ☐ newly diagnosed	
Q7. Have you been in hospital before due to heart problems? ☐Yes ☐No	
Appointments	
Q8. How many scheduled appointments did you have in the last 12 months? (repeat medication and check-ups):	
Q9. In the last 12 months, how many appointments did you miss? (check-up or repeat medication).	

Q10. If you have, what are the reasons for missing your appointment?	YES	NO
a) Transportation (distance from clinic, money)	☐	☐
b) No time (family obligations)	☐	☐
c) No money for consultation	☐	☐
d) Forgetting	☐	☐
e) Not having somebody to go with	☐	☐
f) Others (specify)	☐	☐

Medications

Q11. Do you know the indication and the sideeffects of your medication?

		No of doses	Pill Counts	Compliant		Knowledge
	YES	In pills	In % of pills	YES	NO	Out of 2
Beta Blocker	☐			☐	☐	
ACE Inhibitor	☐			☐	☐	
Diuretic	☐			☐	☐	
Glycoside	☐			☐	☐	
Nitrate	☐			☐	☐	
Calcium Antagonist	☐			☐	☐	
Warfarin	☐			☐	☐	
Asprin	☐			☐	☐	
Slow K	☐			☐	☐	
Amiodaron	☐			☐	☐	
Zocor	☐			☐	☐	
Antidiabetic	☐			☐	☐	
Other	☐			☐	☐	
Total medication=		Total doses=				Total=

Are there any medications (e.g diuretics) that you sometimes skip of because...	YES	NO	Nr of days in last month	If yes, which drug
Forgetting	☐	☐		
b) Cost	☐	☐		
c) Side effects	☐	☐		
d) Hospital pharmacy wasn´t able to provide	☐	☐		
e) Inability to coordinate with food e.g. go to work too early	☐	☐		
f) Sharing with relatives and friends	☐	☐		
g) Running out of tablets	☐	☐		
h) Others (specify)				

Q13. Do you have any of the followig symptoms?	YES	NO
a) Fatigue, tiredness, loss of energy	☐	☐
b) Waking up at night coughing or short of breath	☐	☐
c) Shortness of breath	☐	☐
d) Loss of appetite and abdominal discomfort	☐	☐
e) Swollen ankles or feet	☐	☐
f) Weight gain	☐	☐
g) The need to go to the bathroom at night many times	☐	☐
h) Chest pain or palpitations	☐	☐

Diet/Weight

Q14. Has a doctor or a nurse ever told you that you should weigh yourself daily? ☐ Yes ☐ No

Q15. Do you have a scale at home? ☐ Yes ☐ No

Q16. In the last month, how often have you weighed yourself? □ Daily □ Weekly □ Monthly □ Never

Q17. Did a doctor give you any dietary advice on...?	YES	NO
a) Salt intake	□	□
b) Fat intake	□	□
c) Vegetables and fruit intake	□	□
d) Fluid intake	□	□
e) Alcohol	□	□

Q18. Do you keep a special diet? □ Yes □ No

Q19. If you do, which?	YES	NO
a) Low salt	□	□
b) Low fat	□	□
c) High in vegetables and fruit	□	□
d) Low sugar	□	□
d) Other (specify)	□	□

Q20. Do you add salt to your food while cooking or after? □ Yes □ No

Q21. Do you eat any of the following food?	YES	NO
a) Poloni	□	□
b) Pies	□	□
c) Peanuts, crisps	□	□
d) Canned food (baked beans)	□	□
e) Fried chicken from Kentucky/Nandos	□	□

Q22.Do you eat or drink any of the following?	YES	NO
a) Vegetables with butter	□	□
b) Meat with fat	□	□
c) Skin of the chicken	□	□
d) Mayonaise	□	□
e) Sour milk	□	□

Q23. Do you eat 5 serving of fruit and vegetables everyday? □ Yes □ No

Q24.Could you afford 5 servings of fruit and vegetables everyday? □ Yes □ No

Q25. Do you drink more than 2 litres of fluids (water, juice, fizzy drinks) per day? □ Yes □ No

Exercise

Q26. Have you ever been told by a doctor or a nurse that you should exercise? □ Yes □ No

Q27. What type of exercise do you do?

- □ None
- □ Slow walking for more than 1km per day
- □ Brisk walking
- □ Cycling
- □ Dancing
- □ Running
- □ Gym
- □ Housework/Gardenwork
- □ Other (specify)

Q28.Do you walk 20-30 min everyday? □ Yes □ No

Smoking

Q29. What is your smoking status?

□ Current smoker (How many cigarettes per day_____)
□ Former smoker
□ Never smoked

Q30. Did a doctor or a nurse ever tell you that you should not smoke? □ Yes □ No □ not applicable

Alcohol

Q31.How often do you drink?

□ Only drink on special occasions (current)
□ Regularly (current)
□ Former
□ Never

Q32. How many drinks per week do you currently have?

□ not applicable
□ Beer_____cans (350ml)
□ Wine_____glasses(250ml)
□ Hard liquor_____tot

Knowledge

Q33. Since you were diagnosed with heart failure, have you received any information about heart failure from your doctor or nurse?

□ Yes □ No □ Don´t remember

Q34. How much would you say you know about heart failure?

□ A lot □ Some □ A little □ Nothing

Q35. The following is a list of statements about non-medical ways of taking care of heart failure - please indicate whether you think its true or false or if you don´t know.	TRUE	FALSE	DON'T KNOW
a) Weighing yourself everyday is important	□	□	□
b) You should weigh yourself before you go to bed	□	□	□
c) Weight changes are not related to your heart condition	□	□	□
d) A low salt diet is good for your heart	□	□	□
e) A low fat diet is good for your heart	□	□	□
f) Alcohol is bad for your heart	□	□	□
g) Smoking is bad for your heart	□	□	□
h) Even a little exercise is bad for my heart	□	□	□
i) You should drink more than 2 litres of fluid with your heart condition	□	□	□
j) You can skip your medication once in a while	□	□	□

8. Thesen

1) Die Medikamenten-Compliance in der Studie erreichte mit 71% ähnliche Werte wie in Studien aus anderen Regionen der Welt (Europa, Nordamerika, u.a.). Bisher gab es keine Vergleichsstudien aus afrikanischen Ländern.

2) Zum vorgegebenen Termin der Medikamentenzählung erschienen 82 der in die Studie eingeschlossenen 200 Patienten (41%).

3) Das Ausmaß der Medikamenten-Compliance bei Patienten mit Herzinsuffizienz durch Selbsteinschätzung ist höher als durch Medikamentenzählung.

4) Schwarzafrikaner zeigten eine geringere Compliance als Patienten mit anderer ethnischer Zugehörigkeit (72% vs. 89%).

5) Die Medikamenten-Compliance weiblicher Patienten war geringer als die männlicher Patienten (71% vs. 81%).

6) Die Compliance variierte bei den Medikamenten, die zur Therapie der Herzinsuffizienz zur Anwendung kommen, zwischen 64% für Schleifendiuretika und 79% für ACE-Hemmer und dem Aldosteronantagonisten Spironolacton.

7) Durch eine einfaktorielle Regression ergaben sich folgende Faktoren, welche die Medikamenten-Compliance positiv beeinflussten:
- die Gegenwart von weniger als 3 herzinsuffizienztypischen Symptomen
- die Zugehörigkeit zu anderen ethnischen Gruppen als Schwarzafrikaner
- ein Alter < 65 Jahren
- männliches Geschlecht
- das Führen eines Ein-Personen-Haushalts
- wenig praktische Unterstützung im täglichen Leben
- eine vorhergehende stationäre Aufnahme aufgrund der Herzinsuffizienz

8) Negative Prädiktoren für Medikamenten-Compliance, welche durch eine einfaktorielle Regression ermittelt wurden, waren:
- wenig emotionale Unterstützung im täglichen Leben
- ein geringes Bildungsniveau
- fehlendes Wissen über die Medikamente zur Therapie der Herzinsuffizienz

9) Durch eine mehrfaktorielle Regression fanden sich folgende positive Einflussfaktoren für Medikamenten-Compliance, wenn man eine Effektmodifikation von ≥ 0.5 berücksichtigt:

- Patienten mit weniger als 3 herzinsuffizienztypischen Symptomen adjustiert nach häuslicher Situation
- Patienten, die in einem Ein-Personen-Haushalt wohnten adjustiert nach der Anzahl vorhandener Symptome
- Patienten mit wenig praktischer Unterstützung im täglichen Leben adjustiert nach ethnischer Zugehörigkeit

10) Die Compliance bezogen auf einen gesundheitsfördernden Lebensstil variierte zwischen 2,5 % für tägliche Gewichtskontrollen und 98% für einen moderaten Alkoholgenuss.

11) Nikotin abstinent waren 89% der Schwarzafrikaner verglichen mit lediglich 67% der Patienten anderer ethnischer Zugehörigkeit (p=0.001). Ebenso waren 91% der weiblichen Patienten Nichtraucher im Gegensatz zu 78% der männlichen Studienteilnehmer (p=0.015).

12) Zudem variierte die Aufklärung von ärztlicher oder pflegerischer Seite über einen gesundheitsfördernden Lebensstils ebenfalls stark zwischen 8% hinsichtlich täglicher Gewichtskontrollen und 73% hinsichtlich Nikotinabstinenz.

13) Das Wissen der Studienpatienten über ihre verschriebenen Medikamente war gering: 56% aller Studienteilnehmer konnten weder die Wirkungsweise noch unerwünschte Wirkungen ihrer Medikamente benennen. Insgesamt konnten 68% aller Schwarzafrikaner keine Informationen über ihre Medikamente angeben, im Gegensatz zu 12% aller Patienten anderer ethnischer Zugehörigkeit (p<0,001).

14) Im Durchschnitt wurden 69% der 10 Fragen über erwünschtes Verhalten bei Herzinsuffizienz korrekt beantwortet. Der Prozentsatz korrekter Antworten der einzelnen Fragen variierte zwischen 29% und 89%.

15) Diese Ergebnisse zeigen, dass ähnlich wie in anderen Regionen der Welt, Non-Compliance bezüglich Medikamente und einer gesundheitsfördernder Lebensweise ein wesentliches Problem in Soweto darstellt. Diese Daten unterstreichen die Notwendigkeit für Interventionen, welche in anderen Regionen der Welt (Europa,

Nordamerika, u.a.) schon längst etabliert sind und nachweislich die Gesundheitsversorgung positiv beeinflusst haben. Allerdings sollten diese Interventionen speziell auf die kulturellen Bedürfnisse in Soweto abgestimmt und finanziell zu ermöglichen sein, um die Behandlung, Lebensqualität und Prognose von herzinsuffizienten Patienten in Südafrika entscheidend zu verbessern.

Lebenslauf

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Deutsch		Muttersprache
Englisch		Fließend
Französisch		Fließend
Latein		Grundkenntnisse

Veröffentlichungen
Artikel
1. **Ruf V**, Stewart S, Pretorius S, Kubheka M, Lautenschläger C, Presek P, Sliwa K. Medication adherence, self-care behaviour and knowledge on heart failure in urban South Africa: the Heart of Soweto study. Cardiovascular Journal of Africa 2010, Vol 21, Issue 2, Mar / Apr.
Abstracts
1. Ruf V, Stewart S, Pretorius S, Kubheka M, Lautenschlaeger C, Presek P, Sliwa K. Medication adherence and aspects of heart failure management-a cross sectional study in South Africa. Eur Heart J 2008: 84486
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3. Pretorius S, **Ruf V,** Sliwa K, Walker K, Stewart S. Food choices and their nutritional value in black African patients with heart failure: The Heart of Soweto Study. SAMJ 2007; 97: 11
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1. Ruf V, Stewart S, Pretorius S, Kubheka M, Lautenschläger C, Presek P, Sliwa K. Medication adherence and aspects of heart failure management –a cross sectional study in South Africa. ESC Kongress September 2008
2. Rahn V, Stephan M, Hoffmann F. Posttraumatisches Kausalgie-Dystonie Syndrom. DGN September 2010

_____

Verena Rahn

Selbstständigkeitserklärung:

Ich erkläre hiermit, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet.

Ich versichere, dass ich für die inhaltliche Erstellung der vorliegenden Arbeit nicht die entgeltliche Hilfe von Vermittlungs- und Beratungsdiensten (Promotionsberater oder andere Personen) in Anspruch genommen habe. Niemand hat von mir unmittelbar oder mittelbar geldwerte Leistungen für Arbeiten erhalten, die im Zusammenhang mit dem Inhalt der vorgelegten Dissertation stehen.

Die Arbeit wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

Halle (Saale), Januar 2011

_____

Verena Rahn

Erklärung über frühere Promotionsversuche

Ich habe an keiner Universität, weder im In- noch im Ausland frühere Promotionsversuche unternommen.

Halle (Saale), Januar 2011

_____

Verena Rahn

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