Self-Care, Foot Problems and Health in Tanzanian Diabetic Patients

Comparisons with Matched Swedish Diabetic Patients

BY

BIBBI SMIDE
Dissertation for the Degree of Doctor of Medicine in Caring Sciences presented at Uppsala University in 2000.

ABSTRACT


The overall aim was to study self-care, foot problems and self-perceived health in 150 consecutively invited Tanzanian diabetic patients and to compare them with gender- and age-matched Swedish diabetic patients (n=150) from a middle Sweden area. The main study was cross-sectional and took place at a diabetes clinic in Dar es Salaam. All patients answered questions about their self-care satisfaction, diabetes knowledge and skills, and educational needs. Foot examination also included questions about foot-care and perceived foot problems. The patients' health was assessed using the SF-36 general health questionnaire. The Swahili version of SF-36 was pre-tested in 518 Tanzanian diabetic patients showing an acceptable validity and reliability. Glycaemic control was measured by HbA1c. The results indicated that 45% of Tanzanians and 43% of the Swedes reported satisfaction with their self-care. The Tanzanian patients reported that following doctor’s advice was the most important factor necessary for feeling well, whereas the Swedish patients emphasised diet and exercise. Lack of anti-diabetic drugs and education were reasons of dissatisfaction in the Tanzanian group, whilst the Swedes were dissatisfied with their own behaviour. None of the Tanzanians monitored their blood glucose themselves, whilst 50% of the Swedes did it on a daily or weekly basis. Significantly more Swedes than Tanzanians knew the interaction between insulin, food and exercises, and how to manage hyperglycaemia and hypoglycaemia. The Tanzanians wanted more education about diabetes, treatment and injection technique, whereas the Swedes wanted education about psychological aspects of diabetes, foot-care and oral anti-diabetic treatment. Foot problems reported in the Tanzanian group were pain, numbness and pricking sensations, whereas the Swedes reported ingrown toenails, pain and fissures. Seven Tanzanians and one Swede had foot ulcers. Twenty Tanzanians and 103 Swedes reported to inspect their own feet. The Tanzanians had significantly poorer self-perceived health and glycaemic control than the Swedish patients. A follow-up study was performed with the Tanzanian group of patients after two years. Many patients did not return for the second investigation and 70 patients were re-assessed. They showed an improved self-perceived health and a significant decrease in HbA1c-value. In conclusion the results indicated that Tanzanian patients needed better access to a continuous and regular supply of diabetes drugs. Furthermore the Tanzanians’ burden of diabetes influenced their possibilities to work, whilst Swedish patients were hindered in social activities. In both countries the importance of regular foot inspections of the patients’ feet should be emphasised. Glycaemic control and self-perceived health seemed to be poorly related and for that reason diabetes nurse specialists need to use both measures in order to guide the patients towards the goals experiencing a good health despite having diabetes.

Key words: Diabetes mellitus, Self-care, Foot problems, SF-36, Tanzania, Sweden.

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ORIGINAL PAPERS

This thesis is based on the papers listed below, which are referred to in the text by their roman numerals:

I. Smide B, Ekman L, Wikblad, K. Diabetes self-care and educational needs in Tanzanian and Swedish diabetic patients - a cross-cultural study. (Submitted for publication).

II. Smide B, Wikblad K. Comparing foot problems in Tanzanian and Swedish diabetic patients. (Submitted for publication).


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INTRODUCTION

Diabetes mellitus is a chronic disease worldwide, and there is an increasing number of patients with diabetes in Africa (Amos et al., 1997; Chinnock, 1999; King and Rewers, 1992; Zimmet and Lefebvre, 1996). The World Health Organisation (WHO) has predicted that in year 2025 the number of people with diabetes will have been doubled. WHO has also predicted that out of those 300 million people with diabetes, 76% will be living in low-income countries (King et al., 1998; WHO, 1998).

The main interest in doing this study was to compare diabetes care in a low-income country, Tanzania, with a high-income country, Sweden. The focus was upon comparisons regarding self-care, foot problems and health, from a medical perspective as well as that of the patients’ perceived health. The challenge to perform this work resulted in collaboration between Muhimbili Medical College of Health Sciences in Dar es Salaam, Tanzania and the Department of Public Health and Caring Sciences, Uppsala University, Sweden. In table 1 some data regarding Tanzania and Sweden are presented.

Tanzania, with its approximately 30 million inhabitants, is one of the poorest countries in the world and the literacy rate is estimated to 68 % (Population census, 1991). Although the WHO has classified insulin as a life-saving drug it is not readily available or affordable in all Sub-Saharan African countries (King et al., 1995). Many patients are poor, and the consequence of insulin shortage might be life-threatening, at least to type I diabetic patients (Elbagir, 1997; McLarty, 1997). Many Tanzanians, especially those who have moved to the cities, have changed their way of living into a more western like, sedentary lifestyle. Commonly diabetic patients, living in the Dar es Salaam area, attend the diabetes outpatient clinic at the biggest hospital in the country, Muhimbili Medical Centre (MMC), Dar es Salaam. According to Tanzanian regulations the diabetes drugs are free of charge, when patients are attending MMC clinic, but due to financial problems at the hospital, there are often difficulties in obtaining the drugs. The result is that the patients are then required to purchase their anti-diabetic diabetes drugs at private pharmacies (Chale et al., 1992). Besides there are very few nurses with specialist diabetes education and mostly they have to help patients to solve acute problems. Rarely they have the opportunities to work with a longer perspective in mind.

In Sweden, on the other hand, with a population approaching 9 million inhabitants, diabetic patients find little problem obtaining the drugs they need. Swedish patients get insulin, and syringes free of charge, while oral anti-diabetic drugs are included in policy insurance, “free card”. Swedish patients will also have easy access to participate in diabetes education. The main
concern for Swedish diabetes specialist nurses is to guide diabetic persons how to live a flexible life with diabetes.

**Table 1.** General facts about Tanzania in comparison with Sweden. (The figures are approximate).

<table>
<thead>
<tr>
<th></th>
<th>TANZANIA</th>
<th>SWEDEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>30 mill</td>
<td>8.8 mill</td>
</tr>
<tr>
<td>Population growth rate</td>
<td>3.1 %</td>
<td>0.4 %</td>
</tr>
<tr>
<td>Life expectancy at birth</td>
<td>51 years</td>
<td>79 years</td>
</tr>
<tr>
<td>Population aged 65 and above</td>
<td>2.5%</td>
<td>17.3%</td>
</tr>
<tr>
<td>Total fertility rate</td>
<td>5.49 children born/woman</td>
<td>1.5 children born/woman</td>
</tr>
<tr>
<td>Literacy rate</td>
<td>67.8 % total population</td>
<td>100 % total population</td>
</tr>
<tr>
<td>Doctors/inhabitant</td>
<td>1/27 000</td>
<td>1/321</td>
</tr>
<tr>
<td>Health workers in the country</td>
<td>5 550 health workers</td>
<td>75 800 nurses and midwives</td>
</tr>
</tbody>
</table>

BACKGROUND

Diabetes mellitus

Definition
Diabetes mellitus is a disease with a glycaemic disorder and it is characterised by persistently higher blood glucose values than the normal range. The disease may result in long-term damage affecting various organs. The criteria for diabetes diagnosis is a fasting venous blood glucose value $\geq 6.1$ mmol/l which should be confirmed by repeating the test on another day (Groop, 1998). There are two main types of diabetes. Type 1, previously known as insulin-dependent diabetes mellitus (IDDM), is due to a total deficiency of the hormone insulin. Usually the disease presents itself before age 30. In clinical practice, symptoms such as increased thirst, increased urine volume, decreased weight and tiredness may indicate diabetes. People with Type 1 diabetes need insulin treatment continuously. Type 2 diabetes was previously known as non insulin-dependent diabetes mellitus (NIDDM). It is caused by a relative deficiency of insulin and/or decreased insulin sensitivity. Type 2 diabetics are usually diagnosed in people over the age of 40. Obesity is present in over 50 % of men and 70 % of women. Often the diabetes is present several years before diagnosis. Type 2 diabetic patients are commonly treated with anti-diabetic tablets, in some cases, they are treated by a combination of diet and physical exercise and up to 20 % are treated with insulin. Approximately 85 % of all patients with diabetes have Type 2 (Pickup and Williams, 1997).

Diabetes prevalence in Tanzania
In Tanzania the prevalence of diabetes is approximately 1 % of the population (McLarty et al., 1989). This means that approximately 300 000 individuals are thought to have diabetes. This figure is based upon different Tanzanian studies (Table 2).

Commonly, the diabetic patients are classified into the two major groups: insulin- requiring, and non insulin-requiring (McLarty et al., 1990b). The classification of diabetes Type 2 is often based on factors such as blood-glucose value, glucosuria, increased age, long duration of symptoms, obesity, and absence of ketonuria (Swai et al., 1990).

It is well known that Type 2 diabetes is influenced by sedentary life-style. An increased diabetes prevalence has been reported in groups who have changed from a traditional to an industrial way of living (Elbagir, 1997; King et al., 1995; Papoz et al., 1988; Zimmet et al., 1997). Previously this phenomenon has been investigated in special selected groups living in the Dar es Salaam area. The percentage of diabetes was found to vary from 4.3 % in a group of African nuns (n=140) to 12.2% in a group of high-ranking male government officials (n=174) (McLarty, 1995).
**Diabetes prevalence in Sweden**

In Sweden, various Swedish studies have reported a diabetes prevalence range of 2.2 - 4.3%. Approximately 300 000 people have diabetes, the majority of whom have Type 2 diabetes. Some Swedish diabetes prevalence studies are presented in Table 3.

**Table 2.** Tanzanian diabetes prevalence studies.

<table>
<thead>
<tr>
<th>Year/Authors</th>
<th>Study area</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984 Ahrén and Corrigan</td>
<td>Ndolage, Western Tanzania</td>
<td>0.8%</td>
</tr>
<tr>
<td>1984 Ahrén and Corrigan</td>
<td>Kahangala, Western Tanzania</td>
<td>0.2%</td>
</tr>
<tr>
<td>1984 Ahrén and Corrigan</td>
<td>Mwanza town, Western Tanzania</td>
<td>0.8%</td>
</tr>
<tr>
<td>1995 McLarty</td>
<td>Kilimanjaro area</td>
<td>0.7%</td>
</tr>
<tr>
<td>1995 McLarty</td>
<td>Morogoro area</td>
<td>0.8%</td>
</tr>
<tr>
<td>1995 McLarty</td>
<td>Dar es Salaam</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

**Table 3.** Some Swedish diabetes prevalence studies

<table>
<thead>
<tr>
<th>Year/Authors</th>
<th>Study area</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988 Bitzén</td>
<td>Dalby</td>
<td>2.2%</td>
</tr>
<tr>
<td>1990 Falkenberg</td>
<td>Kisa</td>
<td>4.3%</td>
</tr>
<tr>
<td>1994 Andersson</td>
<td>Laxå</td>
<td>4.3%</td>
</tr>
<tr>
<td>1998 Lundman</td>
<td>Sundsvall</td>
<td>3.3%</td>
</tr>
<tr>
<td>1998 Berger</td>
<td>Skaraborg</td>
<td>3.2%</td>
</tr>
<tr>
<td>1999 Färnkvist</td>
<td>Härnösand</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
Longterm diabetes complications
There are specifically two landmark studies concerning the relation between glycaemic control and late complications. The Diabetes Control and Complications Study (DCCT) has shown that optimal diabetic control in young diabetes Type 1 patients delays the onset of diabetic complications (DCCT, 1993). The United Kingdom Prospective Diabetes Study (UKPDS) has shown that intensive blood glucose control with sulphonylurea or insulin have reduced the risk of late complications in type 2 patients (Turner, 1998). The incidence of microvascular complications were reduced by lowering the blood glucose in the same way as shown in Type I patients presented in the DCCT study. The UKPDS also showed that lowering the blood pressure to a mean of 144/82 mm Hg significantly reduced deaths due to diabetes (ADAb, 1999; Turner, 1998). The results from both the DCCT and UKPDS studies suggest an aggressive approach concerning the glycaemic control (ADAb, 1999).

Furthermore several other studies performed in industrialised countries have shown that poor glycaemic control is correlated with longer duration of the diabetes disease and the occurrence of late complications such as foot-lesions, neuropathy, nephropathy and retinopathy (Andersson and Svärdssudd, 1995; Campbell, 1999; Ohkubo et al., 1995; Pirart, 1978; Reichard et al., 1993). The organs most affected by complications are the eye, the kidneys and peripheral nerves. The most feared diabetes complications are blindness (Callaghan and Williams, 1994) and amputations (ADAb, 2000; ADAc, 2000; Childs, 1994; Draszkiewicz, 1992). Included in the five-year target for the St Vincent declaration in 1989, regarding diabetes care and research in Europe, was a reduction of new cases of blindness due to diabetes (Workshop, 1990). Furthermore the numbers of people entering end-stage diabetes renal failure should be reduced by at least one third. The rate of limb amputation was to be reduced by a half (Watkins et al., 1997).

In Africa, late complications such as retinopathy have been reported by Rolfe, who found evidence of retinopathy in 34 % of 600 Zambian patients (Rolfe, 1988a). Mhando reported about 25 % retinopathy found in 139 diabetic patients in Dar es Salaam (Mhando and Yudkin, 1980). Gill et al have reported a 52 % prevalence of diabetic retinopathy in 36 patients in South Africa (Gill et al., 1995). A 9 % prevalence of nephropathy was reported in 413 patients in Sudan (Elmahadi et al., 1991) to be compared with 30 % in 121 patients in Ethiopia (Lester, 1991). Consequently, studies performed in Sub-Saharan Africa have shown a wide variation in reported prevalence of late complications (Rolfe, 1993). These differences might then be due to different diagnostic criteria.

Foot complications
As previously mentioned, the most serious and feared foot complication is amputation (Apelqvist, 1996; Rolfe, 1997; Sanders, 1994) which also has severe economic consequences (Herman and Eastman, 1998; Raab, 1999). In order to decrease the occurrence of diabetic foot
complications, specific education in foot care and good glycaemic control have been suggested (Apelqvist, 1996; Barth et al., 1991; Kumar et al., 1994; Veves et al., 1994).

In different studies from industrialised countries the prevalence of peripheral neuropathy (PN) has been reported to vary between 13% and 54% (DCCT, 1993; Borssén, 1996; Franklin et al., 1994; Kumar et al., 1994; O’Hare et al., 1994; Plummer and Albert, 1995; Young et al., 1993; Ziegler, 1994). One reason to the discrepancies found in different studies might be different diagnostic criteria as there does not exist a specific single tool for diagnosing neuropathy. Three earlier studies performed in the Dar es Salaam area, Tanzania, have reported about the peripheral neuropathy (PN) frequency ranging from 25% to 32% (Gulam-Abbas and Archibald, 2000; Haddock, 1964; Mhando and Yudkin, 1980). Peripheral vascular disease (PVD) prevalence has been reported to 2% (Mhando and Yudkin, 1980). In three studies from Ethiopia the prevalence of PN varied between 47% and 69% (Lester, 1983; Haimanot and Abdulkadir, 1985; Seyoum and Chaka, 1998). In a study from Sudan, PN was reported to be present in 16% of a group of 128 insulin-treated diabetic patients, and patients with neuropathy were also significantly older than those without these complications (Elbagir et al., 1995). In a Zambian cohort (n=600) studied by Rolfe, a PVD prevalence of 1.7 % was found (Rolfe, 1988b).

Diabetes care

The studies mentioned above have reported about the diabetes complications and the need of good glycaemic control. A major challenge is how the diabetic patients will be able to benefit from this knowledge and how the diabetes care should be implemented (Sandén-Eriksson, 2000).

In Tanzania there are, so far, no national guidelines available regarding diabetes care, although the need for improved diabetes treatment has been highlighted (Kitange et al., 1998).

In Sweden, National Swedish Guidelines based on the St Vincent declaration (Workshop, 1990) have compiled the goals for diabetes care. A major such goal is to achieve good glycaemic control and to maintain good health. This includes preventing acute as well as long-term diabetes complications. In addition the emphasis should be on adequate education concerning self-care in order to allow the patients to make educated decisions about their treatment (National Guidelines, 1999a).

The challenge is to get the patients to make their own decisions, and to be in charge of their own treatments (Borne, 1998; Glasgow, 1995; Glasgow and Osteen, 1992; Rayman and Ellison, 1998; Sullivan and Joseph, 1998). Behavioural science has contributed to a more holistic view (Glasgow, et al., 1999) in diabetes care by concentrating on how patients experience having diabetes. Already in the 1970s Freire introduced the term “empowerment” and emphasised that knowledge should be provided in such a way that people themselves could manage their
situations (Freire, 1970). In diabetes care this means that the patients should have the power over their own care on a daily basis (Anderson, R.M., 1995). It also implies that the patients have the knowledge needed to carry out their self-care management (Thorell et al, 1994). Funnell has defined empowerment as having the "knowledge, skills, attitudes and self-awareness necessary to influence their own behaviour and that of others in order to improve the quality of their lives” (Funnell, et al. 1991).

**Diabetes self-care**

Self-care is an important part of diabetes care. Reports from Sub-Saharan countries have suggested self-care to be included in diabetes education (Gill et al., 1997). There exist different activities in different African countries and at the 6th Pan African Diabetes Congress in Dar es Salaam, 1998, diabetes education activities from north-western part of Tanzania were presented (PADSG, 1998). For example it was demonstrated how a white sheet could be used instead of having a board to write on. A sheet is easy to handle, easy to bring and electricity is not needed for its use. However it seems as self-care education, so far, mostly is implemented by giving information about basic diabetes facts.

In western countries several studies have referred to the patients as informed decision-makers, able to make their own decisions and, being in charge of their own treatments (Borne, 1998; EASD, 1995; Glasgow, 1995; Glasgow and Osteen, 1992; King et al., 1995; National Guidelines, 1999b; Rayman and Ellison, 1998; Sullivan and Joseph, 1998)). In order being able to manage their own care, the patients should be guided how to develop their ability in goal-setting regarding what they want to achieve (Arnold et al., 1995; Wikblad, 1999). In that way the patients themselves should be able to control and have the power over their own care (Rankin and Stallings, 1996). It is an educational challenge for the diabetes nurse specialists to educate the patients, to assist them in finding a satisfactory life-style and experiencing good health despite diabetes. This implies that the nurses are knowledgeable about different diabetes educational matters (Close, 1988). Apparently, the nurses need knowledge from different disciplines i.e. psychological, educational, sociological, pharmacological, medical, physiological (Henderson and Nite, 1978; Hockey, 1978; Wikblad, 1991). In industrialised countries, the diabetes specialist nurse often has the task of being a detective and trouble-shooter besides being an educator, counsellor, manager, communicator and innovator (Gallichan, 1999).

Self-care includes several components, which the patients ought to be aware of in order to manage their daily life with diabetes (Anderson, R.M., 1995; Arnold et al., 1995; Day and Assal, 1997). Self-care satisfaction, the most important factors for feeling well in spite of having diabetes, and experience of abandoning, are all components to be considered (Cox and Gonder-Frederick, 1992; Wikblad, 1991).
Another self-care component, which is important in both countries, is appropriate diabetes knowledge (Carlsson et al., 2000; Elbagir, 1997). Understanding the interaction between insulin, food and exercise as well as knowing what to do in case of hyper- and hypoglycaemia are examples of needed basic knowledge.

Many Type II diabetic patients suffer from obesity, which has a strong association with insulin resistance (Lindahl, 1998). Moreover many patients have a sedentary lifestyle. Regular exercise and weight reduction are supposed to improve insulin sensitivity. In Sweden, Falkenberg has initiated an intensive programme with lifestyle changes in Type 2 diabetic patients. He has reported about the advantages with problem based learning and group activities in comparison with traditional teacher centred learning (Falkenberg, 1997).

Nevertheless changing dietary and exercise habits seems to be problematic (Arborelius, 1996; Cox and Gonder-Frederick, 1992; Falkenberg, 1997). No matter which countries the patients are living in, they need to be guided according to each person’s habits in terms of physique, occupation, cultural habits and religious beliefs (Gill et al., 1997; Watkins et al., 1997; Pickup and Williams, 1997).

Self-monitoring of blood glucose (SMBG) is yet another vital part of diabetes self-care in industrialised countries and is also a helpful tool in improving the patient’s blood-glucose control (Andersson D.K., 1995; Berne, 1992; Cox et al., 1994; Day and Assal, 1997; Gill et al., 1997; Watkins et al., 1997; Pickup and Williams, 1997). The key issue is the understanding of the consequences of a high and low blood glucose value, respectively. This also helps the patient to understand, for example, the relationship between insulin, food and exercise (Day and Assal, 1997). By being responsible for checking the blood glucose themselves, the patients may identify when there is a risk of hypoglycaemia. However, there are major differences in how people may experience monitoring their own blood glucose, and these discrepancies may range from a relaxing feeling to a feeling of vigilance. Furthermore, the experiences may differ over time (Callaghan and Williams, 1994).

Foot care should also be looked upon as an important component of self-care. Abundant data available in high-income countries strongly support the need of diabetic patients being acquainted with the importance of the connection between foot problems and diabetes (Apelqvist, 1996; Barth et al., 1991; Borssén, 1996; National Guidelines, 1999a; Falkenberg, 1990; SPRI, 1998; Larsson et al., 1995; Litzelman et al., 1993; Reiber et al., 1992). This means that the patients themselves ought to be well aware of the importance of foot care and daily foot self-inspections are most important (ADAC, 2000). Ideally, early detection should lead to a major decrease in foot ulcerations (Benbow et al., 1999; Mason et al., 1999; Veves et al., 1994; Ward,
with its subsequent result of mobility dysfunction and in severe cases amputation and long-term disability (Benbow et al., 1999; Ward et al., 1999; Ward, 1991).

In clinical practice continuous foot assessment is necessary in order to identify patients at risk of developing foot ulcers (Boulton, 1996; Bresäter et al., 1996; Helfand and Hirt, 1994; Klenerman et al., 1995). Both Swedish and international guidelines about diabetes treatment have included foot examinations as an important issue in diabetes care (National guidelines, 1999a). Nowadays tuning fork and monofilament are commonly used in foot examinations (ADAc, 2000; Boulton, 1996; De and Scarpello, 1999; Draszkiewicz, 1992; Pablo et al., 1995).

**Self-care prerequisites for Tanzanian diabetic patients in Dar es Salaam**

Some diabetic patients live in villages a long way from any hospital, and four trips a year to MMC for diabetes check-ups and to collect insulin could consume the total annual income of a peasant farmer (McLarty, 1995). Other patients may have access to monitor their own blood-glucose and they also have possibilities to buy anti-diabetic drugs when needed. Many patients judge whether their glucose value is too high by intermittent home urinary examination. In cases when urine test strips not were available or too expensive to buy, they reported dipping their fingers in the urine and tasting it to detect sugar. This way of assessing the glycaemic control was both inadequate and unreliable, yet was often the only available measurement (Kessi, 1993). Besides, the urinary testing method is highly misleading and does not warn of hypoglycaemia (Pickup and Williams, 1997).

By the early 1970s a special outpatient diabetes clinic was established at the MMC. Until 1996 most diabetic patients in the Dar es Salaam area attended this clinic every three months. Patients with continuously high blood glucose values, children, and pregnant mothers came to the clinic more often.

In 1988 the first post for a senior-trained nurse working especially with diabetes was created. Among her responsibilities was to be in charge of diabetes education courses, which took place every Thursday morning before the clinic started (Kessi, 1993). Topics covered mainly diet, exercises, as well as how to inject and store insulin. When available, patients were given the book "Diabetes mellitus - a handbook for patients and their families" which is available in the Swahili language (McLarty and Swai, 1991). Patients on insulin who did not have access to refrigerators were taught to store their insulin in a plastic bag in claypots containing water, hereby keeping the insulin sufficiently cool (Kessi, 1994). Disposable syringes, which are for the use of a single patient may be boiled several times, thus lowering the cost, instead of purchasing new ones (Kessi, 1993).
In 1996 diabetes care in Dar es Salaam was re-organised due to the increased number of diabetic patients coming to MMC. Depending on their abode, patients were transferred to outpatient clinics in the district hospitals of Mwanamanyala, Temeke and Ilala in the Dar es Salaam area. At these three district hospitals patients are required to pay half of the cost of anti-diabetic drugs. Patients remaining at MMC were those with severe complications such as irregularly high blood glucose values and foot ulcers. In addition, pregnant women were seen at MMC. Insulin, when available, was still free of charge at MMC. The staff at each diabetes clinic at the three district hospitals was specially trained in diabetes care. There are plans to expand this training for the staff and then put resources into arranging patient education, so that patients will be able to better care for themselves (Rashid, 2000).

**Self-care prerequisites for Swedish diabetic patients in Uppsala county**

In contrast to the Tanzanian situation, the health care system in Sweden offers a complete health care programme following national guidelines (National Guidelines, 1999a). In Uppsala county, the diabetes clinics within primary health care works in diabetes teams comprising diabetes specialist nurse, medical doctor, dietician, chiropodist, psychologist, physiotherapist and orthopaedic technician. There are approximately 30 diabetes nurses with special diabetes training at university level.

Most people with primarily Type 1 diabetes have contact with the diabetes clinics at the university hospital, Akademiska sjukhuset, or the general hospital, Enköpings lasarett. Commonly the majority of people with Type 2 diabetes attend community health centres for their check-ups and there are approximately 38 community health centres in the county.

Diabetes education both for diabetic patients Type I and Type 2 includes self-monitoring of blood glucose. Test equipment is free of charge and there is no limit regarding the amount of tests strips to be used. Diabetes education also includes the interaction between insulin, food and exercises and the patients are supposed to learn how to adjust their diabetes treatment in case of infections, when using other medicines, when travelling, etc. The diabetes nurse specialist and the physician perform regular foot inspections. The patients are taught how to care for their feet themselves. Furthermore the patients have possibilities to participate in group activities in order to change lifestyle with the aim being to reduce weight or smoking cessation. Insulin and syringes are free of charge, whilst anti-diabetic oral drugs are included in the Swedish insurance policy.

**Health**

Diabetes care needs to be evaluated from a medical perspective as well as that of the patient’s health (Wiklund, 1990). Traditionally, mortality and morbidity have been used as health
measures within medical care (Stewart and Ware, 1992). However these measures do not tell how the patients themselves feel and how they are function in their daily life (Wiklund, 1990).

The wellknown WHO definition of health is very broad in its nature: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" (WHO, 1948). As this definition gives prominence to a person’s wellbeing, the traditional medical model of health (Boorse, 1981), which states that a person with diabetes never can be looked upon as a healthy person, can be rejected. If instead health is defined from a humanistic, holistic view a person may experience good health if he is able to fulfil his own goals (Pörn, 1988; Nordenfeldt, 1987). This means that diabetic persons can experience good health despite having diabetes.

Today it is natural in health evaluations to include the patients own opinions about his feelings, which has been put forward both in low-income (Gill et al., 1997) and high-income countries (Vaughan, 1994; Wändell, 1997). It has even been suggested that special health scales such as for example SF-36 routinely should be given to patients in clinical practice (Garratt et al., 1993). However, in diabetes care the evaluation should include both the patient’s glycaemic control measured by HbA1c, and his self-perceived health evaluated with a health measure. It is thus important that the diabetic persons themselves are well acquainted with the meaning of the outcome measures (National Guidelines, 1999b).

In the current studies, the term ”self-perceived health” has been used. It means that the patients themselves consider and rate their health. Nevertheless, different researchers have used different names to describe what we have referred to as ‘self-perceived health’. Some examples are: health-related quality of life (Elbagir, 1997; Wilson and Cleary, 1995); perceived health (Svärdsudd and Tibblin, 1990); self-perceived health (Schroll et al., 1991) and self-rated health (Krause and Jay, 1994).
**SF-36 questionnaire**

The above WHO health definition was the basis of the widely used generic health questionnaire SF-36 (Short Form). It has been developed within the Medical Outcomes Study (MOS) (Stewart and Ware, 1992). The original MOS questionnaire included 68 items; however, when the SF-36 short form was constructed, measures about health distress, sexual functioning, family functioning, and sleep adequacy were excluded.

In the industrialised world, the generic SF-36 questionnaire has been used in many studies (DCCT, 1996; Bullinger, 1995; Hänninen, 1998; Marquis, 1995; Tarlov, 1997; Wagner et al., 1998; Ware et al., 1993). Furthermore, SF-36 questionnaire has been translated into several languages. The prerequisites for its cross-cultural use, is its appropriateness to the culture in focus, and the comparability of its content (Wagner et al., 1998). In addition to this, SF-36`s properties in distinguishing between the general population and people with chronic conditions e.g. patients with diabetes, have been demonstrated in the United States (Ware and Sherbourne, 1992).

In Tanzania, the SF-36 questionnaire was used in The Adult Morbidity and Mortality Project (AMMP), with its` aims to investigate the frequency of diabetes and associated risk factors in different Tanzanian communities in different geographical areas. It was also considered important to include questions about self-perceived health. One survey area within the AMMP was the Dar es Salaam area, where approximately 4000 subjects completed the questionnaire (McLarty, 1993).

In an African country outside Tanzania, the longer MOS version, including 68-items, has been used in a study reported from Sudan. It was found that the overall quality of life in patients with diabetes Type I was low. It was also reported that patients free from late complications had better health-related quality of life than those with complications (Elbagir, 1997). No other diabetes studies performed in Sub-Saharan African countries have been found using the MOS or the SF-36 health questionnaire.

In Sweden, the SF-36 questionnaire has been tested regarding its psychometric properties by Sullivan, who also has translated the American original SF-36 manual into Swedish (Sullivan et al., 1994; Sullivan et al., 1995). In some Swedish studies the longer MOS version has been used. It has been called "SWED-Qual questionnaire" (Brorsson et al., 1993; Wikblad et al., 1996; Wändell, 1997).
**Medical perspective**

At the MMC diabetes clinic in Dar es Salaam, glycaemic control is mostly evaluated by testing blood glucose level. There are no economical resources to use HbA1c as an outcome measure of diabetes treatment (Kessi, 1993).

In contrast, in Sweden as well as in other western countries, HbA1c is commonly used as an important measure of long-term glucose control and it is supposed to be regularly tested in patients both with Type 1 and Type 2 diabetes (National Guidelines, 1999a). HbA1c evaluates the diabetes care mainly from a medical perspective (Coates and Boore, 1998). However Peyrot has in a study demonstrated that the better the patients manage their self-care the better blood glucose control (Peyrot and Rubin, 1994). This way of using the HbA1c could also be strenghtened by Wikblad who has suggested that it could be looked upon as a valuable tool in assessing patients’ self-care (Wikblad, 1991).

There seems to exist a complex relationship between glycaemic control and perceived health. In a study in adolescent diabetic patients those with overall good glycaemic control reported better general health (Guttman et al., 1998). Hänninen et al found no association between poor HbA1c and impaired health perceptions when studied in 260 Type 2 diabetic patients younger than 65 years (Hänninen et al., 1998). Nor did Weinberger et al (Weinberger et al., 1994) or Wredling et al (Wredling et al., 1995) find any relationship between quality of life and hyperglycaemia, diabetes duration, type of treatment or diabetic complications. Wikblad et al (Wikblad, 1996) found that Type 1 diabetic patients with acceptable glycaemic control (mean HbA1c 7.3 %) had the highest quality of life ratings whilst those with good glycaemic control (mean HbA1c 6.3 %) had lower ratings. Wändell reported that no relationship was found between quality of life and glycaemic control, when investigated in diabetic patients treated in primary health care in Stockholm, Sweden (Wändell, 1997).

However when comparing with diabetic studies performed in Sub-Saharan Africa, very few, except one study from Sudan (Elbagir, 1999) have reported about both self-perceived health and its relation to glycaemic control. Elbagir found that good glycaemic control was likely to relate to poorer health related quality of life. He explained this to most probably be due to improper diabetes care and poor awareness of diabetes, especially in newly detected diabetic patients.
AIMS

The overall aim of this thesis was to study self-care, foot problems and health in Tanzanian diabetic patients and to make comparisons with gender- and age-matched Swedish diabetic patients.

Research questions:

1. What similarities and differences were there between Tanzanian and Swedish diabetic patients regarding self-care satisfaction, diabetes knowledge and skills, and educational needs? (Paper 1)

2. What similarities and differences were there between Tanzanian and Swedish patients concerning reported foot problems, self foot-care, and outcome of foot inspections? (Paper II)

3. How frequent were peripheral neuropathy (PN) and peripheral vascular disease (PVD) and was there any relationship between PN, PVD, and self-perceived health in a group of Tanzanian diabetic patients? (Paper III)

4. Did Tanzanian and Swedish diabetic patients report poorer self-perceived health than general population in the two countries respectively? (Paper IV and V)

5. Did the Swahili version of SF-36 health questionnaire possess a satisfactory validity and reliability? (Paper IV)

6. Did Tanzanian and Swedish patients with poor glycaemic control report poorer self-perceived health than those with acceptable glycaemic control? (Paper V)

7. Was there an improvement in the Tanzanian patients’ perceived health over the two-year period? (Paper VI)
METHODS

Subjects
Three different groups of diabetic patients were included in the current work. One group, participated in the "main Tanzanian data collection" (n=150). One year prior to the main study a group of 518 Tanzanian diabetic patients filled in the SF-36 Swahili version in order to test its validity and reliability. One group contained Swedish subjects (n=150), who had been matched with the 150 Tanzanian patients.

In addition, the Tanzanian subjects were compared with general Tanzanian population and the Swedish subjects with general Swedish population.

Tanzanian subjects in the main data collection  (Paper I, II, III, V and VI)
The main data collection took place during five clinic days in June - July in 1995. During this period totally 209 diabetic patients attended the MMC diabetes clinic. Among these, eight patients every hour were randomly approached, resulting in 162 patients invited to the study. But 3 patients were excluded because of incomplete filled in questionnaires, 6 were younger than 18 years, 3 did not know their age. This means that 150 patients were included.

In paper III, 153 of the 162 patients were included. Three were excluded because of incomplete filled in questionnaires and 6 were younger than 18 years of age.

In paper I, II and V the Tanzanian patients were gender- and age- matched with Swedish diabetic patients. Three of the 153 (presented in paper III) did not know their age and were excluded in the matching, thus 150 patients were compared with Swedish diabetic patients (Paper I and V).

In paper II, finally, 145 of the 150 patients included in paper I and V were compared with their matched controls as 5 of the Swedish patients had incomplete data from the foot examination.

Tanzanian subjects in the study one year prior to the main Tanzanian data collection  (Paper IV)
One year prior to the main study, data collection took place at MMC during 12 clinic days over a four-month period, February to May. Consecutively 536 adult diabetic patients were invited to fill in the Swahili version of SF-36 health questionnaire and everybody agreed to take part. Eighteen patients were excluded due to incomplete filled in questionnaires, thus 518 patients were included.
Tanzanian subjects in the two-year follow-up study (Paper VI)
In 1996 diabetes care in the Dar es Salaam area was re-organised, and the majority of the patients were transferred to the three district hospitals within Dar es Salaam, Mwanamanyala, Ilala and Temeke.

The 150 Tanzanians who had participated in the main study were invited to attend these diabetes clinics for a follow-up study. They were informed through advertisements in the local newspaper, by radio and by patient-lists on the notice-board at the different diabetes clinics. However, there were difficulties tracing the patients. Out of the 150 eligible patients, 3 had moved from Dar es Salaam, and eight had died. Out of the remaining 139 patients 50.4% (n=70) were re-assessed.

The missing 69 patients were traced for another year to explore what had happened to them. The nurse tutors, who had participated in the data collection, checked all patient hospital records in order to find an explanation for why the patients had not returned for the follow-up study. It was found that 2 of the 69 patients had visited the diabetes clinic in autumn 1997, and another 7 in 1998. The other 60 patients had not attended the diabetes clinics after autumn 1997. No reasons were found for the patients’ non-attendance for the follow-up study.

General Tanzanian population
The group of almost 4000 randomly selected Tanzanian people living in the Dar es Salaam area and who were included in the Tanzanian Adult Morbidity and Mortality project (McLarty, 1993; Wagner et al., 1997) filled in the Swahili version of the SF-36 health questionnaire. This group of general population was compared with the group of Tanzanian diabetic patients (Paper IV).

Matched Swedish subjects (Paper I, II and V)
The 150 Tanzanian patients were matched with Swedish ”twin-patients”; for each Tanzanian a matching Swede was identified. The primary matching variables were age and sex. Attempts were also made to match mode of treatment and diabetes duration, but this proved difficult. Demographic and diabetes-related data in Tanzanian and Swedish diabetic patients are presented in Table 4. The matching attempt started at one community health centre. Out of the 278 patients registered as diabetic patients, 38 were found to match the Tanzanian patients. Thereafter approximately 400 medical records were scrutinised at the district hospital, as a result of which another 53 ”twins” were identified. Then medical records at another 3 community health centres were scrutinised and another 34 ”twins” were found. Finally 25 ”twins” were identified via the Uppsala Diabetes Register. Thus 150 Swedish patients matching the Tanzanian ones were identified. A total of 19 Swedish people were unwilling to participate in the study. Some patients were surprised, when they were contacted as they did not have diabetes ”any longer”, and some patients had no time. When a person declined participation another person was directly identified
at the same health centre. These “new patients” were contacted by telephone and agreed to participate.

**General Swedish population**

Swedish population data was collected by Sullivan (Sullivan, 1995). Our diabetic patients’ data were compared with Swedish population living in middle-sized town area (n=1412).

Table 4. Demographic and diabetes related data in the Tanzanian and Swedish diabetic patients in the present studies. (TZ = Tanzania. SWE = Sweden).

<table>
<thead>
<tr>
<th>Paper</th>
<th>n</th>
<th>Sex (M/F)</th>
<th>Age (Years)</th>
<th>Diabetes duration (Years)</th>
<th>Treatment (%Ins/Non-ins)</th>
<th>HbA1c (%)</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I, V</td>
<td>TZ</td>
<td>150</td>
<td>78/72</td>
<td>46.0±13</td>
<td>5.5±5.9</td>
<td>35/65</td>
<td>9.3±3.2</td>
</tr>
<tr>
<td>I, V</td>
<td>SWE</td>
<td>150</td>
<td>78/72</td>
<td>46.0±13</td>
<td>6.5±4.8</td>
<td>48/52</td>
<td>7.0±1.6</td>
</tr>
<tr>
<td>II</td>
<td>TZ</td>
<td>145</td>
<td>76/69</td>
<td>46.0±13</td>
<td>5.5±5.9</td>
<td>35/65</td>
<td>9.3±3.3</td>
</tr>
<tr>
<td>II</td>
<td>SWE</td>
<td>145</td>
<td>76/69</td>
<td>46.0±13</td>
<td>6.5±4.8</td>
<td>48/52</td>
<td>7.0±1.6</td>
</tr>
<tr>
<td>III</td>
<td>TZ</td>
<td>153</td>
<td>77/76</td>
<td>45.0±14</td>
<td>5.2±5.9</td>
<td>37/63</td>
<td>9.5±3.3</td>
</tr>
<tr>
<td>IV</td>
<td>TZ</td>
<td>518</td>
<td>303/215</td>
<td>47.0±12</td>
<td>5.3±5.5</td>
<td>31/69</td>
<td>NA</td>
</tr>
<tr>
<td>VI</td>
<td>TZ</td>
<td>70</td>
<td>37/33</td>
<td>45.0±12</td>
<td>6.0±5.6</td>
<td>44/56</td>
<td>7.5±2.8</td>
</tr>
</tbody>
</table>

1 Matched variable. NA=not applicable.

The comparison between Tanzanians and Swedes showed that the former had shorter school attendance (mean 7.3±4.0 years) compared with the latter (mean 11.0±0.4 years). Also 20 Tanzanians were illiterate. Furthermore Tanzanians had more children (mean 4.9±3.6 children) than the Swedes (mean 1.7±1.2 children). In addition 13 % of the Tanzanians reported “good financial status”; 70 % “neither good or bad”; and 17 % “poor financial status”. Corresponding Swedish figures were 40 %; 39 % and 21%. Three percent of the Tanzanians had previously had tuberculosis and none had reported leprosy.

**Measures**

**Self-care**

Self-care questionnaire (Paper I)
The self-care questionnaire included questions generated from interviews of 55 diabetic patients by Wikblad (Wikblad, 1991) and focused on the following:

- Self-care satisfaction (Satisfied/Less satisfied).
- Experience of abandonment because of diabetes (Never abandon anything/Abandon something important sometimes).
- Most important in self-care in order to feel well (Open question).

21
• Dietary problems (No dietary problems/Reported dietary problems).
• Physical activity (Active/Less active).
• Self-monitoring of blood glucose (Frequency).
• Knowledge of diabetes (Know the interaction between food, insulin and physical exercises/What to do in case of hyper- and hypoglycemia).
• Diabetes education satisfaction (Yes/No).
• Perceived need of more education within different diabetic areas (Yes/No).

Foot protocol
A foot protocol (Paper II and III).
A protocol based on a previous protocol developed by Brismar (Brismar, 1997) and comprising foot care questions and outcome of clinical foot inspection was used.
The protocol included five questions of perceived foot-problems, an open question about current foot problems, and performance of self-foot-inspections.
The foot inspection included presence of skin fissures, corns, warts, calluses, fungal infections, ingrown toenails, hallux valgus, hammer toes, foot ulcers, foot deformities, dry cracked skin, loss of hair from toes and diminished big-toe flexion.
Impaired sensation was tested by using Semmes-Weinstein monofilament 5.07.
Impaired vibratory perception was assessed using a tuning fork (c128).

In Paper III peripheral neuropathy was diagnosed following a modified version of Veves categorisations (Veves et al., 1994). Neuropathy symptom score (NSS) and a modified disability score (NDS) were calculated. The symptoms included in the NSS and the findings for calculating the NDS are presented in Table 5.
To calculate the ankle/brachial index, blood pressure was measured in the right arm with a standard sphygmomanometer with the subject seated. Ankle blood pressure was measured using a laser Doppler (Parks Medical Electronics, INC, USA). Peripheral vascular disease (PVD) was defined as ankle/brachial pressure indices less than one.
Table 5. Presentation of symptoms - Neuropathy symptom scores (NSS) and Neuropathy disability scores (NDS), calculation of the scores.

<table>
<thead>
<tr>
<th>NSS - Symptoms.</th>
<th>NDS - Signs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum scores = 6</td>
<td>Maximum scores = 12 (six signs each foot)</td>
</tr>
<tr>
<td>Symptom</td>
<td>Score</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>Self-reported foot-problems</td>
<td>1</td>
</tr>
<tr>
<td>Pain when walking</td>
<td>1</td>
</tr>
<tr>
<td>Pain when resting</td>
<td>1</td>
</tr>
<tr>
<td>Pain in the feet</td>
<td>1</td>
</tr>
<tr>
<td>Pricking-burning sensation</td>
<td>1</td>
</tr>
<tr>
<td>Numbness</td>
<td>1</td>
</tr>
</tbody>
</table>

Peripheral neuropathy was diagnosed when: NDS signs ≥ 7 only or when NDS signs ≥ 4 + NSS symptoms ≥ 4.

Health

Self-perceived health (Paper III, IV, V and VI)

Self-perceived health was measured using the SF-36 generic standardised questionnaire, intended to measure mental and physical health dimensions. In Tanzania a Swahili version was used and in Sweden a Swedish one. The respondents were asked about their self-perceived health during the previous four weeks. The eight SF-36 health domains are: physical functioning (PF); role physical (RP); bodily pain (BP); general health (GH); vitality (VT); social functioning (SF); role emotional (RE), and mental health (MH). The questions are Likert-type and some with yes/no responses.

For each SF-36 health domain, variable item scores were coded, summed, and transformed to a scale from 0 (worst health state) to the maximum score 100 (best health state) in accordance with the instructions in the SF-36 Manual (Ware et al., 1993).

Glycaemic control (Paper III, V and VI)

Glycosylated haemoglobin (HbA1c) was in Tanzania measured in capillary blood using filter papers (HbA1c via Post®, Boehringer-Mannheim). These test samples were kept in a deep freeze and, at the end of each data collection period, brought to Sweden (Wikblad et al., 1998) for analysis by ion exchange chromatography (mono S, high performance liquid chromatography) (Jeppsson et al., 1996). The normal reference interval for the method was at time for the investigation 3.8 - 5.2 %. Data on Swedish diabetic patients’ HbA1c-values were collected from medical records for samples that had been analysed using the same method as was used for the Tanzanian samples. The patients were categorised in three arbitrary groups according to the outcomes of HbA1c values: those with ≤ 7.5 % were considered to have an acceptable glycaemic
control; those with 7.6 - 9.9 % unacceptable, whereas those with \( \geq 10 \% \) were regarded as having poor glycaemic control.

**Demographic and diabetes-related variables**

Data concerning gender, age, age at diagnosis of diabetes and diabetes duration were recorded. Diabetes treatment was reported as insulin treatment and diet/oral anti-diabetic drugs.

Data was analysed and education was categorised into four groups: those with \( \leq 1 \) year, \( 2 - 7 \) years, \( 8 - 11 \) years and \( \geq 12 \) years schooling. A five-point scale asking about the patients’ self-perceived financial status was transformed so that those reporting ”very good” or ”good” made up one group, ”neither/nor good” remained as one group and those reporting ”poor” or ”very poor” made up the group ”poor financial status”.

**Procedure**

**Tanzanian student nurses assisting in the data collection**

Prior to the start of the first data collection in Tanzania, discussions were held with the Head of the Nursing School in Dar es Salaam. The student nurses, who spoke both Swahili and English, were given permission by the Head of the Nursing School to take part in the investigations. The nurse tutors in charge of the students chose those to be asked to join. All the students had participated in diabetes lessons included in the ordinary schedule at the Nursing School. The students got economical compensation for assisting in the data collection.

**Preparatory training regarding the Tanzanian data collection**

The special preparatory training regarding the current studies included instructions in using the SF-36 Manual (Ware *et al*., 1993), research methodology, interview techniques, and specific instructions concerning the current questionnaires. The three Swedish researchers were in charge for all the preparatory education. The two Tanzanian nurse tutors assisting in the whole data collection procedure participated also in all preparatory education. At the end of each data collection day, follow-up discussions were held between the three Swedish researchers, the Tanzanian nurse tutors and the students. The same procedure was applied at all data collection occasions, although student nurses varied for each time.
Preparations prior to the Swedish data collection

Prior to the data collections, the researchers thoroughly calibrated the specific foot examination procedure.

Translation procedures

Self-care questions had been translated from Swedish into Swahili by staff at the Department for Afro-Asian languages, Uppsala University. Backtranslation from Swahili into English regarding the self-care questions was done by staff at the School of Nurse Teacher Training at MMC, Tanzania. In cases when patients’ answers were written in Swahili two Tanzanian nurse tutors were paid to make the translations into English.

In Tanzania a Swahili SF-36 version was used which had been translated within the AMMP group (McLarty, 1993). In Sweden the Swedish SF-36 version was available and translation had been done by Sullivan (Sullivan et al., 1994).

The Tanzanian data collection at MMC (Paper I, II, III, IV, V and VI)

The diabetes nurse specialist in charge of the diabetes clinic, who also participated throughout the research period, informed the patients about the study. After informed consent was obtained from the patients, the student nurses assisted the diabetes patients to fill in the questionnaires. All data collections regarding filling in questionnaires took place in the waiting area of the diabetes clinics and foot examinations were done in a room close to the clinic. To those patients who were illiterate, the questions were read out and the student nurses filled in the patients’ answers.

At the main data collection one of the student nurses was in charge of taking blood samples, for which he had special training. Another student nurse had special training for assisting during the foot examination procedure, and the same student nurse interviewed the patients about their foot problems. She also translated from English into Swahili or vice versa during the foot examination, which was carried out by the Swedish researchers. Besides the Swedish researchers were continuously supervising all data collection procedures. All questionnaires and equipment needed to do the blood tests as well as the foot examination was brought from Sweden on all occasions.

The Swedish data collection (Paper I, II, and V)

Eligible diabetic patients were introduced to the study by mail and were then contacted by telephone. After giving their consent to participate, the majority of the patients were seen and examined in their own homes. Some patients were seen in BS’ office and three at one of the community health centres. All patients filled in the questionnaires with BS continuously present.
Ethics
The study design was approved by the ethics committee in Uppsala, Sweden and by the research committee at MMC in Dar es Salaam, Tanzania.

Statistics
For all analyses the computer program Statview 4.5 was used. Results are presented as means±S.Ds, unless otherwise specified. Comparison of two groups was performed using t-tests and when more than two groups were compared, ANOVA was used. In all papers χ² test was used for comparisons of discontinuous data. A p-value ≤ 0.05 was regarded as significant. Construct validity was assessed using factor analysis (varimax rotation), thus exploring the underlying health dimensions of the SF-36 items. Content validity was evaluated as correlation between patients’ subjective symptoms reported in the symptom check-list and the SF-36 domains (Spearman Rank correlation). Estimation of internal consistency reliability for each domain (Cronbach’s alpha) was calculated, and a reliability coefficient of ≥0.70 was considered acceptable on group level (Polit and Hungler, 1995). In paper V a confidence interval of 95% was used for differences in ratings between Tanzanians and Swedes regarding SF-36 health domains. In paper VI, ANOVA repeated measures were used for comparisons over time. We considered differences significant at ≤0.05.
RESULTS

SELF-CARE

Similarities and differences between Tanzanian and Swedish diabetic patients (Paper I)

Self-care satisfaction

Sixty-seven out of the 150 Tanzanian and 65 out of the 150 Swedish patients reported satisfaction with their self-care. Reasons for not being satisfied differed between Tanzanians and Swedes. Lack of drugs and need of more education were main reasons in Tanzanians, while very few of the Swedes were able to give any reason. Those Swedes who responded mentioned careless own behaviour as the main reason for dissatisfaction (Table 6).

Table 6. Number of patients and the reported reasons to their dissatisfaction with diabetes self-care. (Some patients may have given more than one answer).

<table>
<thead>
<tr>
<th>Reason to dissatisfaction</th>
<th>Tanzanian patients</th>
<th>Swedish patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=150)</td>
<td>(n=150)</td>
</tr>
<tr>
<td>Number of dissatisfied patients</td>
<td>83</td>
<td>85</td>
</tr>
<tr>
<td>No reasons to dissatisfaction reported</td>
<td>25</td>
<td>72</td>
</tr>
<tr>
<td>Lack of drugs</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Need of more education</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>Lack of equipment for self monitoring of blood and urine glucose</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Need of more attention by diabetes staff/help from others</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Careless own behaviour</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Diabetes disease deteriorates the health</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>More research to cure diabetes</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Sixty-four out of the 150 Tanzanian and 25 of the 150 Swedish patients also reported that they had felt forced to abandon important matters because of their diabetes. The former had abandoned walking long distances and cultivating, whereas Swedes had missed going to dinner parties.

Most important in self-care in order to feel well differed between Tanzanian and Swedish patients. The former regarded following doctor’s advice as most important, whereas Swedish patients found diet, physical activities and healthy lifestyle to be most important. Totally the 300 patients gave 463 responses concerning this matter (Table 7).
**Table 7.** Number of diabetic patients reporting self-care factors important for their well being (Some patients may have given more than one answer).

<table>
<thead>
<tr>
<th>Factors</th>
<th>Tanzanian patients (n=150)</th>
<th>Swedish patients (n=150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To follow doctor’s advice</td>
<td>103</td>
<td>10</td>
</tr>
<tr>
<td>Drug/treatment availability</td>
<td>52</td>
<td>0</td>
</tr>
<tr>
<td>Dietary aspects</td>
<td>45</td>
<td>79</td>
</tr>
<tr>
<td>Physical activities</td>
<td>9</td>
<td>79</td>
</tr>
<tr>
<td>Self-monitoring of blood glucose</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Healthy lifestyle</td>
<td>0</td>
<td>55</td>
</tr>
</tbody>
</table>

**Diabetes knowledge and skills**

Seventeen Tanzanian and 83 Swedish patients reported to know quite well how insulin, food and physical activity interacted ($\chi^2=103.1; df=2; p=<0.000$). Most patients (111 Tanzanians and 121 Swedes) knew at least partly what to do in case of hyperglycaemia, whereas how to manage hypoglycaemia was known by 85 Tanzanians and 140 Swedes ($\chi^2=110; df=2, p=<0.000$) (Table 8).

Approximately one third of the Tanzanians (n=44) and almost half of the Swedes (n=64) reported that they managed their diabetes diet quite well ($\chi^2=5.2; df=1; p=0.02$) and most patients performed physical activities (Table 8). None of the Tanzanians monitored their blood glucose themselves while 50% of the Swedes did daily or weekly monitoring (Table 8).
Table 8. Some aspects of diabetes knowledge and skills in Tanzanian and Swedish patients. (Number of patients).

<table>
<thead>
<tr>
<th>Knowledge of:</th>
<th>Tanzanian patients (n=150)</th>
<th>Swedish patients (n=150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction between insulin–food-physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Know quite well</td>
<td>17**</td>
<td>83</td>
</tr>
<tr>
<td>Yes, partly</td>
<td>61</td>
<td>62</td>
</tr>
<tr>
<td>No, not at all</td>
<td>68</td>
<td>3</td>
</tr>
<tr>
<td>How to manage hyperglycaemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Know quite well</td>
<td>37*</td>
<td>61</td>
</tr>
<tr>
<td>Yes, partly</td>
<td>74</td>
<td>60</td>
</tr>
<tr>
<td>No, not at all</td>
<td>25</td>
<td>29</td>
</tr>
<tr>
<td>How to manage hypoglycaemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Know quite well</td>
<td>25**</td>
<td>114</td>
</tr>
<tr>
<td>Yes, partly</td>
<td>60</td>
<td>26</td>
</tr>
<tr>
<td>No, not at all</td>
<td>62</td>
<td>9</td>
</tr>
<tr>
<td>Skills:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managing diabetes diet</td>
<td>44*</td>
<td>64</td>
</tr>
<tr>
<td>Physically active</td>
<td>110</td>
<td>127</td>
</tr>
<tr>
<td>Daily self-monitoring of blood glucose</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Weekly self-monitoring of blood glucose</td>
<td>0</td>
<td>48</td>
</tr>
</tbody>
</table>

*p≤0.05; **p<0.001. Drop-outs in the different questions ranging between 1 and 16.

Educational needs
Sixty-five Tanzanians and 113 Swedes expressed that they had received sufficient education about diabetes ($\chi^2=31.1; df=1; p=<0.000$). Approximately 50% of the Tanzanians expressed need of more education about diabetes, treatment and injection technique. In the Swedish group of patients, on the other hand, the patients had favoured the psychological aspects of diabetes, foot care and oral treatment (Table 9).
Table 9. Number of patients and their expressed educational needs. (Some patients may have given more than one answer).

<table>
<thead>
<tr>
<th></th>
<th>Tanzanian patients</th>
<th>Swedish patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=150)</td>
<td>(n=150)</td>
</tr>
<tr>
<td>Diabetes disease</td>
<td>73**</td>
<td>10</td>
</tr>
<tr>
<td>Oral treatment</td>
<td>80**</td>
<td>28</td>
</tr>
<tr>
<td>Insulin treatment</td>
<td>77**</td>
<td>16</td>
</tr>
<tr>
<td>Insulin injection technique</td>
<td>62**</td>
<td>10</td>
</tr>
<tr>
<td>Diabetes food</td>
<td>59**</td>
<td>26</td>
</tr>
<tr>
<td>Foot care</td>
<td>50*</td>
<td>29</td>
</tr>
<tr>
<td>Means of assistance</td>
<td>54**</td>
<td>13</td>
</tr>
<tr>
<td>Psychological aspects</td>
<td>43</td>
<td>32</td>
</tr>
</tbody>
</table>

*p<0.01; **p<0.001. Missing data for 2 Tanzanian and 2 Swedish patients.

When differentiating the patients into the two diabetes treatment groups, it was found that Tanzanian patients on diet/oral anti-diabetic drugs expressed significantly more need for education than those on insulin ($\chi^2=6.2; \text{df}=1; n=148; p=0.01$). No significant difference was found in the Swedish group between those on oral/diet anti-diabetic drugs or on insulin treatment regarding the need for more education.

**FOOT PROBLEMS**

Reported foot problems and foot-care in Tanzanian and Swedish patients (Paper II)

Foot problems

More than 60% of the Tanzanian patients reported having current problems with their feet compared to nearly 35% in the matched Swedish group of patients ($\chi^2=22.14; \text{df}=1; p<0.000$). The most frequently self-reported problem in the Tanzanian patients was pain, while Swedish patients reported ingrown toenails and fissures as main foot problems. Patients’ reports on pain, numbness and impaired sensibility showed that significantly more Tanzanian than Swedish patients experienced pain (Table 10).
Table 10. Number of Tanzanian and Swedish patients reporting pain, numbness and impaired sensibility in their feet. (Some patients have given more than one answer).

<table>
<thead>
<tr>
<th></th>
<th>Tanzanian patients (n=145)</th>
<th>Swedish patients (n=145)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain in the legs when walking</td>
<td>70*</td>
<td>10</td>
</tr>
<tr>
<td>Pain in the legs when resting</td>
<td>72*</td>
<td>35</td>
</tr>
<tr>
<td>Pain in the feet</td>
<td>67*</td>
<td>28</td>
</tr>
<tr>
<td>Numbness</td>
<td>48</td>
<td>35</td>
</tr>
<tr>
<td>Impaired sensibility</td>
<td>21</td>
<td>18</td>
</tr>
</tbody>
</table>

*p<0.000

Self foot-care

Only 20 Tanzanian patients reported that they inspected their feet themselves, whereas 103 of the 145 Swedish patients reported to do so ($\chi^2=94.9; \text{df}=1; p<0.000$).

Outcome of foot inspections

Foot inspections showed that Tanzanian patients presented with more signs of foot lesions than the Swedes did, although not significantly more (mean=1.9 vs 1.6; t=1.93; df=288, p=0.06). The frequency distribution is shown in Table 11.

Table 11. Number of Tanzanian and Swedish patients with different numbers of signs of foot lesions.

<table>
<thead>
<tr>
<th>No of signs</th>
<th>Tanzanian patients (n=145)</th>
<th>Swedish patients (n=145)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>34</td>
<td>48</td>
</tr>
<tr>
<td>1-2</td>
<td>69</td>
<td>63</td>
</tr>
<tr>
<td>3-4</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>5-7</td>
<td>13</td>
<td>10</td>
</tr>
</tbody>
</table>

The picture was though quite different in the two groups of patients. The most dominant signs found in Tanzanian patients were dry cracked skin, loss of hair from toes, diminished big toe flexion, foot deformities and impaired sense of vibration, whilst calluses, corns, warts, fissures and redness were most frequent in Swedish patients (Table 12).

Impaired skin sensibility was found in 10.3% of Tanzanian and 7.6% of Swedish patients ($\chi^2=0.68; \text{df}=1; p=0.5$) and impaired sense of vibration in 17.2% Tanzanians and 9% Swedes.
(χ²=4.36; df=1; p=0.05). Seven Tanzanian patients and one Swedish presented with foot ulcers. Only one Swedish and none of the Tanzanian patients had absent foot pulses.

Table 12. Number of the 145 Tanzanian and 145 matched Swedish diabetic patients presented with different signs of foot lesions.

<table>
<thead>
<tr>
<th>Signs of foot lesion</th>
<th>Tanzanian patients (n=145)</th>
<th>Swedish patients (n=145)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry cracked skin</td>
<td>70***</td>
<td>22</td>
</tr>
<tr>
<td>Loss of hair from toes</td>
<td>50***</td>
<td>9</td>
</tr>
<tr>
<td>Diminished big toe flexion</td>
<td>48***</td>
<td>7</td>
</tr>
<tr>
<td>Foot deformities</td>
<td>21***</td>
<td>2</td>
</tr>
<tr>
<td>Impaired sense of vibration</td>
<td>25*</td>
<td>14</td>
</tr>
<tr>
<td>Fungal infections</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Impaired skin sensibility</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Oedema</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Corns and warts</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Foot ulcers</td>
<td>7*</td>
<td>1</td>
</tr>
<tr>
<td>Hallux valgus</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Hammer toe</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Calluses</td>
<td>4</td>
<td>44***</td>
</tr>
<tr>
<td>Redness</td>
<td>1</td>
<td>16**</td>
</tr>
<tr>
<td>Fissures</td>
<td>1</td>
<td>12**</td>
</tr>
</tbody>
</table>

*p=≤0.05; **p=≤0.01; ***p<0.001

**Peripheral neuropathy and peripheral vascular disease in Tanzanian patients**
(Paper III)
Ninetyone (60 %) of the 153 Tanzanian patients were free from peripheral neuropathy (PN) and peripheral vascular disease (PVD). PN was found in 43 (28 %) and PVD in 19 (12%) persons (Table 13).
**Table 13.** Clinical characteristics and glycaemic control in Tanzanian patients (n=153) without PN or PVD; those with PN; and those with PVD are presented.

<table>
<thead>
<tr>
<th>Variables</th>
<th>No PN or PVD (n=91)</th>
<th>PN (n=43)</th>
<th>PVD (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>40.8±13.6</td>
<td>51.7±12.6**</td>
<td>45.5±16.6</td>
</tr>
<tr>
<td>Age at onset (years)</td>
<td>36.8±13.4</td>
<td>46.0±12.6**</td>
<td>36.1±13.7</td>
</tr>
<tr>
<td>Duration of diabetes (years)</td>
<td>4.5±5.4</td>
<td>5.8±5.5</td>
<td>8.6±9.0*</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>136.2±23.5</td>
<td>140.6±27.0</td>
<td>156.7±39.8**</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>81.6±14.2</td>
<td>84.3±13.5</td>
<td>90.3±18.9*</td>
</tr>
<tr>
<td><strong>Glycaemic control</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>9.5±3.5</td>
<td>9.5±2.8</td>
<td>9.1±3.6</td>
</tr>
</tbody>
</table>

Values are expressed as mean ±S.Ds.  *p≤0.05; **p<0.01.

Relation between PN, PVD and self-perceived health in Tanzanian patients (Paper III)

Tanzanians with PN (n=43) had lower scores, indicating a poorer health, in all eight health domains in comparison with those free from foot complications. Significantly lower scores were found in the health domains physical functioning (mean 63.3±25.5 v. 78.3±21.4; F=4.4; df=2/147; p=0.01), role functioning (mean 31.9±33.0 v.52.6±44.5; F=3.8; df=2/148; p=0.03); and bodily pain (mean 42.2±21.4 v. 57.9±27.0, F=5.8; df=2/148; p=0.0004). Thus PN could be an influencing factor on patients’ perceived health. Patients with PVD (n=19) had health scores equal to those without any foot-complications.
HEALTH
Tanzanian and Swedish diabetic patients’ reported self-perceived health in comparison with general population in the two countries respectively (Paper IV and V).

Tanzanian diabetic patients (n=150) rated their health to be poorer than the general population (n=3790) living in the same area. In contrast Swedish diabetic patients (n=150) did not markedly differ from the general population living in middle sized Swedish town (n=1412) (Figure 1).

Swahili version of the SF-36 – validity and reliability  (Paper IV)
The 518 Tanzanian diabetic patients had significantly lower scores in all eight SF-36 health domains in comparison with the sample of general population (n=3790). The psychometric testing of the SF-36 Swahili version showed an acceptable concurrent validity, as when the mean values of the eight SF-36 health domains were compared with the patients’ rankings on the general health question: "In general would you say your health is: very good, good, fair or poor".

Figure 1. Tanzanian and Swedish diabetic patients’ SF-36 ratings in comparison with general population in each country respectively.
Patients in the group "poor self-perceived health" scored significantly lower in all health domains than those in the group "very good".

The construct validity testing using factor analysis explored a third health dimension apart from those two originally underlying dimensions, mental and physical health. This third dimension was called "role functioning" as this domain had strong loadings with the SF-36 health domains "role physical" and "role emotional" ($\geq .70$).

Reliability was tested by calculating the internal consistency by use of Cronbach’s alpha coefficients. The lowest coefficient was found in the general health domain ($\alpha=0.59$). The highest Cronbach’s alpha coefficient was found in the "physical functioning" health domain ($\alpha=0.91$).

**Health comparisons between Tanzanian and Swedish diabetic patients** (Paper V)

Self-perceived health measured by SF-36

Tanzanians (n=150) had significantly poorer health than the Swedes (n=150) in all health domains (Table 14).

**Table 14.** Mean values, mean difference between Tanzanian and Swedish patients, confidence interval and p-values for SF-36 health domains in Tanzanian (n=150) and Swedish (n=150) diabetic patients.

<table>
<thead>
<tr>
<th>SF-36 health domains</th>
<th>Tanzanian patients (n=150)</th>
<th>Swedish patients (n=150)</th>
<th>Mean difference</th>
<th>95 % CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF</td>
<td>74.6</td>
<td>86.8</td>
<td>-12.2</td>
<td>-17.1-7.4</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>RP</td>
<td>47.5</td>
<td>83.0</td>
<td>-35.5</td>
<td>-43.9-27.1</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>BP</td>
<td>53.2</td>
<td>76.9</td>
<td>-23.7</td>
<td>-30.0-17.4</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>GH</td>
<td>48.0</td>
<td>68.1</td>
<td>-20.3</td>
<td>-24.7-15.5</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>VT</td>
<td>55.4</td>
<td>68.9</td>
<td>-13.5</td>
<td>-18.3-8.7</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>SF</td>
<td>66.1</td>
<td>86.1</td>
<td>-20.0</td>
<td>-25.4-14.6</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>RE</td>
<td>48.4</td>
<td>81.8</td>
<td>-33.3</td>
<td>-42.1-24.6</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>MH</td>
<td>63.7</td>
<td>80.3</td>
<td>-16.6</td>
<td>-21.2-12.1</td>
<td>&lt;0.000</td>
</tr>
</tbody>
</table>

All scales 0-100. A high score indicates better health.
Glycaemic control in Tanzanian and Swedish patients  (Paper V)
The mean HbA1c value in the Tanzanian patients was 9.3±3.2 % and in the Swedish group 7.0±1.6 %, (t=8.1; df=145; p=<0.000). The patients had arbitrarily been divided into three groups regarding the glycaemic control (HbA1c value). Fifty-one Tanzanian patients had acceptable (HbA1c ≤7.5 %), 43 unsatisfactory (HbA1c 7.6 – 9.9 %), and 54 had poor (HbA1c ≥10.0%) glycaemic control. In the Swedish group 94 had acceptable, 49 unsatisfactory and 5 poor glycaemic control.

Glycaemic control and self-perceived health in Tanzanian and Swedish patients  (Paper V)
In both countries poor glycaemic control, measured by HbA1c did not associate with impaired self-perceived health, with one exception namely that Tanzanian patients with unsatisfactory (n=43) or poor glycaemic control (n=54) had significantly lower scores than Tanzanians with acceptable glycaemic control (Tables 15 and 16).

Table 15. Mean values (±S.D.), and p-values for SF-36 health domains in relation to acceptable, unsatisfactory and poor glycaemic control in Tanzanian patients.

<table>
<thead>
<tr>
<th>SF-36 health domains</th>
<th>Acceptable ≤7.5 % n=51</th>
<th>Unsatisfactory 7.6 – 9.9 % n=43</th>
<th>Poor ≤10.0 % n=54</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF</td>
<td>73.4±26.0</td>
<td>76.3±21.8</td>
<td>74.4±23.7</td>
<td>0.845</td>
</tr>
<tr>
<td>BP</td>
<td>51.5±41.7</td>
<td>47.7±39.6</td>
<td>44.0±40.9</td>
<td>0.644</td>
</tr>
<tr>
<td>RP</td>
<td>57.7±27.7</td>
<td>50.4±26.9</td>
<td>51.4±26.4</td>
<td>0.353</td>
</tr>
<tr>
<td>GH</td>
<td>51.0±17.3</td>
<td>47.4±18.5</td>
<td>45.7±19.8</td>
<td>0.337</td>
</tr>
<tr>
<td>VT</td>
<td>58.5±20.5</td>
<td>54.8±22.0</td>
<td>52.9±18.6</td>
<td>0.353</td>
</tr>
<tr>
<td>SF</td>
<td>68.6±26.6</td>
<td>67.4±22.5</td>
<td>63.2±24.9</td>
<td>0.503</td>
</tr>
<tr>
<td>RE</td>
<td>54.2±41.6</td>
<td>52.7±37.3</td>
<td>39.5±42.5</td>
<td>0.132</td>
</tr>
<tr>
<td>MH</td>
<td>70.0±18.4*</td>
<td>61.4±21.3</td>
<td>59.0±20.4</td>
<td>0.015</td>
</tr>
</tbody>
</table>

All scales 0-100. A high score indicates better health. *p≤0.05
Table 16. Mean values (±S.D.) for SF-36 health domains in relation to acceptable, unsatisfactory and poor glycaemic control in Swedish patients.

<table>
<thead>
<tr>
<th>SF-36 health domains</th>
<th>Acceptable ≤7.5 %</th>
<th>Unsatisfactory 7.6 – 9.9 %</th>
<th>Poor ≤10.0 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=94</td>
<td>n=49</td>
<td>n=5</td>
<td></td>
</tr>
<tr>
<td>PF</td>
<td>87.8±19.2</td>
<td>84.5±19.0</td>
<td>93.0±7.6</td>
</tr>
<tr>
<td>BP</td>
<td>83.5±32.5</td>
<td>83.2±32.8</td>
<td>85.0±33.5</td>
</tr>
<tr>
<td>RP</td>
<td>80.7±26.6</td>
<td>72.5±31.0</td>
<td>59.4±27.7</td>
</tr>
<tr>
<td>GH</td>
<td>68.9±20.9</td>
<td>65.5±23.4</td>
<td>73.6±21.6</td>
</tr>
<tr>
<td>VT</td>
<td>70.3±21.4</td>
<td>66.8±24.2</td>
<td>65.0±13.7</td>
</tr>
<tr>
<td>SF</td>
<td>87.9±21.0</td>
<td>82.9±24.7</td>
<td>80.0±27.4</td>
</tr>
<tr>
<td>RE</td>
<td>79.8±35.7</td>
<td>87.8±34.5</td>
<td>73.3±43.5</td>
</tr>
<tr>
<td>MH</td>
<td>80.4±19.1</td>
<td>80.8±21.5</td>
<td>73.6±17.6</td>
</tr>
</tbody>
</table>

All scales 0-100. A high score indicates better health.

Improvement in Tanzanian patients’ self-perceived health and glycaemic control over the two-year period (Paper VI)

Those 70 patients who were re-assessed showed a significant improvement in the SF-36 health domains “social functioning” (64.8±23.0 in 1995 v. 72.7±26.2 in 1997; t=2.3; df=69; p=0.02), which indicated that after two years the patients felt that physical and emotional problems interfered less with their social activities. Moreover, a significant improvement was reported in the health domain role emotional (48.6±38.8 in 1995 v. 66.7±39.7 in 1997; t=3.1; df=69; p=0.002), which meant that the patients after the two years experienced fewer problems with work or other daily activities due to emotional problems.

The patients who were examined both in 1995 and 1997 (n=70) had significantly improved their HbA1c from 9.3±3.2% to 7.5±2.8 % (minimum value 3.1 % and maximum value 15.4 %; t=4.5; df=62; P=<0.000).
DISCUSSION

Self-care
The studies have shown that both Tanzanians and Swedes were satisfied with their self-care. But the reason for the dissatisfaction differed between the two countries. Tanzanians were dissatisfied due to lack of anti-diabetic drugs and education, whereas among those few Swedish patients who reported dissatisfaction, it was related to their own behaviour. Tanzanians mentioned following doctor’s advice as the most important factor in feeling well in spite of having diabetes. The Swedes highlighted dietary aspects and physical exercises. Almost half of the patients in the Tanzanian group were not aware of the interaction between insulin, food and exercises. In contrast very few Swedes did not know this. None of the Tanzanians performed self-monitoring of their blood glucose, whereas half of the patients in the Swedish group tested their blood glucose daily or weekly.

Although the Tanzanians had to face the burden of sparse availability of anti-diabetic drugs, which has been highlighted by several authors regarding diabetes in African countries (Elbagir, 1997; King et al., 1998; Kitange et al., 1998; McLarty, 1995; Raab, 1999; Swai, 1998), they were as satisfied as the Swedes concerning their self-care. Moreover, it must be considered as very positive that so many Tanzanians had tried to highlight the causes to their dissatisfaction. In contrast very few Swedish patients had expressed why they not were satisfied, and the reasons to this might need to be further studied.

Another sign of the burden of having diabetes in Tanzania and Sweden respectively, was that more Tanzanians than Swedes reported abandoning something important to them due to their diabetes. In Tanzanian daily life walking, running, and cultivating were important activities and not being able to do this were perceived as major burdens (McLarty, 1995; Tshabalala, 1995; Tshabalala and Gill, 1997). This indicated that the cause of Tanzanians’ abandoning activities had to do more with their survival, managing to work and being able to walk long distances. In contrast, Swedish patients had mentioned refraining from sport activities and going to dinner parties, indicating that Swedish patients had to refrain from social activities only.

A cultural difference could be seen as many Tanzanians regarded "following the doctor’s advice," as an important factor in order to feel well with diabetes. According to the African tradition, patients were supposed to be cured directly by the doctor, not to see the doctor continuously for the same problems. The implications of having a chronic disease might have been poorly understood. The patients might have felt confused and seen no choice but to do as they were told by the doctor (Johansson, 1997; Tshabalala and Gill, 1997). In comparison, very few Swedish patients mentioned the importance of following the doctor’s advice, which might indicate that Swedish patients were
more empowered and that the available diabetes education in Sweden has enabled them to rely on
themselves.

Approximately ten years prior to this work, Wikblad (Wikblad, 1991) investigated diabetes 
knowledge in diabetic patients Type I in Uppsala county. She found that one third of the patients 
knew about the connection between food, insulin and physical activities. In the current study 
approximately half of the Swedish patients reported that they knew the interaction quite well. This 
comparison indicated that the patients today were more knowledgeable, which in turn might be 
explained as an effect of better diabetes education, an improved diabetes care organisation and that 
more nurses had received special diabetes education.

Learning from experience involves a deeper understanding than being informed about what is 
happening when eating, exercising, etc. (Wikblad, 1991). As an example of this, the findings 
indicated that the Tanzanians, might more seldom had to face problems with hypoglycaemia due to 
the sparse insulin availability. On the other hand, it was obvious that they had experience of 
hyperglycaemia, which was the status they had to face when no drugs were available (Gill 
et al.,
1997).

In industrialised countries self-monitoring of blood glucose (SMBG) in order to achieve as normal 
blood glucose values as possible has been widely recommended in diabetes care (ADAd, 2000; 
Berne, 1992). It could have been expected that more Swedes had followed recommendations 
regarding SMBG. Half of the patients in the Swedish group acceptably monitored their blood 
glucose, which could be compared with a study performed in the US where 40 % Type I and 33 % 
Type II patients followed American Diabetes Association’s (ADA) recommendations regarding 
self-monitoring of their blood glucose (Karter et al., 2000). Although Swedish recommendations 
are not as stringent as ADA’s, 50 % of the Swedish patients seemed to neglect recommendations 
given. It seems as this is an educational matter and it is needed to further study why patients do not 
consider the importance of monitoring their blood glucose.

Although we found that Swedish patients had improved their diabetes knowledge over the last 
decade, it could have been expected that Swedish patients should have been more satisfied with 
their self-care, should have known more about diabetes and should have had put more effort into 
monitoring their blood-glucose values. In spite of expanded health programmes and improved 
diabetes care, many Swedish patients seemed to be unaware of the importance of self-care.
Foot problems

Our results have also shown that Tanzanians experienced significantly more foot problems than the Swedes. Foot lesions found at foot inspections in the Tanzanian group were not significantly more than those found in the Swedish group, but the former had more serious ones such as foot deformities and impaired sense of vibration. A very low number of Tanzanians inspected their own feet and very few were interested in getting more foot care education.

The Tanzanian patients’ perceived symptoms could be regarded as dangerous signs for any diabetic patient (Boulton, 1996; Motala, 1998) and were more related to signs of neuropathy (numbness, pricking/burning sensation and pain) (Watkins et al., 1997). These symptoms might also be an effect of poor glycaemic control, as it is known that this increases the risk of developing foot complications (DCCT, 1993; Franklin et al., 1994; Williams, 1992). Unfortunately the limited resources in Tanzania might make it difficult to avoid further complications. Swedish patients, in contrast, had foot problems that could be referred to inappropriate footwear (Caputo et al., 1994; Helfand and Hirt, 1994; White, 1994; Pickup and Williams, 1992).

More Tanzanians than Swedes reported having pain when walking, when resting, and in the feet. However, it is difficult to judge whether the pain was caused by diabetes problems (Ward, 1991). The experience of pain might be different in different cultures as has been highlighted by Sachs in her study about Turkish immigrant women in Sweden (Sachs, 1983). In addition pain could be seen as a kind of suffering in many cultures (Helman, 2000). This indicates that the Tanzanian patients’ reports about their pain could be a sign of general suffering. However, the importance of considering the patients’ own perceived symptoms in diagnosing neuropathy has been highlighted by Boulton (Boulton, 1996), whereas De & Scarpello have pointed out that a clinical history in itself is not enough to detect neuropathy as one quarter of patients are detected at screening only (De and Scarpello, 1999).

Ward (Ward, 1991) has pointed out that the most dangerous threat leading to foot ulceration is the patients’ negative attitudes. Several studies have highlighted the importance of diabetes foot education (ADAc, 2000; Benbow et al., 1999; Boulton, 1996; Bresäter et al., 1996; Childs, 1994; Helfand and Hirt, 1994; Ward et al., 1999). However, the reason for the low concern about foot care among the Tanzanians could be that foot examinations not were performed on a regular basis when they attended the clinics. Most probably they had never learnt about the importance of foot care and regular foot self-inspections. These results can be compared with findings in Ethiopia where almost 24 % of the patients were unaware of the importance of foot care (Seyoum and Chaka, 1998). In comparison 29 % of the Swedish patients reported that they never inspected their feet, in spite of all the easy access to diabetes clinics and diabetes education, they did not do it. The Swedish patients’
foot problems related to poor footwear (White, 1994) could also be an indication that they had not understood the importance of caring for their feet or that they had a negative attitude to doing it.

The Semmes-Weinstein monofilament has been recommended as a useful tool both for clinical practice and for epidemiological research (McGill et al., 1999). In our work we used both this tool, the vibratory tuning fork, and performed foot inspections as well as asked the patients different foot care questions. The advantage of using special tools for foot examinations would hopefully increase the interest in caring for the patients’ feet. Another advantage of using these tools in an African country is that no electricity is needed.

The outcome of the foot examination presented in Paper III indicated that our findings, with an occurrence of 28 % of PN, were similar to previous Tanzanian studies. Haddock, Mhando and Gulam-Abbas have, in separate studies, reported a PN prevalence of 31%, 32% and 25 %, respectively, among diabetic patients at MMC (Gulam-Abbas and Archibald, 2000; Haddock, 1964; Mhando and Yudkin, 1980). It is known that late complications are mostly associated with longer diabetes duration (Pirart, 1978). In our Tanzanian study only 20 % of the patients had reported a diabetes duration for ten years or more and 56 % of the patients had reported a diabetes duration less than 3 years. However, it must be considered that some patients might have had the disease for a longer period, prior to being diagnosed. In this study we could not confirm any differences in glycaemic control between patients with PN, PVD or without PN and PVD. A significantly longer diabetes duration could be verified in Tanzanians with PVD, but not with PN. The occurrence of 12 % of PVD in the current Tanzanian study and the 10 % PVD found in Gulam-Abbas’ study (Gulam-Abbas and Archibald, 2000) was an increase in the occurrence of PVD, when compared with 2 % reported in Mhando’s study, which was performed about fifteen years earlier. It should be noted, however, that different ways of diagnosing PN and PVD had been applied in the different studies.

Health

Medical perspective

The current results, presented in Paper V, have shown that the Tanzanian patients had poorer glycaemic control than the Swedish patients. However, one single HbA1c test has to be considered with caution. In paper VI those Tanzanian patients, who were re-assessed a second time after two years, are presented and had significantly improved their glycaemic control. This improvement might have been due to a better availability of insulin in the country at the time of the re-assessment (McLarty, 1995) or to improved diabetes care.

Our results showing poor glycaemic control in Tanzanian patients could be compared with two earlier African studies, wherein the mean HbA1c value ranged between 8.9 % (Onen et al., 1998)
and 9.3 % (Elbagir, 1997). This poor glycaemic control strengthens the notion of the sparse and irregular availability of anti-diabetic drugs in many African countries (McLarty, 1997).

Our results regarding the Tanzanian patients’ HbA1c values showed that many patients had poor glycaemic control, and we did not find any HbA1c value regarding general population in Tanzania. That was the reason to that we tested HbA1c in a convenient sample (n=56) of enrolled nurse students and staff working within the district hospitals in Dar es Salaam. The mean HbA1c value in this group was 4.0±1 % (range 1.7 - 5.0). The same procedure as used for testing diabetic patients was applied (unpublished data).

**Perceived health**

The comparison between Tanzanian diabetic patients and a general population living in the same geographical area showed that the former had poorer perceived health. In contrast Swedish diabetic patients did not markedly differ from a similar Swedish general population. Furthermore the Tanzanian diabetic patients had significantly lower scorings in all SF-36 health domains in comparison with the matched Swedish diabetic patients. In addition the Tanzanian patients also had poorer glycaemic control than the Swedish ones. However, the group of Tanzanian patients, who were assessed after two years had improved both their health and glycaemic control.

In both countries the SF-36 questionnaire was used to measure the patients’ self-perceived health. The reason for this was that a Swahili version was available in Tanzania as it had been used in general population in the AMMP project (McLarty, 1993). In addition a Swedish version was available for use in Sweden, and the psychometric testing had been done by Sullivan et al (Sullivan *et al.*, 1995; Sullivan and Karlsson, 1998).

The poorer health in Tanzanian patients included both in the main study as well in the study a year prior to the main study, showed poorer perceived health in comparison with the general Tanzanian population living in the same geographical area. These findings as well as results reported by Elbagir in the Sudan study could be seen as an indication of African diabetic patients’ poorer health. However, in Elbagir’s study only patients with type I diabetes were included, whereas in our study both patients on insulin and on diet or oral treatment participated. Being hit by a chronic disease might be experienced differently by patients who are living in different cultures. Most Tanzanians in our study lived in the Dar es Salaam area, where western lifestyle has a great influence. Nevertheless many patients might have their African traditional worldview (Juntunen and Nikkonen, 1996). Diabetes is a life-long disease, and the patients cannot be cured immediately, as they would expect to be according to the traditional African medical view (Johansson, 1997; Tshabalala and Gill, 1997). This could be a reason why the Tanzanian patients experienced poorer health; they were not used to continuously attending medical clinics for the same disease. Another reason could be the worries associated with the irregular availability of
anti-diabetic drugs (McLarty, 1995). Still another reason could be the influences of late complications, which are known to be related to poorer health. An example of this is the poorer health perceived by Tanzanian patients diagnosed with peripheral neuropathy in our study (Paper III). In Sweden on the other hand, diabetic patients need not worry about drug availability. In addition they generally have easy access to diabetes care. Nevertheless there might be other factors, yet to be explored that influence the Swedish patients well-being. When using the SF-36 health questionnaire in assessing the patients’ health, the Swedish patients did not differ from Swedish general population, still many expressed their dissatisfaction with their self-care.

An example of poorer health in diabetic patients compared with non-diabetic age- and gender-matched controls was found in a Finnish study of Type II diabetic patients aged under 65 years (Hänninen et al., 1998). Furthermore, results from a US study reported poorer health in diabetic patients in relation to a general urban population (Ware and Sherbourne, 1992). This indicates that there might be other important factors, not yet explored, which could explain the differences between perceived health in diabetic patients in comparison with non-diabetic patients. Like some other studies we found no association between self-perceived health and diabetes duration (Wikby, 1991; Wredling, 1995) whereas other studies have reported an association (Elbagir, 1999; Hänninen et al., 1998). Nor did our results show a relation between poorer perceived health and poor glycaemic control, with the exception that Tanzanian patients with unsatisfactory and poorer glycaemic control also had poorer perceived health. This corroborated other studies, which have found that poor glycaemic control did not associate with impaired health perceptions (Hänninen et al., 1998). On the other hand, higher levels of glycaemia related to deteriorated quality of life has been reported by Klein (Klein, 1998). Our findings added together and compared with findings from other studies highlight the need of further studies exploring the complex situation for diabetic patients.
Methodological discussion

Classification of diabetes

The classification of patients into the two groups, patients requiring insulin and patients not requiring insulin, might seem "very broad". However we have followed the classification described by McLarty and colleagues in 1990 (McLarty et al., 1990). There were no resources to test C-peptides. Our attempts to classify the patients according to the clinical picture was difficult why we chose to classify according to treatment.

Illiteracy and translation issues

A threat to the internal validity was that some Tanzanian patients were illiterate (n=20). It was necessary to rely on the student nurses’ assistance to help these illiterate patients both to read the questions and to fill in the answers. It was thus difficult to know whether the patients’ results were influenced by the illiteracy or by the diabetes as such.

Psychometric testing

In paper IV we have described the psychometric testing of the Swahili version when used in Tanzanian patients. The main objection for recommendations for further use of the SF-36 Swahili questionnaire is the patients’ misinterpretation of the meaning of "fair health." It was one of the alternatives in the general health questions about “patients’ health”. The SF-36 general health domain included the question “in general would you say your health is” and the respondents had the response choices “excellent”, “very good”, “good”, “fair” and “poor”. There might be different meaning of “fair health” in different countries and fair might in some cultures have a more positive meaning than the basic American meaning of the concept (Wagner et al., 1998).

During the data-collection we found that many respondents answered their health to be “fair” why the matter was highlighted in a Tanzanian classroom situation in November 1995. A class of 22 student nurses, none of them involved in the research project, in their second year of training, were asked about how they perceived their health. Many answered that their "health was fair", which was understood to mean "quite okay," whereas in the SF-36 health questionnaire fair is supposed to be "less than good". This observation might also be supported by the Kenyan fieldwork, where difficulties had been found in translating English terms concerning the health concept (Allen et al., 1997).

The two-year follow-up study

Yet another threat to the internal validity was the low percentage of patients returning for the follow-up assessment. In order to meet this criticism, comparisons regarding demographic and diabetes-related data were made in patients who were assessed once, on the main data collection occasion, and those who subsequently turned up for the follow-up study and were assessed twice.
The only significant difference was that more patients on insulin returned for the second assessment after two years. The difficulties in doing follow-up studies and in tracing patients were in line with the ten-year follow-up study done by Corrigan and Ahrén in Western Tanzania (Corrigan and Ahrén, 1987). In the current study it was shown that Tanzanians who were asked about their perceived health two-years apart had improved their health in four of the SF-36 health domains. This improvement could be due to an increased awareness among the diabetes staff after the reorganisation of the diabetes care in Dar es Salaam. It could also be due to an increased awareness about how to handle diabetes disease among the patients themselves. It might be that diabetic persons who were concerned about the need to continuously attend the diabetes clinics were those who perceived a better health. It could also be an effect of answering the same questionnaire twice. All patients were supposed to attend the diabetes clinic every third month but it seemed as they after the re-organisation of MMC diabetes clinic did not follow this regularity.

Data collection procedures
There was a difficulty in achieving a similar data collection procedure in the two different countries. Tanzanian patients attended the same outpatient clinic where they were interviewed, and Tanzanian student nurses and nurse tutors assisted in the data collection. In Sweden, on the other hand, the patients were invited to the study, although they attended different outpatient clinics within the same county, and the same author (BS) interviewed all patients. This difference regarding the data collection could be a threat to the internal validity as Tanzanian patients did not have any privacy when answering the questions. However, this was the normal procedure when attending the diabetes clinic and our intentions were not to alter the routines.

Another data collection difference was that whereas two Swedish researchers did the Tanzanian foot examination, in Sweden the foot examinations were done by BS. This problem had been foreseen, therefore prior to the Swedish investigation a thorough exercise regarding foot examination procedure was done. In Sweden the same investigator (BS) performed all data collection.

The attempt in this investigation was to match the patients in the four variables “age”, “gender”, “diabetes duration” and “treatment”. It was possible to find "Swedish twin” patients regarding gender and age. When screening the medical records at the different outpatient diabetes clinics, it was difficult to find Swedish patients corresponding to Tanzanians regarding diabetes duration, as many Swedish patients in the right ages had longer diabetes duration. Furthermore, many Swedish patients with Type 2 diabetes had started insulin-treatment, which was not the case in Tanzania. However, it is difficult to know whether these discrepancies had any influence on the outcome as some earlier studies have reported no relation between diabetes duration and treatment, and quality of life (Weinberger, 1994; Wredling, 1995). Elbagir, however, reported that patients with shorter diabetes duration had better quality of life (Elbagir, 1997).
**Summary**

The Tanzanian diabetic patients lacked the prerequisites to fully manage their self-care. Still there was no difference regarding the Tanzanians and Swedes satisfaction with their self-care. The discrepancies were the causes to the dissatisfaction. Tanzanians experienced lack of anti-diabetic drugs and wanted more diabetes education. On the other hand, very few Swedes had highlighted the causes to their dissatisfaction, and they had then mentioned their own behaviour. Furthermore none of the Tanzanians monitored their blood glucose whereas half of the Swedish group did it daily or weekly.

More Tanzanian than Swedish patients experienced foot problems. The most frequently reported foot problem in Tanzanian patients was pain, whereas Swedish patients mostly experienced problems due to badly fitting footwear. Foot lesions in Tanzanian patients were more serious, i.e. foot deformities and impaired sense of vibration. In contrast Swedish patients had foot lesions more related to poor footwear. Furthermore, fewer Tanzanians than Swedes inspected their own feet.

Tanzanians with peripheral neuropathy (PN) reported significantly poorer health than those free from late foot complications, whereas those with peripheral vascular disease (PVD) had health scorings equal to those without any late foot complications. The HbA1c value did not differ between patients with PN, PVD or without PN and PVD.

Tanzanian patients perceived poorer health, assessed by SF-36 questionnaire, than a group of an urban adult general population living in the same area. In addition, Tanzanian diabetic patients perceived poorer health than the matched Swedish patients. In contrast, self-perceived health in Swedish diabetic patients did not markedly differ in comparison with the general Swedish population. Moreover the Tanzanians had significantly poorer glycaemic control, measured by HbA1c, than the matched Swedish diabetic patients.

Those Tanzanian patients who were assessed twice two years apart, showed significant improvement in the SF-36 health domains “social functioning” and “role emotional”. Furthermore, the patients had significantly improved their glycaemic control.
Concluding remarks
People with diabetes, no matter whether living in a low-or high-income country, have the mutual burden of daily efforts in order to manage their self-care. However, the burden differs in quality whether the patients are living in Tanzania or Sweden. Tanzanians had to struggle with irregular drug availability, have fewer possibilities to relevant diabetes education, and they have improper foot care. Added together these matters will most probably result in that many patients will develop late diabetes complications. Furthermore they experience that they have to abandon important factors such as cultivating and walking, which deals with their survival. This will have a major influence on the individual diabetic patients. Nevertheless the follow-up study showed an increased self-perceived health and improved glycaemic control in those Tanzanians who were assessed twice over the two-year period, which highlighted the importance of continuous availability of drugs and other anti-diabetic drugs as well that the diabetes care might have been improved. Therefore it is most important that the members of the diabetes team continuously highlight this problem to Tanzanian health authorities. Swedish patients on the other hand had mentioned hindrances in participating in social activities. Although the Swedes did not differ regarding the self-perceived health in comparison with general Swedish population many were dissatisfied with their self-care. This indicated that there ought to be several factors involved in how people experienced having diabetes. As a whole no relation was found between glycaemic control and self-perceived health, which means that it is not enough to measure only glycaemic control or only self-perceived health, both indices are necessary in diabetes care evaluation. In addition it is needed to explore the reasons why many diabetic patients living in a high-income country, with all its resources within diabetes care, still report that they have insufficient knowledge and skills about diabetes, do not monitor their blood glucose, and do not pay attention to foot care. There exists a major educational challenge to improve Swedish diabetes care. With the increasing number of people with diabetes in the world, it is necessary to exchange educational experiences regarding how to arrange appropriate diabetes education, both for people with diabetes and the staff. Therefore I finally want to highlight the importance of continued exchange of experiences between diabetes staff in Tanzania and Sweden.
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