# Stroke Rehabilitation outcomes in Hebron - Palestine

**Akram Amro**

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**Supervisor: Prof. Anthea Rhoda**
**Co-Supervisor: Prof. Ziad Abdeen**

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# DECLARATION

I declare that stroke rehabilitation outcome in Hebron – Palestine, is my own work, that has not been submitted before, for any degree or examination at any other university, and that all sources that I have used or quoted, have been indicated, and acknowledged by complete references

**Akram Abdel Rahman Othman Amro** **October 2012**

**Signed---------------------------------------------------**

# ABSTRACT

**Background:** Strokes are a major cause of death and disability worldwide. Although the Palestinian population has not been spared this disease, limited information is available about the outcome of strokes in this country.

**Aim:** To investigate strokes, epidemiology, stroke characteristics, use of care and rehabilitation outcomes, and factors predicting these outcomes in stroke patients in Hebron city, in southern Palestine. **Design**: A one-year hospital-based, observational, descriptive, case-control, cohort study. **Sample:** One hundred and thirty nine (139) stroke patients were recruited from two main hospitals in Hebron city (Alia and Al-Ahli hospitals). **Procedure:** Objective assessment, patient interview, file screening and observation of the recruited cases was performed, risk factors were recorded and impairment, functional activity and participation were captured at baseline (T1), three months (T2), and six months (T3).

**Sample description:** The mean age of the sample was 67.64 year, and 39.6% of the sample consisted of males, and 60.4% females. The majority of patients (80.6%) had ischemic strokes; the rest (19.4%) had hemorrhagic strokes. The severity at baseline, measured by the National Institute for Health Stroke Scale (NIHSS), indicated that 46.8% had a severe stroke, 41% a moderate stroke, and 12.2% a mild stroke.

**Results of the epidemiological study:** The main predictors of strokes were diabetes, hypertension, physical inactivity, consumption of a fatty diet and stress. The five most prevalent risk factors in strokes were hypertension, obesity, diabetes, fatty diet and stress. The risk factors most associated with incidences of strokes were heart failure and diabetes. Those less likely to have a stroke were males who were younger than 60 years old, with a history of Transient Ischemic Attack (TIA).

**Results of the use of care study:** Thirty eight per cent (38%) of the patients at T2 and 67% at T3 did not have any type of rehabilitation. In-patient rehabilitation was accessed by 14.4% for an average length of stay of 43.25 days at T2, and 2.2% at T3, with an average length of stay of 24.67 days. Patients mainly used a home rehabilitation setting (49.60%), for an average of 50 days at T2, and this percentage of patients using this setting, reduced to 21.60% at T3, with a mean length of stay of 59.6 days. Outpatient rehabilitation increased from 10.8% of patients accessing it at the T2 period, to 15.1% at T3. There was an increase in the period of average

use of this rehabilitation setting, 49.24 days in T3, compared to an average of 44.7 days at the T2 period. The main motivations for using or not using rehabilitation services, were financial reasons, medical insurance (inpatient setting), doctors' and therapists' recommendations (home rehabilitation setting) and transport difficulties and patient mobility (outpatient setting).

**Results of the rehabilitation outcome study:** Significant improvement was recorded between the baseline and the three month assessments, and between the three-month and the six-month assessments, on the three assessment domains of ICF (impairment, functional activity and participation) ($P< 0.05$).

**Predictors of motor function impairment at six months**, as measured by the Rivermead Motor Assessment Test were: total hours of family-performed exercises (B=0.1159), total physiotherapy hours at the outpatient setting (B=0.144), and patients' reports about the regular use of the affected hand in functional activities. (B= 17.85). Predictors of lower motor function at six months were: age of the patient (B=- 0.139) and the baseline swallowing problems (B = -7.58). The model explained 62.72% of the variance of motor function impairment at six months.

**Predictors of six months functional activity**, as measured by the Barthel Index were total physiotherapy hours in the home rehabilitation setting at T2 and T3 (B = 0.220) and the total occupational therapy hours in the inpatients setting at T2, and T3 (B = 2.48). Lower level of functional activity at six months was predicted by the age of the patient (B = -0.461), and swallowing problems at baseline (B. = -19.959). The model explains 64.21% of the variation in functional activity at six months.

**Predictors of six months participation level,** as measured by Modified Rankin Scale (MRS) were total physiotherapy hours in the home rehabilitation setting (B = -0.007), patient report of performance of regular self-assisted hand exercises (B = -0.877), patient report of use of the hand in functional activities ( B = -1.082), baseline arm part of Rivermead (RMA- A) (B = -0.262), gross function of Rivermead (RMA-G) (B.= -0.454), and the total family-performed exercises (B. = - 0.007). Lower levels of participation (higher MRS) were predicted by the age of the patient (B. = 0.019), and baseline National Institute of Health Stroke Scale (B. = 0.023). The model explained 63.13% of variance of participation level at six months. .

**Conclusion**: Palestinian stroke patients in Hebron, Palestine, showed a particular pattern of risk factors, similar to those found in other studies. Positive family and patients' personal contributions to the rehabilitation programme were associated with better stroke outcome in terms of reduced impairment, improved functional activity, and better social participation.

**Keywords:**

Stroke

Rehabilitation

Outcome

Impairment

Participation

Activity

Settings

Improvement

Predictors

Palestine

Risk factors

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# DEDICATION

I dedicate this work to my parents, my wife Afnan, professors, and all the people who passed away while fighting for freedom and peace spreading in Palestine, South Africa, and the entire world.

# TABLE OF CONTENTS

**CHAPTER 4: RESULTS** 

## LIST OF FIGURES

# LIST OF TABLES

## ABBREVIATIONS

**ADL**: Activities of Daily Living
**AHA**: American Heart Association
**BI:** Barthel Index
**BMI**: Body mass index
**CBR**: Community based rehabilitation
**Cons**. Constant
**Cof**.: Coefficient
**CVA**: Cerebral vascular accident
**Dif**.: Difference
**ESD**: Early supported discharge
**FIM**: Functional Independence Measure
**ICF**: International classification of function
**Lt**. : Left
**MI**: Myocardial infarction
**MRS**: Modified Rankin Scale
**n**: Number of participants
**NGO**: Non-governmental organisation
**NIHSS**: National Institute of Health Stroke Scale
**NO**.: Number
**OR**.: Odd ratios
**RCT**: Randomised control trial
**RMA**: Rivermead motor assessment
**RR**: Relative risk
**Rt**.: Right
**SLT**: Speech Language Therapy
**SPSS**: Statistical Packages for Social Sciences
**Std**.: Standard deviation
**T1**: First assessment within the first week after the stroke
**T2**: The second assessment three months after the stroke
**T3**: The third and final assessment point, six months after the stroke.
**TIA**: Transient Ischemic Attack
**TRG**: Triglycerides level

**WHR**: Waist hip ratio

**WHtR**: Weight height ratio

# CHAPTER 1:

## 1.1 INTRODUCTION

trokes are a leading cause of death and serious disability worldwide (American Heart Association [AHA], 2011a). According to the World Health Organization (WHO, 1989: 1412), a stroke is defined as "rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin". Feigin, Lawes, Bennett and Anderson (2003) reported in a review of international (America, European countries, and China) studies concerned with stroke epidemiology, that the prevalence of strokes per 1 000 people ranged from 46 to 72 in people older than 64 years and from 4.2 to 11.7 in people older than 54 years respectively. Stroke incidence varies worldwide, where it was reported as low as 27.5 per 100 0000 in some Arab countries (Benamer & Grosset, 2009), and as high as 310 per 100 000 in Norway (Feigin *et al*., 2003). Young and Forster (2007) estimated that 5.54 million deaths worldwide could be attributed to strokes annually.

In terms of stroke risk factors, the American Heart Association (AHA, 2012) refers to diabetes mellitus, high blood cholesterol & other lipids, high blood pressure, being overweight and obesity, physical inactivity, smoking, and bad nutrition as main risk factors of strokes. Meanwhile, the order of priority for these risk factors vary worldwide as will be shown in (chapter 2.3.4).

In Palestine, there is no information about the burden of strokes in terms of stroke prevalence. In terms of stroke incidence in Palestine, Sweileh, Sawalha, Al-Aqad, Zyoud, and Al-Jabi (2008) reported an age-adjusted stroke incidence of 51/100,000, in northern Palestine. In terms of the most prevalent stroke risk factors in Palestine, hypertension and diabetes are the most prevalent. However, there is no information about the difference of stroke risk factors' prevalence between stroke patients (cases), and the Palestinian population in general. Data published by the Palestinian Ministry of Health are mainly associated with causes of death. The percentage of deaths attributed to strokes in Hebron was 5% during 1995, 10% during 1996 and 1997, and 11% in 1998 (Palestinian Ministry of Health, 1999), indicating an annual increase in the number of deaths attributed to strokes in Palestine. In 2005 the attributed stroke mortality represented 11% of total deaths in Palestine (Palestinian Ministry of Health, 2005).

### 1.1.1 Disability post stroke

The impact of a stroke can be conceptualised within the International Classification of Functioning, Disability and Health (ICF), as a conceptual framework used in clinical rehabilitation and research to highlight the impact of a stroke on body function and the wellbeing of the stroke patient. Kostanjsek (2011) described ICF as an international common language to describe functional status and that it is a reflection of the biopsychosocial model that allows the examination of the influence of social, medical, environmental and personal aspects on functioning and disability. The ICF has been recommended as a useful framework in research relating to outcomes (Carter, Lubinsky & Domholdt, 2010). The ICF was therefore used as the conceptual framework in this study to determine the rehabilitation outcomes of patients with strokes in Hebron, Palestine.

The ICF has three domains (Fig.1.1), namely body function and structure, activities and participation. Each of these domains is influenced by environmental and personal factors, as is reflected in the diagram below (WHO, 2001).

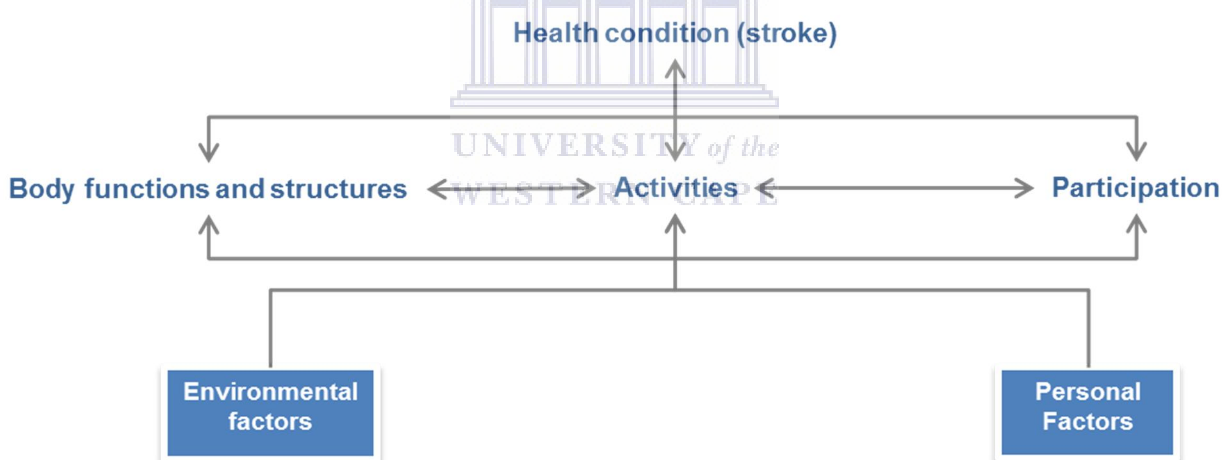



**Figure 1.1: International Classification of Functioning, Disability and Health (WHO, 2001)**

The main impact of ICF domains on stroke victims is briefly explained as follows: on the impairment level, body functions and structures might be affected. This might include but not be limited to, motor function, muscle tone, speech impairments, depression, sensation, bladder control, dysphagia, cognition and communication, (Lawrence *et al*., 2001). The impact of a stroke on activity could be due to any combination of the above-mentioned impairments that may lead to a decrease and sometimes loss of a patient's functional activities of daily living (Young & Forster, 2007). These activities are described as losing the ability to perform major functional activities such as walking, dressing, eating, speaking, toileting and communication.

The stroke patient therefore often requires the assistance of a caregiver to supervise, assist with, or fully perform these activities (Geyh, Cieza, Schouten, Dickson, Frommelt & Omar, 2004). On the participation level, the impact of a stroke was described by Miller *et al*. (2010) as a problem that prevents the patient from regaining or starting a societal life, such as going back to work, since a significant number of stroke survivors do not return to work (Miller *et al*., 2010). The impact of a stroke on the individual could range from minimal impairment to death. Further detailed explanations about stroke impact will be presented in section (2.4) of the study

### 1.1.2 Rehabilitation after a stroke

The purpose of rehabilitation is to limit the impact of a stroke on the individual by using a variety of therapeutic and problem-solving approaches and rehabilitation services (Duncan *et al*., 2005). With regards to conditions such as stroke, Young and Forster (2007) define rehabilitation as "a complex set of processes usually involving several professional disciplines and aimed at improving quality of life for people facing difficulties with activities of daily living caused by chronic diseases". Rehabilitation is a multi-disciplinary process (Ference, 1999) that includes delivering rehabilitation services through multi-disciplinary rehabilitation-oriented professionals that may include the medical doctor, nurse, physiotherapist, occupational therapist, speech therapist, social worker and psychologist (Nair & Wade, 2003). The rehabilitation of stroke patients can occur in various settings including specialised stroke rehabilitation units, generic inpatient rehabilitation centres, outpatient settings and home-based care (Duncan *et al*., 2005; Miller *et al*., 2010; Young & Forster, 2007). According to Stucki, Ewert, and Cieza (2002), rehabilitation is a treatment strategy (to treat impaired body structures and functions); a rehabilitative strategy (to help overcome impaired body functions, activity limitations and participation restrictions) and finally a preventive strategy (preventing further symptoms and disability), especially at the sub-acute stage where rehabilitation will be managing the functional activity level through addressing participation, and functional limitations (Miller *et al*., 2010).

Studies have shown that significant improvement in functional outcomes and quality of life can be achieved with stroke patients after timely and intensive rehabilitation (Milinaviciene, Rastenyte, & Krisciunas, 2007; Rosenberg & Popelka, 2000; Ryan, Enderby & Rigby, 2006). Although this is the case, approximately 40% of stroke survivors will continue to have varying degrees of functional limitations (Young & Forster, 2007). Further research and investigation is imperative to gain insight into best practice models of prevention, acute care, and optimal rehabilitation processes with the potential to decrease the percentage of post-stroke functional impairment.

To structure the research and investigation, stroke rehabilitation can be examined within a clearly defined theoretical or research framework. The Structure Process and Outcomes framework can be used to examine rehabilitation interventions (Hoenig *et al*., 1999). When examining the structure of care, the facilities available for rehabilitation and the rehabilitation professionals required to provide treatment are determined while the type, content and intensity of rehabilitative therapy comprises the process of care. Changes noted in terms of impairment, activity and participation following rehabilitation constitute the patient outcomes (Hoenig, Horner, Duncan, Clipp, & Hamilton, 1999). According to Stucki *et al*. (2002), the ICF, mentioned previously, could be used to monitor rehabilitation outcomes from admission to reintegration into the community. This process also involves the identification of personal and social obstacles, as well as the management of interventions and measuring the effectiveness of rehabilitation interventions. Based on this, stroke outcomes could be investigated in terms of motor impairment, in terms of ability to perform activities of daily living and participation as return to work and improvement in execution of leisure activities. The present study investigated rehabilitation process variables in order to predict their influence on the outcomes of the participants.

All stroke patients in Hebron, Palestine are admitted to either one of the two general hospitals (Alia and Al-Ahli hospitals) during the acute stage. They are usually received at the emergency room. Imaging is performed in the majority of cases and then most patients are admitted to the general medical ward, or surgical ward in the case of haemorrhagic strokes, which require cranial surgery. The length of stay in hospital usually extends from one week to ten days depending on the severity of the stroke and the stability of vital signs, such as heart rate and increased blood pressure. Upon discharge, patients are referred to inpatient rehabilitation centres, outpatient centres, or home-based rehabilitation based on a set of criteria. Those who are medically insured could be referred to inpatient settings for up to two months. Those who are not medically insured are guided by their financial status, regarding the rehabilitation settings and services that they could receive. No information is available regarding the distribution of patients in the different settings or services, and the outcome of rehabilitation in these specific settings.

One of the main expected outcomes of this study is that it will be the first study to present the current stroke rehabilitation process in Palestine in terms of settings and services and the outcomes of stroke patients who have followed the current processes as measured by the three ICF domains (impairment, functional activities and participation).

## 1.2 PROBLEM STATEMENT

This study addresses the four main problems and gaps in literature relating to stroke patients in Palestine. These problems and gaps are represented in the lack of a Palestinian stroke risk profile (that might help in stroke prevention, and reducing the potential stroke recurrence), the dearth of information about the Palestinian stroke patients' rehabilitation process (rehabilitation services and settings), the lack of literature about the impact of stroke and stroke rehabilitation outcomes in Palestine (impairment, activity and participation levels) and finally, the lack of information about the rehabilitation and socio-demographic variables associated with stroke rehabilitation outcomes in Palestine. The gap in this field was highlighted by Husseini *et al*. (2007, P 1041) who reported in his review about cardiovascular diseases in Palestine that “minimal reliable data is available for the occupied Palestinian territory about the nature, treatment, and outcomes of cardiovascular diseases”. This minimal data seems to be unpublished data at that time, and seems to be from general records of the Ministry of Health.

In terms of a stroke risk profile, there is no information about the actual Palestinian risk profile. It is evident that strokes are on the increase in Hebron, Palestine, made apparent through increasing stroke-attributed mortality, as reported by the Palestinian Ministry of Health (1999, 2005). No preventive plans have ever been declared to decrease the incidences of strokes. For this, a potential future stroke prevention plan, risk factors of stroke patients have never been investigated in Palestine regarding their distribution and prevalence in stroke patients compared to non-stroke patients. As the only study done, Sweileh *et al*. (2008) described the percentage of stroke patients suffering from different stroke risk factors without comparing them to the non-stroke population with similar socio-demographic characteristics.



In terms of the rehabilitation process, it is also evident that the rehabilitation services for people who have suffered a stroke are available. However, there is a dearth of information relating to the process for the provision of rehabilitation services in Hebron, Palestine. This is especially true since the Palestinian authority decreased its governmental expenses, including the outstanding outsourcing of the health services bill, which forms the basis of health insurance-covered rehabilitation referrals for stroke patients in Palestine. We therefore have no idea about the percentage of patients who are receiving any type of rehabilitation service, at any rehabilitation setting. Neither do we know what the determinants and motivations are behind choosing or not choosing a certain rehabilitation setting or service. This means that some patients will have the benefits of an ideal rehabilitation process, and others may get no rehabilitation at all, which might affect their ultimate stroke outcome. On the other hand, adopting evidence based stroke rehabilitation guidelines in Palestine, should be based upon the availability of the main rehabilitation elements of those guidelines within the Palestinian setting. For example, stroke units, which were strongly supported in stroke literature, are non-existent in Palestine, despite the bulk of literature that is supporting their effect on the optimum outcome of stroke rehabilitation. In addition, affordability of other available and well-supported rehabilitation settings like generic rehabilitation wards might be questionable, in a low-income area such as Palestine, with a very high cost for each night of rehabilitation in those generic inpatient settings. In the light of these facts, it becomes necessary to understand the extent of use and affordability of existing rehabilitation potentials in Palestine. These need to be built upon, including existing availability of elements of rehabilitation care, to progress to a better use of available resources in a future optimal rehabilitation intervention.

The third problem addressed by this study is represented in the fact that there isn't any information about either the outcomes of a stroke, in terms of impairment, activity, and participation level of Palestinian stroke patients, or the stroke rehabilitation outcome in terms of the previous mentioned variables (impairment, activity and participation). This information about the stroke rehabilitation outcome might lead to the adoption of best available rehabilitation practices that are associated with a better stroke rehabilitation outcome. Based on the researcher's observation, these seem to be highly variable among different Palestinian stroke patients, regarding prognosis and rehabilitation outcomes.

The fourth problem being investigated is the lack of information about the socio-demographic and rehabilitation factors that might affect the prognosis in Palestinian stroke patients, within the available rehabilitation services and settings. There is also a lack of information on the resulting effect of patients' personal effort as active participants in their own rehabilitation and the role played by their relatively large extended families on the stroke rehabilitation outcome. This is especially relevant as Palestine is different from many other countries in terms of the availability and affordability of some literature-supported rehabilitation services and settings.

## 1.3 RESEARCH QUESTIONS

The main questions that this study is investigating are represented in:

1. What are the main socioeconomic and personal characteristics of stroke patients and the main risk factors for stroke in Hebron- Palestine?

2. What is the distribution of referrals to rehabilitation settings for stroke patients, and what rehabilitation services stroke patients in Hebron, Palestine, receive?
3. What are the impairments, the functional outcome, and participation status post stroke, and what are the factors influencing the outcomes of the stroke patients at three and six months post stroke?

## 1.4 RESEARCH AIM

The aim of the study was to investigate the characteristics and risk profile of stroke patients and outcomes of rehabilitation of Palestinian patients with a stroke in Hebron.

## 1.5 RESEARCH OBJECTIVES

1. To investigate the personal and socioeconomic characteristics of stroke patients in Hebron, Palestine
2. To investigate the main risk factors of strokes in Hebron- Palestine.
3. To determine the frequency with which stroke patients use the various rehabilitation settings (home care, outpatient, or rehabilitation institutions) in Palestine.
4. To identify the factors influencing the choice of rehabilitation settings.
5. To investigate the rehabilitation services received by Palestinian stroke patients in Hebron.
    a. To investigate the type of rehabilitation services (physiotherapy, occupational therapy and speech therapy) stroke patients receive.
    b. To investigate the intensity of services received by stroke patients
6. To determine the functional outcomes, impairments, and participation status of stroke patients at admission, three and six months post-stroke
7. To determine socio-demographic and rehabilitation process factors influencing the main outcome as determined by the Rivermead Motor Assessment (Impairment), Barthel Index (Functional activity), and (participation) Modified Rankin Scale scores at 3 and 6 months post-stroke.



## 1.6 SIGNIFICANCE OF THE STUDY

The study can make four important contributions to the extent of knowledge on stroke rehabilitation in Palestine, with its unique socioeconomic and demographic data, and data about different availability and affordability of existing rehabilitation services.

Firstly, the study will lead to the compilation of a database of information about the risk profile of stroke patients in Palestine. This is a new field of knowledge that has never been discussed in terms of comparing risk profiles of stroke patients, with similar non-stroke patients within similar age categories in Palestine. This data will allow the Ministry of Health to put in place a future preventive plan that might decrease stroke incidence based on a local risk profile, rather than internationally published risks.

Secondly, this study will build up baseline information about the distribution of rehabilitation referrals, use, and process in Hebron-Palestine. This database will contribute to future planning of health rehabilitation services and highlight shortages of potential modifiable rehabilitation process elements. The database will be a "light" for stakeholders' planning, working towards future equal opportunity of stroke rehabilitation accessibility for Palestinian stroke patients.

Thirdly, the information captured could assist in the formulation of a stroke rehabilitation policy in Palestine. The findings and subsequent recommendations could enhance the development of a best practice model of stroke rehabilitation in Palestine and potentially result in improved rehabilitation outcomes (RO). It will highlight the rehabilitation process elements, in terms of settings, services, intensity, personal and environmental elements, which could lever the ultimate stroke rehabilitation outcomes. By highlighting the underlying factors that might predict a better outcome, and unlocking the puzzle of variance in stroke patients' prognosis, the research could enhance a future optimal, available, affordable, and locally adapted best stroke rehabilitation model. This would lead to a better stroke patient post-stroke body structure function, functional ability and participation.



The fourth contribution of this study to Palestinian stroke rehabilitation practices is to highlight the effect of the patient's personal efforts and family involvement in exercises, on the stroke rehabilitation outcome. This is an important aspect of stroke rehabilitation that is often not stressed or emphasised in stroke rehabilitation literature. The patient and his/her family being active participants and contributors to the rehabilitation process, is especially important within the Palestinian context, with its large extended families and emphasis on communal goals.

## 1.7 OUTLINE OF THE THESIS

This thesis is presented in six chapters. Chapter one highlights the definition of a stroke, the impact of a stroke within the conceptual framework of the ICF, the rehabilitation process in terms of rehabilitation settings and services, research questions and aims and objectives are also presented. The problem statements are considered and the significance of the study is described.

In Chapter two, the researcher presents a review of the relevant literature in terms of eight main sections. These are entitled: introduction to the chapter, stroke background, stroke epidemiology, stroke impact on the basis of ICF domains, stroke outcome measures measuring different ICF domains of the stroke survivor, rehabilitation process (settings and services), stroke rehabilitation outcome on ICF domains and factors contributing and predicting this outcome.

In Chapter three, the researcher presents the sample description (size, recruitment, inclusion and exclusion criteria), the methodologies of the four main sections of this thesis (stroke baseline profile, stroke epidemiological study, stroke rehabilitation process and stroke rehabilitation outcomes). Ethical commitment and considerations are also presented in this chapter.

In Chapter four, the results of the different sections of the study are also presented in four main sections. In Section one, the researcher presents the results and the statistical analysis of the baseline profile section. This addresses the first objective of the thesis on the characteristics of stroke patients in Hebron, Palestine. Here the type of stroke, side of stroke, length of hospital stay, method of diagnosis, baseline stroke impact and other factors are presented. In Section two the results and statistical analysis of the epidemiology of stroke section are presented, which addresses the second objective of the thesis - identifying the main risk factors of stroke patients. In Section three, the research presents the results of the rehabilitation process regarding the intensity of rehabilitation services and settings and the determinants behind the choice of using or not using each rehabilitation setting. This section addresses objectives 3-5 relating to determining the frequency with which stroke patients use the various rehabilitation settings, the factors influencing their choice of setting and the determination of the rehabilitation services received by Palestinian stroke patients in Hebron. The final Section of Chapter four, addresses objectives 6-7 relating to the identification of baseline, three months and six months stroke outcomes (based on ICF), and the factors predicting these outcomes. Changes of outcome on the different ICF domains are presented between the different assessment points. Factors predicting changes are also presented and highlighted.

In Chapter Five, the different sections presented in Chapter four, are discussed in terms of the local Palestinian setting and in relation to the related published literature presented in Chapter two.

Finally, in Chapter six, the research presents the conclusions and recommendations of this study based on the results and discussion of the four sections of this thesis. Recommendations are presented to decision makers in the Ministry of Health, rehabilitation professionals and to future researchers who want to continue further research in the area of stroke rehabilitation outcomes.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 INTRODUCTION

In this chapter, the literature in the field of strokes are reviewed and discussed. The chapter is divided into eight main sections. After an introduction to the chapter in section one, section two addresses the medical background of strokes (definition, diagnosis and subtypes); section three reviews the epidemiology of strokes (incidence, recurrence, prevalence, mortality, fatality, and risk factors); section four discusses the impact of strokes, section five highlights the different outcome measures that evaluate the impact of strokes and stroke rehabilitation outcomes, based on the International Classification of Function (ICF); section six addresses different stroke rehabilitation settings and services; section seven discusses different stroke rehabilitation approaches; and section eight highlights the different variables and predictors that affect the stroke patients' rehabilitation outcome.

Several electronic databases were searched during the literature review, including, Ebscohost, PubMed, Google Scholar, CINAHL, Medline and Science Direct. Combinations of the following search terms were used: "stroke", "cerebrovascular accidents", "epidemiology", "rehabilitation", "outcome", "prognosis", "predictors", "impact".



## 2.2 DEFINITION AND BACKGROUND OF STROKES

In this section, the researcher presented the definition, types, and methods of diagnosis and the prevalence of specific types of strokes, as reported in different countries.

In most of the literature, the global stroke definition of the World Health Organization is used that defines a stroke as an incident where a patient "rapidly develop(s) clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin" (WHO, 1989, p.1412).

Truelsen, Begs and Mathers (2000) refer to two types of strokes, namely, infarction (ischemic) and haemorrhagic. Ischemic strokes are caused by occlusion of one or more blood vessels or arteries in the brain due to atherosclerosis, or an embolism occluding an artery and depriving brain tissue of blood supply. Haemorrhagic strokes are caused by the spontaneous rupture of a brain blood vessel, leading to deprivation of blood and oxygen, ultimately leading to damage in the brain tissue. Truelsen *et al*. also mention sub-types of strokes, namely Lacunar strokes (small and deep infarcts in the small penetrating arteries of the brain), and sub-arachnoid haemorrhage (rupture of aneurysms at the inferior surface of the brain). The literature presented seems to suggest that the ischemic stroke is the most prevalent type of stroke.

Findings of studies on the prevalence of specific types of strokes are shown in Table 2.1. Peak percentages of haemorrhagic strokes came from South American countries (46%), Sudan (41%), and Asian countries (33%).

**Table 2.1: Prevalence of specific types of stroke**

| Authors | Type of stroke |
|---|---|
| Sudlow & Warlow (1997) | **European countries**: Ischemic strokes 80%; haemorrhagic strokes 10-15%; subarachnoid haemorrhage 5%. |
| Asia Acute Stroke Advisory Panel (A.A.S.A Panel, 2000) | **Asian countries**: Haemorrhagic strokes17-33% and ischemic strokes 67-83%. |
| Sokrab, Sid-Ahmed, & Idris (2002) | **Sudan**: Ischemic strokes 58.3%, haemorrhagic strokes 41.6%. |
| Saposnik & Brutto (2003) | **South American countries**: Ischemic strokes 54-74%; haemorrhagic strokes 26-46%. |
| Banerjee & Das (2006) | **India**: A ratio of 2.21 ischemic strokes for each haemorrhagic stroke. |
| Li *et al*. (2008) | **China**: Ischemic strokes 68.7%; intra-cerebral haemorrhage 31.3%. |
| Benamer & Grosset (2009) | **Arab countries** (Kuwait, Saudi Arabia, Qatar, Bahrain, Sudan, Jordan, Libya, Iraq): Ischemic stroke 80%; haemorrhagic stroke 20% (except in Sudan where 40% of strokes were haemorrhagic) |
| Sridharan *et al*. (2009) | **Southern India**: Ischemic strokes 74.8%; haemorrhagic stroke 10.1%; subarachnoid haemorrhage 4.2%. |

There also seems to be a difference in prevalence of different types of stroke between males and females. Appelros, Stegmayr, and Terént (2009), in a multinational review conducted in Sweden, found that males had more intracerebral infarctions and haemorrhages, while females had more subarachnoid haemorrhages.

Regarding stroke diagnosis, Medical doctors mainly make clinical diagnoses for strokes and research indicates that this is usually accurate. Kothari, Brott, Broderick, and Hamilton (1995) reported that emergency doctors in large teaching hospitals demonstrate a high sensitivity in diagnosing strokes with high accuracy, especially when it is concerned with haemorrhagic stroke. These results were supported by the work of Ferro *et al*. (1998). They reported that medical practitioners diagnosed strokes through neurological examinations in emergency departments before a CT scan was done. However, the gold standard for stroke diagnosis in relation to region and size is magnetic resonance imaging (MRI) (Schellinger, Jansen, Fiebach, Hacke, & Sartor, 1999), and computerised tomography (CT) scan (AHA, 2011c). Use of these diagnostic scans depends on the availability of this technology in general hospitals. In developing countries, diagnosis of the type and size of stroke was reported less in reviews, where MRI and CT scans are less available (Connor, Walker, Modi, & Warlow, 2007).

From the above studies, the conclusion is that the ischemic stroke is the most common type of stroke, and that the most accurate method of stroke diagnosis involves the use of an MRI and CT scan. Both of these diagnostic methods depend on the availability, especially in developing countries.

## 2.3 EPIDEMIOLOGY OF STROKE

In this section, the studies from literature that investigated the epidemiology of strokes will be presented. Most of the studies targeted stroke incidence, prevalence, stroke-attributed mortality (percentage of certain country deaths attributed to strokes), stroke risk factors, and stroke case fatality (stroke percentage of death within the first week, month, or year) (Thorvaldsen, Asplund, Kuulasmaa, Rajakangas & Schroll, 1995).



### 2.3.1 Stroke incidence

Domholdt (2000) defines incidence as “the number of new cases of a condition that develop during a specified period of time”. Incidence is calculated by dividing the number of new cases by the number of the population at risk. This is presented as the number of cases per 100,000 in most of the studies. Sudlow and Warlow (1997) discussed the criteria of comparing incidence studies and mentioned that one of the problems facing the process of comparison is that many studies did not specify the type of stroke incidence being reported. Based on seven studies included in a review of stroke incidence in South American countries, Saposnik and Brutto (2003) reported the incidence of strokes to range between 35 and 183 per 100,000. Benamer and Grosset (2009) reported a stroke incidence of 27.5 to 63 per 100,000 persons in Arab countries. Some of the incidence rates per country are shown in Table 2.2.

**Table 2.2: Incidence of strokes in different world regions and countries**

| Country | Incidence per 100,000 (Authors) |
|---|---|
| Australia | 210 (Feigin *et al*., 2003); 67 (Feigin, Lawes, Bennett, Barker-Collo, & Parag, 2009) |
| Denmark | 310 (Feigin *et al*., 2003) |
| Finland | 160 (Feigin *et al.,* 2003) |
| France | 112 (Feigin *et al*., 2009) |
| Germany | 130 (Feigin *et al*., 2003) |
| India urban | 151 (Feigin *et al*., 2009); 105 (Banerjee & Das, 2006) |
| India rural | 268 (Banerjee & Das, 2006) |
| India/southern | 135 (Sridharan *et al*., 2009 ) |
| Iran | 139 (Azarpazhooh *et al*., 2010) |
| Ireland/Dublin | 193 (Hannon *et al*., 2010) |
| Italy | 220 (Feigin *et al*., 2003); 821 (*Feigin*, 2009) |
| New Zealand/ Auckland | 126 (Feigin *et al*., 2009) |
| Norway | 310 (Feigin *et al*., 2003) |
| Portugal rural | 118 (Feigin *et al*., 2009); 305 (Correia *et al*., 2004) |
| Portugal urban | 261 (Feigin *et al*., 2009), 269 (Correia *et al*., 2004) |
| Russia | 310 (Feigin *et al*., 2003) |
| Sweden | 260 (Feigin *et al*., 2009) |
| Tanzania | 108-315 (Walker *et al*., 2010) |
| UK | 130 (Feigin *et al*., 2003) |
| Ukraine | 280 (Feigin *et al*., 2003) |
| USA/Barbados | 88 (Feigin *et al*., 2009) |
| North Palestine | 51.4 ( Sweileh *et al*., 2008) |

In certain regions of the world, there is limited information about stroke incidence. Examples of this are mentioned below. In sub-Saharan Africa, there are no ideal stroke incidence studies (Connor *et al.,* 2007). A community-based study in Nigeria, between 1975 and 1977, reported that the adjusted annual incidence rate of strokes were 15 per 100,000, which was thought to be highly underestimated, due to logistic shortages in the research team and personnel, and the mobile nature of the population.

In conclusion, incidences of strokes seem to vary dramatically between different countries (27.5 – 310/100,000). This may be due to underreporting (Connor *et al*., 2007), reporting of different type of stroke (Sudlow & Warlow, 1997), and different ways of reporting incidence (crude/age adjusted). Also, difference in life style (Thrift, Dewey, MacDonnell, McNeil & Donnan, 2001), differences in accumulative risk profiles associated with different ethnic and racial backgrounds (White *et al*., 2005), and primary health service level vary between different countries. Reported incidences were less in Arabic countries than African countries and both African and Arabic countries were less than Europe, while Western European figures were less than those in Eastern Europe. The highest incidences of strokes were reported in Western Europe with peak incidence reported in Portugal and Scandinavian countries. All these factors may justify the differences in the reported stroke incidence in different countries and different studies.

#### *2.3.1.1 Individual differences in stroke incidence*

In this section, the research presents studies about individual variation in the incidences of strokes in terms of gender, age categories and ethnic background, which all had been shown to influence figures of stroke incidence.

In terms of gender difference, males seem to have a higher incidence of strokes compared to women. Thorvaldsen *et al.* (1995) compared the incidences of strokes in 16 European countries, in the WHO MONICA Project. They reported the stroke incidence to be 101 to 285 in men and 47 to 198 in women, per 100,000. in a multinational study conducted in Sweden Appelros *et al*. (2009) also reported that men had a 33% higher incidence of strokes compared to women. Spengos and Vemmos (2010) reported a ratio of 1.3:1 males: females, from the Athens Young Stroke Registry recording details of young adults aged between 15 and 45. Li *et al*. (2008) studied 1913 consecutive hospitalised patients with first time strokes, and found more males (57%) than females (43%) in his sample. This difference in incidence might be attributed to the reported gender differences in risk profile between males and females, as males in the literature were associated with a higher percentage of smoking, a heavier alcohol intake, and a higher prevalence of peripheral vascular disease (Roquer, Campello, & Gomis, 2003; Terent, 1988). Goto, Baba, Ito, Maekawa, and Koshiji (2007) also found that men have a higher prevalence of hyperlipidemia, severe carotid artery stenosis, abdominal aortic aneurysms, severe carotid artery stenosis and severe aortic atherosclerosis; all of which may have contributed to the previously mentioned incidence differences.

In terms of age, Béjot *et al*. (2010) studied the incidence of strokes in old and very old patients, and found a significant difference in stroke incidences in the above 80 years old category (997 per 100,000), compared to the below 80 years old category, where incidence was 68 per 100,000. The severity and one month outcome was also worse in the older category.

In terms of ethnic background, Kleindorfer *et al*. (2010) studied the effect of ethnicity on incidences of strokes, and reported a significantly higher incidence of strokes in Afro-Caribbean compared to Caucasian ethnic groups, in the Cincinnati study, similar results were reported by White *et al*. (2005).

From the above it can be seen that the personal variations in stroke incidence were significant and that being a male, of black ethnicity and older seems to lead to higher incidences of strokes, compared to white, younger females that might be attributed to the above mentioned variation in lifestyle, and therefore accumulative risk profile.

#### ***2.3.1.2 Age of stroke patients at the time of stroke***

In terms of average age at onset of strokes, the reported average was presented as part of the results of research that were originally designed to study stroke epidemiology, outcome, or any other stroke related fields. In terms of age-oriented stroke studies, this research identified two types of age related stroke studies; general stroke studies concerned with the general stroke population (the majority of the studies), and the other type focused on younger stroke patients, mainly aged between 15-45 (Spengos & Vemmos, 2010; Wasay *et al*., 2010).

Deleu *et al*. (2011) studied ischemic strokes in the Arab Gulf countries and reported a mean age of 58.9 years at onset. In China, Li *et al*. (2008) reported an average age of stroke patients as 64 years. Sridharan *et al*. (2009) studied stroke epidemiology in southern India and identified the median stroke age as 67 years. From Africa, Desalu *et al*. (2011) reported the average age of stroke patients in Nigeria as 68 years (±12). In Europe, Saric, Buric, Vasilj, and Simovic (2011) reported the average age of stroke patients in Bosnia as 73 years (±12). In Korea, Kim, Ahn, Kim and Hong (2011) reported the average age as 64.4 (±12.6). In the USA, Biswas, Sen, and Simmons (2009) studied the stroke risk factors in Indian Americans in New York, and reported an average stroke age of 71.4 (±12).

Other research targeted the young category of stroke patients and focused at young stroke patients aged 15-45 years. Spengos and Vemmos (2010) who used the Athens Young Stroke

Registry found that young females were less than 30 years old. Wasay *et al*. (2010) found a mean age of 34 years for ischemic strokes in young Asian women.

In terms of gender differences in average age of stroke patients, it seems that females are reported to have a higher average age at the incidence of stroke. Appelros *et al*. (2009) in Sweden reviewed studies from different countries and found that the mean age of first-ever strokes in females (72.9 years) were higher than in males (68.6 years).

In summary, the reported average age of stroke onset, is different between males and females, with the mean age of females higher than males. Between countries, these differences may be related to risk profiles, mentioned in the previous section, as females may take a longer time to develop a stroke. In terms of countries, ethnic variations, differences in lifestyle (including diet, smoking habits, and physical activity levels) and level of primary health care, might play an important role in the mean age of stroke.

### 2.3.2 Stroke recurrence

Stroke recurrence refers to the possibility of the patient sustaining another stroke, at any stage or time after a first-ever stroke, as the previous stroke represents an important risk for another one. Some studies that showed different percentages of stroke recurrence are presented in Table 2.3.



**Table 2.3: Stroke recurrence**

| Authors | Participants | Risk of recurrent stroke (%) | | Conclusion |
|---|---|---|---|---|
| Mohan *et al*. (2011) | Systematic Review and Meta-Analysis | **30 days**<br>**1 year**<br>**5 years**<br>**10 years** | **3.1**<br>**11.1**<br>**26.4**<br>**39.2** | In over 10-years there is variation in the stroke recurrence risk profile |
| Feng, Hendry, and Adams (2010) | 10 399 stroke patients after discharge from South Carolina hospital with an initial stroke in 2002 | **1 month**<br>**6 months**<br>**I years**<br>**2 years**<br>**3 years**<br>**4 years** | **1.8**<br>**5**<br>**8**<br>**12.1**<br>**15.2**<br>**18.1** | The risk of stroke recurrence is higher in the first year, then continued to increase within the 4 years. |

| | | | | |
|---|---|---|---|---|
| Ay *et al*. (2010) | | **14 days**<br>**90 days** | 2.6<br>6 | Approximately 50% of the recurrence stroke, which occurred in the 90 days, happened during the first 14 days. |
| Ois *et al*. (2008) | 698 patients with minor strokes or TIA, who had NIHSS lower than 4. | **7 days**<br>**90 days** | 9.3<br>16.1 | Factors associated with recurrence were severe symptomatic arterial disease, weakness, speech impairment, severe alcohol intake, heart failure, previous TIA, and vertebrobasilar events. |
| Fujimoto *et al*. (2004) | 283 patients with brain embolism. | **Mean of 3.4 years of follow up** | 11.3 | strong relationship between atherosclerosis of the aortic arch and the risk of stroke recurrence, as major cause of ascending embolisms to the brain. |
| Hillen *et al*. (2003) | 1 626 first-ever stroke patients | **3 months**<br>**1 year**<br>**3 years**<br>**5 years** | 2.6<br>8<br>14.1<br>16.6 | In terms of sub-types of strokes, lacunar strokes and primary intracerebral haemorrhages were more associated with recurrence, and in terms of risk factors, diabetes and atrial fibrillation were more associated with recurrence. |



The literature varies in the number of recurrences at different points and can range from 5% at three months to 16% at 6months. In other studies atherosclerosis, atrial fibrillation, diabetes, and lack of knowledge seem to be most frequent factors contributing to the issue of recurrent strokes. Some of the studies do not give more information about the stroke patients who had a recurrent stroke, so it is not clear about modification of life style after the first onset of a stroke, where a positive change of behaviour could be evaluated in terms of its potential ability to prevent further strokes, which is highlighted by the findings of Audebert and Haberl (2003) who stressed the important role of lifestyle modification (cessation of smoking, increasing physical activity, low diet cholesterol) in decreasing the recurrence of strokes. Also from the above-mentioned studies, we notice that some authors like Ois *et al*. (2008) based their conclusion of stroke recurrence on deterioration at follow up testing. While it may be that not all the patients who showed deterioration necessarily had another stroke and that the researcher of the previous study should have confirmed the recurrence of strokes by an MRI or CT scan.

### 2.3.3 Stroke prevalence

Prevalence is defined by Domholdt (2000) as the proportion of the population that exhibits a certain condition at a given point time. Prevalence is calculated by dividing the number of existing conditions over the number of the population studied at a given point in time. The prevalence increases by the number of new cases and decreases with a full recovery of the particular condition under testing, or by death of cases.

Differences in stroke prevalence between several countries were reported by the study of Feigin *et al*. (2003). The prevalence of strokes per 100 000 is indicated as follows: USA 470, Bolivia 170, New Zealand 1020, England 470, Taiwan 595, and Italy 730. Saposnik and Brutto (2003) reported in their systematic review based in South America, that the prevalence of strokes were between 174 – 651/100 000 persons. In Arab countries, the systematic review of Benamer and Grosset (2009) found that the prevalence of strokes ranged between 42 and 68 per 100 000.

In New Zealand, Bonita, Solomon and Broad (1997) reported stroke prevalence to be 461 stroke patients per 100 000 population, after excluding those who have sustained full recovery from the original number. Age-standardised stroke prevalence in New Zealand was shown to be 883 per 100 000. One of the reasons that may justify the increase of prevalence as mentioned by Feigin *et al*. (2003) may be an increased incidence of strokes that may increase prevalence or decrease in mortality rate after strokes that may also increase stroke prevalence.

Han *et al*. (2009) studied the prevalence of strokes, Transient Ischemic Attacks (TIA), and other cerebrovascular disorders in Korea and found that the prevalence among the population above 65 years of age to be 10.1% and 8.9% for TIA. Appelros *et al*. (2009), in a multinational review, found that prevalence was 41% more in men than in women.



Prevalence in Arabic countries is less, compared to the literature coming from other regions of the world. Prevalence seems to be higher in Eastern Europe than Western Europe. Prevalence rates vary between different countries, which might have to do with the previously mentioned stroke incidence, and difference in severity of strokes that might affect the number of stroke related deaths and recovery. Accurate screening would also contribute to more accurate data for stroke prevalence.

### 2.3.4 Stroke mortality

The most important resource for mortality rates comes from the death statistics that report causes of death by disease. Another source is longitudinal studies that track registered cases and follow them up for a certain time. This last source is regarded as stroke fatality, rather than stroke mortality in most of the reported studies.

Klag, Whelton and Seidler (1989) studied the trend in stroke mortality in the USA and found a decline in mortality due to a stroke from 1973 to 1981, which the authors attributed to the improvement and development in hypertensive medication. In Africa, Connor *et al.* (2007) reported that strokes contributed to 3% of overall deaths, compared to 16% in Europe, and from 1975 to 1980, strokes contributed to 8% of deaths in Africa. They also concluded that over 80% of the deaths from strokes happened in middle and low income countries. In one study of a South African population, Connor *et al*. (2007) pointed out that strokes were found to contribute to 6% of deaths in a rural area of the country. Banerjee and Das (2006) reported that strokes attributed for 1.2% of all deaths in India. Strokes contribute to 11% of mortality causes in the Palestinian Occupied Territories, Palestine (Palestinian Ministry of Health, 2005).

Sutton, Marsden, Watkins, Leathley, and Dey (2010) studied the mortality trends in middle-aged people and found that between 1979 and 2005 in England. Age-standardised stroke mortality in people of 40 to 69 years, dropped from 93 to 30 per 100 000 in men and from 62 to 18 per 100 000 in women. Mortality was higher in older age groups but the difference between older and younger age groups appears to have decreased over time for both genders.

Based on the research mentioned above, one can conclude that strokes area major cause of death (1.2% – 16% of total deaths). Statistics differ between countries, as mentioned previously, as the incidence of strokes are different between different countries, which will ultimately affect the expected number of stroke-related deaths contributing to this difference in stroke-related mortality. It is considered that the difference in the health and socioeconomic status in each country may affect the level of stroke management, in terms of proper diagnosis and treatment, which will also affect the stroke outcome. The different levels of primary health care in the different countries will affect the level of medical follow-up at the sub-acute stage of a stroke, which will ultimately affect survival and stroke-related mortality.



### 2.3.5 Stroke fatality.

In a literature review, a differentiation should be made between stroke fatality and mortality, as the fatality seems to be concerned with the number of deaths within the selection of stroke cases concerning types and the time of stroke incidence. Stroke mortality, on the other hand, studies death from stroke from a public health point of view regarding the contribution of stroke-related deaths to the overall mortality and death rate in a particular setting. From the studies and reviews concerned with stroke fatality (presented in Table 2.4), it is obvious that these words have been used interchangeably.

**Table 2.4: Stroke fatality**

| Authors | Study Design/ Participants | Follow up | Fatality (%) | Conclusion |
|---|---|---|---|---|
| Benamer & Grosset (2009) | Systematic literature review/31 articles about stroke (Arab countries) | 30 days | 10-17.3 | Mortality rate increase with age. |
| Appelros *et al*. (2009) | Systematic review/ 98 articles | 1 month (men)<br>1 month (women) | 19.7<br>24.7 | Stroke severity was higher in women than in men. |
| Feigin *et al.* (2009) | Systematic review/ 56 stroke incidence studies | From 21 to 30 days | 17-30 | haemorrhagic strokes, fatality was less in high income countries (25%-35%), it was 30-45% in low income countries for the same period of time |
| Connor *et al*. (2007) | Systematic review/ 27 articles | 3 weeks (Nigeria)<br>1 month (average) | 35<br>33 | Case fatality at 3 weeks was highest in intracranial haemorrhage and in subarachnoid haemorrhage (61% and 62% respectively). |
| Deleu *et al*. (2011) | Prospective hospital-based observational study/780 ischemic stroke patients. | 90 days | 2.1 | There was no difference in mortality between various subtypes of stroke |
| Spengos & Vemmos (2010) | Hospital-based prospective observational study/ 253 first-time ischemic stroke patients (aged 15-45 years) | 10 years (survival) | 86.3 | The main predictors of mortality were heart failure and severity. |
| Feng *et al*. (2010) | 10399 stroke patients after discharge from South Carolina hospital with an initial stroke in 2002 | **1 month**<br>**6 months**<br>**1 year**<br>**2 years**<br>**3 years**<br>**4 years** | **14.6**<br>**20.6**<br>**24.5**<br>**30.9**<br>**36.2**<br>**41.3** | The risk of stroke mortality is higher in the first year, then continued to increase with each year. |

| | | | | |
|---|---|---|---|---|
| Sridharan *et al*. (2009) | Population-based study/ all first-time strokes occurred among 185 000 rural and 741 000 urban subjects in Trivandrum, Kerala. | 28 days (urban)<br>28 days (rural) | 24.5<br>37.1 | There are similarities in the epidemiology between developed and developing countries. |
| Saposnik *et al*. (2008) | Cohort Study/ 3631 patients with an acute ischemic stroke in Canada. | **7 days**<br>**30 days**<br>**1 year** | **6.9**<br>**12.6**<br>**23.6** | Severity and process of care affects case fatality. |
| Thorvaldsen *et al*. (1995) | Cross-sectional study/ 2 Asian populations and 16 European countries in the WHO MONICA Project. (aged 35-64 years) | 28 days (average) | 30 | 28 days case fatality ranging from 15-49% among men and 18-57% among women. |
| Kotila, Waltimo, Niemi, Laaksonen & Lempinen (1984) | 255 patients with stroke | **3 months**<br>**12 months** | **65**<br>**60** | SAH patients recover better, Patients (aged <65) recover better than patients (aged >=65) |



Christensen, Broderick, Vincent, Morris, and Steiner (2009) reported a 90 day haemorrhagic stroke mortality in 14 countries. The percentage of patients who died within the first 90 days following haemorrhagic strokes were as follows: Spain (38%), Netherlands (32%), Finland (27%), Canada (25%), Israel (22%), Australia (19%), USA (17%), Italy (15%), Germany (14%), France (14%), China (13%), Sweden (10%), Denmark (9%) and Singapore (5%).

Gender differences were reported by many authors, but Członkowska and Kobayashi (2003) reported that twice as many women than men die from strokes (16% vs. 8%). Olsen, Dehlendorff, and Andersen (2008) found different results in their study about gender differences in the stroke mortality rate. The study involved 39 484 stroke patients, 48% women and 52% men and the median follow-up was 1.5 years. A multivariate survival analysis showed that women had lower stroke mortality and those women who lived after a stroke usually lived longer than men ddid.

Many researchers have investigated the causes and predictors of stroke mortality. Ovbiagele (2010) investigated the mortality of inpatients admitted with strokes in the USA. He identified older age, female gender, lack of medical care insurance and multiple co-morbidities as independent predictors of mortality. Pekmezovic, Tepavcevic, Jarebinski, Kostic and Bumbasirevic (2007) conducted a cohort analysis on stroke mortality in Belgrade, Serbia between 1989 and 2003. The results showed that the stroke mortality risk was strongly related to age in both genders.  Huang *et al.* (2008) pointed out that previous TIA and anaemia were predictors for mortality and recurrent strokes within two years. Christensen *et al*. (2009, 62) studied predictors of mortality in haemorrhagic strokes and summarised them as: “age, volume of haemorrhage, neurological deficit at baseline, smoking, use of mechanical ventilation, and total stay at hospital”. Appelros, Nydevik, and Viitanen (2003) used multivariate regression models to analyse predictors of survival, dependency and stroke recurrence and defined predictors of poor outcome after a first-ever stroke. One-year mortality was 33%, while 37% of the survivors were dependent; 9% of survivors had a recurrent stroke within a year and major predictors of the outcome were age, stroke severity, and heart failure. Stroke recurrence was predicted by age and presence or absence of dementia.

From the above studies and reviews on stroke fatality and mortality looking at relevant causes and predictors, it seems obvious that there is great variation in the literature reporting on these domains. This issue of variation led many researchers to concentrate on the cause of fatality rather than just reporting percentages. One suggestion for the variation could be that causes of both stroke mortality and fatality have to do with many parallel factors. These factors include age, stroke severity, and existence of other co-morbidities, especially cardiac diseases (Appelros *et al.*, 2003). Other factors may include subtypes, neurological deficit at baseline, smoking, use of mechanical ventilation, and total stay at hospital (Christensen *et al.,* 2009). Ovbiagele (2010) also includes availability of health care facilities and being female. It seems that these factors and other secondary personal attributes contribute to the variability of stroke mortality and causes of fatality in different communities.

### 2.3.6 Stroke risk factors

In this section the research will present the literature about stroke risk factors in three parts namely, general stroke risk factors, cardiovascular risk factors in Palestine, and literature about specific risk factors association with strokes.

#### *2.3.6.1 General stroke risk factors*

Ciancio (2002) defines risk factors as the variables that increase the likelihood of an event or a disease occurring. General epidemiological studies do not concentrate on the prevalence of one risk factor; they studied mainly the most prevalent factors in terms of percentages of patients suffering from different diseases before having a stroke. In many studies, the following diseases were established as risk factors for strokes: large artery atherosclerosis, hypertension, diabetes mellitus, hyperlipidaemia, hypercholesterolemia, obesity, atrial fibrillation, high diastolic blood pressure and ischemic heart disease (Benamer & Grosset, 2009; Deleu *et al*., 2011; Han *et al*., 2009; Kotsaftis *et al*., 2010; Sokrab *et al*., 2002).

Arboix *et al*. (2008) studied the trends in risk factors over 19 years in Barcelona, Spain, and found that the risk profile changed through this period. They found an increase in average age, hypertension, atrial fibrillation, ischemic heart disease and diabetes, while there was a decrease in smoking. Członkowska and Kobayashi (2003) ranked the risk factors of strokes in Poland from most to least important as; hypertension, diabetes, dyslipidaemia, atrial fibrillation, coronary heart disease, previous stroke, smoking, alcohol abuse, obesity and lack of physical activity.

Li *et al*. (2008) studied the clinical characteristics and outcomes of 1913 consecutive hospitalised patients with first-ever strokes in China. They found that after adjusting for age and gender, atrial fibrillation was the only predictive factor of anterior circulation infarction, hypertension was an independent predictive factor for lacunar strokes, and alcohol intake was an independent risk factor of intra-cerebral haemorrhage.



It would seem that stroke risk factors are different in the percentage of distribution between young and elderly stroke patients. Many researchers have studied risk factors for elderly stroke patients. Béjot *et al*. (2010) studied ischemic stroke risks and subtypes and the outcomes in elderly patients in France (over 80 years old), and found that they were characterised by a lower prevalence of diabetes, hypercholesterolemia and alcohol intake. However, hypertension, arterial fibrillation, history of myocardial infarction (MI), and use of anticoagulants increased. Similarly, Lee, Huang, Weng, Jiann-Der Lee, and Tsong-Hai Lee (2007) found that patients over 80 years more often had atrial fibrillation, and fewer occurrences of diabetes, hypertension and better smoking habits. Many researchers have highlighted stroke risk factors in young patients, including De Silva *et al*. (2009), who investigated the risk factors of stroke in young adults in Sri Lanka, aged between 15-45 years. They identified hypertension (21%); family history of stroke (18%); transient ischemic attack (16%); hyperlipidaemia, (8.0%) and diabetes (5%) as the main factors. Spengos and Vemmos (2010) used the Athens Young Stroke Registry to investigate stroke risk factors in young adults aged between 15 and 45 years. They found that smoking and dyslipidaemia were prevalent in 59.3, and 41.1% respectively, while small vessel disease constituted 17.4% of cases. Wasay *et al*. (2010) also studied ischemic strokes in young Asian women (aged from 15 - 45) concerning risks, subtypes and outcomes. Hypertension was prevalent in 29%, diabetes (14%), pregnancy (11%), valvular heart disease (10%) and cigarette smoking in 3%.

In conclusion, most of the studies found that hypertension seems to be the most prevalent risk factor in most of the cases, followed by diabetes, cardiac diseases (mainly atrial fibrillation), smoking, and dyslipidaemia. The priority risk order and variables seem to be different between very old and young stroke patients. Likewise, the presentation of those risks also differ between young and elderly patients, in patients below 40 with stroke patients >40 years old (Zeiler *et al*., 1992). There is a possibility that these differences between elderly and young may have to do with reduced physical activity, accumulation of risk profile and changes in lifestyle, such as diet and smoking habits.

#### *2.3.6.2 Literature about cardiovascular disease from Palestine*

This review identified three studies targeting stroke and its cardiovascular disease risks in general. Baune, Aljeesh and Bender (2004), in a case control study, found that there is significant association between stroke and non-compliance to use hypertensive medications, excessive salt at meals, fatty diet and high stress-levels. No association was confirmed in this study between strokes and smoking and found that regular physical activity has a preventive effect on the risk of developing a stroke. One important criticism of this study that makes it impossible to generalise as a risk factors study for strokes is that it was mainly concerned with hypertensive strokes and that it had excluded all other stroke patients that had any other physical diseases like diabetes, atherosclerosis, atrial fibrillation, asthma, pulmonary oedema, and myocardial infarction. That makes it a study of risk factors for a sub-category of stroke patients, rather than a stroke risk factors study in Palestine.

Sweileh *et al*. (2208) studied the prevalence of risks in 186 stroke patients without comparing them to any control group and found that the most prevalent risk factors were hypertension, diabetes and renal dysfunction. One of the problems with this study was that it included both recurrent strokes and first-ever strokes, which is different in terms of vulnerability of stroke risks. The other issue was that this study did not take any control over comparing stroke patients' prevalence of risks with non-stroke patients. As might be sees, the prevalence of certain stroke risks in the sample may be less than its prevalence in the non-stroke community within a similar age category.

Husseini *et al*. (2009) reported on the risk factors of cardiovascular disease and found that the most prevalent risk factors were hypertension, diabetes and smoking. The problem with this study was that the researcher took the risks from literature, and compared them to survey results from a study done by the Central Bureau of Statistics. in the study did not indicate any age categorisation, so the percentages of reported prevalence will be lower than other studies that targeted the elderly population or participants over 60. This makes it hard to compare these results with other stroke-oriented studies.

### 2.3.7 Association between specific risk factors and strokes

In this sub-section, the research reviews studies that have investigated the role of each one of the most prevalent stroke risk factors; the role of each risk factor in developing a stroke.

#### *2.3.7.1 Hypertension*

Most of the literature refers to hypertension as the most significant risk factor of strokes (Table 2.5), especially concerning haemorrhagic strokes and its relation with other risk factors that could predispose a person for strokes is also well-known. Johansson (1999) presented an explanation for the mechanisms by which hypertension leads to strokes. He explained the role of hypertension in weakening the arterial walls, which makes them susceptible to ruptures and occlusions. The study also highlighted its role in causing arterial sclerosis, the changes that it makes to the peripheral arterial resistance that leads to compromise of the collateral circulation, and its main role in forming aneurysms that may rupture when they become thin or weakened. Because of this, most of the studies found that hypertension is a primary risk, described in most of the studies as an independent risk factor, or main risk factor for a stroke event. Table 2.5, presents some of the studies that illustrates the relation between hypertension and strokes.

**Table 2.5: Hypertension and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Papadopoulos and Papademetriou (2006) | Expert's review | 9 studies (USA) | Hypertension is most important contributor to stroke prevention and incidence. |
| De Vecchis *et al*. (2011) | Case control study | 46 stroke (ischemic, TIA) patients, and 60 control subjects (Italy) | Moderate to severe hypertension in very old age predicts ischemic stroke. |
| Suzuki, Izumi, Sakamoto, & Hayashi, (2011). | Retrospective cohort study | All stroke patients(1 323) who were admitted to the all 9 hospitals founded by the Akita (1991 – 1998) (Japan) | High blood pressure is the strongest risk factor for all types of stroke |
| Takahashi *et al*. (2011) | Cohort study | 7 847 stroke patients (aged > 55 years) (Japan) | Hypertension was a significant risk factor in males and females, |
| Yasui *et al*. (2010) | Longitudinal observational study | 1 690 untreated and 700 treated hypertensive patients (aged 35 years and older) (Japan) | Stroke risk increased in a linear fashion in hypertensive patients. |
| Inoue *et al*. (2007) | Longitudinal observational study | 1271 subject (aged >= 40 years) (Japan) | Systolic hypertension is associated with a high stroke risk. |
| Bener, Kamran, Elouzi, Hamad, & Heller (2006) | Prospective and retrospective cohort study | hospitalised stroke patients at Hamad hospital (1999 – 2003) (Qatar) | Significant association between hypertension and other cardiovascular diseases with the risk of stroke. |

Key: USA = United States of America



The relation hypertension has with strokes are clear in most of the studies, and targeting it in treatment has been shown to have a preventative effect on the incidence of strokes. The mechanism of hypertension leading to strokes have been highlighted earlier, but it seems that hypertension can also predispose other risk factors of strokes such as cardiac disease (congestive heart failure), atherosclerosis and decreased collateral circulation due to the hardening of the arterial walls (Johansson, 1999).

#### *2.3.7.2 Diabetes mellitus*

Studies have emphasised the positive correlation of diabetes with strokes. It is described as a multidirectional risk of stroke, in terms of secondary and primary levels. As diabetes increase the possible build-up of more low-density lipoprotein which contributes to the increased incidence of strokes (National Stroke Association [NST], 2011). One of the other mechanisms explaining this positive correlation between diabetes and strokes can be seen in the review done by Kuller (1995). The study reported that diabetes is responsible for many occlusions in the paramedical penetrating arteries (arteries that supply the paramedian zone of the basilar portion of the pons), which in turn are responsible for the small infarcts in the white matter of the brain. Due to the fact that diabetes is increasing, the possibility for other cardiovascular diseases, such as atherosclerosis, which in turn contribute to the increased risk of stroke incidence secondary to diabetes. The mechanism by which diabetes leads to atherosclerosis was well-described by Beckman, Creager and Libby (2002) who conducted a systematic review about diabetes and atherosclerosis, where the author reported that diabetes impairs endothelium dependent vasodilatation. Diabetes also decreases the endothelium-induced nitric oxide, and leads to excess liberation of fatty acids from adipose tissue. It has been previously reported that diabetes increases vessel wall permeability (Tuomilehto, Rastenytė, Jousilahti, Sarti & Vartiainen, 1996). Mayhan, Simmons and Sharpe (1991) stated that diabetes is associated with delayed response of the cerebral arteries, which could be another explanation for mechanisms by which diabetes may lead to strokes.

Many researchers highlighted the association between strokes and diabetes in many countries. A summary of some of these studies are presented in Table 2.6.



**Table 2.6: Diabetes mellitus and risk of stroke**

| **Authors** | **Design** | **Participants (Country)** | **Main Findings** |
|---|---|---|---|
| Sander, Sander & Popper (2008) | Review | (Germany) | Diabetic patients have significantly increased risk of strokes compared to non-diabetic patients. |
| Alajbegovic, Alajbegovic & Resic (2009) | Retrospective cohort study | 96 Patients with diabetes (Bosnia and Herzegovina) | Patients with type 2 diabetes mellitus had a greater risk for ischemic cardiovascular diseases when compared to type 1 diabetes patients. |
| Ottenbacher, Ostir, Peek & Markides (2004) | Prospective cohort study | 690 Mexican American (aged older than 65 years) (USA) | There is an increased hazard ratio for strokes in diabetics who are over 65 years old. |
| Ho, Paultre & Mosca (2003) | Prospective study | 27 269 Woman (aged 30 years and older) (USA) | Diabetes mellitus is one of the independent risk factors of strokes that has been associated with the 1.8 – 6 fold increase in risk of developing strokes, compared to non-diabetics. |

| | | | |
|---|---|---|---|
| Davis, Mills, Stratton, Holman & Turner (1999) | prospective study | 3 776 Patients aged 25 - 65 years) (UK) | 2.6% of the sample developed strokes at 7.9 years follow-up. |
| Tuomilehto, Rastenyte, Jousilahti, Sarti & Vartiainen (1996) | Prospective study | 8 077 men and 8 572 women (aged 30 and 59 years) (Finland) | The main risk factors of strokes were: diabetes, antihypertensive drug treatment and serum total cholesterol.<br>Diabetes mellitus was the strongest risk factor for stroke mortality. |
| Mortel, Meyer, Sims & McClintic (1990) | Cohort study | 293 participants - 75 were volunteers, and 218 were patients with stoke symptoms (USA) | Stroke symptoms and signs were more among diabetics, which may be due to the fact that diabetes aggravated other risk factors including hypertension, heart disease and hyperlipidaemia. |

From the above mentioned studies, it can be concluded that diabetes tends to be associated with more severe strokes when compared with non-diabetic patients. Moreover, diabetes is associated with strokes on more than one level (primary and secondary), where primary has to do with direct effect of diabetes on stroke occurrence, as in the mechanisms reported by Kuller et al. (1995), and on a secondary level by affecting other risks that may in turn predispose a stroke, as in the case of atherosclerosis (Beckman *et al*., 2002).



#### *2.3.7.3 Hypercholesterolemia*

Hypercholesterolemia studies have emerged from medical field research where they were investigating the effects of certain hypercholesterolemia medication on incidence of stroke and studying its association with stroke subtypes. Other researchers have highlighted the effects of a higher cholesterol level on the functional outcome and mortality of stroke patients within the first month (Pan, Lien & Chen (2010).

The mechanism by which high cholesterol blood level is associated with a high stroke risk was also explained by the National Stroke Association (NSA, 2012). They highlighted the role of elevated low density lipoprotein in building up of plaques that has the potential to block an artery, and by a secondary mechanism, where high LDL is also associated with the incidence of heart diseases that could in turn predispose a stroke

The bulk of literature, as shown in Table 2.7, supported the positive association between hypercholesterolemia and strokes.

**Table 2.7: Hypercholesterolemia and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Hankey *et al*. (2010) | Systematic review | East Asian and Western Pacific countries (Australia) | Ischemic strokes are associated with the prevalence of hypercholesterolemia. |
| Athyros, Tziomalos, Karagiannis, Wierzbicki & Mikhailidis (2010) | Review | 254 512 patients (UK) | Cholesterol levels were not associated with any more risk for haemorrhagic strokes. |
| Amarenco, Labreuche, Lavallée & Touboul (2004) | Systematic review | Greater than 90 000 patients (France) | Statin (for cholesterol ) treatment was associated with a 21% RR reduction of stroke |
| Fitchett, Goodman & Langer (2008) | Clinical studies | 4 731 patients (Canada) | Cholesterol reduction reduced the incidence of strokes by 16% in recent strokes, TIA and coronary artery disease. This would suggest that a reduction in cholesterol levels leads to a decrease in fatal strokes. |
| Nago, Ishikawa, Goto & Kayaba (2011) | Prospective cohort study | 12 334 healthy adults (aged 40 - 69 years) (Japan) | High total cholesterol levels were not associated with increased mortality rate from strokes. On the contrary, they observed that higher mortality was associated with low blood cholesterol levels |
| Varbo *et al*. (2011) | Longitudinal study | 7 579 women and 6 372 men from the Copenhagen Heart Study (Denmark) | Low density lipoprotein (LDL) levels >9.00 mmol/liter, were associated with an increased risk of ischemic strokes in men. |
| Amarenco *et al*. (2009) | Clinical trial | 4 731 Patients with recent stroke or TIA (France) | Cholesterol treatment by 80.mg of atorvastatin per day is effective in preventing strokes and other cardiovascular events. |
| Huxley, Clifton, Perkovoc Woodward & Neal (2009) | Retrospective study | Statistics and data from other studies (Australia) | Reduction of 10% in low-density lipoprotein will lead to 2 279 fewer deaths from coronary heart disease and 641 fewer deaths from ischemic strokes. |

| | | | |
|---|---|---|---|
| Tirschwell *et al*. (2004) | Case-control study | 1 242 patients with ischemic strokes, 313 with haemorrhagic strokes, and 6 455 controls (USA) | Higher total and lower density lipoprotein cholesterol levels were associated with increased risk of ischemic stroke. |
| Vauthey, De Freitas, Van Melle, Devuyst, & Bogousslavsky (2000) | Prospective study | Consecutive patients with first-ever ischemic strokes (Switzerland) | Higher total serum cholesterol was associated with lower stroke mortality. |

From most of the studies mentioned above, it can be concluded that hypercholesterolemia is a risk factor for strokes, although some of the studies did not suggest this finding. These differences may be due to differences in lifestyle related to activity type of diet of different samples and different cholesterol measurements. Additionally, the medical follow up may also differ in terms of patients receiving anti-hypercholesterolemia medication, which could have mitigated the effect of the increased serum cholesterol on the risk of stroke. The research also suggests that other stroke risk factors were not controlled in the different studies, which may have affected the consistency of the reported results in the studies that investigated the role of the hypercholesterolemia in increasing the risk of strokes.



#### *2.3.7.4 Increased serum triglyceride*

Serum triglycerides (TRG) levels and strokes have mainly been studied in terms of triglycerides therapy to prevent strokes, or regarding the strength of association between triglyceride levels and the incidence of strokes in its two sub-types. Others investigated the correlation between serum TRG levels with stroke severity, mortality and outcome.

The main studies discussing the relation between triglycerides and stroke are summarised in Table 2.8.

**Table 2.8: Increased serum triglyceride and risk of stroke**

| Authors | Design | Participants (Country) | Main findings |
|---|---|---|---|
| Labreuche, Touboul & Amarenco (2009) | Systematic review | 31 studies (France) | 11 studies reported a significant correlation with triglyceride levels and there was a positive association between triglyceride levels and strokes. |
| Bonaventure *et al*. (2010) | Prospective cohort study | 8 393 men and women (aged 65 years and older) (France) | Increased level of triglycerides was associated with an increased risk of ischemic vascular disease in that an adjusted hazard ratio showed that per 1 mmol/l there is an increase of 1.21 in risk of developing an ischemic stroke. Conversely, a low level of triglyceride (<=0.94mmo1/l) was associated with an increased risk of haemorrhagic stroke. |
| Lee, Kim, Kim & Yoon (2010) | Prospective study | 1 067 Consecutive patients with first-time acute ischemic strokes for five years (Korea) | A low serum triglyceride level is an independent predictor of mortality after an ischemic stroke. |
| Freiberg, Tybjaerg-Hansen, Jensen & Nordestgaard (2008) | Cohort study | General population (Denmark) | For every increase in the fasting triglyceride, the hazard ratio for ischemic strokes increased. |
| Pikija *et al*. (2006) | Prospective study | 121 consecutive patients with acute ischemic strokes (aged 47-93 years) (Croatia) | An increased serum triglyceride level (within 24 hours of admission) was associated with a lower infarct volume and milder clinical symptoms in acute ischemic stroke patients with higher triglyceride. This indicates an association between serum triglyceride levels and stroke severity. |
| Dziedzic, Slowik, Gryz & Szczudlik (2004) | Prospective study | 863 consecutive patients with acute ischemic strokes (Poland) | Severe stroke patients had significantly lower serum triglyceride levels compared to patients with mild/moderate strokes. |



An increased triglyceride level seems to affect both stroke incidence and severity and even stroke outcome. This contradicts results presented linking increased triglycerides levels with stroke severity. This might be due to the same reason presented in the previous section on hypercholesterolemia (different measurement, lifestyles, and diet consumed by participants in different samples).

#### *2.3.7.5 Obesity*

Stroke patients in some cases are hard to weigh on a regular weight scales as they may be flaccid or in a coma. Because of this, other measures, such as waist/hip ratio (WHR), and waist/height ratio (WHtR) are used, as they are sensitive/predictive of obesity, and at the same time, those measures are easier to use in the case of stroke patient weight assessment.

Barclay (2010) used the WHtR to investigate obesity in relation to cardiovascular risks in children. He pointed out that a cut-off point of 0.5 should be adopted as obesity definition. Lee, Huxley, Wildman and Woodward (2008) concluded in their research about indices of abdominal obesity that "statistical evidence supports the superiority of measures of centralised obesity, especially WHtR, over BMI, for detecting cardiovascular risk factors in both men and women". The same results were supported by Browning, Hsieh & Ashwell (2010) who also adopted that 0.50% should be the global cutoff point for WHtR.

The association of obesity with the risk of stroke had been highlighted by many authors as shown in table 2.9, where there was a consensus between them on this association, in cohort and case control studies about obesity and stroke risk.



**Table 2.9: Obesity and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Isozumi (2004) | Systematic review | 24 studies (Japan) | Most of the papers referred to abdominal obesity as a risk factor for ischemic stroke (but not for haemorrhagic) and obesity defined BMI was not proven to be an independent predictor of strokes unless it is accompanied with other comorbidities like hypertension, glucose intolerance and hyperlipidaemia. |
| Yatsuya, Folsom, Yamagishi, North, Brancati & Stevens (2010) | Cohort study | 13 549 black and white patients (aged 45 - 65 years) (USA) | Obesity measured by BMI, waist circumference, or WHtR is a significant risk factor for ischemic stroke regardless of race or gender. As the difference of the relative risk between the highest and the lowest quintile (according to body mass index) was 3.19 and 1.43. |

| | | | |
|---|---|---|---|
| Towfighi, Zheng & Ovbiagele (2010) | Cross-sectional study | 7 234 subjects (aged 35 - 64 years) (USA) | In women aged (35 – 54 years), Higher waist circumference was the only independent stroke risk factor, which suggests a strong relationship between risk of stroke and being overweight in this age group, as OR for each 15-cm in waist circumference increase was 1.2. |
| Bazzano *et al*. (2010) | Prospective cohort study | 154 736 patients (aged 40 years or older) (China) | The relative hazards of developing both ischemic and haemorrhagic strokes increases with high body mass index (RH= 1.43) compared to patients with normal body mass index (RH = 0.86). |
| Winter *et al*. (2008) | Case control study | 1 137 participants (Germany) | A positive association between obesity and abdominal fat mass with risk of stroke and TIA.<br>The relative risk increased with each consecutive tertile, as it was 2.78 for the second tertile, and 7.69 for the third tertile. |
| Kim, Lee, Lee, Yoon, and Park (2007) | Case-control study | 2,712 subjects (Korea) | Obese people are three times more likely to get intracranial hemorrhage than those with normal BMI. |
| Ruland, Hung, Richardson, Misra & Gorelick (2005) | Multi-centered clinical trial | 1 711 African American patients with a previous ischemic stroke (USA) | Seventy six per cent of the subjects were overweight, which supported the link between the risk of stroke and increased weight in stroke survivors. |
| Suk *et al*. (2003) | Case control study | 576 subjects of first ischemic stroke, 1 142 controls (USA) | A greater risk of stroke was associated with increased WHR in men and women, more than BMI. |
| Kurth, Gaziano, Skerrett & Manson (2003) | Prospective cohort study | 21 414 male physicians (aged 40 - 84 years) (USA) | There is a significant association between excess weight and the relative risk of ischemic, haemorrhagic and total stroke, with relative risk of 1.95, 2.25, and 2 respectively. |



From the above studies, it seems obvious that there is evidence that obesity is associated with increased stroke risk. The mechanism in how obesity may lead to stroke had been discussed by many authors. Kurth *et al.* (2003) pointed out to the increase in prothrombotic factors observed among overweight and obese individuals, which may contribute to their increased risk for ischemic events, they also highlighted the role of increase in prothrombotic factors observed among overweight and obese individuals and its contribution to an increased risk for ischemic cardiovascular events. Kahn, Hull, and Utzschneider (2006) also highlighted the mechanism in which obesity and increased BMI could lead to a major contribution of stroke incidence through its relation with the development of type 2 diabetes, where in obese individuals, there is a tendency for adipose tissue to release some material that could predispose type 2 diabetes, like non-esterified fatty acids, hormones, glycerol, pro-inflammatory cytokines and other factors.

#### *2.3.7.6 Physical activity*

Studies about physical activity in relation to incidences of strokes support the fact that higher levels of physical activity are associated with a lower risk of having a stroke, and vice versa. Physical activity is also linked to many other risks, such as hypertension, diabetes and obesity, in addition to cardiac problems, and vascular pathologies that share many similar risk factors with strokes (Marwick *et al*., 2009; Hamer, 2006; Goran, Reynolds & Lindquist, 1999).

Marwick *et al*. (2009) discussed the mechanism in which physical exercises affect diabetes, where physical exercises were shown to lead to better glucose sensitivity and better glucose transporters movement through muscular contractions in physical activity. On the other hand, physical activity also reduces hypertension (one of the main stroke risk factors). The mechanism in which physical activity reduces blood pressure had been well described by Hamer (2006) where he concluded that physical activity reduces vascular resistance, that the heart should overcome in order to keep the flow in the circulatory system, in addition to the benefits of vasodilatation that takes place with physical activity that is resultant from the relaxation of the vascular smooth muscles, which ultimately leads to a decrease in the blood pressure. The role of physical activity in reducing obesity is through allowing better energy consumption, which means that there will be a better fuel utilisation that will decrease the possibility of storing more fat, which will ultimately lead to fewer obesity occurrences (Goran *et al.,* 1999).



Table 2.10 summarises the studies that targeted the relation between physical activity and the risk of stroke incidences.

**Table 2.10: Physical activity and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Diep, Kwagyan, Kurantsin-Mills, Weir & Jayam-Trouth (2010) | Meta-analysis | 13 articles (USA) | Risk of stroke is reduced with increased physical activity. For females, a higher level of physical activity is required to achieve a reduction in stroke risk, when compared to males. |
| Lee , Folsom & Blair (2003) | Meta-analysis | 18 cohort and 5 case control studies (USA) | Active individuals had a 25% lower risk of stroke incidence or mortality (RR=0.73) compared to people with less active lifestyles. |
| Mostofsky *et al.* (2011) | Multicenter case-crossover study | 390 ischemic stroke patients (USA) | Active patients had a lower risk of developing strokes (RR= 2.3) than the other sedentary lifestyle stroke patients (RR=6.8). |
| Goldstein (2010) | Prospective cohort | 39 876 healthy woman over the age of 45 (USA) | When the level of leisure-time physical activity increased the risk of strokes decreased for women. |
| Sattelmair, Kurth, Buring, and Lee (2010) | Prospective cohort study | 39 315 women (aged higer or equal to 45 years) (USA) | Inverse relationship between physical activity and the risk of developing stroke. As the relative risk (RR) was decreasing with increase of the amount of kcal burned per week. |
| Blair & Sierverdes (2010) | Thesis | NA (USA) | There is a significant inverse relationship between incidences of strokes and cardio respiratory fitness. |
| Liang *et al.*(2009) | Case control study | 838 participants (China) | Leisure time physical activity and the risk of ischemic strokes are inversely related. |
| Willey *et al*. (2009) | prospective cohort study | 3 298 older stroke-free individuals (USA) | Physical activity with moderate to heavy intensity was associated with a lower risk (hazard ratio = 0.65) of ischemic strokes compared to participants that reported no physical activity (HR = 1.16). |



All these studies confirmed that physical activity reduces the incidence of stroke, as physical activity is also related to well-known risks such as diabetes, heart diseases, and obesity. Their mechanisms of causing strokes were explained earlier.

#### *2.3.7.7 Smoking*

In the studies investigating the effects of smoking on incidences of strokes, there were unanimous agreement of the association between smoking and stroke occurrence. Most of the studies stressed the intensity of smoking as a significant factor that contributes to this relationship. From the studies discussed in Table 2.11 it seems clear that this relationship is aggravated by the presence of other risk factors in addition to smoking.

**Table 2.11: Smoking and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Oono, Mackay & Pell (2011) | Meta-analysis | 20 studies (UK) | Evidence of strong association (suggestive of causal relationship) between second hand smoking and stroke occurrence. |
| Hata *et al*. (2011) | Cohort study | 2 421 men and women (aged 40 - 79 years) without a history of cardiovascular disease (Japan) | Smoking raised the risk of ischemic strokes, subarachnoid haemorrhage and CHD occurrence, and that this effect of smoking was increased by the presence of hypercholesterolemia. |
| Kelly *et al*. (2008) | Prospective cohort study | 169 871 participants (aged 40 years and older) (China) | There is a positive relation between the intensity of smoking and the risk of stroke incidence and mortality, as relative risk was 1.28 for stroke incidence, and 1.3 for mortality, compared to non–smokers. The relative risk among smokers increased linearly with the number of cigarettes being smoked per day. |
| Mannami *et al*. (2004) | Prospective cohort study | 41282 men and women (aged 40 - 59 years) (Japan) | Smoking raised the risk of total stroke, subarachnoid haemorrhage for both men and women, and increased ischemic stroke incidence. The relative risk of smokers compared to non-smokers was 1.28. |

| | | | |
|---|---|---|---|
| Ueshima *et al.* (2004) | Cohort study | 9 638 men and women (aged 30 years and older) with no history of cardiovascular disease (Japan) | Smoking in patients with moderate serum total cholesterol levels, was a strong risk factor for strokes, especially cerebral infarction, regardless of gender, and for cardiovascular and ischemic heart disease for men. |
| Gill *et al.* (1989) | Case control Study | 621 patients with strokes and 573 control subjects (UK) | An increase in relative risk was found to be positively related to the daily cigarette intake for all types of strokes combined. |
| Wolf, D'Agostino, Kannel, Bonita & Belanger (1988) | Cohort study | 4 255 men and women (aged 36 - 68 years) (USA) | The relative risk among heavy smokers (40 cigarettes per day) was twice the relative risk of light smokers (<10 cigarettes per day). |

From the preceding research, it can be concluded that most of the studies concentrated on the daily dose of smoking rather than the fact of smoking itself, and that smoking of the spouse is associated with an increased risk of stroke. At the same time smoking was associated with both types of strokes, and stroke mortality. Smoking is related to structural damage of the arteries, and atherosclerosis of the carotid artery (Kurth *et al.*, 2003). Donnan *et al*. (1989) also highlighted that smoking decreases the cerebral flow, suggesting increased risk of stroke.



#### *2.3.7.8 Stress*

Stress can be considered as an independent risk factor for strokes. The relation between stress, hypertension and other cardiovascular diseases is well-known. Rozanski, Blumenthal and Kaplan (1999) discussed the mechanism in which psychological stress may contribute to strokes through its association with unhealthy behaviour such as smoking and an unhealthy diet, together with its effect on body function, as it tends to be associated with acceleration of atherosclerosis, activation of platelets function, and increasing of blood viscosity, together with narrowing of the coronary arteries. This all may be associated with stroke incidence. Some of the studies that investigated the relation between the risk of stroke and stress are presented in Table 2.12.

**Table 2.12: Stress and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Stuller, Jarrett & Devries (2011) | Review | NA (USA) | Stress is one of the triggers of ischemic strokes and its presence together with elevations in glucocorticoids negatively affects survival after ischemic attack |
| Tsutsumi, Kayaba, Kario & Ishikawa (2009) | Community-based prospective study | 6 533 workers (Japan) | Workers who had more stress at work had double the risk to develop a stroke compared to those with less occupational stress. |
| Truelsen, Nielsen, Boysen & Grønbaek (2003) | Prospective observational study | 12 547 participants (aged 20 - 98 years) (Denmark) | Those with high reported stress intensity had double the chance to develop a stroke and that self-reported stress was positively associated with the risk of stroke. |
| Everson *et al*. (2001) | population-based, longitudinal study | 2 303 middle-aged men (Finland) | Stress has a direct significant relation to hypertension, and is mentioned as a possible etiologic factor of strokes. |
| Harmsen, Rosengren, Tsipogianni & Wilhelmsen (1990) | Cohort study | 7 495 men (aged 47-55 years) (Sweden) | Psychological stress was the third most important independent variable to predict a haemorrhagic stroke, after hypertension and smoking. (OR 2.1, CI 1.3-3.2) |



Based on the evidence presented above, stress may contribute to the incidence of strokes in direct and indirect ways. For example, it has a strong relationship with other risks that would predispose a stroke, especially hypertension (Everson *et al*., 2001) and cardiac disease (Rozanski *et al.,* 1999).

#### *2.3.7.9 Atrial fibrillation*

Cardiac and stroke risks have been shown to have much in common and cardiac disease itself is in many cases a risk for strokes independent of other risks. Atrial fibrillation (AF) is a common cardiac arrhythmia and one of the most serious cardiac risks that predisposes for strokes, as there is a tendency of thrombus formation in the left atrium that can migrate to the brain and block a cerebral artery (Thrombosis Adviser, 2011). Hart, Palacio and Pearce (2002), identified the cardiogenic embolism as the main mechanism in which AF could lead to stroke. Porebska and Nowacki (2005) pointed out that atrial fibrillation is a possible mechanism in causing a stroke. It may be that fibrillation affects haemodynamic activity of the heart, reducing cardiac output and possibly decreasing cerebral blood flow. It is also possible that atrial fibrillation disturbs the auto regulation mechanism of cerebral circulation in patients suffering from an acute stroke.

Studies that have discussed the association between strokes and atrial fibrillation are presented in Table 2.13.

**Table 2.13: Atrial fibrillation and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Vega (2008) | Best evidence review | | Atrial fibrillation is the most common cause of cardio embolic stroke |
| Iwahana *et al.* (2011) | Cohort study | 10 929 participants (Japan) | Atrial fibrillation is the major risk factor for strokes, especially in women. |
| Chien *et al*. (2010) | community-based prospective cohort study | 3 560 men and women (China) | Highlighted atrial fibrillation as a significant risk factor of strokes, in a Chinese community, after adjusting for age, BMI, and other confounding factors. |
| Crandall *et al.* (2009) | Case control study | 3 288 participant (343 atrial fibrillation patients, 2 945 controls) (USA) | Atrial fibrillation is a variable that significantly increases the risk of stroke and mortality. |
| Porebska & Nowacki (2005) | NA/English abstract/Polish language | NA (Poland) | Atrial fibrillation was associated with a fivefold increased risk of ischemic stroke. |
| Penado, Cano, Acha, Hernández & Riancho (2003) | Retrospective cohort study | 915 patients (aged 50 - 94 years) with an ischemic stroke (Spain) | Atrial fibrillation was an independent risk factor for stroke recurrence over a wide age range. |

| | | | |
|---|---|---|---|
| Yuan *et al*. (1998) | Retrospective cohort study | 4 284 subjects (aged > 64 years) (USA) | After adjustment for age, ethnic group, gender and comorbid conditions, atrial fibrillation remained a significant risk factor for both non-embolic and embolic strokes and for mortality. . |
| Wolf, Abbott & Kannel (1991) | Cohort study | 5 070 men and women with atrial fibrillation and without cardiovascular disease (USA) | There was a more than five-fold risk of a stroke in subjects when atrial fibrillation is present in persons with coronary heart disease or cardiac failure. Atrial fibrillation doubled the stroke risk in men and trebled the risk in women. |

Most of the studies conducted on the relation between atrial fibrillation and stroke risk confirmed this positive relationship and that it contributes to stroke mortality and recurrence, especially when combined with other risks.

#### *2.3.7.10 Atherosclerosis*

According to the American Heart Association (AHA, 2008a) website, atherosclerosis is defined as "the process by which deposits of fatty substances, cholesterol, cellular waste products, calcium and other substances build up in the inner lining of an artery". As shown in Table 2.14, most of the studies support the positive relationship between atherosclerosis and the risk of s stroke, as plaques can easily block an atherosclerotic artery.

**Table 2.14:** ***Atherosclerosis and risk of stroke***

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Ohira *et al.* (2011) | Cohort study | 13 560 patients (aged 45 - 64 years) followed from 1987 to 1989 (USA) | There is increased risk for all stroke subtypes with carotid atherosclerosis , when comparing highest quintile of patients with high intima-media thickness of ≧ 0.85 mm, to lowest quintile of patients with intima-media thickness of ≦ 0.61 mm. |
| Lee *et al*. (2011) | Cohort study | 1 367 patients who underwent coronary artery bypass grafting (CABG) (South Korea) | Cerebral atherosclerosis was associated with the occurrence of a post-CABG stroke. |
| Meves *et al.* (2010) | Prospective, non-interventional cohort study | 6 880 patients (aged >=65 years) followed-up for 5 years (Germany) | Risk of stroke doubled with those who suffered peripheral arterial disease and tripled in patients who suffered fatal strokes. |
| Cheng-Ching *et al.* (2010) | Cohort study | 10 367 patients who have had open heart surgery (USA) | Intracranial atherosclerosis a mechanism for stroke after open-heart surgery. |



In summary, it seems that the bulk of research supports the link between atherosclerosis and the incidence of strokes and the association of atherosclerosis with hypertension, which was shown to be a significant risk of strokes in the previous section (2.3.5.1).

#### *2.3.7.11 History of previous transient ischemic attack (TIA)*

Most of the studies about TIA concentrated on the percentage of patients developing a stroke after an incident of TIA. These studies, presented in table 2.15, have reported different percentages of developing a stroke after various time-periods of TIA. Furthermore, some researchers studied the risk of TIA with the presence of other risks. Table 2.15 highlights findings of some of the authors who investigated the relation between the history of TIA and the risk of a stroke.

**Table 2.15: History of previous TIA and risk of stroke**

| Authors | Design | Participants (Country) | Main findings |
|---|---|---|---|
| Wu *et al.* (2007) | Systematic review and meta-analysis | 11 studies (Canada) | The early risk of a stroke was 3.5%, two days after TIA, 8% at 30 days post TIA, and 9.2 % at 90 days after TIA. |
| Eliasziw, Kennedy, Hill, Buchan & Barnett (2004) | Systematic review | 11 studies (Canada) | Patients who had a TIA related to internal carotid artery disease had a high risk of stroke in the first few days after the TIA event. |
| Bonifati *et al.* (2011) | Cohort study | 121 342 participant patients with TIA (Italy) | Around 6% of 502 TIA patients had developed CVA, in a mean follow up period of 11.4 months. |
| Hart (2006) | COMMENTARY | | Stroke risk after TIA is 5% within 48 hours and 8% within 7 days. |
| Gladstone, Kapral, Fang, Laupacis & Tu (2004) | Prospective cohort study | 789 participants. 371 Patients with TIA, 418 patients with an ischemic stroke (Canada) | The 30-day stroke risk was 5% overall and 8% among those with a first-ever TIA.<br>Half of the cases of stroke occurred within the first 2 days after TIA. |



It seems that most of the studies supported TIA as a risk factor of strokes within the first few days after a stroke.

#### *2.3.7.12 Family history of strokes*

The family history of strokes has been mainly studied through the medical history taken after a stroke has occurred. Table 2.16 presents and summarises some of the studies related to the association of the family history of strokes, with the risk of stroke occurrence.

**Table 2.16: Family history of stroke and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Flossmann, Schulz & Rothwell (2004) | Systematic review | (UK) | Family history is a significant risk factor of strokes. |
| Knottnerus *et al.* (2011) | Case control study | 157 patients with a first-time lacunar stroke (Netherlands) | Fifty-two per cent of patients reported a positive relation with family histories of strokes in at least one of their first-degree relatives. |
| Mvundura, McGruder, Khoury, Valdez & Yoon (2009) | Retrospective study | 4 819 participants (USA) | Risk of stroke and high blood pressure is significantly associated with a family history of strokes. |
| Choi Lee, Kang, Kang & Bae (2009) | Case control study | 400 Patients with acute stroke, 400 control subjects with non-vascular disease (Korea) | Sibling history of stroke was more positively associated stroke risk than parent history of stroke. |
| Hsu *et al*. (2009) | Case control study | 223 patients with acute strokes, 461 control subjects (Taiwan) | There is a familial contribution to strokes in the case of both cerebral infarction and cerebral haemorrhage, but the study failed to show any relation with strokes attributed to cardio embolisms. |
| Meschia *et a*l. (2006) | Prospective cohort study | 505 patients with first-time symptomatic ischemic strokes (USA) | Sibling history of stroke increased the likelihood of a more severe stroke, independent of age, sex and other potential confounding factors. |
| Lisabeth, Smith, Brown, Uchino & Morgenstern (2005) | Prospective study | 404 Patients with completed ischemic strokes (aged 45 years and older) (USA) | Forty percent reported family history of stroke in at least one first degree relative. Family history of stroke was related to ischemic stroke subtype and with poorer outcome and was not significantly related to the initial severity of the stroke or to the stroke mortality. |
| Kim *et al.* (2004) | Case control study | 537 participants Women aged (18 - 44 years) 109 subjects (46 ischemic, 63 haemorrhagic), 428 control subjects (USA) | Positive family history of strokes is a risk factor for both haemorrhagic and ischemic strokes among young females. |

| | | | |
|---|---|---|---|
| Kubota *et al*. (1997) | Case control study | 502 first-ever stroke patients (aged 20-70 years), 502 control subjects (Japan) | Family history of subarachnoid haemorrhage and intra-cerebral haematoma were positively associated with each of the subtypes of strokes, suggesting that genetic factors may play a minor role in the development of subarachnoid haemorrhage. |

In summary, family history of strokes were found to be positively related to incidences of strokes in the majority of the studies conducted in this field, suggesting that genetic factors (in addition to socio-demographic and lifestyle factors) may play a major part in the pathogenesis of strokes.

#### ***2.3.7.13 Alcohol consumption***

Excessive alcohol consumption is not common in Palestine because of the social and religious pressures against its consumption, and those who do drink in Palestine, are mainly drinking in a mild intensity. The mechanism in which alcohol may lead to an ischemic stroke was described by Gorelick (1989) who pointed out that alcohol consumption enhances platelet function, activates clotting cascade, and causes contraction of cerebral vascular smooth muscles, which in turn reduces cerebral flow.

Studies conducted were mainly either cohort, or control studies. Table 2.17 highlights their findings and conclusions

**Table 2.17: Alcohol consumption and risk of stroke**

| Authors | Design | Participants (Country) | Main Findings |
|---|---|---|---|
| Daniel & Bereczki, (2004) | Systematic review | 14 case control and cohort studies (Hungary) | Consensus reached that heavy drinking is associated with haemorrhagic strokes. |
| Bazzano *et al*. (2007) | Prospective cohort | 64 338 men (aged 40 and older) who were free of a stroke at baseline (China) | Heavy alcohol drinking among Chinese men may increase the risk of strokes. |
| Mukamal *et al*. (2005) | Prospective cohort | 38 156 men without cardiovascular disease or cancer. Follow-up period of 14 years (USA) | Light to moderate alcohol consumption did not show association with stroke incidence, but heavier intake was associated with higher risk of ischemic strokes. |
| Iso *et al*. (2004) | Case control study | 19 544 Men (aged 40 - 59 years) 11 years of follow-up (Japan) | Heavy drinkers had an excess of 68% risk of strokes compared to light and moderate drinkers. |
| Gill *et al.* (1991) | Case control study | 621 patients with strokes, 573 control subjects (UK) | Heavy consumption of alcohol is associated with both haemorrhagic and non-haemorrhagic strokes. |



From these studies, it seems that alcohol consumption association to stroke, and stroke subtypes, depends on the dose. In particular, it seems that heavy consumption of alcohol contributes to the incidence of haemorrhagic strokes.

#### *2.3.7.14 Ethnicity and risk of stroke*

Researchers investigated ethnicity as a stroke risk factor. In many studies (Table 2.18), ethnicity was pointed out to be related to risk behaviour or to its role in predisposition to some other risk factors of strokes.

**Table 2.18:** ***Ethnicity and risk of stroke***

| Authors | Design | Participants (Country) | Main findings |
|---|---|---|---|
| White *et al*. (2005) | Prospective study | 714 stroke patients (USA) | Incidence of ischemic stroke per 100 000 was 88 in whites, 149 in hispanics, and 191 in blacks. |
| Bravata *et al*. (2005) | Cross-sectional study | 11 163 stroke patients (USA) | Difference in stroke risk could be attributed to income differences. |
| Sturgeon *et al.* (2007) | Cohort study | 15 792 men and women (USA) | Risk of stroke was more associated with African-American ethnicity, older age, and hypertension. |
| Sacco, Kargman, Gu & Zamanillo (1995) | Prospective cohort study | 438 stroke patients with different ethnicities (USA) | Non-white people had an OR of 0.8 for atherosclerosis, and 7.8 for intracranial atherosclerosis. They also have more diabetes and hypercholesterolemia compared to white people |

From the studies above, we can see that Afro-Americans are associated with higher risk to develop a stroke than whites. This difference in stroke risk may be associated with differences in lifestyle.



### *2.3.7.15 Non-compliance and risk of stroke*

The studies on non-compliance mainly concentrated on the effect of non-compliance of hypertensive, and anti-coagulant medication and their association with stroke risk; cohort and case control studies. Table 2.19 highlights the non-compliance as a significant stroke risk that should be considered in preventative plans.

**Table 2.19: Medication non-compliance and risk of stroke**

| Authors | Design | Participants (Country) | Main findings |
|---|---|---|---|
| Baune, Aljeesh, & Bender (2005) | Case control study | 112 patients (Palestine) | Compliance with therapeutic and non-therapeutic measures protective regimens reduces incidence and prevalence of stroke in hypertensive patients. |
| Maulaz, Bezerra, Michel, & Bogousslavsky, (2005). | Case control study | 309 participants (Switzerland) | Aspirin cessation yielded a 3.4 odd ratio to develop stroke, compared to patients committed to their aspirin intake |
| Klungel *et al*. (2000) | Case control study | 460 cases and 2 966 control subjects (USA) | The risk ratio for uncontrolled hypertension is 1.5 for ischemic and 3 for haemorrhagic strokes. A good proportion of strokes could be prevented by control of hypertension in hypertensive patients. |
| Monane *et al.* (1996) | Retrospective cohort study | 4 068 elderly outpatients (USA) | Non-compliance of hypertensive medication leads to sub-optimal results in prevention of cardiovascular complications and strokes. |
| Friday (1999). | | NA (USA) | Compliance of hypertensive medications by African-American stroke patients has a significant effect on the rate of recurrent strokes. |



From the studies presented in Section 3, it can be concluded that hypertension, diabetes and cardiac diseases seem to be the strongest stroke risk factors reported by researchers. Conflicting conclusions have been reported regarding the role of hypercholesterolemia (HDL) and hyperlipidaemia in the incidence of strokes. In addition, TIA, family history of strokes, and physical inactivity were associated with an increased risk of stroke. Smoking and alcohol consumption seem to be closely associated with strokes, rather than just a positive history.

## 2.4 STROKE OUTCOME (WITHIN THE FRAMEWORK OF ICF)

In this section, the researcher highlights the consequences of strokes on stroke patients at baseline (admission), without any reference to recovery or factors affecting or predicting it, in terms of body structure and motor impairment, functional limitations and participation restrictions. The impact of a stroke can be conceptualised using the International Classification of Functioning Disability and Health (ICF) (Miller *et al*., 2010).

Geyh *et al.* (2004) discussed the literature and expert opinion on the application of the sets of ICF, the short and the long versions, to stroke patients. They identified the aspects that ICF, included as body structures, body functions and environmental elements and came to a consensus on the aspects of strokes that could fall under the umbrella of stroke outcome (impact). They also stated that stroke patients are really affected on the body structural level of the ICF in a few categories, such as the brain, the cardiovascular system, and complications that may occur after that in the muscles and other body joints. However, the main manifestation of strokes on the ICF levels is the restriction of functional activities, such as in mobility, communication, learning, grooming, toileting, bathing, activities of daily living (ADL), walking, transfer and self-care, as well as participation level (work, leisure, and life role). Since strokes target a very sensitive body structure, the brain which controls all of the above activities, it is expected that all body functions and other body structures, which fall under the ICF classification, may affected.

### 2.4.1 Impairments post-stroke



Strokes impact on the individual body and body structure in various ways. As strokes cause varying degrees of problems in body structure and function, each is noted as impairment (Salter, Foley, Jutai, & Teasell, 2007). The most common impairments following a stroke include impaired muscle tone, impaired coordination, disturbed balance, changes in sensation, bladder control, cognition, and communication (Lawrence *et al*., 2001). Geyh *et al*. (2004) provided examples of body functions that are impaired after a stroke. These include consciousness, orientation, mental functions of language, attention and memory function. Miller *at al*. (2010) suggests that stroke-related structural impairments result in psychological and physiological malfunctions, as a result of direct brain structure impairment or secondary to stroke consequences such as contractures.

In the Copenhagen Stroke Study, Jorgensen *et al.* (2000) reported that upper extremity paresis on admission was prevalent in 69% of patients, severe in 46% of cases and mild or moderate in 54% of cases.

Kelly-Hayes *et al*. (1998) reported to the American Heart Association (AHA) about classification of stroke outcomes. They highlighted the following impairments that should be assessed in assessment of stroke impairment: motor impairment in the arm, leg and face, speech and swallowing problems, muscle strength and tone, reflexes, balance, gait, coordination and apraxia, and deep and superficial sensation. In addition, the following impairment domains were mentioned: cognition problems, depression, language impairments such as aphasia, dysphasia, visual problems, fatigue, decreased consciousness, and other impairments.

In this thesis, the National Institute of Health Stroke Scale (NIHSS scale) was used to measure severity and neurological impairment, which will be described later in more details. It is a score that measures stroke severity on a scale between 0 and 42, where the more severe patients score higher. Many researchers have used the NIHSS scale for this purpose and the reasons for using the scale in this study are explained in a later section (3.4.1.2). Shenhar *et al.* (2008) assessed the neurological impairment in 196 acute stroke patients with a mean age of 68.34 and reported that their mean NIHSS at admission (within 24 hours of the stroke) was 4.185 (± 4.1). Uchino, Billheimer and Cramer (2001) reviewed 90 clinical trials in a review called baseline characteristics in stroke trials. The authors reported that there were 22 studies that reported a baseline NIHSS of 5 – 19 and a median NIHSS at baseline of 12. Kameshwar *et al*. (2011) conducted a pilot clinical stroke trial and the researchers reported the baseline stroke outcome as NIHSS mean of 11.38 at baseline.

The Rivermead Motor Assessment is another tool for reporting motor impairment in stroke patients (also further explained in section 3.4.1.2). Rivermead Motor Assessment (RMA) is a scale that ranges between 0 - 38, where motor functions in upper and lower extremities and the trunk are assessed and observed, and given either score of zero (not able) or one (able). Soyuer and Soyuer (2005) studied the impairment and disability in stroke patients and their relation to age of subject and lesion in the brain. The authors reported a mean total Rivermead (RMA) at baseline as 13.75 (±1.22), gross motor part (G-RAMA) as 4.29 (± 0.41), Leg and trunk part (RMA-L) as 4.34(±0.38) and arm part (RMA-A) as 5.01(± 0.47).

### 2.4.2 Activity limitations post-stroke

The combination of the above mentioned impairments may lead to a decrease and sometimes loss of the patient's ability to perform activities required in daily living. An activity can be defined as the execution of a task or action by an individual (WHO, 2001). Miller *et al*. (2010) described stroke impact on functional activity as the loss of the patient's ability to perform activities of daily living (ADL). Geyh *et al*. (2004) pointed out that a stroke may affect many functional activities of a patient such as walking, dressing, eating, speaking, toileting, and communication. Kelly-Hayes *et al*. (1998) reported on the American Heart Association's (AHA) classification of stroke outcome, and highlighted the following elements as functional activities that might be affected in stroke patients and that should be taken into consideration in the functional impact of a stroke: mobility, transfer, urinary and faecal incontinence, dressing, eating, bathing, grooming and toileting. They also highlighted the importance of recording and assessing "the instrumental activities of daily living that extend functional activities to beyond the basic functions" (Kelly-Hayes *et al*., 1998: 1277) and this would include using the telephone, shopping, financing, using public transport, maintenance of household needs, which are all items that underline broader outdoor independence.

Medin, Windahl, von Arbin, Tham, and Wredling (2011) studied the eating difficulties of stroke patients in Sweden. They found that 81.7% of stroke subjects reported one or more eating difficulty. The commonest eating problems were managing food on the plate while eating (66·3%), food consumption (54·8%) and sitting position as a preparation for eating, (45·2%). Inability to dress independently was also one of the functional limitations after a stroke. Swann (2011) studied dressing after a stroke, and concluded that physical motor loss and loss of cognitive and perceptual abilities may be responsible for the loss of independent dressing. Welmer, Holmqvist, and Sommerfeld (2008) highlighted the importance of fine motor control of the hand in performance of functional activities such as grasping, eating and dressing. They studied recovery of fine hand movements after a stroke and found that 70% had problems with fine motor control of the hand at the first week after a stroke. In the Copenhagen Stroke Study, urinary and faecal dysfunction were reported by Jorgensen *et al*. (2000) in 50% of the patients at baseline assessment - 36% had full urinary incontinence, and 11% had partial urinary incontinence. Putman *et al*. (2007b) reported that urinary incontinence was prevalent in different percentages in four European centres where incontinence was reported in 18% of stroke patients in Belgium, 30% in the UK, 14% in Switzerland and in 17 % in Germany.

Pan, Lien, and Chen (2010) reported a mean baseline Barthel Index (functional measure 0-100, see 2.5.2 for more details) at baseline as 36 (4 ± 28.5). Sinha *et al*. (2009) used the Barthel Index to report on functional outcomes of 22 stroke patients. They reported a mean Barthel Index at admission as 40.00 (± 30.11).

Another functional outcome used by researchers is the Nottingham Extended Activities of Daily Living (a functional scale composed of 22 functional activities scored between 0-3). Walker, Gladman, Lincoln, Siemonsma, and Whiteley (1999), in a randomized control study, reported baseline extended activities of daily living median scores (N=94) and control (N= 91) groups as10 (4–15) and 12 (3–16) respectively.

### 2.4.3 Participation restrictions post stroke

Despite increasing awareness and a significant increase in participation assessment, relatively few studies include assessment at this level. According to Salter *et al.* (2007), participation is defined by involvement in a life situation. A stroke can lead to social isolation and prevents the individual's participation in many domains like public occasions, regular sport, work, leisure, and outdoor pursuits. Miller *et al.* (2010) describes the stroke impact on participation as a problem that prevents the patient from regaining or starting a societal life, such as going back to work.

Shenhar *et al.* (2008) assessed 196 acute stroke patients' mean age (68.34) and reported that their mean MRS at admission was 1.95 (± 1.6). Kelly-Hayes *et al.* (1998) highlighted the AHA classification of stroke outcome, and reported on some of the items that fit into the participation of stroke patients describing them as religious responsibilities, employment, leisure time and recreational activities.



### 2.4.4 Summary of stroke outcome

In conclusion, it appears that strokes affect the three domains of ICF and the various impairments caused by a stroke dramatically affect functional ability that may lead to participation restriction. Most of the studies identified muscle tone, paralysis, aphasia, dysarthria, weakness, imbalance, loss of coordination, cognitive dysfunction, memory loss, and sensory disturbance as impairments associated with a stroke. The NIHSS and Rivermead Motor Assessment are used in the assessment and evaluation of stroke-related impairment (together with many other outcomes).

The impact of a stroke on functional activities was highlighted, in different domains, such as mobility, transfer, urinary and faecal incontinence, dressing, eating, bathing, grooming, and toileting. Studies also highlighted the importance of recording and assessing instrumental activities of daily living that extended functional activities to beyond the basic functions at home. Functional activities, such as using the telephone, shopping, financing, using public transport and maintenance of household needs are all items that illustrate broader independence.

The participation level at baseline and different follow up assessment points was highlighted in terms of mean and median modified Rankin Scale scores, social activities, leisure activities, and employment. The ICf was therefore viewed as an appropriate framework to investigate outcomes of Palestinian stroke patients.

## 2.5 MEASURING STROKE OUTCOMES

This section highlights the methods of evaluation and reporting of stroke consequences using the ICF concept, using impairment, functional limitations and participation restrictions as point of departure. Salter *et al*. (2007) suggested that the ICF provides a multidimensional framework for health and disability suited to the classification of outcome instruments. Stroke outcomes can be measured in any of the domains of the ICF using various instruments. Many outcome measures are proposed by stroke associations that study and evaluate patients under the ICF domains of impairment, activity, and participation, even though they were not originally developed based on this classification. For example, the Barthel Index was used and developed before the dissemination of ICF, and is still used as a major activity outcome measure.

The psychometric properties of the outcome measure are also an important consideration. Domholdt (2000) referred to reliability as “the degree to which test scores are free from errors of measurement” - he also gave synonyms to the reliability concept such as, consistency, accuracy, and stability of measurements. Domholdt also discussed the different aspects of reliability, for example the consistency of the results, achieved by the same researcher testing the same subject on a different date (intra-rater reliability). Additionally, the consistency of results of two researchers testing the same subject with the same instrument is considered inter-rater reliability. Domholdt (2000) also defined validity as “appropriateness, meaningfulness, and usefulness of the specific inferences made from the score”. He also discussed its types, which discussed  the extent of how much the instrument is really measuring what it was supposed to measure (construct validity) and the issue of the extent to which the instrument is measuring the complete representation of a concept under the study (content validity).

The best evidence in stroke rehabilitation outcome had recently been provided by the systematic review that was conducted by Salter (2011) in which a comprehensive review about evidence based outcome measures in assessment of stroke was given. The authors in this review discussed more than 40 stroke outcome measures from the point of view of their validity, reliability, responsiveness, advantages and disadvantages. Therefore, in this study, the attention should be placed on some of the outcome measures with their reliability and validity evidences. Table 2.20 shows some of those outcome measures, with their relevant validity and reliability supporting studies. Those outcome measures could be used to measure the change in domains of ICF (impairment, functional limitation, and participation restriction).

**Table 2.20: List of some valid and reliable outcome measures that measure the three domains of ICF**

| Impairment scales | Validity | Reliability |
|---|---|---|
| Canadian Neurological Scale (CNS) | Correlation between CNS and a prospective Scandinavian Stroke Scale ranged from 0.54 to 0.85 (Stavem, Lossius, & Rønning, 2003). | High reliability, kappa ranged from 0.76 to 0.96 (Stavem *et al*., 2003). |
| Fugl-Meyer Assessment | Spearman correlation between Fugl-Meyer Assessment and BI >= 0.86 (Mao, Hsueh, Tang, Sheu & Hsieh, 2002). | Cronbach's alphas ranging from 0.94 to 0.98 (Lin, Hsueh, Sheu, Hsieh, 2004). |
| General Health Questionnaire (GHQ-12) | Significant negative correlation (r) between the global quality of life scores and GHQ-12 ( r= -0.56) (Montazeri *et al*., 2003). | Cronbach's alpha value ranged from 0.37 to 0.79 (Low, Quek, Razack, & Loh, 2001). |
| Modified Ashworth Scale | Pearson correlation between the Fugl-Meyer Assessment and Modified Ashworth Scale = -0.94 (Katz, Rovai, Brait, and Rymer , 1992). | kappa = 0.83 (Gregson, Leathley, Moore, Sharma, Smith, and Watkins, 1999). |
| Mini Mental State Examination (MMSE) | Correlation between the Wechsler Adult Intelligence Scale-Revised and the MMSE ranging from 0.36 to 0.52 (Hopp, Dixon, Grut & Backman, 1997). | Alpha internal consistency= 0.78 (McDowell, Kristjansson, Hill & Hebert, 1997). |
| NIHSS | High concurrent validity with BI (r=0.79) (Lyden et al., 1999). | Kappa = 0.969) (Meyer, Hemmen, Jackson, & Lyden, 2002<br>Inter rater reliability was 0.8 using Kappa statistics (Berger *et a*l.1999). |
| Revearmed Motor assessment | Spearman correlation ( r) between RMA and BI > 0.6. (Hsieh, Hsueh, and Mao, 2000. and r=0.79 (Endres, Nyary, Banhidi, & Deak,1990). | Correlation for the leg, trunk, and arm subscales (r = 0.93, and r = 0.88, respectively) (Lincoln & Leadbitter, 1979) |

| | | |
|---|---|---|
| Barthel Index | Concurrent validity of the modified BI (r = 0.73 - 0.77) with a measure of motor ability (Wade & Hewer, 1987). | Cronbach's alpha of 0.90 (Shah, Vanclay, & Cooper, 1989). |
| Berg Balance Scale (BBS) | Significant correlation between BBS and the Functional Independence Measure (r=0.76) (Wee, Bagg, & Palepu, 1999) | The Cronbach's alphas was greater than 0.97 (Berg, Wood-Dauphinee,& Williams, 1995). |
| Timed Up and Go (TUG) | Correlation between the TUG and BI = -0.48 (Berg, Maki, Williams, Holliday & Wood-Dauphinee, 1992) | The test-retest reliability (ICC) = 0.97 (Steffen, Hacker & Mollinger, 2002) |
| Functional Independence Measure (FIM) | Spearman correlation between the Motor-FIM and BI = 0.95. (Kwon, Hartzema, Duncan & Min-Lai, 2004) | Cronbach's alpha = 0.98 (Sharrack, Hughes, Soudain, & Dunn, 1999) |
| Frenchay Activities Index (FAI) | Excellent correlation between BI and FAI (r= 0.79) (Mahoney & Barthel). | Excellent internal consistency (alpha = 0.81) (Miller, Deathe & Harris, 2004). |
| Nottingham extended activities of daily living (NEADL) | Construct validity: significant Spearman correlation with Barthel Index ( 0.69) (Hsueh, Huang, Chen, Jush, & Hsieh, 2000) | Test-retest reliability was satisfactory (rs0.81-0.90) (Nicholl, Lincoln, & Playford, 2002). |
| **Participation scales** | **Validity** | **Reliability** |
| Modified Rankin Scale (MRS) | Concurrent validity was an excellent Spearman correlation coefficient between the Motor-FIM and the Modified Rankin Scale (r = -0.89) (Kwon *et al*., 2004). | Intra-rater reliability was excellent (=0.81, w 0.94) (Hsueh *et al*., 2003). |
| Canadian Occupational Performance Measure (COPM) | The correlation between BI and COPM = -0.225 is not significant and low (Cup, Thijssen & Van Kuyk-Minis, 2003). | The test re-test reliability = 0.842 (Pan, Chung & Hsin-Hwei, 2003). |
| Stroke Adapted Sickness Impact Profile (SA-SIP30) | The correlation between BI and SA-SIP30 = -0.517 (Cup, Scholte op Reimer, Thijssen & Van Kuyk-Minis, 2003). | Alpha internal consistency = 0.82. (Van de Port, Ketelaar, Schepers Van den Bos & Lindeman, 2004). |
| Stroke Impact Scale | Correlation between Barthel Index and stroke impact scale = 0.82 (Duncan *et al*., 1999). | Cronbach's alpha ranging from 0.83 to 0.90 (Duncan *et al*., 1999). |

## 2.6 THE PROCESS OF STROKE REHABILITATION

In this section, the researcher presents the stroke rehabilitation process in three main parts. The first part addresses rehabilitation settings, the second part addresses the main rehabilitation services (physiotherapy, occupational- and speech therapy), and the third part provides a brief description of stroke rehabilitation in Palestine. The relationship between the rehabilitation process and stroke rehabilitation outcome will be presented in a different section about factors affecting stroke outcome (2.8.4) as this section is only concerned with description and classification of those rehabilitation settings and services.

Acute strokes are considered as an emergency and should be managed in hospitals, where the initial stage of rehabilitation can occur in a specialised stroke unit or general medical ward (Centers for Disease Control and Prevention [CDC], 2007). There is a difference between acute management and post-acute management of a stroke, where the first is involved at the pathophysiological level and body structure function, and the later management is involved in improvement at the functional activity level through addressing participation and functional limitations (Miller *et al*., 2010). The length of stay (LOS) in acute hospital care has been reported on by many authors. In California (USA) LOS was reported as 7 days and that was decreased to 4.26 days after the implementation of an acute stroke programme (Atkinson, 1996). In the Netherlands, Van Straten, Van Der Meulen, Van Den Bos and Limburg (1997) criticised the unexplained long hospital stay after a stroke, waiting to be discharged that led to a mean stay of 28 days. Chang, Tseng, Weng, Lin, Liou and Tan (2002) reported that LOS for stroke patients in Taiwan averaged 11 days and ranged between 1-122 days. The main predictor of LOS was severity as measured by NIHSS.

According to Stucki *et al*. (2002), rehabilitation is a continuous process, which involves the identification of problems and needs. These authors indicated that ICF can be used to monitor rehabilitation from admission to reintegration into the community. The process also involves the identification of personal and social obstacles as well as the management of rehabilitation interventions and measurement of the effectiveness of rehabilitation interventions.

Stroke rehabilitation is an interdisciplinary process (Ference *et al*., 1999). The rehabilitation team should include medical doctors, rehabilitation nurses, speech therapists, physiotherapists, occupational therapists, social workers, and psychologists (Duncan *et al*., 2005; Nair & Wade, 2003). This rehabilitation process after the acute stage can be provided at stroke inpatient rehabilitation, outpatients or in home-based rehabilitation settings (Duncan *et al*., 2005).

### 2.6.1 Rehabilitation settings

There is evidence that patients improve after being enrolled in a multi-disciplinary and well-planned rehabilitation programme after an acute stroke. Features of the rehabilitation process have been organised into guidelines that result in better stroke outcomes. Guidelines set criteria for quality of care for stroke rehabilitation processes (Duncan *et al*., 2005).

#### *2.6.1.1 Inpatient rehabilitation settings*

Duncan *et al.* (2005) define inpatient rehabilitation as "rehabilitation performed during an inpatient stay in a free-standing rehabilitation hospital or a rehabilitation unit of an acute care hospital". Inpatient rehabilitation settings can be in either of these settings, in a stroke unit, or in generic inpatient rehabilitation ward in a rehabilitation institution or nursing facility. Lee, Huber and Stason (1996) indicated that 73% of older American stroke survivors aged over 65 had received institutional or ambulatory rehabilitation care.

*2.6.1.1a Stroke unit*

According to Young & Forster (2007), stroke units are multi-disciplinary care centres providing stroke patients with specialist rehabilitation opportunities and involving caregivers in the rehabilitation programmes. Stroke units are also defined by the Canadian Best Practice for Stroke Management (2009, P.2) as "speciali(s)ed, geographically defined hospital units dedicated to the management of stroke patients, and staffed by an inter-professional team" (Lindsay *et al*., 2008).



*2.6.1.1b General inpatient wards (institutions, hospitals, or nursing facilities)*

Miller *et al*. (2010) described the inpatient rehabilitation setting as "hospital-level care that provides comprehensive management, targeting the upgrading of the patient's functional level through an inter-disciplinary team." Miller *et al*. (2010) also points out that in inpatient rehabilitation, the patient is present for 24 hours a day, with an average length of stay of 25 days, in during which time, (s)he has access to a physician and a nurse that is specialised in rehabilitation. At the same time patients are expected to engage in at least five days of rehabilitation, during which at least 3 hours of physiotherapy, occupational therapy, speech therapy, and prosthetic services is available if needed. Miller *et al*. (2010) also highlighted that a patient must be admitted to this setting only if the interdisciplinary team decides that he will benefit from a rehabilitation programme that will be held in a reasonable amount of time. In this setting, there should be evidence of medical follow up, assessment and reassessment, goal setting, and goal modification. One of the known benefits of inpatient rehabilitation is the availability of a team of rehabilitation professionals. Lee *et al.* (2010) studied the utilisation of inpatient rehabilitation services and found that only 34% of patients received inpatient rehabilitation services. The main reason for seeking this rehabilitation setting was the severity of the stroke.

#### ***2.6.1.2 Community rehabilitation settings***

In this section, community-based rehabilitation is presented as rehabilitation that takes place either in homes of the patients or in any of the outpatient hospital wards or clinics.

##### *2.6.1.2a Early supported discharge*

Teasell *et al*. (2009) referred to early supported discharge (ESD) as an approach that aims to decrease the length of stay in hospital or stroke unit towards the continuum of rehabilitation in the community setting that can be either home-based rehabilitation or outpatient-based rehabilitation (at a day hospital care or outpatient clinic). Lindsay *et al*. (2008) describes ESD as a well-coordinated and resourced service provided by interdisciplinary specialists that aim to provide an alternative to prolonged stay in a hospital or stroke unit. It also includes different specialists in the team, including a nurse, physical- (PT), occupational- (OT), and speech therapist (SLT). ESD should only be considered when there are sufficient available services in the community to cover the patient's needs.



##### *2.6.1.2b Outpatient rehabilitation*

Outpatient care is a rehabilitation setting where the patient spends part of the day in a rehabilitation unit that can be independent or attached to a hospital. Day care units fall under this definition. Rehabilitation can be provided on the basis of one hour per day, for three days a week or more (Duncan *et al*., 2005). A study done by the Centers for Disease Control and Prevention in Colombia district in USA (CDC, 2007) found that only 30.7% of stroke survivors in 21 districts received care in outpatient settings.

Miller *et al*. (2010) describe the outpatient clinic as part of a hospital, or self- established care setting that provides rehabilitation services that could not be administered at home, and can include a physician, OT, PT, SLT, social worker, pharmacist, nurse, and psychologist. Miller *et al*. (2010) also points out that it might include a home visit to evaluate the home environment to focus on individual need that will inform the potential rehabilitation programme.

#### *2.6.1.2c Home-based rehabilitation*

This is the rehabilitation process that is provided at the patient's home, rather than in a clinical facility (Duncan *et al*., 2005), supported by trained therapists. Home-based rehabilitation is an important component of stroke rehabilitation according to the American Stroke Guidelines. Duncan *et al.* (2005) defined this setting as community-based rehabilitation, where patients receive their rehabilitation in their home environment. Miller *et al*. (2010) suggests that home-based rehabilitation is considered a type of outpatient setting where health professionals mentioned in the outpatient rehabilitation setting may be administering their services in a patient's home.

### 2.6.2 Rehabilitation settings in Palestine

In Palestine, there is no published data that would indicate the extent of stroke services provided in different rehabilitation settings, so the information provided in this section is based on personal knowledge and communication entered into by the researcher. In Palestine, stroke rehabilitation is provided through inpatient, outpatient and home-based rehabilitation settings. There are no stroke units available. Main rehabilitation services provided are PT, OT and SLT. Psychological counselling is provided only in the inpatient rehabilitation institutions.

#### ***2.6.2.1 Inpatient rehabilitation settings in Palestine***



There are no stroke units in Palestine. Acute stroke management takes place in general medical wards in hospitals. In addition, the only inpatient settings are institution-based in three non-governmental, charitable organisations that run three rehabilitation centres in Palestine.

- **Abu Raya Rehabilitation Centre**: This is a 52-bed centre, located on the West Bank, north of Jerusalem in Ramallah. The centre is more oriented towards spinal cord injuries, but also admits other types of patients such as those with a stroke, head injuries, and orthopaedic inpatients.
- **Princess Basma Rehabilitation Centre**: This 20-bed centre is based in East Jerusalem and is mainly oriented towards children with cerebral palsy, but has a few beds for other neurological patients, such as those with stroke.
- **Bethlehem Arab Society for Rehabilitation**. This is a 65-bed centre based on the West Bank, south of Jerusalem, in Bethlehem. This centre is more specialised in stroke and head injury rehabilitation, with the capacity to receive other neurological and orthopaedic patients.

In these inpatient institutions, patients have access to all types of rehabilitation services, including PT, OT, SLT, psychological counselling and physical medicine specialists' follow-up. The centres are open to patients based on different methods of referrals, such as governmental health insurance referrals, United Nations refugee agency referrals, private insurance companies, and private patients who can afford to pay around 100 USD per night.

For admission the patient must have a referral from a medical specialist, then a meeting is arranged where a multi-disciplinary team evaluates the patient before admission. Decisions to accept patients are based on their potential to benefit from a rehabilitation programme.

#### *2.6.2.2 Outpatient rehabilitation settings in Palestine*

For admission to outpatient facilities, the patient must have a referral from any medical practitioner, who provides a diagnosis of a stroke. There is no early supported discharge approach in stroke rehabilitation in Palestine and outpatient rehabilitation setting providers are scattered throughout Palestine without much central organisation.

- **Charitable non-governmental sector** where therapy services are provided in an outpatient clinic. Costs of sessions vary to fit the patient's ability to pay.
- **United Nations Relief and work agency clinics** provide mainly physiotherapy and occupational therapy as a free service for registered refugees only.
- **Government outpatient clinics** usually provide rehabilitation through outpatient physiotherapy clinics affiliated to governmental hospitals. Referrals come from medical specialists employed in the government hospital service. These centres only serve patients who can afford to contribute to the governmental health insurance scheme.
- **Private sector outpatient clinics** provide therapy to those patients who can afford to pay for each session, which might cost an average of $15 per session.



#### *2.6.2.3 Home rehabilitation settings in Palestine*

Currently in Palestine, some physiotherapy is provided at home, but there is little provision of other services in home-based rehabilitation settings.

One kind of service contributing to home-based rehabilitation in Palestine are the community-based rehabilitation programmes (CBR). These are run by many non- governmental organisations (NGOs) and provide mobile clinics to reach rural areas, adapt homes for people with disability and train health workers in the community to enable them to contribute to the effectiveness of home based rehabilitation. CBR workers rely on the cooperation of first-degree caregivers, such as mothers, fathers, sons and siblings.

### 2.6.3 Rehabilitation services

In this section, the research presents the literature describing the rationale for the different rehabilitation services usually provided for stroke patients, which are mainly physiotherapy, occupational therapy, speech therapy and psychological counselling, without any reference to their effect on stroke rehabilitation outcome, as this will be discussed further in section 2.8.

Rehabilitation should involve services and programmes that aim to reduce impairment, enhance recovery and adaptation to residual disabilities. The three major rehabilitation services are physiotherapy, occupational, and speech therapy (Duncan *et al*., 2005). To study the activities involved in physiotherapy and occupational therapy sessions, Putman *et al.* (2006) recruited stroke rehabilitation experts who provided the 12 categories of treatment activity domains that physiotherapists and occupational therapists use during stroke rehabilitation. These categories are: mobilisation exercises, selective movement, balance exercises in lying, sitting and standing, sensory training, transfers, personal activities of ADL, domestic ADL, leisure and work activities, and miscellaneous techniques. Putman suggested that OTs and PTs had different emphases during treatment sessions, which highlights the fact that the professions are different and had a different focus. At the same time, they were similar in focus on balance in sitting, exercise, selective movement, and mobilisation.

#### *2.6.3.1 Physiotherapy*

Physiotherapy aims to provide services to develop, maintain and restore maximum function. In a systematic review conducted by Van Peppen *et al*. (2004), the research found that activities included in physiotherapy treatment sessions mainly addressed impairments such as loss of motor function, impaired muscle tone and painful shoulders. All these aspects of the physiotherapist’s role need to be considered in quality indicators.

The length and contents of the physiotherapy sessions vary between different countries. The average of these sessions and their contents was reported by De Wit *et al*. (2007) who reported that on four stroke rehabilitation centres in Europe where the mean length of physiotherapy treatment session was 41.7 minutes. Most PT activities reported were exercises in standing and balance activities in standing and lying. Figure 2.1 shows the most frequent activities in a one-hour physiotherapy session presented by De Wit *et al*.(2007). O'Mahony, Rodgers, Thomson, Dobson, and James (1997) highlighted the importance of knowledge provided for the stroke patient by the therapist about diagnosis, management, available services, prognosis and other related domains.

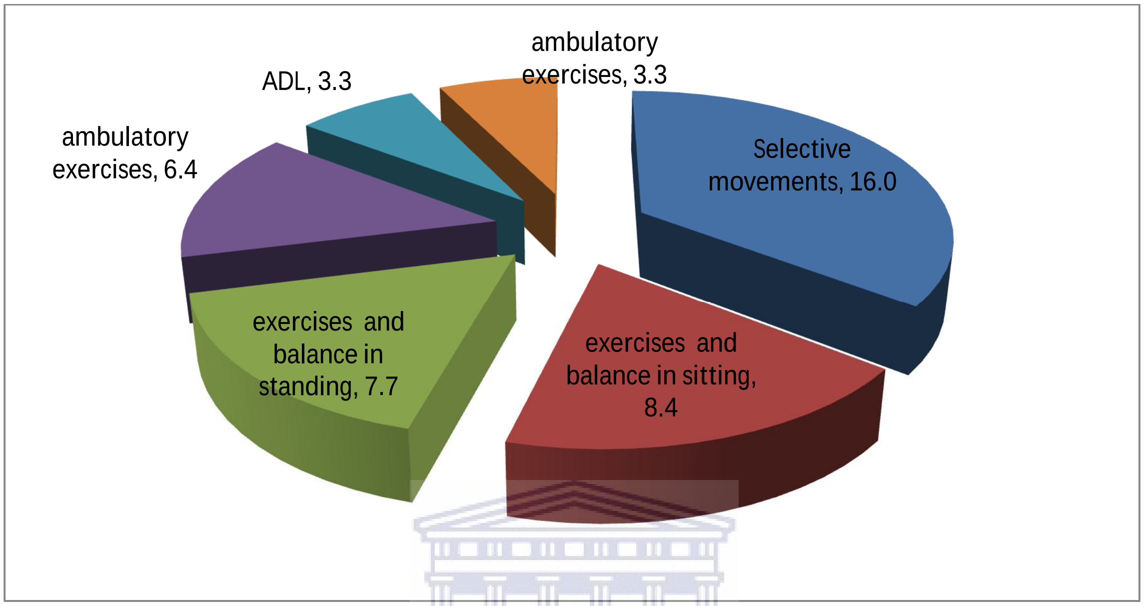



**Figure 2.1 Physiotherapy therapeutic activities in one hour of physiotherapy according to De Wit *et al*. (2007)**



#### *2.6.3.2 Occupational therapy*

Smallfield and Karges (2009) classified the time spent by occupational therapy intervention with stroke patients. They found that more time is spent on pre-functional activity preparation than the functional activities themselves and that strategies of musculoskeletal intervention were used in more than half of the sessions. Putman *et al*. (2006) reported that the average OT length of session in four European countries was 35 minutes, and the most frequent therapeutic activities were domestic activities and perceptual and sensory training. Putman *et al*. (2006) documented the time used by occupational therapists and physiotherapists. They compared length of sessions and concluded that the average length of PT session was higher than OT in each unit. Occupational therapists assess the impact of changes in motor function, sensation, coordination, visual perception, and cognition and the person's capacity to manage daily life tasks (Rowland, Cooke, & Gustafsson, 2008)

#### *2.6.3.3 Speech and language therapy*

Greener, Enderby, and Whurr (1999) indicates that language problems were present in around 25% of stroke patients, and that these problems could be a combination of verbal expression, understanding, writing or overall communication. Language problems affect communication and social interaction with others and can have psychological consequences for stroke patients. Speech therapy can be provided at different settings (hospital, institution, clinic, or at home) and by different caregivers (speech therapist, trained family member, or volunteers). Greener *et al.* (1999) also suggested that the average time for commencing the speech therapy after a stroke was one and a half months post-stroke.

#### *2.6.3.4 Psychological counselling*

Psychological counselling is defined as a "psychological specialty that facilitates personal and interpersonal functioning across the lifespan with a focus on emotional, social, vocational, educational, health-related, developmental, and organisational concerns" (Ofordile, 2010: 9). White and Johnstone (2000) emphasised the psychosocial aspect of stroke rehabilitation, as physical rehabilitation does not highlight the psychological concerns of the patient regarding the new identity of dependency after a stroke, unity with past abilities, and fear of the future with new perceptions of the self.

Issues of evidence-based practice within rehabilitation services have not really been addressed in Palestine and practices are not based on recognisable guidelines. The limited quality of services highlight the lack of subspecialty and postgraduate skills of rehabilitation specialists in Palestine. Better quality of practice may be achieved when international guidelines are taken into consideration and recommendations for rehabilitation programmes are followed, taking into consideration the optimal evidence base, using a problem solving approach, rather than a "recipe" approach to treatment.



## 2.7 STROKE RECOVERY (OUTCOME)

In this section, the research presents literature addressing different outcomes of strokes: neurological, functional, and participation recovery within the framework of ICF. Tracking the recovery of stroke patients can be possible through testing change in the same measures used for measuring stroke impact (based on ICF). This, however, depends on the focus of the domain of recovery.

### 2.7.1 Recovery of impairment

On the impairment level Mayo *et al*. (1999) found that at three months after a stroke, 27% of subjects were still suffering from problems in balance that directly affected their functional abilities. In the Copenhagen Stroke Study, urinary and faecal dysfunction were reported by

Jorgensen *et al.* (2000) in 50% of the patients at baseline assessment, 36% with full urinary incontinence, and 11% had partial urinary incontinence. At a follow-up of mean length of 37 days, only 15% stayed incontinent, and 13% became partially incontinent. In terms of faecal incontinence, 40% had faecal incontinence, 34% of them presented with full faecal incontinence and 6% partial faecal incontinence.

On the neural level, stroke recovery is thought to be attributed to changes in the functional organisation of the brain cortex, where there will be a re-representation of the presentations of muscles and joints on the motor map, together with remoulding of the neural connections enhanced by activity and behaviour (Nudo, 2003). Putman *et al*. (2007b) compared motor and functional recovery in four European centres and found that in Belgium, UK, Switzerland and Germany, swallowing problems were prevalent in 18% in Belgium, 30% in UK, 14% in Switzerland, and 17% in . Dysarthria was prevalent in 52%, 34%, 39%, and 44 %, in the same centres respectively.

### 2.7.2 Recovery of functional activity

Kwakkel, Kollen, and Wagenaar (1999), in a review of literature about the effect of therapy on functional recovery of strokes, highlighted the role of spontaneous recovery in partial justification of functional recovery observed in stroke patients. Bohannon, Ahlquist, Lee, and Maljanian (2003) suggested that functional recovery was evident during acute stroke hospitalisation, where functional activities improved in terms of walking, transfers and eating. In functional recovery, the concentration is on the ability of the patient to perform his regular ADL activities and recovery on the impairment level will address positive changes in signs and symptoms of strokes, measuring movement, tone and body function. Miller *et al.* (2010) estimates that there are 50 million stroke survivors worldwide that are still struggling with cognitive, physical and emotional disabilities and that of these, 25-74% still need help from other people in fulfilling their activities of daily living. Dennis, O'Rourke, Lewis, Sharpe and Warlow (1998) described the functional state of stroke patients after their six months follow-up, in a study of the emotional outcome of stroke patients and caregivers. They reported that 7% of the stroke patients were dependent in everyday activities, 27% were unable to walk independently, 16% had urinary incontinence, 5% were faecally incontinent, 13% required help with transfers, 26% needed assistance with climbing stairs, 13% needed assistance with toileting, 37% needed assistance with bathing, 25% with feeding, 29% with dressing, and 12% with grooming. Bonita *et al.* (1997) investigated the prevalence of stroke and stroke-related disability in the Auckland Stroke Studies and reported that one third of stroke patients needed assistance in at least one functional activity. Mayo *et al.* (1999) studied disablement after a stroke in Canada, through a series of longitudinal and observational studies. They found that three months after a stroke, 85% of patients were still suffering with gait speed problems, 78% had not reached their age-specific normal movement of upper extremity, and 37% were still in need of help and assistance in basic activities of daily living at three months. Christensen, Broderick, Vincent, Morris, and Steiner (2009) reported on the different functional outcomes of haemorrhagic strokes between countries, using the modified Rankin Scale and Barthel Index. Ninety days after the haemorrhagic stroke, the percentage of patients with a Barthel Index of (0-94) was reported as follows: The Netherlands (67%), Finland (73%), Canada (66%), Israel (65%), Australia (57%), USA (62%), Italy (75%), Germany (63%), France (51%), China (62%), Sweden (46%), Denmark (50%), Singapore (80%), with the average of all countries at 64%.

#### 2.7.1.3 Recovery of Participation

On the participation level, recovery is measured by regaining of life role and social status. However, there appears to be no consensus in the published literature on the concept of recovery in terms of domains or cut-off points of the outcome measure scores that measure this potential recovery (Duncan, Min Lai & Keighley, 2000). Alaszewski, Alaszewski, Potter and Penhale (2007) reported that more than a third of the stroke participants younger than 60 years had returned to work after a period of 18 months follow-up. Miller *et al*. (2010) indicated that a significant number of stroke survivors do not return to work. Christensen *at al*. (2009) also reported about the percentage of patients with a MRS of ≥ 2 90 days after the rehabilitation period and pointed out that it varied between countries. The highest level was recorded in Israel with 100% of patients falling into this category, Finland with 96% and Spain with 93%. The lowest scores were from The Netherlands at 74%, Denmark 77% and Germany with 74%. The average score for all countries were 81%.

Some studies that described recovery in stroke patients, in terms of achieving cut off defined points and percentages of different outcome measures, representing the different domains of the ICF (Table 2.21).

**Table 2.21: Percentage of patients achieving certain levels on different outcome measures, with their relevant ICF domain.**

| Authors | Participants | Point of time | Domain of recovery | (%) | ICF Domain |
|---|---|---|---|---|---|
| **Uchino *et al*. (2001)** | Systematic review | 6 M<br>6 M | **BI ≥ 90**<br>**BI ≥ 60** | **24 –88**<br>**40-71** | **F. activity**<br>**F. activity** |
| **Spengos & Vemmos (2010)** | 253 first ischemic stroke (aged 15 - 45 years) | 10 Y | **MRS 0-2**<br>**MRS 0-1**<br>**MRS 3-5** | **92.7**<br>**82.6**<br>**7.2** | **Participation**<br>**Participation**<br>**Participation** |
| **Wasay *et al*. (2010)** | 958 Women (aged 15 - 45 years) | 30 D of follow up | **MRS =0**<br>**MRS =1** | **22**<br>**37** | **Participation**<br>**Participation** |
| **Dam *et al*., (1993)** | 51 stroke patients. | 2 Y | **Independent walking**<br>**BI >70** | **74**<br>**79** | **F. activity** |
| **Leys *et al*. (2002)** | Young stroke patients (15-45) | 3 Y | **MRS (0-2)** | **94** | **Participation** |
| **Dennis *et al.* (1998)** | 376 stroke survivors | 6 M | **MRS ≥3** | **43** | **Participation.** |
| **Welmer *et al*. (2008)** | 66 consecutive stroke patients | BL<br>3 M<br>18 M | **Problems with hand fine motor control** | **70**<br>**41**<br>**45** | **Impairment** |
| **Kotila *et al*. (1984)** | 255 Stroke patients > 65 yeas | BL<br>3 M<br>12 M | **Functional independence** | **22**<br>**51**<br>**52** | **F. activity** |

**BL** = Baseline; **D**= days; M= months; Y=years; **F. activity** = Functional activity

Other authors described recovery as a change between baseline assessment and follow-up points on different domains of the ICF using different outcome measures (Table 2.22).

**Table 2.22: Change between assessment points in different outcome measures**

| Authors | Participants | Recovery Domain | Time of flow up | Scores | ICF Domain |
|---|---|---|---|---|---|
| Kameshwar *et al.* (2011 | 10 stroke patients | NIHSS | **BL** | **11.38** | |
| | | | **1 M** | **7.88** | **Impairment** |
| | | | **6 M** | **4.48** | |
| Soyuer & Soyuer (2005) | 100 ischemic stroke patients | Rivermead | **BL** | **13.75** | **Impairment** |
| | | | **3 M** | **21.30** | |
| | | RMA-L | **BL** | **4.34** | **Impairment** |
| | | | **3 M** | **6.60** | |
| | | RMA-A | **BL** | **5.01** | **Impairment** |
| | | | **3 M** | **7.23** | |
| | | RMA-GF | **BL** | **4.29** | **Impairment** |
| | | | **3 M** | **7.51** | |
| Pan *et al*. (2010) | 109 first-time ischemic stroke patients | Barthel Index | **BL** | **36.4** | **Functional activity** |
| | | | **2 W** | **68.9** | |
| | | | **1 M** | **81.7** | |
| | | | **2 M** | **85.2** | |
| | | | **4 M** | **88.4** | |
| | | | **6 M** | **89.9** | |
| Arsava *et al.* (2009) | 240 new stroke patients | MRS ↓ leukoaraiosis | **6 M** | **1.7** | **Participation** |
| | | MRS ↑ leukoaraiosis | **6 M** | **2.5** | |
| Whiting, Shen, Hung, Cordato & Chan (2011) | 186 consecutive acute stroke patients | MRS | **5 Y** | **3.1** | **Participation** |
| Huang, Chung, Lai, and Sung (2009) | 76 stroke patients | BI | **1 M** | **38.2** | **Functional activity** |
| | | | **3 M** | **64** | |
| | | | **6 M** | **68.1** | |

| | | | | | |
|---|---|---|---|---|---|
| Sinha *et al*. (2009) | 22 acute ischemic stroke patients | NIHSS | **BL** | **10.62** | **Impairment** |
| | | | **3 M** | **3.12** | |
| | | BI | **BL** | **40** | **Functional activity** |
| | | | **3 M** | **75** | |

**BL** = Baseline; **D**= days; M= months; **Y**=years;

From the studies discussed above, it can be seen that the recovery percentage varies between different studies, as Dam *et al.* (1993) reported a score of 74% for walking is a prerequisite for independence while 70% were reported as independent by Chausson, Olindo, Cabre, Saint-Vil, and Smadja (2010). The author of this study identified some problems in the comparison of results, such as the use of different outcome measures as a definition of recovery. Consideration of other variables could have attributed to recovery. Some studies connected the cut-off points of MRS to cut-off points in the Barthel Index (Sulter, Steen, & De Keyser, 1999). Others discussed the different uses of reporting percentages of patients achieving favourable outcome in MRS, where some considered 0-1, and other considered 0-2 as a favourable outcome (Weisscher, Vermeulen, Roos, & De Haan, 2008) and in both cases, percentages of patients were compared but on the basis of different actual assessment and outcome criteria.



Other than that, each outcome measure had its own definition of the cut-off point of a severe, moderate, or mild stroke that does not necessarily have a parallel translation or a definite predictive value of a different outcome measure. It may be that a patient has an NIHSS (impairment) of x and a BI of (functional activity) of y, that they are not always similarly related in every patient. A possible reason for this may be that the relation of different variables to the recovery is interrelated and conditional and can be calculated differently in each study due to the different gender distribution (with its relevant effect), different age categories (as in the above mentioned example), different comorbidities, different severities at baseline, and different rehabilitation variables.

## 2.8 PREDICTORS OF STROKE REHABILITATION OUTCOME

In this section, the research presents the potential factors associated with stroke outcome. The section is divided into parts, general predictors of outcome, the effect of personal variables (gender, age, race, socioeconomic variables, and comorbidity), stroke related variables (side, type, and severity of stroke), and rehabilitation related variables (rehabilitation settings and services).

Studies that investigated outcome were different in their aims, as one group studying stroke outcome in general, highlighted all related factors associated with or predicting a certain stroke outcome, While others studies were investigating the effect of a particular variable on stroke rehabilitation outcome, with or without manipulation of that particular variable.

### 2.8.1 General predictors of outcome

Stroke outcome seems to be variable in many studies from different countries (Christensen *et al*., 2009; Putman *et al*., 2007b). In this section, the researcher presents the studies concerned with multiple predictors of outcome, not concentrating on one specific or particular factor prediction of outcome of stroke. There are three main types of studies in this area: the first type is studies that used association, difference of means, and percentages of patients achieving a pre-defined level of a particular outcome (MRS<2 for example). The second type of study are those that have investigated predictors of outcome on a multivariate level of statistical analysis and included different impairment, functional, and socioeconomic factors that might predict stroke outcome in their analysis. The third type involves systematic reviews that investigated and analysed a collection of the best evidence on predictors, based on analysis of the results of hundreds of studies.



Milinaviciene *et al*. (2007) argue that the main aim of all stroke outcome studies are to distinguish those subjects who will achieve good improvement from those who will end with poor outcome. They summarise the main factors, which will affect outcome of stroke rehabilitation as "age, gender, initial severity of stroke, functional status at admission to hospital, urinary incontinence, impairment in cognitive function [and] unilateral neglect syndrome".

Kwakkel, Wagenaar, Kollen, and Lanhherst (1996) reviewed 78 studies that investigated the factors predicting the functional outcome of strokes, and found only 13 studies that met 8/11 elements in methodological criteria to be included in the review (three only had nine out eleven criteria). Based on those 13 studies the reviewers concluded that the valid predictors of functional outcome post-stroke were age of patient, recurrent stroke, sitting balance, admission ADL score, level of social support, severity of stroke, disorientation of place and time, urinary incontinence and metabolic rate of glucose outside the infarct area in patients with hypertension.

Cifu and Stewart (1999) reviewed the medical literature in a systemic review from 1950 – 1998 to explore the association between outcome and different interventions and found that there is a strong relationship between better outcome and increased functional ability at admission, early start of rehabilitation, and inter-disciplinary versus multi-disciplinary setting. They found a weak relationship between outcome and high intensity of rehabilitation and use of specific rehabilitation services. Meanwhile they did not find a relationship with the use of a particular type of rehabilitation setting.

Hendricks, Zwarts, Plat, and Van Limbeek (2002) conducted a systematic review that included 14 studies selected from 174 studies that initially went for evaluation with the aim of studying motor recovery after strokes. They concluded that severity of paralysis is the most predictive factor of motor recovery after stroke.

Meijer *et al*. (2003) conducted a systematic review to investigate the literature about prognostic factors for ambulation and ADL, in the sub-acute phase of a stroke. Their review found that 26 of 1027 studies met their inclusion criteria. Urinary incontinence was the predictor that was found in three studies with Level A evidence. Other predictors found in one study at least with Level A evidence were initial functional ability and mobility, age, severity of paralysis, impaired swallowing, apraxia, and factors related to the complications of ischemic strokes.

The above-mentioned reviews summarised the results of hundreds of cohort studies in the field of predictors of stroke outcome. Table 2.23 shows some examples of single studies that have targeted different types and ages of stroke patients, and highlighted certain personal, and rehabilitation variables as predictors of a better or worse outcome.

**Table 2.23: General predictors of stroke outcome**

| Authors | Study design/ participants | Outcomes | Point of time | Predictors |
|---|---|---|---|---|
| Kotila *et al*. (1984) | Prospective study / 154 stroke survivors in Finland | Discharge from hospital, ADL, return to work | 3 and 12 months after stroke | Factors that negatively affected prognosis, including age, acute stage hemiparesis, impairment of intelligence and memory, visuo-perceptual deficits, inadequate emotional reactions, and living alone. |
| Barker, Gill & Brauer (2007) | Retrospective cross-sectional survey / 220 stroke survivors. | 10-point recovery rating scale, Stroke Impact Scale, subjective report on recovery | 3 months after stroke | Commitment to recovery, type and amount of exercises, knowledge of progress of rehabilitation, and use of the hand in ADL as the strongest variables. Limited hand movement was associated with negative stroke rehabilitation outcome |
| Jorgensen *et al*. (2000) | prospective, community-based study / 1197 acute stroke patients from the Copenhagen Stroke Study | Scandinavian Stroke Scale (SSS), BI | Admission, weekly through hospital stay, discharge, 6 months follow-up | Body temperature, blood glucose, and stroke in progression, stroke type and treatment in a dedicated stroke unit. |
| Shaughnessy (1996) | Prospective study / 173 stroke survivors<br>From Whitney and colleagues dataset | BI and other outcome measures | the time of the strokes, and 3, 6 and 12 months after stroke | Younger age , had good social support or higher functional or neurological status scores at three months were more likely to achieve full functional recovery |
| Öneş, Yalçinkaya, Toklu & Çağlar (2009) | Prospective study / 88 stroke patients | Ashworth Scale, FIM, Mini Mental State Evaluation (MMSE), | Admission, discharge | FIM at admission, spasticity, age , cognitive and motor abilities. |

| | | | | |
|---|---|---|---|---|
| Chen, Liu, Li & Quiben (2006) | retrospective study / 92 stroke patients | stroke rehabilitation assessment of movement (STREAM) | Admission, discharge | Time post-stroke was the strongest single predictor of functional recovery in terms of efficiency, completeness, and time to recover. |
| Huang *et al*. (2008) | Prospective study / 66 first ischemic stroke patients | recurrent stroke & MRS | regularly followed up for 24 months | Greater age, total anterior circulation syndrome, stroke in evolution and pneumonia were predictors for poor functional outcome. |
| Wandel, Jørgensen, Nakayama, Raaschou & Olsen (2000) | Consecutive and community based / 859 acute stroke patients | BI, Scandinavian Stroke Scale (SSS) | Admission, weekly during rehabilitation. | better coping with ADL measured by BI, and developing strength in the first week |
| Vibo, Kõrv & Roose (2007) | population-based study / 433 patients with first-ever stroke | MRS, BI | 7th day, 6 months, and 1 year after stroke | predictors of dependency at one year after stroke, were: female gender, older age, elevated blood glucose, and severity of stroke. |
| Verheyden *et al*. (2007) | Multi-centre study / 102 stroke patients | Trunk Impairment Scale (TIS), BI | Admission and 6 months after stroke | trunk control at baseline and baseline static balance |
| Van de Port, Kwakkel, Schepers & Lindeman (2006) | Prospective cohort study / 217 stroke patients | Rivermead Mobility Index (RMI) and BI | Admission, 1 year | Sitting functional status at admission, balance, time between stroke onset and beginning of rehabilitation, and age |
| Masiero, Avesani, Armani & Ermani (2007) | multivariate analysis / 185 first-ever stroke patients | FIM, the upper and lower Motricity Index), the Trunk Control Test (TCT) | Admission, discharge | Predictors of mobility at discharge were age, baseline motor and functional outcome. |



From the above studies and reviews involving analysis of hundreds of cohort studies and randomised and controlled trials, it can be seen that the issue of prognosis and outcome relates to different aspects of strokes such as mobility, functional ability, walking, and returning to work. The issue of comparing studies sometimes looks problematic due to the different nature of those studies in terms of points of follow-up, at different times post stroke and in terms of the different outcome measures used to evaluate these outcomes. Another problem that may affect the ability to compare those studies are the different personal and comorbid factors of the patients, in terms of type of stroke (haemorrhagic, ischemic or both), and the different age categories focused on in these studies.

A number of predictors were identified in these reviews, such as urinary incontinence and swallowing problems at the impairment level (Kwakkel *et al*., 1996; Meijer *et al*., 2003). On the functional level severity at baseline seems to be the main predictor (Hendricks *et al*., 2002; Kwakkel *et al*., 1996; Masiero *et al*., 2007; Meijer *et al.*, 2003; Vibo *et al*., 2007). The main personal predictor of outcome was age (Hen *et al*., 2006; Huang *et al*., 2008; Kwakkel *et al*., 1996; Masiero *et al.,* 2007; Meijer *et al*., 2003; Van de Port *et al*., 2006; Vibo *et al*., 2007). On the socioeconomic level, the main factors predicting outcome were education, income, and social support (Kwakkel *et al*.1996; Putman *et al*., 2007a; Van de Port *et al*., 2006; Verheyden *et al*., 2007; Weir, Gunkel, McDowall & Dennis, 2005). At the rehabilitation level, the literature stressed the time between stroke and start of rehabilitation and intensity of rehabilitation services as independent predictors of outcome (Chen *et al*., 2006; Cifu & Stewart, 1999; Van de Port *et al*., 2006).

### 2.8.2 Personal variables affecting outcome



In this part, presentation of the studies relating the patients' personal variables to stroke outcome are presented: age, gender, ethnic identity, and studies investigating the presence of different comorbidities on stroke outcome are also presented here.

#### *2.8.2.1 Age and stroke outcome*

Age has been reported as one of the most predictive variables of poor prognosis in most of the studies. One of the reasons might be that it plays a role in the accumulation of the aging process of many body systems, and the prevalence of many chronic diseases, which may contribute to poor outcome. Table 2.24, presents some studies that targeted age association with stroke outcomes

**Table 2.24: Age and stroke outcome**

| Authors | Design | Participants (Country) | Conclusion |
|---|---|---|---|
| Russo, Felzani & Marini (2011) | Systematic review | 16 studies (Italy) | Age over 80 is associated with higher one-month (30-days) stroke fatality, more dependency, and less use of diagnostic procedure. |
| Denti *et al*. (2010) | Observational cohort study | 1 555 stroke patients at hospital rehabilitation (Italy) | Poorer outcome in older stroke patients aged over 80.<br>Mortality rate were higher among older patients in comparison with patients aged <80 (18.9% vs. 5.1%), same for disability (50.9% vs. 33%). |
| Béjot *et al*. (2010) | 22-year population-based study | 3 540 patients with first-ever strokes (France) | In patients aged >=80: Stroke was more severe, their one-month outcome was worse, Fewer patients were discharges to pre-stroke residence, and Length of stay at hospital >30. |
| Öneş, Yalçinkaya, Toklu & Çağlar (2009) | Prospective cohort study | 88 stroke patients at rehabilitation hospital (Istanbul) | Age is one of the significant predictors of stroke outcomes |
| Saposnik *et al*. (2008) | Multicenter Cohort Study | all hospitalised patients (26 676) with an acute ischemic stroke (Canada) | Patients aged 80 years or older had longer length of hospital stay, higher mortality rate, less likely to be discharged to their original residence. |
| Berlowitz, Hoenig, Cowper, Duncan & Vogel (2008) | Cohort study | 2 402 stroke rehabilitation patients at Veterans Affairs facility (6 months follow-up) (UK) | Did not find age prediction of lower outcome. |
| Black-Schaffer & Winston (2004) | Prospective study | 979 patients with stroke (aged 20-98 years) at acute care rehabilitation hospital (USA) | Admission FIM <40: the older the patient the poorer the outcome.<br>Negative relationship between age and total FIM change and home discharge. |
| Alexander (1994) | Retrospective study | 520 stroke patients (aged 16-97 years) at rehabilitation hospital (USA) | Age and severity of stroke at admission are still the strongest predictors of the dependent variables represented in recovery and discharge to own home. |

Zhou *et al*. (2010) compared the stroke outcomes of patients in Kunming, China, with stroke patients in Limoges in France. They highlighted the fact that the socioeconomic effect of strokes were significant in China compared to France, because Chinese stroke patients were younger and were still working at the time of their stroke. This underlines the greater effect of stroke patients' age on participation of younger stroke patients as they may be more economically and socially active, as compared to older stroke patients

It seems that most of the previous studies agree on the negative effect of age on outcome of stroke, except for two studies that found age effect to be positive or did not find age to be an independent predictor of strokes. One possible reason why these researchers did not reach to consensus on the predictive power of age for the outcome of the stroke might be the difference of age of the stroke participants in the different studies that could have contributed to variant degrees of age effects on stroke outcome, especially because in many studies there was no control for age variable.

#### *2.8.2.3 Gender and stroke outcome*

Most studies found that females regain less functionality after a stroke, but did not manage to highlight gender as a predictive variable for functional recovery, as shown in Table 2.25.



**Table 2.25: Gender and stroke outcome**

| Authors | Study design/ participants | Outcome measures | conclusion |
|---|---|---|---|
| Appelros, Stegmayr & Terént (2010) | Review / 90 papers | | Female patients were older, have less favourable functional outcome, were more depressed and report a low quality of life, more likely to have aphasia, visual field disturbances, and altered consciousness and have more severe strokes. |
| Salihovic, Smajlovic, Sinanovic & Kojic (2010) | 2 833 subjects with acute ischemic strokes. | Scandavian stroke scale | Female patients were older, had higher 30-day mortality, higher stroke severity at admission and higher disability. |

| | | | |
|---|---|---|---|
| Gall *et al*. (2010) | population-based study / 1 316 first-time stroke patients | NIHSS | Female patients were older (76 vs. 72), had more severe strokes (6 vs. 5 on NIHSS), more impairment.<br>Female patients had higher 28-day mortality (32 vs. 21), and higher stroke severity (44 vs. 63). |
| Kapral *et al*. (2005) | 3 323 stroke patients at care hospitals in canda | Stroke impact scale-16 | Female patients were older, had longer length of hospital stay, were functionally worse at 6 months after the stroke, had greater disability<br>There were no significant difference in 6-month mortality, stroke severity, and quality of life between men and women. |
| Di Carlo *et al*. (2003) | Prospective study / 4 499 hospitalised patients with first-ever strokes. 2 239 males and 2 260 females. | BI, MRS, survival | Female patients were older, had a higher fatality rate, had a longer length of hospital stay, and worse pre-stroke disability than males.<br>Female gender was a significant positive predictor of disability.<br>There was not any significant effect of gender on survival. |
| Roquer *et al.* (2003) | 1 581 subjects with first in a lifetime acute stroke | Canadian score scale (CSS), MRS | Female patients were older, had a higher mortality rate and more impairment.<br>Females who survived usually were more disabled than males at 3 months. |
| Glader *et al.* (2003) | 19 547 stroke patients at 75 hospitals in Sweden. | Questionnaire on ADL | Female patients were older, and at three months seemed to be more disabled and institutionalised |
| | 459 stroke patients | BI | Female patients were older and achieved less functional activity at 6 months post-stroke. |

From these studies, it can be deduced that the majority of studies concluded that females are associated with poorer functional outcome of strokes at different assessment times. Some of this negative association between female gender and poor outcome seems to be due to higher age, more severe strokes at admission and the richer risk profile of comorbidity prevalence in female patients.

### *2.8.2.4 Ethnicity and stroke outcome*

Ethnic origin has not much to do with improvement in outcome of strokes, but it has to do with many genetic and hereditary factors that play a role with the prevalence of comorbidities in these patients. Ethnicity may correlate with outcome, together with the variant socioeconomic status that could be associated with the different ethnic groups and its correlation with outcome mentioned in some of the literature (Table 2.26).

**Table 2.26: Ethnicity and stroke outcome**

| Authors | Study design/ participants | Outcomes | conclusion |
|---|---|---|---|
| Putman *et al*. (2010) | Multi-centre observational prospective cohort study / 732 stroke patients in the United States. | FIM | There were no significant differences in the discharge FIM between the white groups and the African American. |
| Ottenbacher *et al*. (2008) | Retrospective study / 161 692 first-time stroke patients in the United states | FIM | At discharge, Hispanic patients had more FIM (79.43) than non-Hispanic whites (81.54).<br>Functional independence was the same in both groups. |
| Chiou-Tan, Keng, Graves, Chan & Rintala (2006) | Retrospective study / 171 hospitalised stroke patients | FIM, length of stay | Ethnicity was not significantly related to discharge FIM or length of hospital stay. |
| Horner, Swanson, Bosworth & Matchar (2003) | Prospective Cohort study / 1073 hospitalised stroke patients in the USA followed up for 1 year | ADL | After 1 year of their stroke, low income black patients who experienced delay in initiation of rehabilitation were associated with lower functional recovery compared with white patients. |



In conclusion, researchers have found contradictory results in terms of the relationship between ethnicity and the functional outcome of strokes. One study found that blacks were more often discharged to their homes, two studies supported better outcomes among whites, and another two did not find any association between ethnicity and outcome. These studies highlight the fact that differences could be mainly attributed to the effect of other variables' variance associated with race, mainly the socioeconomic status.

### *2.8.2.5 Socioeconomic variables and stroke outcome*

Not many studies concentrated on socioeconomic factors, such as income, educational level, employment or living with a spouse as potential predictors of outcome. However, socioeconomic variables can certainly affect the ability to access certain rehabilitation services in particular rehabilitation settings. It is also associated with the ability to manage existing comorbidities, all of which might ultimately affect outcome. Table 2.27 presents the studies that investigated the association between socioeconomic status and outcome.

**Table 2.27: Socioeconomic status and stroke outcome**

| **Authors** | **Study design/ participants** | **Outcomes** | **conclusion** |
|---|---|---|---|
| Addo *et al*. (2012) | Updated systematic review | NA | People with low income are associated with low stroke outcome. |
| Putman *et al*. (2007a) | Multi-centre study, 419 stroke patients in Europe. | RMA, BI | During inpatient stay, education was associated with less functional activity and less RMA (arm).<br>After discharge, low income was associated with lower functional activity and lower three domain of RMA. |
| Weir *et al.* (2005) | 2 709 stroke patients | MRS, ADL | There was a positive relationship between lower socioeconomic status and dependency in ADL. |
| Kalra *et al*. (2004) | Blind, single, randomised controlled trial / 300 patients with stroke and their caregivers. | BI | training of family carers was associated with lower levels of carer anxiety, stroke burden, and depression, and had a higher quality of life. |
| Tsouna-Hadjis, Vemmos, Zakopoulos & Stamatelopoulos (2000) | 43 first-ever stroke patients | BI | At six months after stroke, family support was associated with better functional ability, less depression. |
| Glass, Matchar, Belyea, and Feussner (1993) | prospective cohort study / 46 stroke patients | NA | at six months after stroke, patients with strong family social support were significantly better in functional activity as measured by BI. |

From the above, it can be seen that socioeconomic status plays a role in outcome, either in direct or indirect ways, as income and education seem to be connected to the ability of the patient to deal with consequences of a stroke in a way that leads to a better outcome, which was clearly highlighted in Putman *et al*. (2007a).

#### *2.8.2.6 Co-morbidity and stroke outcome*

Comorbidities can affect outcome as a risk factor for recurrent stroke, and mortality, and on functional outcomes as a hindering factor to recovery. Table 2.28 shows that comorbidity was associated with hospitalisation, lower outcome, and mortality.

**Table 2.28: Co-morbidity and stroke outcome**

| Authors | Study design/ participants | Outcomes | conclusion |
|---|---|---|---|
| **Ferrari *et al*. (2010)** | Prospective cohort study / 8 291 stroke patients | NIHSS,MRS | 374 patients from the 8 291 patients (4.5%) showed worsening during their initial days of admission.<br>in a multivariate analysis, they found that hypertension, diabetes, and acute infection are independent risk predictors of early deterioration. |
| **Ogata, Yasaka, Wakugawa, Ibayashi & Okada (2009)** | Retrospective study / 543 stroke patients | NIHSS | The more comorbidities, the more the deterioration was seen.<br>The more deterioration the less patients were discharged to go home. |
| **Berlowitz *et al*. (2008)** | Cohort study / 2 402 stroke patients | FIM | Comorbidity was associated with stroke rehabilitation outcome, hospitalisation, and death. |
| **Nybo, Kristensen, Mickley & Jensen (2007)** | Observational study / 250 ischemic stroke patients | Scandinavian Stroke Scale (SSS) | Anaemia was associated with more sever strokes, and it is a predictor of negative outcome at six months after stroke (23/250 died at six months). |
| **Fischer *et al*. (2006)** | Prospective study / 266 ischemic stroke patients | MRS, NIHSS | diabetes, coronary artery disease, atrial fibrillation, and severity of stroke were associated with unfavourable outcomes. |

| | | | |
|---|---|---|---|
| **Jawad, Ward & Jones (1999)** | Comparative study / 86 hospitalised stroke patients younger than 80 years. | BI | Pre-morbid incontinence was the strongest significant predictor for stroke survivors outcome after six months, with BI <15 (19/86 died before six months). |
| **Sinyor *et al*. (1986)** | 64 stroke patients | Coping scale, nursing scale, and other psychological scales | Depression was associated with lower functional level at admission and discharge, with a negative impact on the stroke rehabilitation process and outcome. |

Most of these studies showed diabetes and hypertension to affect the outcome of stroke rehabilitation. Not many studies are done on the effect of other factors like Myocardial Infarction(MI )and cardiac disease on stroke outcome rather on risk of stroke itself, where many studies could be found.

### 2.8.3 Stroke related variables affecting stroke outcome

In this section the research presents related studies of stroke related variables, and stroke outcome. Stroke-related variables can be presented in terms of type of stroke (ischemic, haemorrhagic, lacunar), side of the stroke, location and size.



DeHaan, Limburg, Van Der Meulen, Jacobs and Aaronson (1995) studied the effect of stroke lesion type, laterality, and location on quality of life after the stroke. They found no difference in terms of haemorrhagic and ischemic strokes regarding quality of life, but found that left lesions had more quality of life deterioration due to the fact that left-sided lesions had more speech impairments. Paolucci *et al*. (2003) compared the prognosis of the haemorrhagic first-ever strokes with ischemic strokes, and found that at discharge from rehabilitation, haemorrhagic strokes achieved better BI, RMA, and higher Canadian Neurological Scale scores. Lefkovits *et al*. (1992) studied the effect of stoke trsubtype on stroke outcome, and found that there was a significant difference of outcome of subtypes of stroke, as mortality reached up to 34% in haemorrhagic strokes, and 1% in lacunar strokes.

Di Carlo *et al.* (2006) investigated risks and outcome of stroke in seven European countries, where the mean age was 70.5 (STD 12.4). Total and partial circulation infarctions were associated with 50% lower chance to be discharged to go home, compared to lacunar strokes, which were also associated with higher mortality at one month, disability and a handicap at three months.

Jorgensen, Nakayama, Raaschou, and Olsen (1999) in the Copenhagen Study of Strokes, emphasized the initial severity of strokes as the strongest factor that affects prognosis in a stroke. Kwakkel *et al*. (2010) studied the ability of NIHSS to predict functional outcome based on BI scale after six months of a stroke and found a statistically significant correlation of initial NIHSS and BI at six months, regardless of when it was done during the first nine days of initial stroke.

Gialanella, Monguzzi, Santoro and Rocchi (2005) showed that outcome and prognosis worsens with patients who suffer from anosognosia (unawareness or denial of disability), especially in the presence of unilateral neglect after a stroke. Olsen (1990) examined upper and lower extremity paresis as a predictor of outcome, and found that improvement in the upper extremity happened in 52%, in a mean of 9 weeks, and improvement in the lower extremity took place in 89%, in a mean of 10 weeks. They concluded that extremity paresis is a useful indicator that would predict outcome.

Based on the studies in sections 2.8.3 and 2.8.4 it seems that some of the stroke-related variables do affect outcome. For some of them, there is no evidence of their effect on outcome. Severity seems to be one of the variables with most consensuses about its negative effect on stroke outcome (Hendricks *et al*., 2002; Kwakkel *et al*., 1996; Milinaviciene *et al*., 2007; Vibo *et al*., 2007). Type of stroke was highlighted in different studies, where haemorrhagic strokes were shown to a have better prognosis and more one month fatality (Chen *et al*., 2006; Huang *et al*., 2008; Jorgensen *et al*., 2000; Meijer *et al*., 2003; Wandel *et al*., 2000).



Size of lesion appears to be negatively associated with outcome, as it is another reflection of severity. Its role was highlighted in the studies of Christensen *et al.* (2009) and Wandel et al. (2000). These might be the most important factors that affect outcome related to strokes and studies that concentrated on them were mentioned in the previous section. Lai, Alter, Friday, Lai and Sobel (1998) conducted a study in California in the USA to investigate the characteristics of stroke patients who are not sent home and found that older patients with language problems, lower extremity weakness and neurological deficits, had a 3.5-fold risk of being sent to a nursing home or rehabilitation institution.

### 2.8.4 Rehabilitation settings and stroke outcome

In this section, the research presents the effects of using different stroke rehabilitation settings on the outcome after stroke. The association between outcome, different types of community rehabilitation settings (early supported discharge, outpatient and home-based inpatient) and inpatient rehabilitation settings (stroke unit, hospital and rehabilitation institution based rehabilitation) will be presented. Definitions and descriptions of these settings have been provided previously in the section (2.6).

#### *2.8.4.1 Inpatient rehabilitation setting and stroke outcome (stroke units and general wards)*

Most of the literature about the inpatient rehabilitation setting emerged from studies about the stroke unit as compared to generic stroke rehabilitation wards. Table 2.29 summarises some of these studies and reviews.

**Table 2.29: Inpatient rehabilitation setting and stroke outcome**

| **Authors** | **Study design/ participants** | **Outcomes** | **Main Findings** |
|---|---|---|---|
| Stroke Unit Trialists (2007) | Cochrane Review / 31 trials, 6 936 stroke patients | Survival, living at home | Stroke units were associated with longer life. More independence, and higher percentage of stroke patients living at home, at one year after stroke than those who received non-specialist rehabilitation in general medical wards |
| Walsh *et al*. (2008) | Retrospective analysis / 136 stroke patients | Survival, recurrence | Stroke units were associated with a lower rate of recurrent stroke and lower mortality but a higher institutionalisation rate after four years. |
| Indredavik, Bakke, Slordahl, Rokseth & Haheim (1999) | Randomised controlled trial / 220 stroke patients | BI, living at home | SU care improves survival and leads to positive effects on functional activities and it is associated with more patients living at home after 10 years of their stroke. |
| Jørgensen, Nakayama, Raaschou & Olsen (1999) | Community-based study / 1 241 stroke patients | SSS, comorbidity, survival | 1-year mortality was 32% compared to 39% in general medical wards and this decrease of mortality extended to 5-years mortality of 64% vs. 71% in stroke units and general wards respectively. |
| Ronning & Guldvog (1998) | Randomised controlled trial / 251 stroke patients | Survival, BI | Patients at seven months who had died or were dependent (<75 BI) was 23% at the stroke unit and 38% in the community rehabilitation group.. |

| | | | |
|---|---|---|---|
| Patel, Potter, Perez & Kalra (1998) | Controlled study / 184 Stroke patients with moderate disability. | BI | Stroke units improve functional outcome. |
| Kalra & Eade (1995) | Randomised control study / 142 stroke patients | | Stroke units compared to medical wards were associated with less institutionalisation (19% versus 47%), shorter length of hospital stay (43 days versus 59), and lower mortality (21% compared to 46%). |
| Duncan *et al*. (1998) | RCT / 20 mild to moderate stroke patients | BI; Fugl-Meyer Motor Assessment; Berg balance test; instrumental ADL; and other outcomes | Experimental group (strength and endurance home-based programme) showed better hand motor function, greater gait speed, and greater distance walking potential and better balance |



Other researchers targeted the generic inpatient rehabilitation care, which includes patients with diagnosis other than a stroke, which was shown to be effective but to a lesser extent when compared with stroke units (Stroke Unit Trialists, 2007). Sulch, Perez, Melbourn and Kalra (2000) examined two disciplines of rehabilitation (integrated care pathway versus multidisciplinary rehabilitation) in 152 patients and concluded that in the multidisciplinary group, patients' functional recovery improved more and faster and quality of life was better. Hopman and Verner (2003) reported that health related quality of life improved with patients receiving inpatient rehabilitation; however, this improvement declined at 6 months after they were discharged.

From the previous studies, one can concluded that the stroke unit is associated with better functional outcome and survival; however, it is not clear what practices within the stroke units are associated with this improvement. This keeps the stroke unit as a setting of stroke rehabilitation, without much information about the structure, and process of care in this rehabilitation setting.

#### *2.8.4.2 Community-based rehabilitation setting and stroke outcome*

Usually studies about the three types of community rehabilitation settings are inter-related, as early supported discharge studies, refer to home-based rehabilitation or to outpatient rehabilitation as an extension of the early supported discharge.

*2.8.4.2a Early supported discharge*

Early supported discharge was defined and discussed earlier (2.6.2). Teasel *et al.* (2009) suggests that there is strong evidence supporting this approach associated with successful rehabilitation in mild strokes, as it reduces the length of stay by one week. There is conflicting evidence about its ability to reduce costs of rehabilitation compared to other settings. The National Stroke Foundation of Australia (2010) referred to ESD as an approach that could provide an alternative to inpatient rehabilitation with similar outcomes, but there is limited evidence of its ability to reduce costs of rehabilitation (National Stroke Foundation, 2010). Its effect and association with stroke rehabilitation outcome is illustrated in Table 2.30

**Table 2.30: Early supported discharge and stroke outcome**

| Authors | Study design / participants | Outcomes | Main findings |
|---|---|---|---|
| ESDT (2005) | Systematic Review / 11 trials that included 1 597 stroke patients. | BI, Frenchay Activities Index, Nottingham Health Profile, Hospital anxiety and depression scale. | Early supported discharge was associated with eight days decrease in hospital length of stay, better functional ability, ADL and patient satisfaction, and less dependency, institutionalisation and stroke-related death.<br>No evidence was found on caregiver's stratification, mood, or mental health as a result of ESD. |
| Thorsén, Wides, Holmqvist, de Pedro-Cuesta & Von Koch (2005) | Randomised control study / 83 subjects with mild to moderate impairments. | Length of stay, motor capacity assessment, participation, BI, Katz Extended ADL Index, Frenchay Activities Index, sickness impact profile | The group that received coordinate home-based rehabilitation (ESD) was more independent on extended ADL activities but was less active in their regular home activities. |
| Anderson *et al*. (2000) | Randomised control trial / 86 hospitalised stroke patients. | General health status (SF-36), mini mental state examination, Frenchay Activities Index | Quality of life did not differ in the two groups while mental health of caregiver was less in home care group, and their length of stay at hospital was significantly less. |
| Mayo *et al*. (2000) | Randomised control trial / 114 acute stroke patients. | BI, SF-36, SCALE OF instrumental activities of daily living | ESD with home-based rehabilitation led to better social integration, higher functional activities (ADL), higher quality of life, and shorter length of stay in hospital. |

*2.8.4.2b Home-based stroke rehabilitation setting and stroke outcomes*

Hale, Bennett, Bentley, Crawshaw and Davis (2003) suggest that home-based rehabilitation is associated with benefits such as decreased costs, convenience, increased family awareness and increased privacy of the patient. The Outpatient Stroke Trialists (2003) also supported home-based rehabilitation in terms of actual improvement in functional activity and activities of daily living.

The studies presented in Table 2.31 targeted stroke home rehabilitation settings from different angles, including spouse education, trained family caregiver and comparison with other stroke rehabilitation settings.

**Table 2.31: Home-based rehabilitation setting and stroke outcome**

| Authors | Study design / participants | Outcomes | Main Findings |
|---|---|---|---|
| Duncan *et al*. (1998) | Randomised controlled pilot study / 20 patients with mild to moderate strokes. | Fugl-Meyer Motor Assessment, BI, Berg Balance Scale. | Functional activity level was similar in the group that received 8 weeks home-based rehabilitation when compared to the group that received usual care. |
| Holmqvist *et al*. (1998) | randomised controlled trial / 81 stroke patients. | BI, length of stay, and other outcomes | The home-based group with spouse education had no statistical significant difference in functional outcome gained, compared to the other group, and were more satisfied, used less resources, and shorter length of hospital stay compared to conventional settings. |
| Dennis, O'Rourke, Slattery, Staniforth & Warlow (1997) | randomised controlled trial / 417 acute stroke patients. | BI, Frenchay Activities Index, general health questionnaire and other outcome measures. | The group that had a trained family stroke worker improved in both patient and family satisfaction, had shorter length of hospital stay. |

*2.8.4.2c Stroke outpatient rehabilitation settings*

Authors mentioned in Table 2.32 highlighted the association between outpatient rehabilitation settings compared to conventional treatment, or other rehabilitation settings.

**Table 2.32: Outpatient rehabilitation setting and stroke outcome**

| Authors | Study Design / participants | Outcomes | conclusion |
|---|---|---|---|
| Hillier & Inglis-Jassiem (2010) | Systematic review / 11 trials. | NA | Home based rehabilitation was associated with better functional outcome and carer satisfaction. |
| Werner & Kessler (1996) | Randomised control single blinded study / 49 stroke patients | FIM, Sickness Index Profile, and other outcomes | The patients who received treatments four days a week composed of 1 hour of physiotherapy and one hour of occupational therapy for 12 weeks on an outpatient basis demonstrated a significant functional gain in addition to socialisation and self-esteem compared to the control group that did not receive any treatment. |

In conclusion, it seems that, when compared with rehabilitation on geriatric wards, stroke units have been associated with better outcome in terms of lower mortality (Jørgensen *et al*., 1999; Kalra & Eade, 1995; Ronning & Guldvog, 1998; Stroke Unit Trialists, 2007; Walsh *et al*., 2008), lower recurrence rate (Indredavik *et al*.,1999; Walsh *et al.*, 2008), better functional outcome (Indredavik *et al*., 1999; Ronning & Guldvog, 1998; Stroke Unit Trialists, 2007), shorter length of stay and less institutionalisation (Kalra & Eade, 1995). Early supported discharge seems to improve the outcome of strokes in terms of more independence (ESDT, 2005; Thorsén *et al*., 2005), less institutionalisation and more social integration (ESDT, 2005; Mayo *et al*., 2000), decreases LOS (Anderson *et al*., 2000; ESDT, 2005) better functional outcome (ESDT, 2005; Mayo *et al*., 2000; Thorsén *et al*., 2005) and quality of life (Mayo *et al*., 2000). There was not enough evidence that early supported discharge decreases costs (ESDT, 2005). Both outpatient and home rehabilitation proved to contribute to functional movement (Duncan *et al*., 1998; Werner & Kessler, 1996). However the home-based rehabilitation setting seems to be preferred to outpatient rehabilitation in terms of sustainability of functional gains (Hillier *et al*., 2010; Gladman & Lincoln, 1994), in addition to the fact that home-based rehabilitation has been associated with better ADL at home and lower costs (Holmqvist *et al*., 1998).

### 2.8.5 Rehabilitation services variables and outcome

In this section, the research provides a brief review of the association of rehabilitation variables with the outcome of strokes in terms of different rehabilitation services (PT, OT, and speech therapy), intensity, length of stay and time between onset of stroke and beginning of rehabilitation.

Teasell *et al*. (2009) stated in their evidence-based review of practices of stroke rehabilitation, that stroke patients had demonstrated a reduction in their functional disability, despite the fact that there was not a substantial decrease in their level of impairment. This highlights the important role of rehabilitation in improving functional activities of stroke patients that could be improved even if the neurological improvement was not optimal. Stroke rehabilitation varies between different countries in terms of intensity, organisation and efficiency (Brandt, 2007). Organised post-acute rehabilitation services by a skilled inter-disciplinary team are said to decrease risk of death, improve function and decrease the length of stay in hospital and institutional care (Miller *et al*., 2010). Stroke rehabilitation is the combined and coordinated use of medical, social, educational, and vocational measures for retraining a person to his/her maximal physical, psychological, social, and vocational potential, consistent with physiologic and environmental limitations (Bruno, 2007). Patients are usually treated, based on a problem solving approach that depends on the clinical picture of their particular stroke. The common therapies that stroke patients receive in an ideal setting include medical follow-up, physiotherapy, occupational therapy, speech therapy, social and psychological follow-up (Young & Forster, 2007; CDC, 2007; AHA, 2008b).

#### ***2.8.5.1 Rehabilitation services***

The best evidence and recommendations for best practices within physiotherapy, occupational, and speech therapy can be observed from the clinical guidelines in rehabilitation of strokes (Duncan *et al*., 2005; Van Peppen *et al*., 2004; Teasell *et al*., 2009). Below are some examples of the studies that highlight the effect of the rehabilitation services on the domains of stroke outcome (impairment, function and participation).

##### *2.8.5.1a Physiotherapy rehabilitation services and stroke outcome*

Extensive evidence on most of the practices used in physiotherapy rehabilitation are found in the guidelines and evidence-based practice reviews, as the one performed by Teasell *et al*. (2009) who conducted evidence-based reviews of stroke rehabilitation devices, techniques, approaches. They provided evidence-based recommendations on many stroke rehabilitation practices. Practices were rated as strong or level 1a (supported by 1 meta-analysis, or 2 RCTs of fair quality at least), moderate or level 1b (results supported by a single RCT at least), and limited or level 2 (results supported by one controlled study at least with 10 subjects). They argued that there is strong evidence for task-specific training and treadmill training to improve gait. Cardiovascular training is considered to improve fitness and physical performance, Transcutaneous Electrical Nerve Stimulation (TENS) is said to decrease spasticity, and functional electrical stimulation with gait training improves gait and strength. Electro somatosensory stimulation improves hand function and mental imagery improves function and ADL. Constraint-Induced Movement Therapy is considered useful for patients with hand and wrist movement. Robotic devices used as sensory motor training improves elbow and hand function and functional electrical stimulation (FES) improve upper extremity function.

Teasell *et al*. (2009) also suggested that there is moderate evidence for motor learning approaches reducing length of stay, ankle orthosis with posterior tibial nerve denervation improving gait and virtual reality improving motor function.

In addition to the guidelines, there are plenty of systematic reviews that targeted many aspects of care in the practices of physiotherapy in stroke management, as shown in Table 2.33.

**Table 2.33: Systematic reviews about evidence based practices in physiotherapy.**

| Authors | Study design | Main findings |
|---|---|---|
| Pollock, Baer, Langhorne & Pomeroy (2007). | Systematic review | There is strong evidence that a mixed physiotherapy programme that includes neurophysiology and motor learning approaches improves functional outcome. |
| Lexell & Flansbjer (2008). | Systematic review | Muscle strength training improves function and participation |
| Schabrun & Hillier (2009) | Systematic / 14 RCTs | Researchers concluded that there is evidence that supports the effectiveness of passive sensory training in terms of sensory impairment and motor function. |
| Miller *et al*. (2010) | Evidence-based review | Growing evidence base for different physiotherapy practices in rehabilitation of stroke patients, like facilitation of muscles around shoulder for shoulder pain, functional electrical stimulation, constraint- induced movements, hand and arm movements in muscle control, use of treadmill in improving walking are well researched. |



In addition to systematic reviews and published guidelines, there are thousands of older physiotherapy intervention trials, which highlighted important aspects of physiotherapy practices in relation to better outcome, as in the case of_Bütefisch, Hummelsheim, Denzler and Mauritz (1995) who conducted a study to investigate the effect of repetitive hand movements on the outcome of the centrally paretic hand. The study included 27 patients with hemiplegic hand and the training consisted of repetitive hand and finger flexion and extension with various loads and was carried out twice daily for 15-min periods. The researchers found that the outcome in terms of strength, peak force, and acceleration in the intervention group (repetitive hand movement) was significantly better than the other conventional therapies, such as the Bobath approach that concentrated on negotiating tone in the upper extremity alone. The authors highlighted the importance of repetitive hand movements, recommended frequent movement repetition for paretic hand motor rehabilitation, and suggested not concentrating on spasticity reduction without the early initiation of active movements. Van der Lee *et al*. (1999) conducted a randomised controlled study to investigate the effect of forced hand use on functional outcome. The forced hand use included intensive functional training and the immobilisation of the unaffected hand for a period of two weeks. The trial was conducted on 66 stroke patients and used the Action Research Arm test, the upper extremity section of the Fugl-Meyer Assessment scale, and e-Motor Activity Log tests, as outcome measures. The researchers found, after adjusting for baseline scores, that the intervention had significantly better results in the research arm dexterity test, and the motor activity log test. At one-year follow up, an improved effect was observed in the action research arm test, which highlights the significance of forced use of the paretic upper extremity on the upper extremity clinical outcome in stroke patients.

*2.8.5.1b Occupational therapy and stroke outcome*

Govender and Kalra (2007) emphasised the importance of occupational therapy (OT) in the rehabilitation of stroke patients. The effect of occupational therapy on rehabilitation of a stroke patient had been identified by many researchers (Table 2.34), with the main effect on activities of daily living, extended ADL and social participation.



**Table 2.34: Occupational therapy and risk of stroke**

| **Authors** | **Study design** | **Main findings** |
|---|---|---|
| Turoni, Bertozzi & Carnaroli (2012) | Systematic review | Occupational therapy significantly improves social participation and independence in ADL. Not much evidence on its ability to improve cognitive abilities of stroke patients. |
| Legg, Drummond & Langhorne (2009) | Systematic review | Patients who receive occupational therapy are more independent and less likely to deteriorate |
| Walker *et al*. (2004) | Meta-Analysis | Community occupational therapy is associated with better NEADL scores, and more leisure scores. |
| Steultjens *et al*. (2003) | Systematic review | Occupational therapy improves ADL, Extended ADL, and social participation |
| Hubbard, Parsons, Neilson, and Carey (2009) | Review | Specific task training has a strong effect on the upper extremity outcome in stroke patients. |

| | | |
|---|---|---|
| Logan, Gladman, Drummond & Radford (2003) | RCT | Training on a specific ADL or leisure interventions led to improvements in relevant outcomes |
| Walker, Gladman, Lincoln, Siemonsma & Whiteley (1999) | RCT | Occupational therapy significantly reduced disability and handicap |
| Walker, Gladman, Lincoln, Siemonsma & Whiteley (1999) | RCT | Occupational therapy was associated with higher median score on NEADL (10 at baseline → 16 at 6 months) compared to control (12 → 12 ) at the same assessment points |

#### *2.8.5.1c Speech therapy*

As shown in Table 2.35 and in the following guidelines that evidence on the effect of speech therapy on the outcome of aphasia in stroke patients. It seems that the evidence was low at the early 2000 and that it tended to become stronger with time, either with the improvement of techniques and skills in the field, or through the accumulative effect of better studies in this rehabilitation field.

**Table 2.35: Speech therapy and aphasia outcome after stroke**

| **Authors** | **Study design** | **Main Findings** |
|---|---|---|
| Brady, Kelly, Godwin & Enderby (2012) | Systematic review | There is an evidence on the effectiveness of speech language therapy (SLT) on functional gains of Aphasic stroke patients |
| Kelly, Brady & Enderby (2010) | Systematic review | There is indication of effectiveness of SLT on patients with aphasia, better results were achieved with more intensive SLT despite the higher percentage of dropouts. |
| Cherney, Patterson, Raymer, Frymark & Schooling (2008) | Systematic review | There is modest evidence on the effectiveness of intensive SLT and constraint-induced language therapy (CILT) in aphasic stroke patients based on the measures of language impairment and communication |
| Greener, Enderby & Whurr (2000). | Systematic review | SLT neither effective nor non-effective, further studies are required to prove either of the results. |
| Bhogal,Teasell & Speechley (2003) | Systematic review | Intense speech therapy, over a short period of time, seems to be associated with better aphasia outcome when compared with less intense speech therapy over a longer period of time. |
| Enderby Whurr (1999) | Systematic review | Speech therapy after stroke was proven neither as effective nor as ineffective and called for further research in this field. |

Further evidence also comes from guidelines of evidence-based practices in rehabilitation of stroke patients. Teasell *et al*. (2009) suggested that there is strong evidence that speech therapy that is more intensive has a better result compared to conventional speech therapy and that trained volunteers and specialist speech therapists have similar outcomes in treatment of aphasia post-stroke. At the same time, Teasell *et al*. (2009) in the Canadian guidelines suggested that there is moderate evidence that group speech therapy improves communication and language post-aphasia in stroke patients. They also conclude that there is limited or weak evidence that community based speech programmes can improve language on impairment and disability levels.

*2.8.5.1d Psychological counselling*

Kneebone and Dunmore (2000) conducted a systematic review to investigate the effect of psychological interventions after a stroke. The researchers highlighted the positive effect of cognitive behaviour therapy as a specific form of psychological intervention. It was identified as worthy of further investigation. House (1987) suggested that mood disorders may be a specific complication of a stroke, and that recognising and treating disorders may be an important need of survivors of a stroke that may be achieved through counselling. This psychological counselling should be available to both patient and caregiver and should address patient fears of permanent dependency and other recurrent stroke possibilities. Clark, Rubenach and Winsor (2003) conducted a randomised controlled trial to evaluate the effectiveness of education and counselling interventions for families after stroke. The aim of the trial was to highlight the effect of the counselling on 62 patients and their families. They were divided into two groups (intervention and control). The intervention group received visits from a social worker trained in family counselling. The researchers found that the intervention group presented better functional outcome, as measured by the Barthel Index and better social integration and showed better social recovery in domestic chores, household maintenance and social activities. Families of the intervention group also showed better family functioning. These results underline the importance and positive outcome of psychological counselling for both family and patients.

#### *2.8.5.2 Early start of rehabilitation*

In a systematic review that included 79 articles, Cifu & Stewart (1999) concluded that early initiation of rehabilitation is one of the predictors of better stroke rehabilitation outcome. Hu, Hsu, Yip, Jeng and Wang (2010) studied the effect of early, intensive rehabilitation on the prediction of functional outcome in stroke patients admitted to intensive care units. They found that the time of rehabilitation commencement and intensity of treatment were predictors of

Barthel Index after adjustment for severity and age. They strongly recommended early intensive therapy for people with new strokes. In a study about factors predicting better outcome, Chen *et al*. (2006) highlighted the predictive value of an early start of rehabilitation for stroke outcome. Cifu and Stewart (1999) reviewed the medical literature from 1950 – 1998, to explore the association between outcome and different interventions and found a strong relationship and increased functional ability at early start of rehabilitation.

Van de Port *et al*. (2006) studied mobility and outcome of stroke in 217 patients and identified the time between stroke onset and beginning of the rehabilitation process as an independent predictor of outcome, with negative correlation between time of starting rehabilitation and the outcome of the stroke.

#### *2.8.5.3 Length of stay in rehabilitation and outcome*

Bode, Heinemann, Semik and Mallinson (2004) studied the effect of longer stay at a rehabilitation institution and the effect of more intense rehabilitation on overall outcome of first-ever stroke patients. They found that gains in self-care are well predicted by longer stay and more intense function-focused occupational therapy. Jette, Warren and Wirtalla (2005) investigated the relationship between intensity of therapy, length of stay and improvement of independence in mobility and ADLs. They found that higher intensity therapy was associated with shorter LOS and better functional outcomes.



#### *2.8.5.4 Intensity of treatment and outcome*

Kwakkel, Wagenaar, Koelman, Lankhorst and Koetsier (1997) used meta-analysis to study the effects of intensity of rehabilitation on stroke rehabilitation outcome. They concluded that there was "a small, but statistically significant, intensity-effect relationship". Hesse, Welz, Werner, Quentin and Wissel (2011) compared two groups of intermittent home-based intensive rehabilitation with continuous low intensity home-based rehabilitation (96 session vs. 104 sessions respectively) over a year. The results showed patients in both groups equally improved functionally over time and intermittent high-intensity and continuous low-intensity therapy were equally effective.

In a prospective study on 50 patients, Keren *et al*. (2004) evaluated intensity of the inpatient rehabilitation setting and functional outcome at discharge. FIM and impairment were measured at admission and discharge. Their main predictor variables were intensity of rehabilitation services, demographic variables, length of stay, and time since onset of stroke. Saxena, Ng, Yong, Fong and Koh (2006) studied factors predicting dependency in ADL and effect of therapy intensity on outcome of stroke rehabilitation. Dependency on ADL was 54% at admission, which declined to 19% at discharge. The main predictors were cognitive impairment dependency at admission, severe neurological impairment at admission and recurrent stroke. After adjusting for all those variables, every hour of therapy positively and significantly affected the ADL dependency.

In light of this brief literature review, it seems that there is a positive effect of rehabilitation services on the outcome of a stroke (Govender & Kalra, 2007; Greener, Enderby, & Whurr, 2000; Steultjens *et al*., 2003). The earlier rehabilitation starts, the better the outcome (Chen *et al*., 2006; Cifu & Stewart, 1999; Hu *et al*., 2010) and longer periods in rehabilitation are associated with better outcome (Bode *et al*., 2004; Kotila *et al.,* 1984).

## 2.9 SUMMARY OF THE LITERATURE REVIEW

From the literature discussed in this chapter, it can be seen that males had more stroke incidence than females in most of the reported literature and that females had a higher age and worse stroke outcome when compared to males. In terms of stroke risk factors, the reported priority of risk varied between different countries, in most of them hypertension seems to be the most common risk factor, followed by diabetes, atrial fibrillation, smoking, and dyslipidaemia.



In terms of the rehabilitation process, stroke units seem to be associated with better stroke outcome, especially when followed by early supported organised community-based rehabilitation discharge. Rehabilitation services contribute to a favourable outcome of stroke rehabilitation and the evidence of the effects of physiotherapy and occupational therapy on functional outcome is well-established. Conclusions on the role of speech therapy in improving of patient outcome were seen.

In terms of factors predicting outcome, the strongest evidence from the literature, highlighted eight main stroke outcome predictors: urinary incontinence, swallowing problems, motor and functional severity at baseline, age, education, income, social support and early start of rehabilitation.

Some of the aspects of the rehabilitation were mentioned less in the literature than other aspects, like the literature about the therapeutic role of the patient and the caregivers (family) in the rehabilitation process, and the motivation of patients to choose, or not to choose any particular rehabilitation setting (inpatient or community rehabilitation).

# CHAPTER 3: METHODOLOGY

## 3.1 INTRODUCTION

The current research was conducted to investigate the growing problem of stroke in Palestine. The research is composed of four main sections, with each section addressing a different aspect of the research objectives as stated in chapter one. The first section, namely the baseline profile, addresses the first and part of the sixth objective of the research, namely investigating the personal and socioeconomic characteristics of stroke patients in Hebron, Palestine and attempts to determine the functional outcomes, impairments, and participation status of stroke patients at admission. The second section is a case-control study conducted to address the objective of investigating main risk factors and epidemiology of stroke in Hebron, Palestine. The third section covers the rehabilitation process of stroke patients in Hebron, Palestine. It addresses the third and fourth objectives of the study namely, establishing a profile of the stroke patients' rehabilitation process in terms of different rehabilitation settings (inpatients, outpatient, and home rehabilitation) and the use of different rehabilitation services (physiotherapy, occupational therapy, and speech therapy), in the above mentioned settings, in relation to period of use, intensity, frequency and total hours of those rehabilitation services used. The fourth section, namely stroke rehabilitation outcome, was a longitudinal observational prospective study (main study), addressing the objectives number six and seven, which were aiming to describe the functional activity (activity limitations), motor function (impairments), and participation restrictions at three and six months post- stroke, and identifying the factors in the baseline stroke profile, and rehabilitation process, that could predict stroke rehabilitation outcomes at three and six months after a stroke.

The research setting, sampling and ethical considerations will be presented for all four sections together in this chapter. The different methodologies of the three study sections (design, instrumentation, data collection, and statistical analysis) will be presented separately for each section.

## 3.2 RESEARCH SETTING

The study was conducted in 2010, in Hebron City (Fig. 3.1), South Palestine, which has a population of 600 364 inhabitants (Palestinian Central Bureau of Statistics, 2011). In terms of impact of chronic diseases in Palestine, the most credible information comes from mortality rates due to the lack of prevalence studies. Abdeen (2006) highlighted the presence of strokes as a major contributor to the mortality rates in Palestine, as mortality attributed to strokes in 2001 was 18.7 per 100 000 and increased to 27.1 in 2002, 30.3 in 2003 and declined to 23.4 in 2004. These figures show that strokes are a major contributor to death in Palestine, especially when it is compared with other causes of death like hypertension 16.6/100 000), diabetes (10.2/100 000) and heart diseases (54.4/100 000).

In Palestine, there are four main pillars of health care providers: the governmental sector, charitable non-governmental organisations, the United Nations (UNRWA) which supports primary health care centres, and the private sector that runs many maternity hospitals, private clinics and one-day surgery units. The private setting and the charitable setting, which is considered semi-private in Palestine, has a lower bed occupancy rate and higher qualified staff when compared with the public hospitals and therefore, care provided in the private and semi-private setting could be better (Kondilis *et al*., 2011). The private sector is also characterized by being more client-orientated, through showing better responses and efforts to address patients' needs, which is also supported by better drug availability and aspects of delivery of care when compared to the public sector (Berendes, Heywood, Oliver, & Garner, 2011).




**Figure 3.1: Map showing Hebron location in Palestine (Wikipedia, 2011)**

Patients in the current study were recruited from the two main hospitals in Hebron City namely Al-Ahli Hospital, and Alia Hospital. Follow-up data were taken at patients' homes in Hebron. Al-Ahli Hospital is a general charitable society hospital of 200 beds and Alia Hospital is a general governmental hospital with 208 beds. Both hospitals have medical, surgical, orthopaedic, gynaecological, radiology, paediatric and physiotherapy departments. They cover the whole area of Hebron. Stroke patients represent a major part of the every-day admissions to both hospitals.

Usually stroke patients are admitted to emergency departments, where they are taken to radiology for a CT scan or MRI (the MRI machine is at Al-Ahli hospital only) to rule out haemorrhagic or ischemic strokes, after clinical assessment and relevant history had been taken. After that, patients are referred either to the ICU if the case is critical or to the medical department if the stroke status is stable. Rarely are they referred to the neurosurgery department if the patient is suffering from a subarachnoid or subdural haematoma. To date in Palestine, there are no specialised stroke units, as in more developed countries, or situations where stroke patients are managed and treated in specialised wards or stroke units by a stroke-orientated team. Referral is to the medical department where the main aim is to control risks such as hypertension, diabetes, lipids profile, and stabilisation of the patients' case. Usually conscious patients might stay for one or two nights maximum in the governmental Alia Hospital, and one week is the average of stay at Al-Ahli Charitable Hospital. Those who are unconscious might stay for longer periods that might exceed one month in many cases. After that, the patient is discharged and expected to start rehabilitation at any of the previous mentioned settings.

Rehabilitation after hospital discharge depends on many factors, including the affordability, availability and access to any of the three major rehabilitation settings provided by any of the previously mentioned health providers. Some patients may access rehabilitation at a generic inpatient rehabilitation setting (one non-governmental charitable inpatient institution of rehabilitation in Bethlehem area), outpatient setting (many charitable, United Nations, governmental and private service providers), or a home rehabilitation setting, which is purely provided by the private sector where the patient contracts with a private therapist to provide rehabilitation in the patient's home. It is also important to mention that charitable institutions do not provide free rehabilitation services.

## 3.3 STUDY POPULATION AND SAMPLING

### 3.3.1 Sampling method

The study used a non-probability consecutive sampling method, which according to Domholdt (2000), is a form of convenient sampling that is different from the traditional convenient sampling in that the population of the study does not exist at the beginning of the study. Consecutive sampling also includes recruitment of every patient that meets the inclusion criteria, until a certain sample size has been recruited, or a certain length of time has passed, or a certain outcome had been observed (Domholdt, 2000). Lunsford and Lunsford (1995) assert that consecutive sampling is the best choice of non-probability sampling techniques because studying available subjects can provide a good representation of the overall population that presents at a particular treatment site and is possible in a reasonable period of time.

As consecutive sampling is a non-probability sampling method, it means that the whole population will not have the same chance to be recruited to the study. In consecutive sampling, the researcher may recruit the entire accessible population of the study, and it is frequently used in physiotherapy research due to two main reasons. The first reason is the financial cost, as most of the studies are self-funded, and the second reason is that these studies are confined to certain settings where the researcher will make his/her effort to recruit each potential participant (Domholdt, 2000).



### 3.3.2 Inclusion criteria

Patients were eligible to participate if:

1. They had their first-ever stroke diagnosed and confirmed by imaging and/or medical report, regardless of severity and impairments involved.
2. they reside in Hebron.
3. they sign a consent form (or their caregivers if patients are not capable to do so).

### 3.3.3 Exclusion criteria

Patients were excluded from the study if:

1. they had any other neurological disease of the brain or the spinal cord, as this will interfere with the conclusions about outcome of rehabilitation.
2. they had their stroke more than two weeks before assessment, as this affects baseline testing, as the patient might have improved after the two weeks.

3. they sustained a subdural haematoma, as it improves after surgical removal of the haematoma, or haematoma absorption and this will affect the understanding of the nature of the stroke outcome.

### 3.3.4 Sample size

In other similar studies in the same field (stroke outcome), the majority of these studies adopted consecutive sampling for certain periods of time as a method of subject recruitment rather than limiting recruitment to a certain number of cases, possibly assuming that the ultimate number will be more than sufficient to run the requested statistical analysis (Abdul-Ghaffar, El-Sonbaty, El-Din, Marafie, & Al-Said, 1997; Roquer *et al*., 2003).

Sample size is more commonly determined by conducting a power analysis that refers to the ability of the test to detect a difference when such a difference exists (Domholdt, 2000). Usually the more participants in the sample the stronger the power of the test to detect the statistical significance of difference if there are any (Munro, 2001). This is especially important for intergroup comparison of results to be run in terms of outcome differences that could be attributed to the rehabilitation process and socio-demographic variables. Power is directly related with three other variables and if we know any three, we can calculate the fourth, and this is why it is used in calculation of adequate sample size after knowing the expected number of independent (predictors) variables. So, to calculate a sample size (for regression analysis), as the sample size calculation also is affected by the intended statistical analysis (Munro, 2001), the following three variables need to be known:

1. The <u>(U)</u> which refers to the number of the intended independent variables to be introduced in the model.
2. The ($R^2$) which is the defined as the expected effect size of the independent variable on the dependent variable (Munro, 2001). Munro (2001) also suggests the pre-set definition of effect size produced by Cohen (1987), named as a small effect as an $R^2$ 0.02, moderate effect as an $R^2$ of 0.13, and a large effect as an $R^2$ of 0.3. This effect size could be set on moderate when it is not known, or taken from the literature if there were any previous studies that used Cohen’s (1987) formula of sample size (power analysis).
3. The (L) which is obtained from a table, and defined by Munro (2001) as a function of power (which represents 80% confidence) and a given number of independent variables at a given alpha level which he suggested to be ($p$ =0.05).

If the above-mentioned variables are known, the following formula presented by Cohen (1987) and suggested by Munro (2001) could be used to calculate the sample size for regression analysis.

$N = (L * (1- R^2) / R^2) + u +1$

Recently, there are many available software packages that will do these calculations electronically. For power analysis in this research, the previous mentioned criteria suggested by Munro (2001) were used. Regression analysis was specified as a particular analysis test and number of variables (predictors) was set as eight. Based on the literature mentioned in Section 3.4.3.3, effect size was set to moderate (0.13), significance level at 0.05, and power of 0.80. The software (statistics calculators 3.0 beta) was used to determine minimum sample size. The minimum sample size for this study, based on the above formula, was 123 patients.

In this research the sample was composed of all the stroke patients admitted to the hospitals of Hebron with a new stroke, so the whole targeted population was included during the year this study was conducted (except those who refused to sign a consent form).

This calculated sample size of 123 patients also supports the provisional regression model's requested number of participants. As in multivariate analysis, for each predictor variable to be considered in the model, ten participants are required (Munro, 2001). In this case then, 80 patients were required to investigate the eight predictors of strokes identified in the literature. These predictors are: age, gender, incontinence, dysarthria, swallowing problems, level of education, and hours of therapy and baseline tests (Alexander, 1994; Black-Schaffer & Winston, 2004; Kwakkel *et al*., 2004; Lai *et al*., 1998; Putman *et al*., 2007a; Roquer *et al*., 2003; Teasell *et al*., 2009). The additional number of participants allows for more potential variables to be recruited in the outcome prediction model.

One of the disadvantages of longitudinal designs is drop-out, or loss of subjects. Intention to treat analysis is adopted in this research as the lost or dead patients will be included in the data analysis by adding the worse score for dead patients in the used outcome measures scores.

## 3.4 METHODOLOGY OF THE FOUR STUDY SECTIONS

In the following section, the methodologies of the main four sections of the thesis are explained: designs, instrumentation, data collection procedures and data analysis methods will be addressed separately, for each section of the study.

### 3.4.1 Section One: Baseline profile

#### *3.4.1.1 Design*

A descriptive prospective design was used to fulfil the first, and part of the sixth research objectives, this section addresses the personal and socioeconomic characteristics of stroke patients in Hebron, Palestine, and determining the functional outcomes (activity limitations), impairments (motor function), and participation status of stroke patients at admission. Those variables are investigated and described with no intention to manipulate any of them.

Grimes and Schulz (2002: 145) refer to the descriptive design as having three main uses that include "trend analysis, health-care planning, and hypothesis generation" and in this section of the study, the data obtained will help in a better understanding of the three domains of descriptive design uses.

The main advantages of descriptive design are that it answers the questions appropriately, and that the data is available and inexpensive to use. Other advantage of descriptive design is that data are also easy to obtain with low cost. The main disadvantage of this design is that it might not give a clear association between variables) and that some causal inferences cannot be made (Grimes & Schulz, 2002). There may be a lack of accuracy sometimes, where the participant will tend to give answers that may suit the researcher's expectations. Also, the subjectivity of the design may make the researcher ignore some data that might not confirm the research hypothesis, and the questions sometimes are constructed in a way that supports the perspective of the researcher. The descriptive design was considered the most suitable design for this research, as the aim was not to make any causal inferences (Domholt, 2000).

#### *3.4.1.2 Instrumentation*

The following section will explain the baseline data gathering sheet and the outcome measures used at the baseline testing to collect data for this part of the study.

*3.4.1.2a The baseline data gathering sheet*

A data gathering sheet used to capture baseline data was designed by the researcher based on literature (Alexander, 1994; Sturm *et al*., 2004). The instrument consists of four sections (see Appendix 1). To determine face and content validity this data sheet was sent to experts in stroke rehabilitation (Physiotherapists at the Western Cape Rehabilitation Centre, Bobath Instructor, stroke tutor, neurology lecturer in the physiotherapy department of Stellenbosch University and physiotherapists in Palestine). These experts were asked to comment on its face validity. Their comments were discussed and were adopted. Suggested changes were made in the sequence of questions and questions were added on contraceptives as a risk factor, and improvements in the construction of the data capturing sheet were all adopted.

The baseline gathering data sheet included the following:

Section A: The socio-demographic questions that included the patient's code, age (Cohen,1987; Kotila *et al*.,1984), date of birth, hospital name, gender, (Alexander, 1994; Sturm *et al*., 2004), inclusion/exclusion status and reason for exclusion, address, marital status and contact numbers.

Section B: The socio-economic data, (Jørgensen *et al*., 1999), level of education, income level, household income (Putman *et al*., 2007a), employment status, working hours, and reason for not working for unemployed participants (Luk, Cheung, Ho & Li, 2006), total number of children and number of children living at home (Xu, Tse, Yin, Yu & Griffiths, 2008).

Section C: Stroke-related factors: This part included the date of stroke, date of admission, date of discharge, length of hospital stay (*Duarte et al*., 2002), days between stroke and assessment, type of imaging, date between stroke and imaging, side and region of the stroke in the brain, type of stroke (Paolucci *et al*., 2003) and size of the stroke in the brain. Highest functional level (bed ridden, sitting with assistance, standing with assistance, standing independently, walking with assistance, walking independently) was also recorded (Cifu & Stewart, 1999; Di Carlo *et al*., 2006; Jorgensen *et al*.,1999).



*3.4.1.2b Standardised outcome measures (main assessment battery)*

The main assessment battery consisted of 5 standardised and validated outcome measures (Appendix 3a–3e). The Barthel Index (BI) and Nottingham Extended Activities of Daily Living (NEADL) were used for measurement of functional outcome. For measuring impairment, the research used the National Institute of Health Stroke Scale (NIHSS) for measuring and recording severity, and the Rivermead Motor Function to measure motor function impairment. For the participation part of the ICF, the researcher used the Modified Rankin Scale (MRS), which had items that include variables investigating participation, work, social, and leisure activities, and variables that focus also on impairment and functional activities. Many reasons play a role in the use and choice of the particular outcome measures. Often those outcome measures, used in similar studies in the field, were used to facilitate comparison on an international level, which is the case in this research.

*3.4.1.2c National Institute of Health Stroke Scale (NIHSS)*

The NIHSS (Appendix 3b) is an outcome measure used to measure neurological deficit (severity) of stroke patients (Tong *et al*., 1998). It is an outcome that can range between scores of 0 – 42 (Rudolf *et al*., 1999). Scoring is based on 15 items (level of consciousness, extraocular movements, visual fields, facial muscle function, extremity strength, sensory function, coordination ataxia, language, speech, and hemi-inattention), each one scored between 0 as minimum, and 4 as maximum, where the patient is less severely impaired s/he is approaching zero. The more impaired the patient is, the higher his NIHSS score will be. Usually the NIHSS is completed through observation of the patient, while he is responding to a verbal command given by the therapist who is evaluating the patient.

The NIHSS is considered valid, based on data validity studies by Lyden *et al*. (1999). And reliable (Berger *et al*., 1999; Hemmen, Jackson, & Lyden, 2002), as shown in Table 2.20. It has been used by many researchers for prediction of outcome of stroke (Adams *et al*., 1999; Smith *et al*., 2005).

A cut-off point for defining severity using NIHSS was adopted, stating that NIHSS<8 is considered a mild stroke, NIHSS 8-16 as a moderate stroke, and NIHSS>16 as a severe stroke (Briggs, Felberg, Malkoff, Bratina & Grotta, 2001).

*3.4.1.2d Rivermead Motor Assessment (RMA)*

The Rivermead Motor Assessment (Appendix 3c) is a scale that measures motor function impairment. It is composed of three parts, namely gross function (13 items) with a sub-score of 0-13, trunk and leg (10 items) with a sub-score of 0-10, and arm part (15 items) that has a sub-score of 1-15. Each item is scored by denoting “unable” as 0 or “able” as 1. The Rivermead total score could range between 0 and 38, where 0 is the worst, and 38 is the best score (Bagley, Hudson, Forster, Smith & Young, 2005).

As shown earlier in Table 2.20, RMA had been shown to be valid (Endres *et al.*, 1990; Hsieh, Hsueh & Mao, 2000), and reliable (Lincoln & Leadbitter, 1979). Severity cut-off point of motor impairment was defined based on the gross function part of the RMA (RMA-GF), as mild (RMA-GF 7 to 13), moderate (RMA-GF 4 to 6) and severe (RMA-GF 0 to 3) (Putman *et al*., 2006).

*3.4.1.2e Barthel Index (BI)*

The Barthel Index (Appendix 3a) is an outcome measure that measures functional activities of patients. Wade and Collin (1988) described it as a standard, yet reliable, sensitive, and valid outcome measure. It has 10 main items; usually completed and evaluated though direct observation, or information provided by the caregiver. The ten items cover the areas of walking, stairs, bowel and urine control, toileting, dressing, grooming, eating, and transfer. The scores are given based on patients' independence to perform the requested task, and the scores for each item range between 0 for inability to be independent at that particular task, and 10-15 when that patient can independently perform the requested item, (5) is given for some of the items when they are done with assistance.

The Barthel Index is a valid (Wade & Hewer, 1987) and reliable outcome measure (Shah, Vanclay & Cooper, 1989; Collin, Wade, Davies & Horne, 1988; Shinar *et al*.,1987) as shown in Table 2.20.

Severity by BI was defined and stratified as 100 on the Barthel Index= physical independence, 75-95 BI = mild disability, 50-70 BI = moderate disability, 25-45 BI = severe disability, 0-20 BI = very severe disability (El-Shater & Yassin, 2008). Poor rehabilitation outcome was defined as BI < 60 (Sulter, Steen & De Keyser, 1999).



*3.4.1.2f Nottingham Extended Activities of Daily Living (NEADL)*

Nottingham Extended Activities of Daily Living (NEADL) questionnaire (Appendix 3e) is an outcome that measures functional activity and is composed of 22 items. It investigates the ability to perform duties and activities of everyday living, where each item is given a grade between 0-3, representing the ability to perform that particular activity independently (3), independently with difficulty (2), perform the activity with help (1) or not able to do that particular activity at all (0). It has four major domains within the 22 items. Items 1 to 6 addresses mobility, 7-11 addresses kitchen activities, items 12-16 target domestic activities, and items 17-22 addresses leisure activities (Nouri & Lincoln, 1987). NEADL has been used in many studies as a measure of functional activity outcome after stroke, or after certain rehabilitation setting or intervention (Thomas & Lincoln, 2008; Walker *et al*., 2004). Clinical improvement was defined on NEADL as improvement of 2 points on the total score of 22, where in some studies the scoring of sub-items, was minimised to (0) and (1), which caused the total score of NEADL to be 22 (Nouri & Lincoln, 1987).

Table 2.20 shows the NEADL questionnaire which is considered to be a valid and reliable outcome measure (Hsueh, Huang, Chen, Jush & Hsieh (2000) and reliable (Nicholl, Lincoln & Playford, 2002; Nouri & Lincoln, 1987).

*3.4.1.2e Modified Rankin Scale*

For participation, the researcher used the 2.5.3.1 Modified Rankin Scale (MRS).

The Modified Rankin Scale contains in its items, parts that address work, leisure activities, family, and home responsibilities, which all fall in the area of participation. The grading of the MRS (Appendix 3d) allows the researcher to capture data on the status of each item before and after the stroke event. It is reported on a scale of 0 – 5, where 0 means that there is no disability in any of the items the scale includes, and 5 means that the patient is in need of constant care. Death as an outcome in studies is given the score of 6 in MRS (Christensen *et al*., 2009; Leys *et al*., 2002).

The Modified Rankin Scale is considered a valid and reliable outcome measure (Kwon, Hartzema, Duncan & Min-Lai, 2004; Hsueh, Wang, Sheu & Hsieh, 2003), as shown in Table 2.20. Favourable outcome was defined MRS ≤ 2, poor outcome was defined as any MRS>3 (Sulter *et al*., 1999).



***3.4.1.3 Data collection procedure***

After ethical clearance was obtained from the University of the Western Cape and the Ministry of Health in Palestine, an agreement was entered into between the Ministry of Health, medical superintendents and the researcher relating to reporting of any stroke patient admitted to the previously mentioned hospitals, to the researcher. One of the research assistants checked the records in the medical, surgical, and intensive care departments on a daily basis for any new stroke admissions. Those stroke patients who met the inclusion criteria mentioned in Section 3.3.2 were screened by the research assistant and were invited and recruited to take part in the study, and the aims of the study were explained to them. If they agreed, they were requested to provide written informed consent (Appendix 2). Where the patients were not able to provide consent, their caregivers were approached to do so. This process was conducted from the beginning of August 2009 to the end of July 2010.

Once written informed consent was obtained, the research assistant extracted the relevant data from the medical file (Fig 3.2 shows a flow chart of the process of this stage). The patient was then interviewed to complete the baseline data-capturing sheet. Following this, the Barthel

Index, Rivermead Motor Assessment Scale, National Institute of Health Stroke Scale, Modified Rankin Scale, and Nottingham Extended Activities of Daily Living were completed at the bedside of the patient. Each stroke patient needed an average of one hour for the assessments and the interview. Patients were also informed about the follow-up after three and six months before signing the consent form.

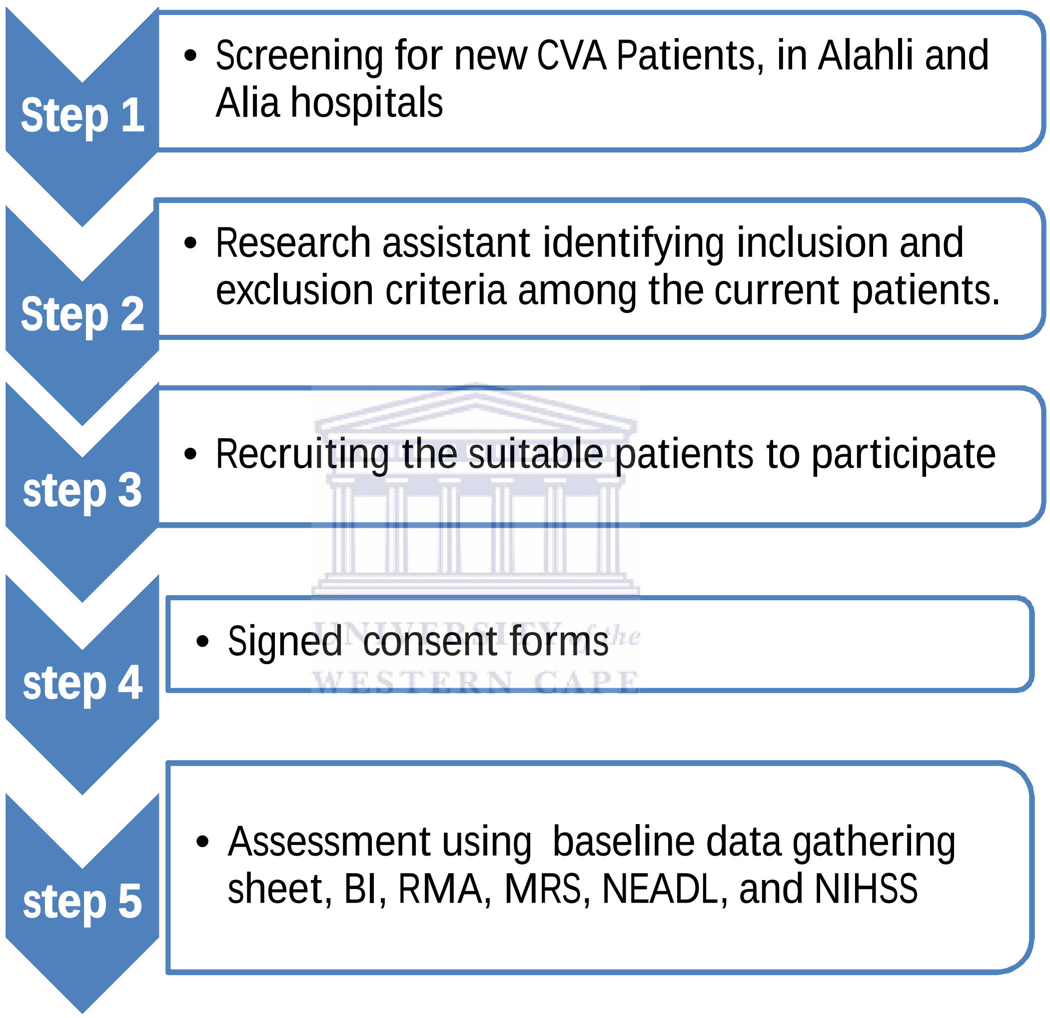



**Figure 3.2: Flow chart of baseline patient recruitment**

#### *3.4.1.4 Statistical analysis*

Data were captured and analysed using SPSS version 17. Descriptive statistics were performed calculating mean, standard deviations, and frequencies of baseline data of age, number of children living at home or elsewhere, gender, level of education, household income, employment status, length of hospital stay, side of stroke, impairment, method of diagnosis, area in the brain, and highest functional position at assessment where appropriate. Mean scores were also calculated for baseline impairment (NIHSS Rivermead), activity (Barthel Index, NEADL), and participation level (MRS).

### 3.4.2 Section two: Stroke epidemiological study

#### *3.4.2.1 Study design*

For this section of the study, a case-control study design was used to fulfil the second objective of this study - investigating the main risk factors of strokes in Hebron, Palestine. Domholdt (2000) describes case-control study designs as one that identifies a particular effect of interest in a group (case group), and identifying a matched group that does not have that particular effect of interest (control group), then studying the presence of factors that might have caused this effect, and highlighting the proportions of presence of those (causes) factors in the two groups.

This type of study is very useful in the exploration of risks and highlighting the effect of exposure to a certain risk on the incidence of a particular medical condition. As Rothman, Greenland and Lash (1998) point out, there are two main types of non-experimental epidemiological designs, cohort and case-control studies. Where diseases or outcome are rare, cohort studies become practical and case-control studies become a convenient design to study that disease. For this study the effect factor under study was the presence of a stroke, presence of stroke risk factors published in literature (explained and referenced in Section 3.4.2.3). These were investigated in the stroke group and compared to their presence in a non-stroke group that had a similar mean age.

For this case-control study, the cases were the same: 139 stroke patients, as described in section 3.3. For the control group, data were captured from the files and records of participants of the Al-Quds University Stroke Risk Factors Campaign that was done to evaluate the prevalence of stroke risk profiles in patients above 60 years of age in Hebron city. This campaign was conducted in August 2010 and included 350 persons who consented to participate in that campaign and allowed the use of their data for future scientific purposes and allowing future contact and follow-up for further research. From the 350 control files (participants of Al-Quds University stroke risk factors screening campaign), the researcher aimed to get one control for each case (139), and an extra 15 patients were added, to compensate for possible death, or refusal to participate in the research. The Research Randomizer Software (Version 3.0) that was developed by Urbaniak and Plous (2010) was used to sample the 154 control files (Appendix 5) from the 350 files (without matching for age or gender).

#### *3.4.2.2 Instrumentation*

Data regarding the presence of stroke risk factors in both the cases and the control groups, were collected through section D of the baseline data capturing sheet (Appendix 1), which was based on the stroke risk factors published in the literature review (Arboix *et al*., 2008; Han *et al*., 2009; Li *et al*., 2008; Sokrab *et al*., 2002) and included all of the following variables, with their operational definitions as presented in the literature. Age was calculated by subtracting the date of birth from the date of assessment. Hypertension (HTN) was defined as patients with systolic blood pressure of 140 mmHg and above, and diastolic blood pressure of 90 mmHg and more (AHA, 2012). Diabetes Mellitus (DM) was defined by the current WHO diagnostic criteria for diabetes as "fasting plasma glucose ≥ 7.0mmol/l (126mg/dl) or 2–h plasma glucose ≥ 11.1mmol/l (200mg/dl)".(WHO, 2008). (total) Cholesterol (Chol.) values were defined as desirable at less than 200 mg/dl, 200 – 240 mg/dl borderline high risk and above 240 mg/dl as high risk (AHA, 2011b; National Cholesterol Education Program, 1988). Triglyceride (TRG) was defined as less than 150 mg/DL to be desirable, 150 – 199 mg/DL as borderline high risk and more than 200 mg/dl is considered high risk for coronary artery diseases (Miller *et al*., 2010)

Height and waist circumference were measured by tape measure. Waist circumference was captured at 2 cm above the umbilicus (Yan *et al*., 2007). Waist circumference and height were also captured for the participants who were part of the control group. The waist height ratio was therefore calculated to determine obesity among patients and controls. A cut-off point of WHtR≥ 0.5 was used to describe overweight patients as according to Hsieh, Sheu, Hsueh & Wang (2002) and Browning *et al*. (2010).

Cardiac diseases were documented if the patient/control had atrial fibrillation, ischemic heart disease, valve pathology, cardiomyopathy or heart failure. Stress was measured by a nominal question (yes/no), questioning if the patient was subjected to a stressful event in the week before the stroke. Examples given were; death of a relative or friend, certain loss, fear, anxiety, or an unusual stressor that happened in the last week, and is not usual on normal days (Harmsen *et al*., 1990; Tsutsumi *et al*., 2009).

Previous TIA, family history of stroke (first-degree relatives), history of smoking in terms of average number of cigarettes smoked, total years of smoking, and if stopped period of cessation was recorded. Consumption of a fatty diet, such as butter, white meat, and animal products, was determined using a subjective scale on a point scale, starting from none, mild, moderate, and up to high consumer. Physical activity was determined by the number days that participants were physically active in a week. Physical activity was referred to as continuous activity of 30 minutes that increases the heart- and breathing rate (American Dietary Guidelines for Americans, 2005).

#### *3.4.2.3 Data collection procedure*

Data collection for the case group was gained through both capturing the data from the medical records plus an interview with the stroke patient, as well as the measurement of height, and waist circumference. Data collection of the control group was captured from the files and records of Al-Quds University Stroke Risk Factors screening campaign in Hebron, for people over 60 years old, that adopted the same data capturing sheet that was developed by the researcher (Part D of the baseline data gathering sheet, Appendix 1). Figure 3.3 explains the process of data collection.

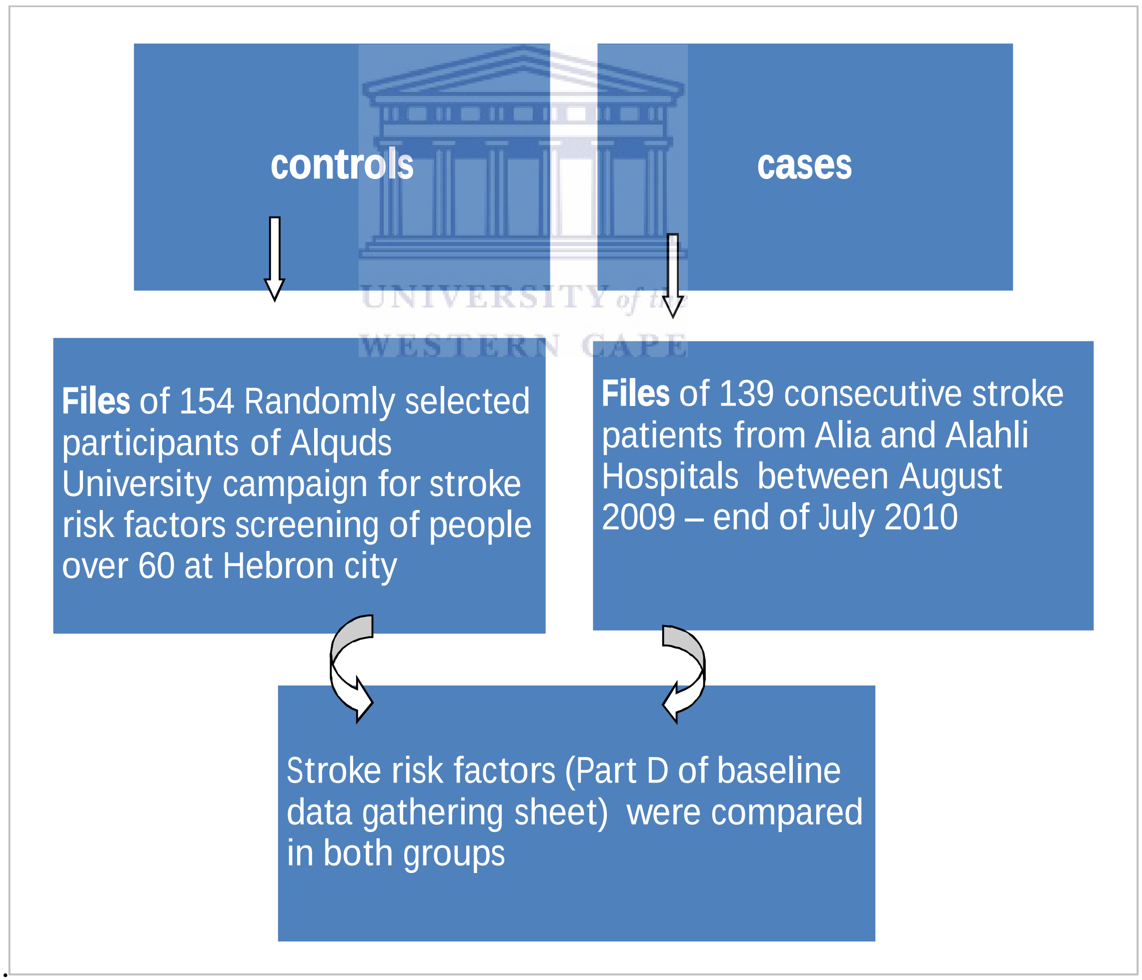



**Figure 3.3: Process of data collection of the epidemiological study**

After finishing data collection for both cases and controls, the researcher telephonically contacted all the control participants who had a positive family history of stroke, and a history of TIA, or both, to establish whether changes of lifestyle were put into place after these two events. Later after data analysis, and in order to explain findings in some results (that emerged after data analysis, that were different than what is found in literature), ninety-one participants in the control group were contacted, of whom 29 had both TIA and a family history of stroke, 26 had positive family history of strokes only, and 36 had a history of TIA only. Questions about potential modifications or measures that had been taken regarding the modifiable risk factors for strokes mentioned in Section 3.4.2.2 were asked (smoking, diet, physical activity, anticoagulant medication, monitoring of blood sugar, hypertension and lipids level).

#### *3.4.2.4 Data analysis*

SPSS version 17 was used for data capturing and analysis. Double entry was used to prevent data entry errors. Descriptive statistics analysis was performed to describe the personal characteristics, and prevalence of risk factors among the participants in both groups. Chi-square and odds ratio was calculated to investigate the strength of association between the prevalent risk factors and the incidence of strokes. Multivariate analysis was performed, using logistic regression to investigate stroke risk factors that could predict strokes. This logistic regression analysis included all the above-mentioned risks as potential risks (predictors) of stroke.



### 3.4.3 Section three: Stroke rehabilitation process in Palestine

In this section, the research addresses the third to fifth objectives of this study, namely determining the frequency with which stroke patients use the various rehabilitation settings (home care, outpatient, or rehabilitation institutions) in Palestine. The fourth objective related to identifying the factors influencing the choice of setting (choice planning), and the fifth objective of this research project that was related to determining the rehabilitation services and intensity received by Palestinian stroke patients in Hebron in terms of physiotherapy, occupational therapy and speech therapy.

#### *3.4.3.1 Design*

A descriptive, longitudinal observational design was used in this section. Descriptive design definition, advantages and disadvantages were explained earlier in section 3.4.1.1 of this chapter. The design is observational as no manipulation of variables was performed and longitudinal as it involved assessing and gathering information from patients over a period of time. The main motivation for using this design, was that the researcher aimed to follow up the patients without any intention of the researcher's intervention, and with the aim of capturing data about the various rehabilitation settings and services that the stroke patients might have used. In addition to patients' motivation behind choosing or not choosing a particular rehabilitation setting, together with capturing data about the rehabilitation services utilized by stroke patients (in terms of physiotherapy, occupational therapy, speech therapy, and psychological counselling) over the period of the first six months after stroke.

#### *3.4.3.2 Instrumentation*

A follow-up data capturing sheet (Appendix 4) was developed by the researcher, which was used by the research assistants to capture information on medical and rehabilitation settings use, rehabilitation services received, stroke patients mortality and stroke recurrence. The data sheet was used at three (T2) and six months (T3) assessment points, and it was included also in the assessment forms sent to stroke experts and in the pilot study mentioned in Section 3.4.6. This data sheet was completed at the patient's homes, and consisted of seven sections (A-I).

Section A: This section included information about mortality, date and cause of death (Benamer & Grosset, 2009; Feigin *et al*., 2009; Kotila *et al*., 1984), hospital readmissions and causes, stroke recurrence, side and date of stroke recurrence if applicable (Ay *et al*., 2010; Feng *et al*., 2010)



Section B: This section captured data relating to the rehabilitation process at the inpatient rehabilitation setting and included questions about motivation for choosing or not choosing rehabilitation services at inpatient settings, at three months (T2) and at six months (T3) assessment points. Moreover, for those who accessed inpatient rehabilitation settings, a table that included the period of rehabilitation use in weeks, average sessions frequency in a week, number of sessions per day, average length of session, and total hours (intensity) of each rehabilitation service (physiotherapy, occupational therapy, speech therapy, and psychological counselling) at inpatient rehabilitation settings.

Section C: This section captured data related to the home rehabilitation process in the home rehabilitation settings, and included questions about motivation of choosing or not choosing rehabilitation services at home settings, at three months (T2) and at six months (T3) assessment points. For those who used home rehabilitation settings, a table that included the period of use in weeks, average sessions frequency in a week, number of sessions per day, average length of session, and total hours (intensity) that was used for each rehabilitation service (physiotherapy, occupational therapy, speech therapy, and psychological counselling), in the home rehabilitation setting.

Section D: This section captured data related to the rehabilitation process that occurred in the outpatient rehabilitation setting. This section included questions about motivation of choosing or not choosing rehabilitation services at outpatient rehabilitation settings at three months (T2) and at six months (T3) assessment points, and for those who used the outpatient rehabilitation setting. A table that included the period of use in weeks, average sessions frequency in a week, number of sessions per day, average length of session and total hours (intensity) that was used for each rehabilitation service (physiotherapy, occupational therapy, speech therapy, and psychological counselling) in the outpatient rehabilitation setting.

Section E: This section included the number of times that the patient visited or was visited by a medical doctor and the reasons for those visits.

Section F: This section included the data relating to the frequency of the patient's use of the affected hand in activities of daily living and the patient's self-assisted exercises.

Section G: This section targeted capturing the data related to the amount of family involvement in patient exercises in terms of periods in weeks, frequency of sessions per week, length of session, number of sessions per day and total hours of exercises performed by the family (intensity).

Section H and section I captured data concerned with the stroke risk factor profile, and socioeconomic status, that were explained in sections D and B respectively in the baseline questionnaire, with the aim of follow-up and future study of the change in risk profile after a stroke, and any changes of socioeconomic status, at three and six months after the stroke.

#### *3.4.3.3 Data collection procedure*

To collect data relating to the process of rehabilitation, the researcher made telephonic contact with the patient or the caregivers, at three, and six months post-stroke. An appropriate appointment was set, and the research assistants then visited the patients at their homes. At these two assessment points (T2 and T3), the follow-up data capturing sheet was completed through a direct interview with the patient and the caregivers. Observation of medical reports and discharge notices were also undertaken. Use of care data capturing sheet was also completed at these follow-up session. Data was captured in terms of rehabilitation setting (inpatient, outpatient and home rehabilitation). The patients were then questioned about the different rehabilitation services that they might have received during the three months after hospital discharge (for T2) and between 4-6 months post-stroke (for T3) in terms of physiotherapy, occupational therapy, speech therapy, and psychological counselling. Extraction of data from the medical files was conducted for those who had been admitted to an inpatient rehabilitation institution, or outpatient clinics upon their consent. This process took place at both assessments points T2 and T3.

#### *3.4.3.4 Statistical analysis*

Data were analysed using SPSS (version 17). Patients were given a code represented by their serial number in the sample to prevent duplication. Double entry was performed to prevent data entry errors.

Descriptive statistics were presented as frequencies to present data about the use of care in different rehabilitation settings. Means and standard deviations were calculated for presenting frequency, length, period, and intensity of the use of different rehabilitation services. If the data were normally distributed, the median was presented, to show the use of care at different rehabilitation settings and related time periods.



### 3.4.4 Section Four: Stroke rehabilitation outcome

In this section, the research has highlighted stroke rehabilitation outcomes by capturing the changes of functional activity (activity limitations), motor function (impairments) and participation restriction over the three assessment points (baseline, 3 months, and six months). In this section the researcher addresses the fifth and sixth research objectives concerning identifying motor function, functional activities, and participation level, at three months (T2) and six months (T3), and the socio-demographic and rehabilitation process factors that predict the stroke rehabilitation outcome at both assessment points, T2 and T3.

#### *3.4.4.1 Design*

The research adopted a descriptive longitudinal observational design. Domholdt (2000) describes it as the collection of data involving description and measurement of the sample at several points over an extended period of time. Farrington (1991) summarised the advantages of the longitudinal study design as giving information about the "onset and desistance, continuity and prediction and providing information about within-individual change” (p.369) and mentioned its main disadvantages, as “confounding factors of aging and period effect, delayed results, continuity of funding, and cumulative attritions”. In this study, the same participants were followed up without manipulation. The differences between base line (T1), and follow-up assessment, at three months (T2), and six months (T3), were detected. This made the longitudinal design the best type of descriptive study to adopt for this part of the thesis.

#### *3.4.4.2 Instrumentation*

For data collection related to stroke rehabilitation outcome, the researcher used the same 5 validated, reliable outcome measures for the purpose of data collection on outcome of stroke rehabilitation at three months (T2) and at six months (T3).

These five standardised and validated outcome measures were previously discussed in Section 2.5 as the main assessment battery. The assessment battery consisted of the Barthel Index (BI), Rivermead Motor Assessment Scale (RMA), Modified Rankin Scale (MRS), National Institute of Health Stroke Scale (NIHSS), and the Nottingham Extended Activities of Daily Living (NEADL) (Appendix 3a–3e) where they were administered in hospitals at T1, and in patients’ homes in T2 and T3 (Further details about those outcome measures are explained in chapter three, Section 3.4.1.2 and in the literature review in chapter two.



#### *3.4.4.3 Data collection procedure*

According to Domholdt (2000) there are four main methods of data collection in descriptive prospective design, namely observation, examination, interview (structured or non-structured), and questionnaire (that may be filled through interview, or independently by the research participant). In this section, the research used examination, observation, and (data capturing sheets) questionnaires (completed by interview with patient and the caregivers).

Patients included in the study were assessed during the first two weeks post-stroke (as mentioned in Section 3.1.3) through revision of medical files, direct observation, interviews, observation and physical assessment. At three and six months assessment points (± one week), patients were contacted through phone call, to set a suitable time and date for reassessment, that was done at patients’ homes, in consultation with care givers. The follow-up data capturing sheets were completed and the patients and/or the caregivers were interviewed regarding the items in the Barthel Index, and the Nottingham Extended Activities of Daily Living. Rivermead Motor Assessment was then assessed by requesting that the patients perform specific activities (under direct observation). Scores of zero were given when the patient could not perform any item, and a score of one was given when the patient could perform any of the items in the three sections of the RMA. Then The NIHSS was also completed by direct observation of the patients' responses to the commands given in the NIHSS, and relevant scores were given for each item. At the end, the Modified Rankin Scale items were captured through an interview.  The follow-up assessments lasted approximately one hour per patient. Figure 3.4 explains the process of data collection for the stroke rehabilitation outcome section.

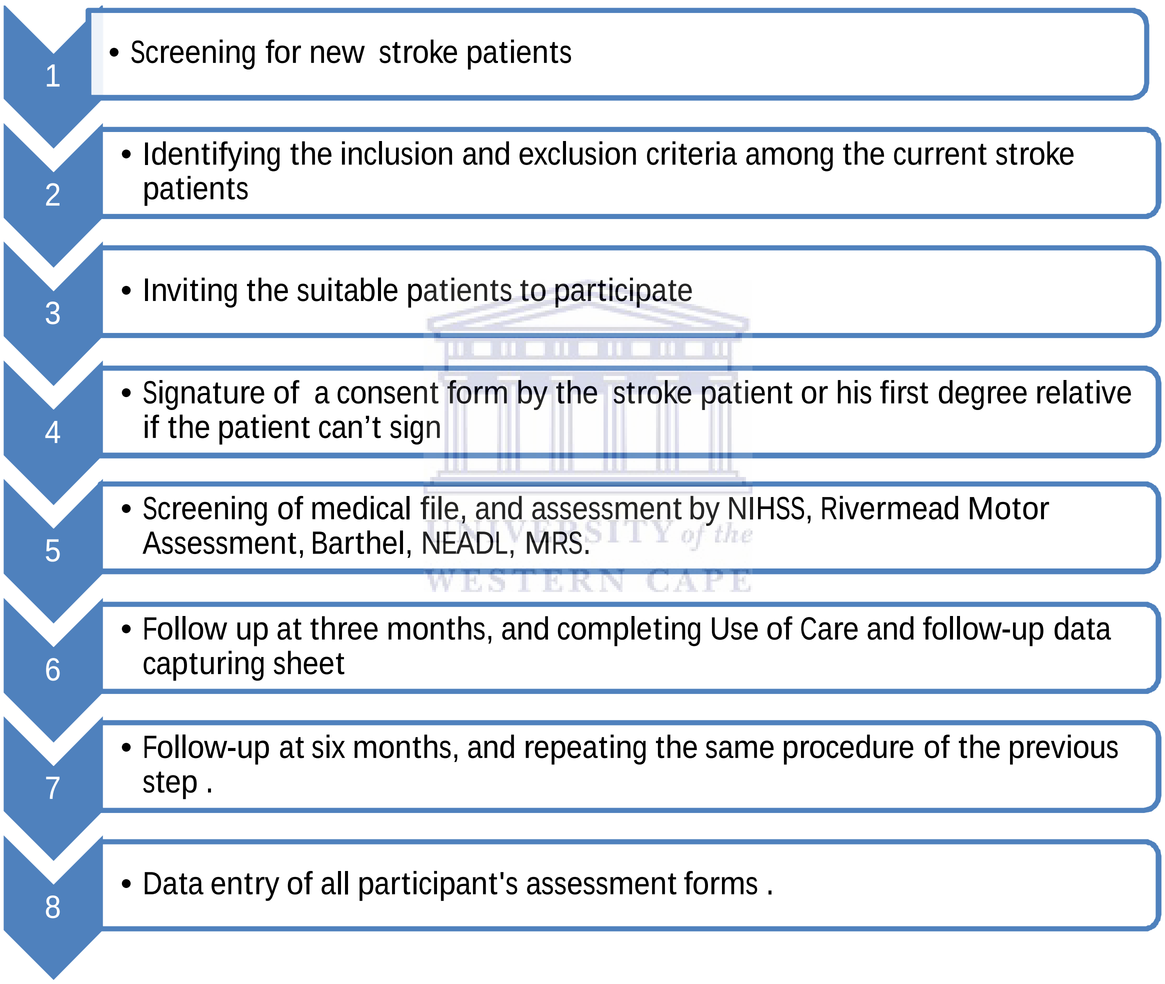





**Figure 3.4: Flowchart shows the process of fourth section of the study (Stroke rehabilitation outcome)**

#### *3.4.4.4 Statistical analysis*

Data were captured and analysed using SPSS (version 17). Patients were given a code represented by their serial number in the sample to prevent duplication. Double entry was performed to prevent data entry errors.

Descriptive statistics were used to present the changes between baseline, three months, and six months assessment points. The correlation between improvement of Barthel Index (activity), Modified Rankin Scale (participation), and Rivermead (motor function), at three and six months, was performed against all possible contributing factors to prognosis, such as socioeconomic and demographic variables, severity at baseline and rehabilitation services and settings and use of care variables, after normality assumptions were tested and found not satisfactory using the Kolmogorov-Smirnov/ Shapiro-Wilk tests ($p<0.05$). The significance of the correlation coefficient was tested at a significance level of 0.05. The Wilcoxon Test was used to investigate the significance of difference of mean between the baseline and T2/T3 was also calculated for each outcome measure in between the three assessment points (T1, T2, and T3). Mann Whitney non-parametric test was used to show the difference of mean (improvement) for each outcome measure, at the T2 and T3 tests to investigate the significance of improvement mean difference between subcategories of nominal variables like gender, education, marital status and rehabilitation setting.

An intention-to-treat analysis was conducted. Data of patients who had died from stroke-related causes were included in the analysis (Hesse *et al*., 2008). Participants who had died were assigned a score of six for the Modified Rankin Scale and zero for the Barthel Index and Rivermead Motor Assessment Scores. Backwards stepwise regression analysis was used to determine factors that could predict the outcome at 3 and at 6 months. These factors included factors mentioned in the literature review (presented earlier in Section 3.3.1). In addition to socioeconomic and demographic factors, factors relating to rehabilitation services and settings, and baseline outcome assessments that proved to be statistically and significantly correlated to improvement were also included in the regression analysis.

### 3.4.5 Training of research assistants

During July 2009, two physiotherapists were trained as research assistants. The training included giving the assistants the outcome measures, baseline and use of care (follow-up data capturing sheets), with the relevant explanatory hand-outs. Theoretical discussions were then held to explain the contents of the instruments and practical parts of the elements of the assessment tools were discussed. At the end practical sessions were held where videos and role-playing were used as a method of training. Different interview and communication skills were revised.

During the piloting of the research assessment instruments, the researcher accompanied the assistants and performed the first two patient assessments in front of the assistants. Each assistant was asked to do four patient assessments while the researcher observed the session.

### 3.4.6 Piloting of the instruments

A pilot study was performed on 10 stroke patients at Alia Hospital after permission was granted from the Palestinian Ministry of Health to start the research, based on the preceding ethical clearance and ethical permission given by the University of the Western Cape and Hebron health directorate.

The aim of the pilot study was to familiarise the research assistants with the use of the assessment battery, that included five standardized outcome measures mentioned in section 3.4.1.2 (BI, RMA, NIHSS, NEADL, and MRS), together with the data capturing sheets (baseline, and follow-up data capturing sheets) that were designed to collect data about socio-demographic, epidemiological, baseline stroke, and rehabilitation process information. There was no intention to analyse the results of the pilot study or include them in the main thesis, as the aim was the training of the research assistants in the process of data collection, and the use of the assessment battery and the addition of any necessary modifications that might appear useful after the end of the pilot study.



#### *3.4.6.1 Procedure of the pilot study*

After permission was given, the research assistants were introduced to the medical and nursing staff in the hospital. The aims and objectives of the study were explained and the ethical considerations were highlighted by the researcher. An agreement regarding the future daily inquiries about new stroke patients was formulated and the research assistants assessed their first patient for the pilot in June 2008. The process of medical file review and data extraction from the medical records was practiced and discussed. The research assistant introduced himself to the patient, explained the aims and objectives, invited the patient to participate in the research and was supervised and evaluated by the researcher. The sequence of the future research procedure was practiced. This consisted of screening of new stroke patients → screening of inclusion/exclusion criteria in the newly admitted patients → invitation to the suitable stroke patients according to the inclusion and exclusion criteria → full explanation for the patient about the aims and objectives of the study → patients who agree to participate, signing a written consent form → medical files reviewed and data captured to the baseline data capturing sheet → baseline data capturing sheet was completed and filled out by interview →

assessment of the patient by NIHSS →RMA →BI → NEADL →MRS→ setting a potential follow-up date at three and six months→ repeating of the 5 standardised outcome measures and filling out of the follow-up data capturing sheet .

#### *3.4.6.2 Outcome of pilot study*

Minor changes were made on the baseline data gathering sheet as one variable targeting the side of impairment in body after stroke had the options of right or left side. After piloting, the researcher added the option of both sides based on the findings of the pilot study. On the application of the assessment battery level, the performance of the research assistants dramatically improved after assessing the last patient, as at that time each one of them had competed the assessment of four patients under the correction, supervision, and feedback of the researcher, in addition to the two patients that were practically demonstrated by the researcher and the other four patients that were assessed to complete the number of participants for the pilot study.

## 3.5 ETHICAL CONSIDERATIONS

Ethical clearance and permission was granted by the Faculty of Community and Health Sciences' Higher Degrees Committee, and the Senate Research Grants and Study Leave Committee of the University of the Western Cape. Permission was also obtained from the local Ministry of Health and the medical superintendents of the two general hospitals. Stroke patients meeting the inclusion criteria were invited to participate in the study. The aim of the study was explained to them. They or their first degree relative or caregiver (spouse, daughter, son, sister, brother), were requested to provide written informed consent if the patients was unconscious. The participants were assured that all information obtained would be handled confidentially, as no names would be used in analysis or presentation of results, and that they had the right to withdraw from the study at any time. They were also assured that if they decided to withdraw that this would not affect any treatment they would be receiving, and that the information obtained will only be used for research purposes. The researcher also stated that counselling services were available at the two hospitals should any of the participants require it.

Results of this study were available for dissemination to the hospitals participating in the study, Bethlehem Arab Society for rehabilitation, and worldwide through publication of the results. Data is locked in a closed locker by the researcher for at least five years after the research for potential future use and further research.

# CHAPTER 4: RESULTS

## 4.1 INTRODUCTION

This chapter will be presented in four main sections and will address the first to seventh objectives of the research. The first section will present the baseline profile of Palestinian stroke patients. Section two will present the epidemiology of strokes and the risk factors in both stroke and control groups to address the risk profile of Palestinian stroke patients. Section three will present the use of different rehabilitation settings and different rehabilitation services at each setting and will highlight the motivation behind choosing or not choosing any particular rehabilitation settings and the intensity for use of care for the different rehabilitation services, at each setting. The fourth section describes the stroke rehabilitation outcome at three and six months after the stroke and presents an analysis of the factors associated with or predicting this outcome.

## 4.2 PALESTINIAN STROKE PATIENTS BASELINE PROFILE

In this section the research describes the sample in terms of recruitment follow-up, demographic and socioeconomic data. Baseline status of the stroke cases will be presented in terms of severity, impairment and functional activities. Side and type of stroke will also be presented in this section.

### 4.2.1 Participants recruitment follow-up

Between August 2009 and the end of June 2010, 351 patients were admitted to both Al-Ahli and Alia Hospitals with signs and symptoms of a stroke (refer to Figure 4.1). Only 147 of these had their first-ever stroke and eight of them refused to participate in the research, so the final sample was composed of 139 patients. Patients recruited from Alia Hospital were 48.9%, and 51.1% were recruited from Al-Ahli Hospital. As mentioned in Chapter three in section 3.1, the target sample was 123 stroke patients at the end of the study. The researcher continued data collection, even after the requested 123 patients were recruited, and stopped at the end of July 2010, which means that this was a full year hospital-based study.

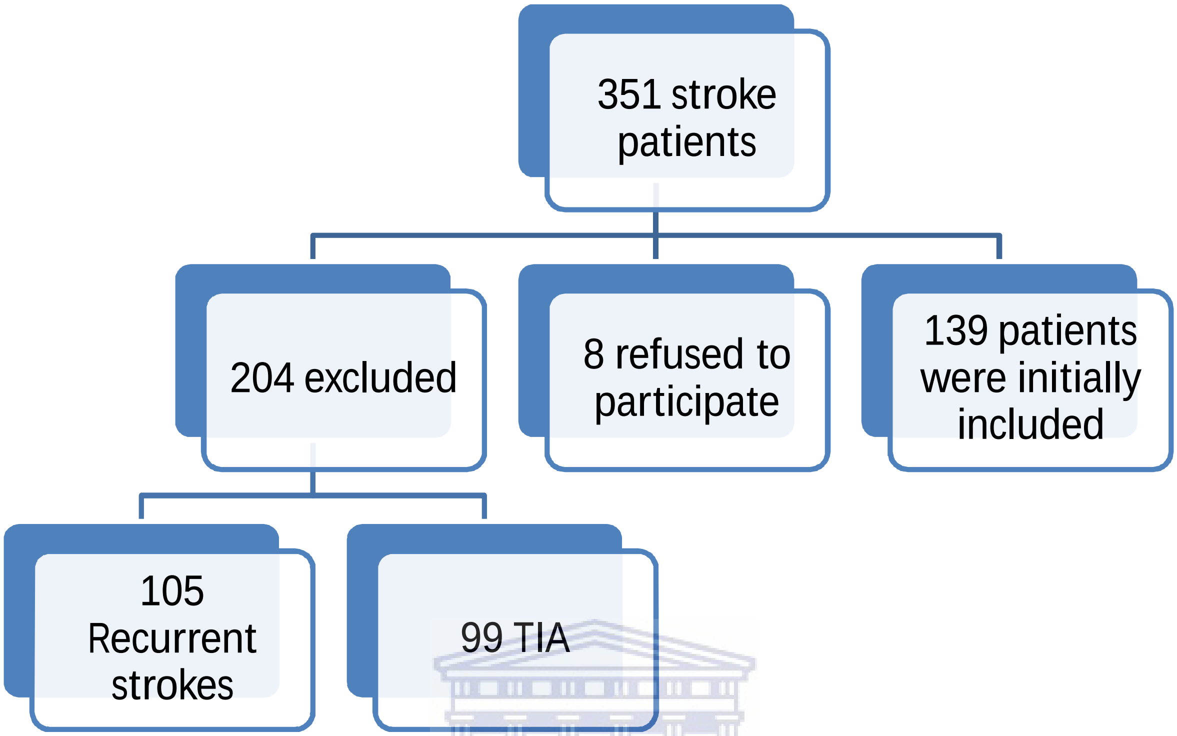



**Figure 4.1: Flow chart of participants' selection**

Figure 4.2 shows that of the 139 recruited stroke patients, 22 died between initial assessment and three months follow-up (T2 assessment point), and 26 patients died between the fourth and the sixth month after their stroke (T3 assessment point). At first assessment (T1) 139 patients were assessed, at (T2) three months after stroke, 117 patients survived and were assessed for the second time, and at (T3) six months after stroke 91 patients survived and were assessed for the third and final assessment.

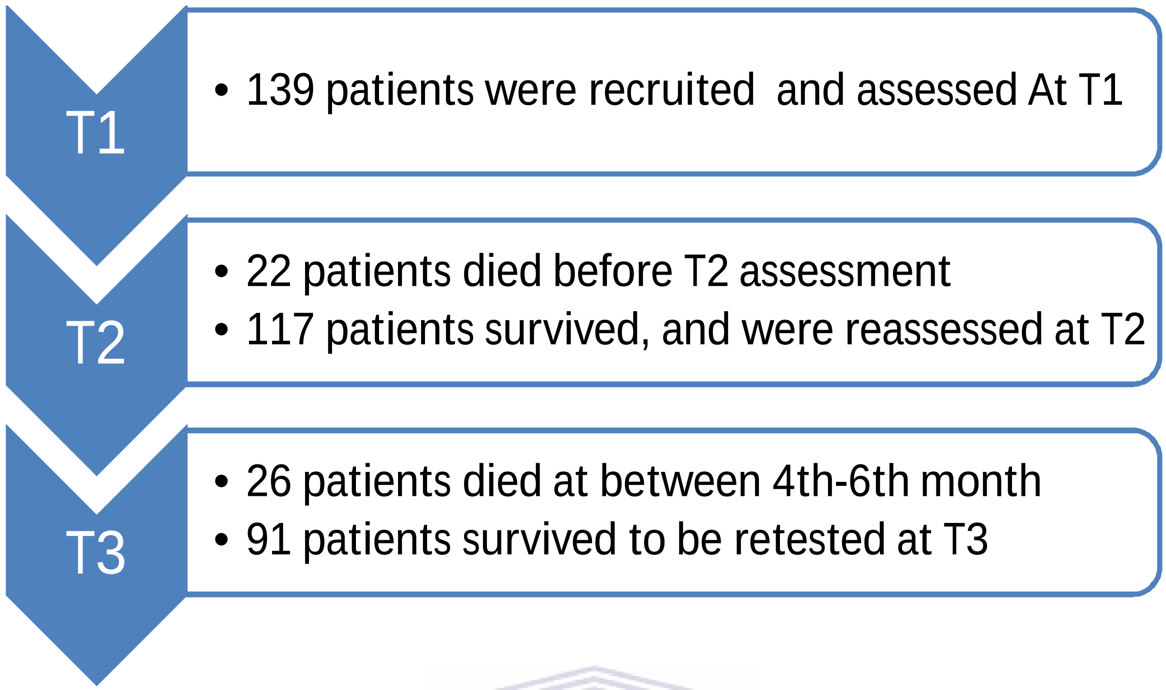



**Figure 4.2 Recruited patients survival at different assessment points**



Patients who died from stroke-related reasons (40 patients, 83% of deaths) were assigned the maximum score, in reassessment points after death, but questions about their rehabilitation process were captured from the caregivers, medical file and closest family relatives**.** The average number of days between stroke onset and death during the first six months post-stroke was 79.53 (Std. = 61.504). One month mortality was 12.94% (n = 18), so 81.85% (18/22) of those who died in the first three months survived the first month post stroke.

Strokes reoccurred in 21.6% (n = 30) of the stroke patients in the first three months after stroke (T2 period). The average days between the first stroke and recurrence was 20.87 days (Std. = 22.420). During the T3 period, 16.5% (n = 23) reported that they had sustained a recurrent stroke, which was confirmed by medical report (discharge sheet) after an average of 124.57 days (Std. = 41.464). All patients who had recurrent strokes had their recurrent stroke on the same side of the first stroke, except for one patient who had a recurrent stroke on the other side. Recurrent stroke patients were included in the analysis of stroke outcome.

### 4.2.2 Socio-demographic profile of the participants

#### *4.2.2.1 Age of participants*

The sample consisted of 139 patients with an average age of 67.64 years, and a median age of 69 years, a mode age of 80 years (10 patients) and a standard deviation of 11.74 (see Figure 4.3).

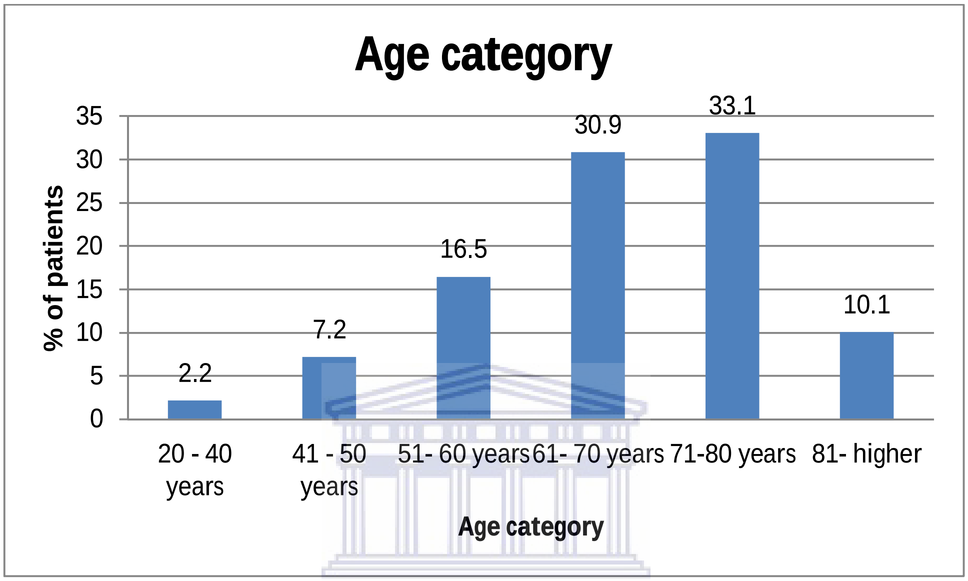





**Figure 4.3 Percentages of different age categories (n=122)**

The mean female age was older than mean age of males (67.00 ± 1.57years) vs. (66.06 ± 1.29 years) respectively (t = 0.501 P>0.05).

#### *4.2.2.2 Gender, marital status and level of education of participants*

There were more females than males in this study. Females accounted for 60.4% of the sample. More than half of the sample was married (55.4%) and living with a spouse; the rest of the participants (42.4%) were either widows or widowers. Table 4.1 summarises the demographic data of the sample.

**Table 4.1: Gender, marital status, and level of education of participants (n=139)**

| Socio-demographic status | n (%) |
|---|---|
| **Gender** | |
| Male | 55 (39.6) |
| Female | 84 (60.4) |
| | |
| **Marital status** | |
| Married | 77 (55.4) |
| Widow | 48 (34.5) |
| Widower | 11 (7.9) |
| Divorced | 2 (1.4) |
| Never married | 1 (0.7) |
| | |
| **Level of education** | |
| Elementary | 29 (20.9) |
| Preparatory | 12 (8.6) |
| Secondary | 14 (10.1) |
| basic Degree | 2 (1.4) |
| Diploma | 1 (0.7) |
| BA | 5 (3.6) |
| None | 76 (54.7) |
| **Total** | **139 (100.0)** |



#### *4.2.2.3 Employment at the time of stroke*

The majority of patients were not working at the time of the stroke (85.1%). Twenty participants (14.4%) were working at the time of the stroke - of these, 17 patients (12.2%) were self-employed, and 3 (2.2%) were formally employed. Participants' main reasons for not being employed were due to illness and disability (43.9%) or that some female patients were housewives (28.1%). Table 4.2 summarises the employment status in the sample.

**Table 4.2: Employment status at time of stroke (n=139)**

| Work variables | n (%) |
|---|---|
| **Work status** | |
| Working at the time of stroke | 20 (14.4) |
| Not working at the time of stroke | 119 (85.6) |
| **Reasons for not working (at the time of stroke )** | |
| Unemployed - preferred not to work | 7 (5.1) |
| Unemployed - looking for work | 4 (2.9) |
| Unemployed due to illness or disability | 39 (28.1) |
| Retired | 8 (5.8) |
| Housewife | 61 (43.9) |
| **Employment** | |
| Employees | 3 (2.2) |
| Self employed | 17 (12.2) |
| **Type of work** | |
| Office work | 8 (5.8) |
| Physical work | 10 (7.0) |
| Both physical and office work | 2 (1.4) |
| **Hours of work** | |
| Full time | 12 (8.6) |
| Irregular hours | 6 (4.4) |
| Part time | 1 (.7) |
| Others | 1 (.7) |



#### *4.2.2.4 Income at the time of stroke*

Approximately 57% reported that they were meeting their monthly expenses with difficulty (Figure 4.4) or with great difficulty and 25.2% reported some difficulty in meeting monthly household costs.

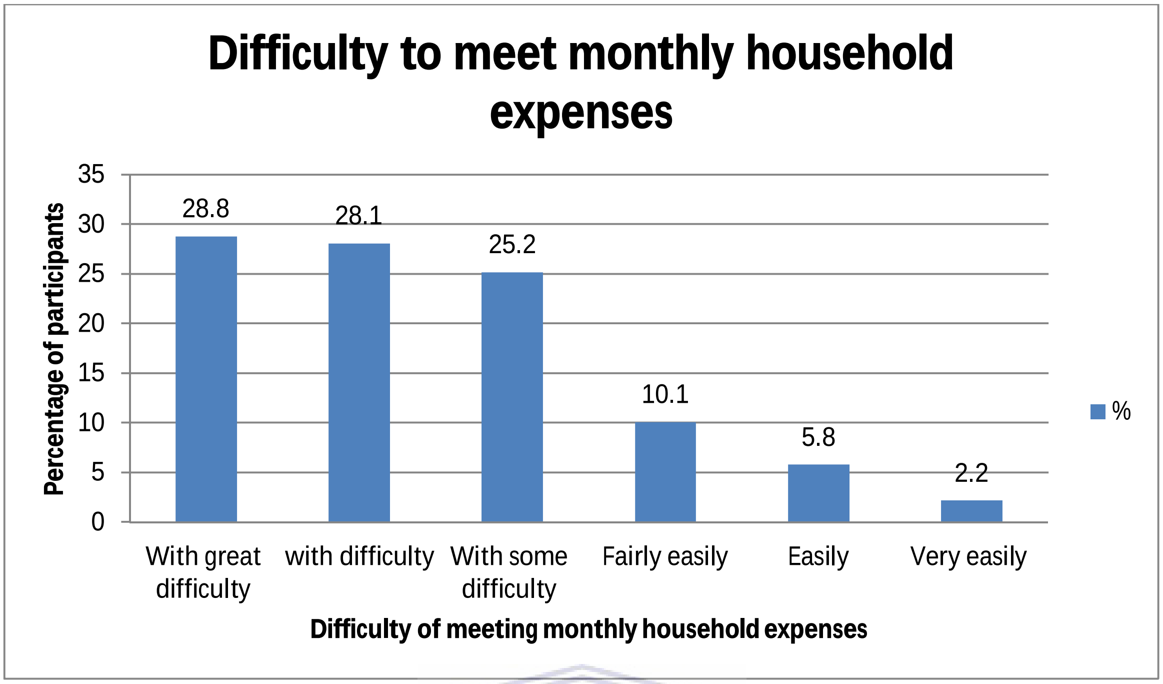



**Figure 4.4: Meeting monthly expenses of their household (n=139)**

### 4.2.3 Stroke description

The majority of the patients arrived at the hospital and had CT scan imaging the same day of the stroke. The average length of stay was around 5.6 days (Std. = 5.73 days). The average days between the stroke and research assessment was 2.04 days (Std. =2.00 days) (see Table 4.3).

**Table 4.3: Descriptive statistics of number of days between stroke and (admission, brain imaging, research assessment and discharge)**

| Variables | Mean (Std.) |
|---|---|
| Number of days between stroke and admission | 0.27 (0.85) |
| Number of days between admission and imaging | 0.27 (0.07) |
| Number of days between stroke and assessment | 2.04 (2.00) |
| Number of days spent at hospital | 5.59 (5.37) |

As shown in Table 4.4, 80.6% of patients had an ischemic stroke, the rest (19.4%) had a haemorrhagic stroke. 95% of the patients had a CT scan, 2.2% were diagnosed by MRI and 2.9% had a clinical diagnosis. Approximately 53% had left side brain impairment (Rt.Hemiplegia), 41.7% had right side brain impairment (Lt. Hemiplegia) and 5.8% had both sides affected.

In terms of anatomical region of stroke in the brain, 68.3% were reported as having cerebral strokes, 10.1% basal ganglia strokes and 7.2% cerebellum strokes. The remaining patients had their strokes in different regions of the brain.

**Table 4.4:** ***Clinical aspects of stroke. (n=139)***

| **Stroke Clinical aspect** | **n (%)** |
|---|---|
| **Type of stroke** | |
| Ischemic | 112 (80.6) |
| Haemorrhagic | 27 (19.4) |
| | |
| **Side of stroke** | |
| Right | 58 (41.7) |
| Left | 73 (52.5) |
| Both | 8 (5.8) |
| | |
| **Method of diagnosis** | |
| CT Scan | 132 (95.0) |
| MRI | 3 (2.2) |
| Clinical | 4 (2.9) |
| | |
| **Region of stroke in the brain** | |
| Cerebral | 95 (68.3) |
| Basal Ganglia | 14 (10.1) |
| Cerebellum | 10 (7.2) |
| Brain stem | 6 (4.3) |
| Parietal | 5 (3.6) |
| Frontal | 3 (2.2) |
| Occipital | 2 (1.4) |
| Thalamus | 1 (0.7) |
| Temporal | 1 (0.7) |
| Others | 2 (1.4) |
| **Total** | **139 (100.0)** |

### 4.2.4 Outcome of stroke at baseline

Stroke impact was assessed within the context of ICF. Baseline assessment of the patients was presented in graphs and tables illustrating the impairments (motor function), functional outcomes (activity limitations) and participation restrictions experienced by the participants. Baseline (T1) assessment was performed within an average of 2.04 days from the time of the stroke.

#### *4.2.4.1 Baseline (T1) impairment in participants*

*A. Stroke baseline severity (NIHSS)*

Stroke severity was measured using the National Institution of Health Stroke Scale (NIHSS), which is an impairment outcome measure that ranges between 0 (normal) to 42 (most severe). The variant degrees of severity was defined based on the Briggs *et al*. (2001) cut-off point of NIHSS severity definitions (severe >17, Moderate 8 - 16, and Mild <8). As seen in Figure 4.5, 46.8% of the participants were identified as severe cases (NIHSS>17), 41% as moderate (NIHSS 8-16), and the rest of the participants (12.2%) were considered as suffering from mild strokes.

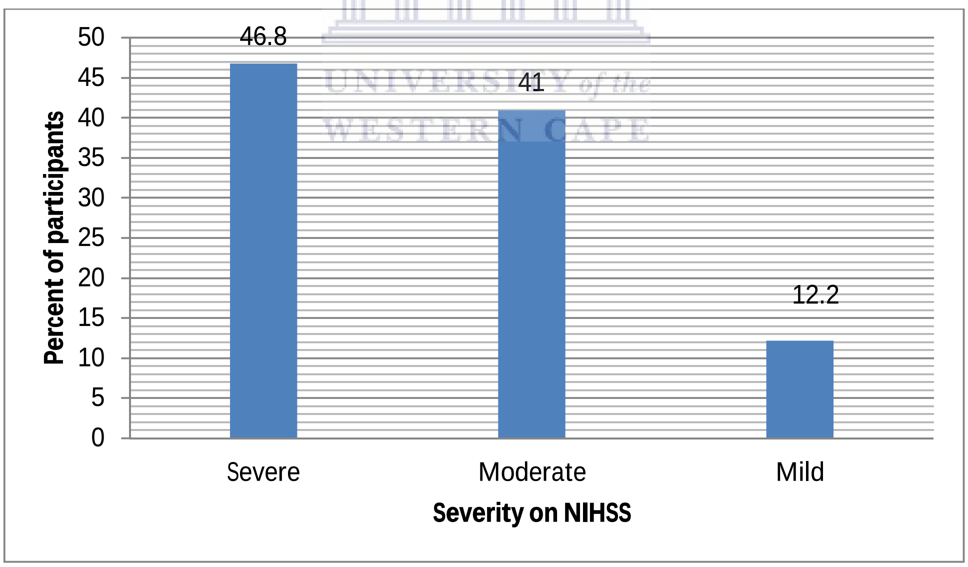
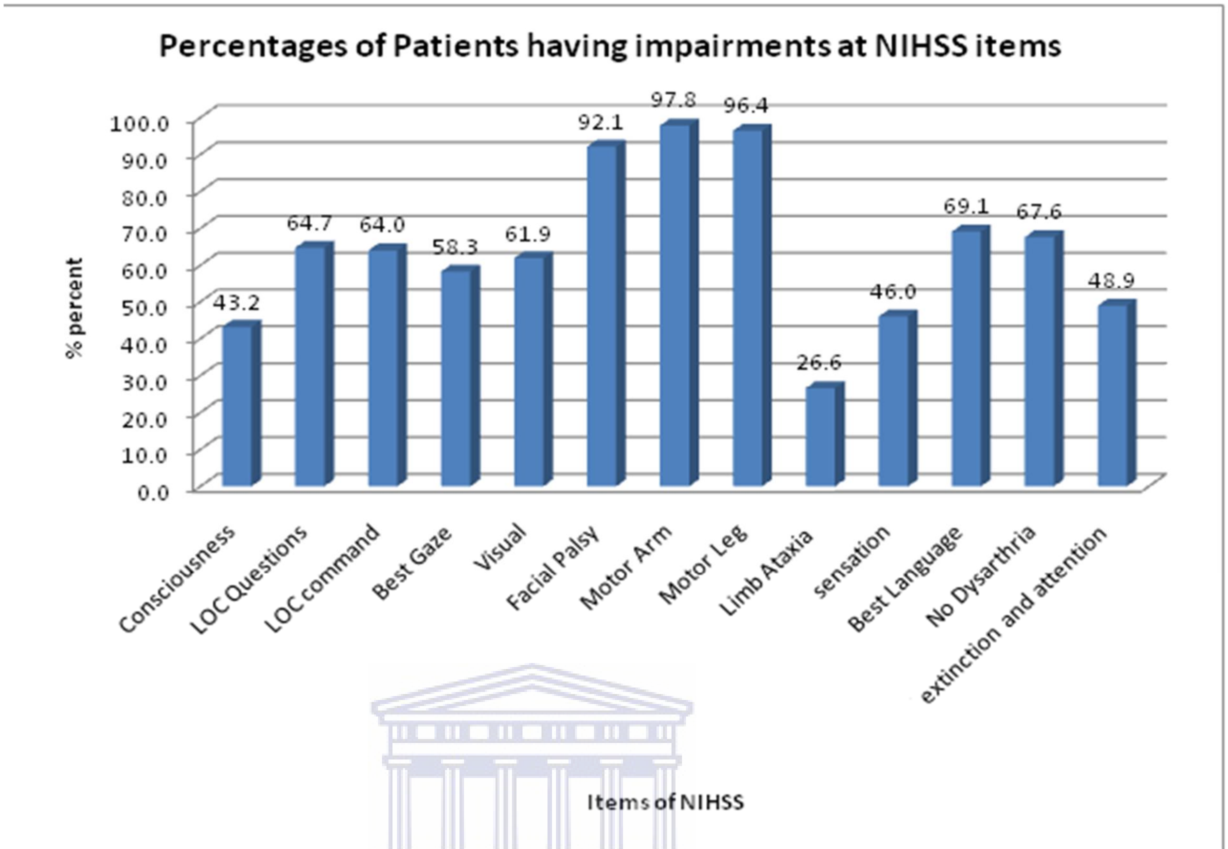





**Figure 4.5: Severity at baseline measured by NIHSS (N=139)**

Frequency of impairments on the NIHSS at T1 is shown in Figure 4.6, which is presented as percentages of patients that had impairment in the different items of the NIHSS (Severe – Mild). It is noteworthy that 43.2% of the patients had cognitive impairment, which in turn negatively affected the other items of the NIHSS.




Key: LOC= level of consciousness



**Figure 4.6: Percentages of patients with impairments on different items of NIHSS (N=139)**

*B. Motor impairment at baseline*

Motor function impairment was evaluated by the Rivermead assessment and the mean Rivermead score of patients at baseline was 1.71 (Std. = 4.55). The motor function impairment at baseline is presented based on the three main domains of the Rivermead Motor Assessment: gross function, leg and trunk and arm.

The mean score of the three parts of the Rivermead Motor Assessment (RMA) is presented in Table 4.5, together with the standard deviation of the three parts of the RMA. The mean in the three parts was less than one, which reflects a very low RMA score at baseline.

**Table 4.5: Mean score of three parts of RMA at baseline.**

| Part of RMA | Mean | Std. |
|---|---|---|
| Gross motor function total at T1 | 0.39 | 1.44 |
| Leg and trunk total at T1 | 0.78 | 1.72 |
| Arm total at T1 | 0.53 | 1.75 |
| **Total RMA** | **1.71** | **1.55** |

*B.1 Rivermead Gross Motor Function (RMA-G)*

The gross motor function at baseline was reflected by the gross function part of the Rivermead Assessment (RMA-G). Figure 4.7 shows the percentages of patients who had been unable to perform different items of (RMA-G). Approximately 83% of the patients could not sit unsupported at baseline. The percentage of patients who were unable to perform the other items kept increasing as the subsequent items in the RMA-G are more difficult to perform.

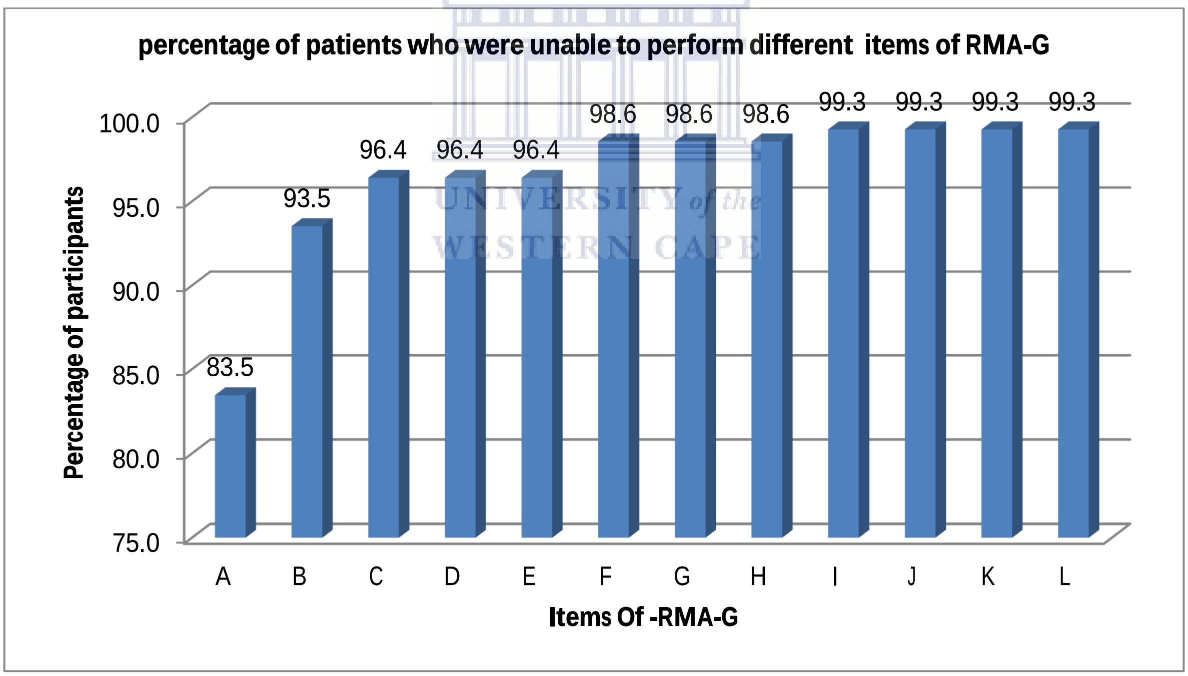



**Figure 4.7 Percentage of patients who could not perform different items of RMA-G at T1 (N=139)**

**Key for items of RMA-G**

**A:** Sit unsupported without holding onto edge of bed, feet unsupported

**B**: Lying to sitting on side of bed using any method

**C**: Transfer from wheelchair to chair towards unaffected side. May use hands

**D**: Transfer from wheelchair to chair towards unaffected side. May use hands

**E**: Transfer from wheelchair to chair towards affected side. May use hands

**F**: Walk 10m indoors with any walking aid. No stand-by help

**G**: Climb stairs independently

**H**: No stand-by help. No caliper, splint or walking aid

**I**: Walk 10m, pick up bean bag from floor, turn and carry back. Bend down any way

**J**: Walk outside 40m. May use walking aid, caliper or splint. No stand-by help

**K**: Walk up and down four steps. Patient may use an aid or stairs without a rail

**L**: Run 10m. Must be symmetrical

*B.2 Rivermead Motor Assessment - leg and trunk scores at T1 (RMA-LT).*

The percentages of patients who were unable to perform the items of the leg and trunk section of the Rivermead Motor Assessment are presented in Figure 4.8. In this part of the RMA, impairment does not follow a hierarchical order.

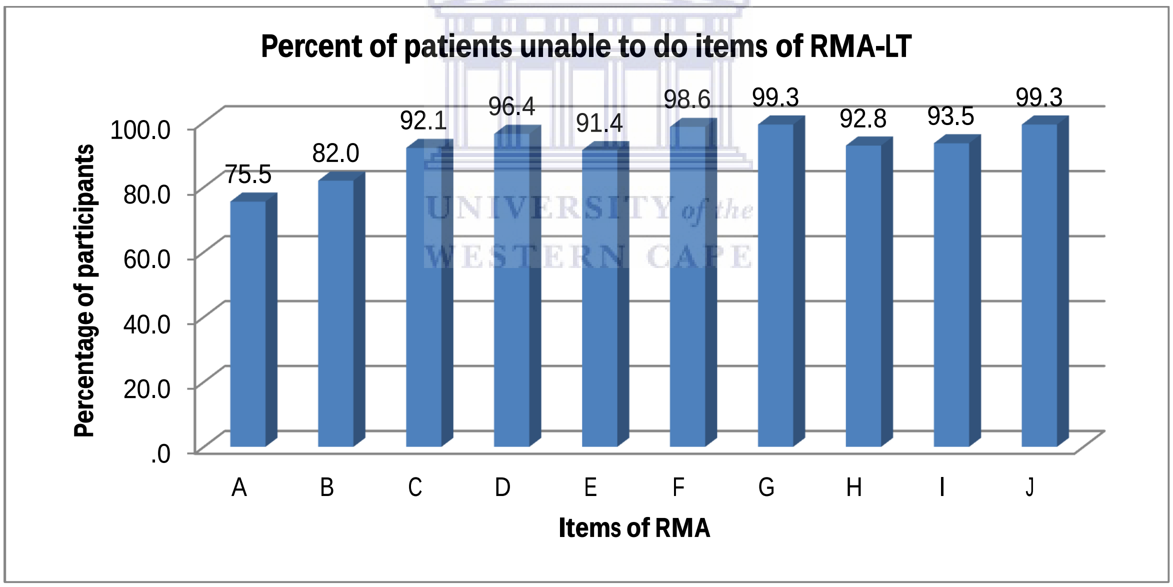



**Figure 4.8 Percentage of patients unable to perform different items (RMA-LT) at T1 (N=139)**

**Key for items of RMA-LT:**

A. Roll to affected side

B. Roll to unaffected side

C. Half-bridging

D. Sitting to standing

E. Lift affected leg over side of bed

F. Step unaffected leg on and off block in standing

G. Tap ground lightly 5 times with affected leg in standing

H. Dorsiflexion of affected ankle in lying with knee flexion

I. Dorsiflexion of affected ankle in lying knee extension

J. Place affected leg in neutral position, with knee flexion

*B.3 Rivermead Motor Assessment, arm part (RMA-A)*

The percentage of the patients who were unable to perform the items of the arm part of the Rivermead Motor Assessment (RMA-A) are presented in Figure 4.9.

Approximately 81% of the patients could not protract the shoulder while the arm was elevated while around 90% could not hold an extended arm in elevation. The vast majority (>95%) could not perform the other items of the arm and upper extremity at RMA-A.

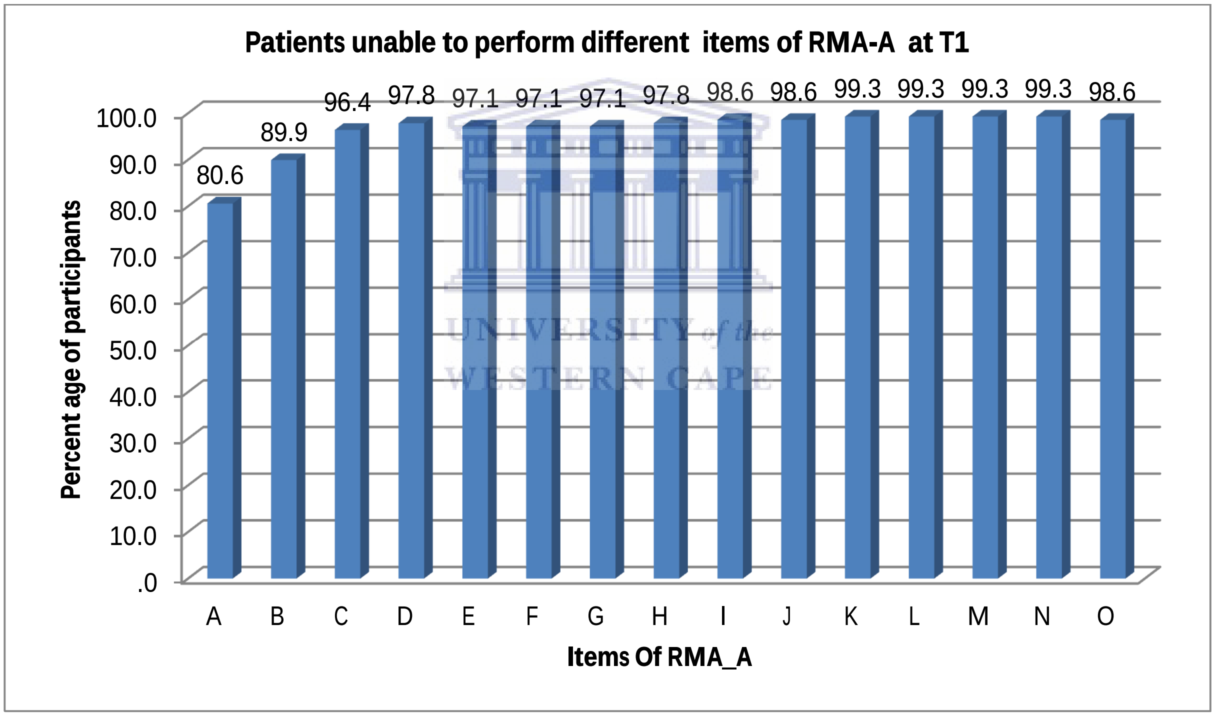



**Figure 4.9 Percentage of patients unable to perform different items of RMA-A at T1 (N=139)**

**Key for items of RMA-A:**

A. Lying, protract shoulder girdle with arm in elevation

B. Lying, hold extended arm in elevation.

C. Flexion and extension of elbow.

D. Sitting, elbow into side, pronation and supination

E. Reach forward, pick up large ball with both hands and place down again

F. Stretch arm forward, pick up tennis ball from table, release on affected side

G. Stretch arm forward, pick up pencil from table, release on affected side

H. Pick up a piece of paper from table in front and release five times

I. Cut putty with a knife and fork on plate

J. Stand on spot, maintain upright position pat large ball on floor with palm

K. Continuous opposition of thumb and each finger

L. Supination and pronation onto palm of unaffected hand

M. Standing, with affected arm abducted to 90 degrees with palm flat against wall

N. Place string around head and tie bow at back

O. “Pat- a-cake” seven times in 15 sec, Mark crosses on wall at shoulder level

#### *4.2.4.2 Functional abilities at baseline*

Functional ability was assessed using the Barthel Index (BI) test and the test range is (0-100) where patients who achieve 100 are functionally independent. The mean BI of patients at baseline was 9.89 (Std. = 17.43). BI is an outcome measure that assesses the independence of the patient in ten different domains of activities of daily living (feeding, dressing, grooming, toileting, urine and bowel control and mobility). Figure 4.10 shows that the vast majority of the participants needed assistance (at different levels) in performing most of their activities. Approximately 93% needed assistance in feeding, 96.4% needed help in bathing, and 99.3% could neither walk independently, nor use stairs without assistance, while 87.1% suffered different percentages of urinary incontinence. Only 0.7% had BI of 95 or more and 3.1% had their BI equal to or greater than 60.

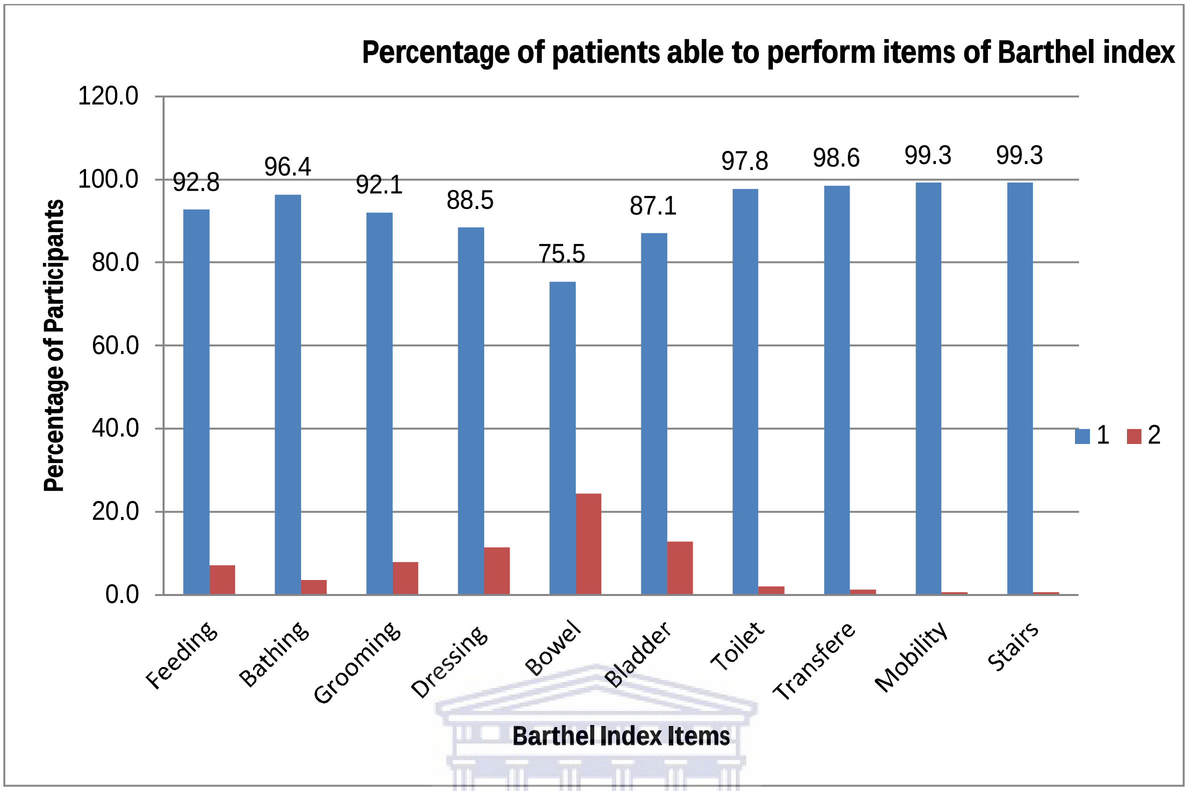



**Figure 4.10 Functional abilities assessment measured by Barthel Index at T1 (N=139)**

**Key**: Unable or needs assistance in performing the functional activity; 2= Able to perform the task independently



#### *4.2.4.3 Participation restriction at baseline*

Participation restriction was measured by Modified Rankin Scale (MRS), which is an outcome of 0 - 5, where 5 is the most severe, and 0 represents normal.

*A. Modified Rankin Scale at baseline assessment*

The average MRS at baseline assessment was 4.86 (Std. = 0.37). The percentage of different Modified Rankin Scale scores achieved by patients at baseline is presented in Figure 4.11, which shows that 87.1% of the patients were in need of constant care at baseline assessment (first week of the stroke).

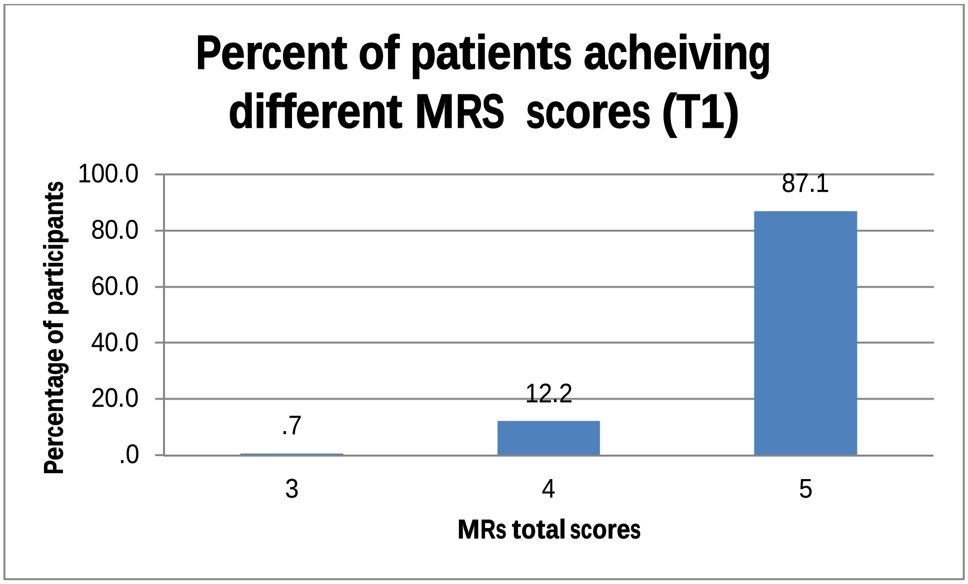



**Figure 4.11 Percentage of patients achieving different MRS scores at T1 (n=139)**

*B. Social activities at baseline (MRS)*

All the patients who had a role in work, family responsibility, leisure and social activities at the time of the stroke reported a change in their ability to participate in those roles post-stroke. 43% reported a decrease in their abilities to participate in these activities; the rest had reported that they are unable to take a role on these activities at the current time. At the work participation level, 14.4% (n = 20) of the participants reported that they had been working at the time of the stroke, all of them were subjected to change of this ability to participate in this role after stroke. One participant reported less ability to work; the rest (13.7%) (n = 19) reported that they were unable to work at the current time. On the impairment part of the MRS, swallowing problems were reported in 45% of the patients. On the family responsibilities part, 62.6% (n = 87) reported a change in their ability to participate in this field and 1.4% (n = 2) reported decreased ability, and the rest (60.4%) (n = 84) reported that they are unable to participate in this role at this time (baseline measur) (see Table 4.6).

**Table 4.6: Participation items change at baseline (n=139)**

| Social activity and participation | Role performed prior to stroke | Change in the role after stroke | Amount of change at (T1) Reduced ability | Unable |
|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) |
| Work | 20 (14.4) | 20 (14.4) | 1 (0.07) | 19 (13.7) |
| Family responsibilities | 87 (62.6) | 87 (62.6) | 3 (2.2) | 84 (60.4) |
| Leisure and social activities | 115 (82.7) | 115 (82.7) | 2 (1.4) | 113 (81.3) |

### 4.2.5 Summary of the section

The mean age of the sample was approximately 68 years. Approximately 14% were working at the time of the stroke. The majority of the sample had reported a difficulty in meeting household monthly expenses. The sample consisted of 39.6% males and 60.4% females. The vast majority of the sample had a CT scan on admission. 80.6% of patients had an ischemic stroke, the rest, 19.4%, had a haemorrhagic stroke. Severity at baseline was measured by NIHSS. 46.8% had a severe stroke, 41% moderate and 12.2% had a mild stroke.



## 4.3 STROKE EPIDEMIOLOGY

In this section, results will be presented as characteristics and risk factors of stroke patients compared to their controls. This section will address the second objective of this study, concerning the identification of main risk factors of Palestinian stroke patients in Hebron. Mortality will not be discussed in this section as it will be addressed in Section 4.5 when discussing the stroke rehabilitation outcome.

### 4.3.1 Characteristics of the samples in case and control groups

#### *4.3.1.1 Age and gender in case and control groups*

The average age of the whole sample was 66.4 years, with the average age for the case study group of 67.64 years, and the control group of 65.3 years, with mean difference of 2.4 years between the two groups, as is illustrated in Table 4.7. 56% of the sample were males, and 43.8 were females. The distribution of age categories for the two groups is presented in Figure 4.12.

**Table 4.7: Age and gender characteristics (n=139)**

| Group | Mean Age | Std. | Gender | n | Percent | Total n |
|---|---|---|---|---|---|---|
| Control | 65.3 | 7.9 | Male | 109.0 | 71.2 | 153.0 |
| | | | Female | 44.0 | 28.8 | |
| Stroke | 67.6 | 11.7 | Male | 55.0 | 39.6 | 139.0 |
| | | | Female | 84.0 | 60.4 | |

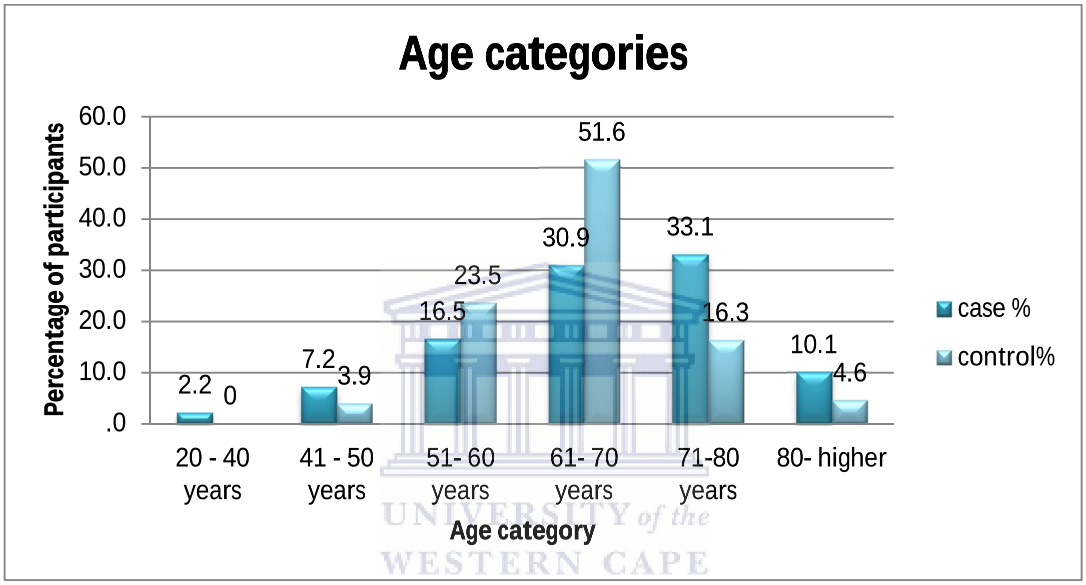



**Figure 4.12 Age distribution in both groups (n=139)**

#### *4.3.1.2 Age categories within gender in case and control groups*

There were more females over 80 than males (13.10% vs. 5.5%) in the case study group (see Table 4.8). The majority of both males and females in the case group were between 71-80 years old, (40%) and (34%) respectively. In the control group, the majority of males and females (52.3% vs. 50%) were between 61-70 years old.

**Table 4.8: Age categories within gender in case and control groups. (n=139)**

| | | % 20-40 | % 41-50 | % 51-60 | 61-70 % | % 71-80 | % > 80 |
|---|---|---|---|---|---|---|---|
| **Case** | Male | 3.6 | 7.3 | 18.2 | 25.5 | 40 | 5.5 |
| | Female | 1.2 | 7.10 | 15.5 | 34.5 | 28.6 | 13.10 |
| **Control** | Male | 0.00 | 4.60 | 22.9 | 52.3 | 15.6 | 4.6 |
| | Female | 0.00 | 2.30 | 25 | 50 | 18.2 | 4.5 |

### 4.3.2 Univariate analysis of prevalence of risks in stroke and control groups

In this part, the distribution of prevalence of different risks was presented in percentages for the stroke and the control groups. The differences in percentage of prevalent risks were also highlighted. The most prevalent risks, as seen in Table 4.9, were hypertension (77.7%), obesity (71%), diabetes (69%), consumption of a fatty diet (56%), stress (49.60%), hypercholesterolemia (44%), family history of stroke (41%), increased triglyceride level (40.9%), physical inactivity (37.4%), and previous TIA (24.5%).

**Table 4.9: Stroke risk factor prevalence (%) in stroke and control groups (n=139)**

| Risk | Case (%) | Control (%) | Mean Dif. (%) |
|---|---|---|---|
| **Hypertension** | 77.70 | 53.90 | 23.8 |
| **Obesity** | 71.2 | 59.5 | 11.7 |
| **Diabetes** | 69.10 | 24.30 | 44.8 |
| **Consumption of fatty diet** | 56.8 | 38.8 | 18 |
| **Stress** | 49.60 | 21.60 | 28 |
| **Hypercholesterolemia** | 44.00 | 51.00 | -7.00 |
| **Family history of stroke** | 41.70 | 35.90 | 5.8 |
| **Triglycerides** | 40.90 | 42.50 | -1.60 |
| **Physical inactivity** | 37.4 | 10.5 | 26.9 |
| **History of TIA** | 24.50 | 42.50 | -18.00 |
| **Quit smoking** | 15.15 | 30.90 | -15.75 |
| **Ischemic heart disease** | 13.7 | 6.5 | 7.2 |
| **Current smoking** | 13.70 | 17.60 | -3.90 |
| **Cardiomyopathy** | 7.9 | 14.4 | -6.5 |
| **Heart failure** | 7.2 | 0.7 | 6.5 |
| **Atrial fibrillation** | 7.2 | 1.3 | 5.9 |
| **Cardiac valves pathology** | 3.6 | 2.0 | 1.6 |

### 4.3.3 Bivariate analysis of association of risk factors of strokes

In this part, the research presents the statistically significant associated risk factors of strokes using the Odds Ratio statistics (OR), and a cut-off point of (0.05) significance which is presented in terms of 95% confidence interval (CI). Chi square ($X^2$) statistics were also used to highlight the statistically significant difference of prevalence of each stroke risk factor, in cases compared to control groups.

#### *4.3.3.1 Risk factors that had a statistically significant positive association with stroke incidence*

Risk factors are ordered according to their strength of association with the stroke incidence (based on their highest Odds Ratio) (see Table 4.10). From the table below it can be seen that the risk factors most strongly associated with strokes were heart failure (OR = 11.738), diabetes (OR = 6.939), atrial fibrillation (OR = 5.853), physical inactivity (5.80), stress (OR = 3.584), hypertension (OR = 2.974), ischemic heart disease (OR = 2.264), consumption of fatty diet (OR = 2.07) and obesity (OR = 1.686). A statistically significant difference in mean average of cigarettes smoked per day was also found between cases and control (22.68 vs. 15.17, respectively), t= 1.933 (p = 0.03).

**Table 4.10: Stroke risk factors with statistically significant positive association with stroke (n=139)**



| Risk | OR | CI | X2 | P |
|---|---|---|---|---|
| **Heart failure** | 11.783 | 1.488 - 93.282 | 8.595 | .003 |
| **Diabetes** | 6.939 | 4.141-11.629 | 58.519 | 0.000 |
| **Atrial fibrillation** | 5.853 | 1.259 – 27.199 | 6.405 | .011 |
| **Stress** | 3.584 | 2.155- 5.962 | 25.251 | 0.000 |
| **Physical inactivity** | 5.800 | 2.729-9.459 | 29.303 | 0.000 |
| **Hypertension** | 2.974 | 1.784 - 4.958 | 18.073 | 0.000 |
| **Ischemic heart disease** | 2.264 | 1.014- 5.055 | 4.143 | .042 |
| **Consumption of fatty diet** | 2.070 | 1.300 - 3.314 | 9.454 | 0.002 |
| **Obesity** | 1.686 | 1.034-2.749 | 4.221 | 0.036 |

#### 4.3.3.2 *Risk factors with statistically significant negative association with stroke incidence*

The two factors that had a statistically significant association (their presence decreases the incidence of stroke) are listed in Table 4.11. These factors were if previous smokers quit smoking in the past and the history of previous TIA.

**Table 4.11: Stroke risk factors that had a statistically significant negative association with stroke**

| Variable | OR | CI | X2 | P |
|---|---|---|---|---|
| Quit of smoking | 0.398 | 0.223 – 0.709 | 10.139 | 0.001*. |
| Previous TIA | 0.348 | .265- 0.247 | 10.558 | 0.01* |

#### 4.3.3.3 *Risk factors in the literature that were not found statistically significant in this research*

Some of the published risks in the literature were not found to be statistically significantly associated with stroke incidence (as shown in Table 4.12). This is based on their confidence interval of the Odds Ratios of those variables such as triglycerides, cholesterol, current smoking [without attention to intensity], cardiomyopathy, cardiac valve pathology and family history of stroke).



**Table 4.12: Risk factors in published literature that were not found to have a statistical significant association with stroke**

| Variable | Case | Control | % Dif. | OR | 95% CI | $X^2$ | P |
|---|---|---|---|---|---|---|---|
| Triglycerides | 40.90% | 42.50% | -1.60% | 0.937 | 0.378 – 2.325 | 2.325 | 0.020 |
| Current smoking | 13.70% | 17.60% | -3.90% | 0.739 | 0.390–1.398 | 0.868 | 0.351 |
| Cholesterol | 44.00% | 51.00% | -7.00% | 0.755 | 0.323 – 1.769 | 0.518 | 0.419 |
| Cardiomyopathy | 7.90% | 14.40% | | 0.512 | 0.238 -1.098 | 3.037 | 0.081 |
| Cardiac valve pathology | 3.60% | 2.00% | 1.60% | 1.866 | .438 -7.955 | 0.732 | 0.392 |
| Family history of stroke | 41.70% | 35.90% | 5.80% | 1.276 | .796-2.045 | 1.025 | 0.311 |

### 4.3.4 Multivariate analysis of risk factors predicting a stroke: logistic regression

Logistic regression shows the results as Odds Ratios, with confidence intervals.

Using multivariate logistic regression, the variables that could predict stroke occurrence, were chosen from demographic variables of stroke (age and gender) and the statistically significant associated factors in bivariate analysis. The best logistic multivariate model was achieved ($X^2$ = 7.621) with a significance of p = 0.471 in the Hosmer-Lemeshow test of goodness of fit of the model. This means that the actual number of strokes is not significantly different from that predicted by this model, and that the overall model is good (Bewick, Cheek, & Ball, 2005).

Logistic regression analysis was performed on the stroke cases only by setting the SPSS programme to remove all the variables that had a p value of > 0.05, as shown in Table 4.13. From the logistic regression table below (Table 4.13), it can be seen that the strongest predictor of a stroke was diabetes with diabetic people being around six times more likely to develop a stroke compared to non-diabetics (OR = 5.95). This is followed by hypertension which caused hypertensive people to be twice as likely to develop a stroke compared to non-hypertensive people (OR = 2.069). Physically inactive people were twice as likely to develop a stroke compared to physically active people (OR = 2.043) and a recent stressful event doubles the likelihood of developing a stroke compared to non-stressed people (OR = 2.995).



**Table 4.13: Logistic regression model (predictors of stroke)**

| | | | | 95% C.I. for Exp(B) | |
|---|---|---|---|---|---|
| **Predictors of stroke** | **B** | **P** | **Exp(B)** | **Lower** | **Upper** |
| Diabetes | 1.784 | 0 | 5.956 | 3.094 | 11.464 |
| Hypertension | 0.727 | 0.036 | 2.069 | 1.048 | 4.083 |
| Inactivity | 0.715 | 0.048 | 2.043 | 1.005 | 4.153 |
| Consumption of a fatty diet | 0.822 | 0.018 | 2.276 | 1.155 | 4.486 |
| Stress | 1.097 | 0.002 | 2.995 | 1.482 | 6.051 |
| Age under 60 | -0.727 | 0.039 | 0.483 | 0.243 | 0.963 |
| Previous TIA | -1.219 | 0.001 | 0.295 | 0.146 | 0.6 |
| Male gender | -1.262 | 0.003 | 0.283 | 0.124 | 0.647 |

Predictors of a lower possibility of developing a stroke were: age category - people under 60 has a 50% (OR= 0.483) decreased likelihood to develop a stroke compared to people over 60. Previous TIA (OR= 0.295) was responsible for a 20% decrease in possibility of developing a stroke compared to TIA history-free patients. Finally being a male contributed to around 28% less likelihood developing a stroke (OR= 0.282).

### 4.3.5 Modification in lifestyle by control group participants after experiencing TIA or a family member developing a stroke

The results of the information obtained telephonically, regarding the potential modifications that took place after experiencing a TIA, or a family member developing a stroke, are summarised and explained in Table 4.14, which shows the changes in the major risk behaviours and risks. 69% of TIA patients decreased fatty diet consumption, around 80% regularly started to monitor their blood pressure and diabetes level, and 10% increased their physical activities (sports or walking). In the group that had experienced a family member developing a stroke, around 30% started conducting regular monitoring of blood pressure and blood sugar levels, and 35% stopped smoking.

**Table 4.14: Percentage of patients having history of TIA/family history of stroke, changing behaviour after event**

| Modified risk behaviour after the event | History of TIA (n = 65) % | Family history of stroke (n = 55) % |
|---|---|---|
| Decreased fatty diet consumption | 69.2 | 21.8 |
| Regular BP monitoring | 78.5 | 30.9 |
| Regular blood glucose monitoring and/or management | 84.6 | 27.3 |
| Increased physical activity | 10.8 | 1.8 |
| Regular lipids profile tests | 56.9 | 5.5 |
| Stopped smoking | 4.7 | 35 |
| Started regular anti-coagulants | 80.0 | 7.2 |

### 4.3.6 Summary of the section

Different risk factors associated with strokes were investigated in stroke patients and non-stroke patients. The main variables that were reported to have a possibly protective effect on stroke incidence were: age under than 60, history of TIA and being a male. Main predictors of a stroke were diabetes, hypertension, physical inactivity, consumption of a fatty diet and stress. The most prevalent risk factors in strokes were: hypertension, obesity, diabetes, consumption of a fatty diet and stress. The risk factors most associated with incidence of strokes were heart failure, diabetes, stress, physical inactivity and hypertension. Participants in the control group who had a TIA or a family member developed a stroke, appeared to reduce risk factors through behavioural strategies.

## 4.4 PROCESS OF REHABILITATION

In this section, the research presents the rehabilitation process factors in terms of the use of different settings, the type of services received and the intensity of these services.

### 4.4.1 Use of rehabilitation settings

Patients mainly used the home rehabilitation setting (49.60%) for an average of around 50 days (as shown in Table 4.15). This percentage declined (21.60%) at the third assessment point (T3), while the mean number of days increased (59.6 days). Inpatient rehabilitation was used by 14.4% at T2. This percentage declined to 2.2% at T3, with a decline in average days spent at T3 at the inpatient setting (24.67 days at T3, compared with 43.25 days at T2). The percentage of patients using outpatient rehabilitation increased from 10.8% of patients using it at T2, to 15.1% at T3, with a decline of the average period of use of around 2 days less at T2 compared with T3.



**Table 4.15: Description of the use of care in the rehabilitation settings in six months**

| Rehabilitation setting | T2 (3 months) | | | T3 (6 months | | |
|---|---|---|---|---|---|---|
| | % patients | Mean days | Std. | % patients | Mean days | Std. |
| **Inpatient** | 14.4 | 43.25 | 21.173 | 2.2 | 24.67 | 5.508 |
| **Home** | 49.6 | 51.36 | 27.480 | 21.6 | 59.53 | 22.289 |
| **Outpatient** | 10.8 | 44.07 | 20.899 | 15.1 | 49.24 | 19.120 |

Some of the patients combined different types of rehabilitation settings. In the same rehabilitation period, they received inpatient rehabilitation and then followed-up in a home rehabilitation setting (8% of patients) or had home rehabilitation at the beginning and then continued at an outpatient rehabilitation setting (4%). Table 4.16 shows the percentage of patients using a single rehabilitation setting and percentages of patients combining different rehabilitation settings in the same rehabilitation period. There are also those who did not receive any rehabilitation at all in the T2 (38%) and T3 periods (67%).

**Table 4.16: Combination of the different rehabilitation settings at T2 and T3**

| Rehabilitation settings | T2 | T3 |
|---|---|---|
| Home only | 38% | 17% |
| Outpatient only | 6% | 9% |
| Inpatient only | 5% | 1% |
| Inpatient & home | 8% | 0% |
| Outpatient & home | 4% | 5% |
| Inpatient & out | 1% | 1% |
| Inpatient & home & out | 0% | 0% |
| No rehabilitation at all | 38% | 67% |
| | 100% | 100% |

### 4.4.2 Participants' motivations in the choice of rehabilitation settings at different assessment points

#### *4.4.2.1 Motivation behind using or not using an inpatient rehabilitation setting*

The main motivation for using an inpatient rehabilitation institution at T2 was a doctor's recommendation at discharge from hospital (50%), followed by the medical insurance covering the expenses of that rehabilitation setting (45%) and only 5% were motivated by a therapist's recommendation. AT T3, the reason for choosing an inpatient rehabilitation institution was divided equally between doctor's recommendations and therapist's recommendation and having health insurance covering the inpatient rehabilitation expenses with 33.3% for each one of them.

Reasons for not choosing an inpatient rehabilitation institution at T2, is summarised in Figure 4.13. The main reason was financial (27.3%), followed by severity of stroke (21.6%), availability of home care rehabilitation (13.7%) and psychological barriers to attending a rehabilitation institution (5.8%).

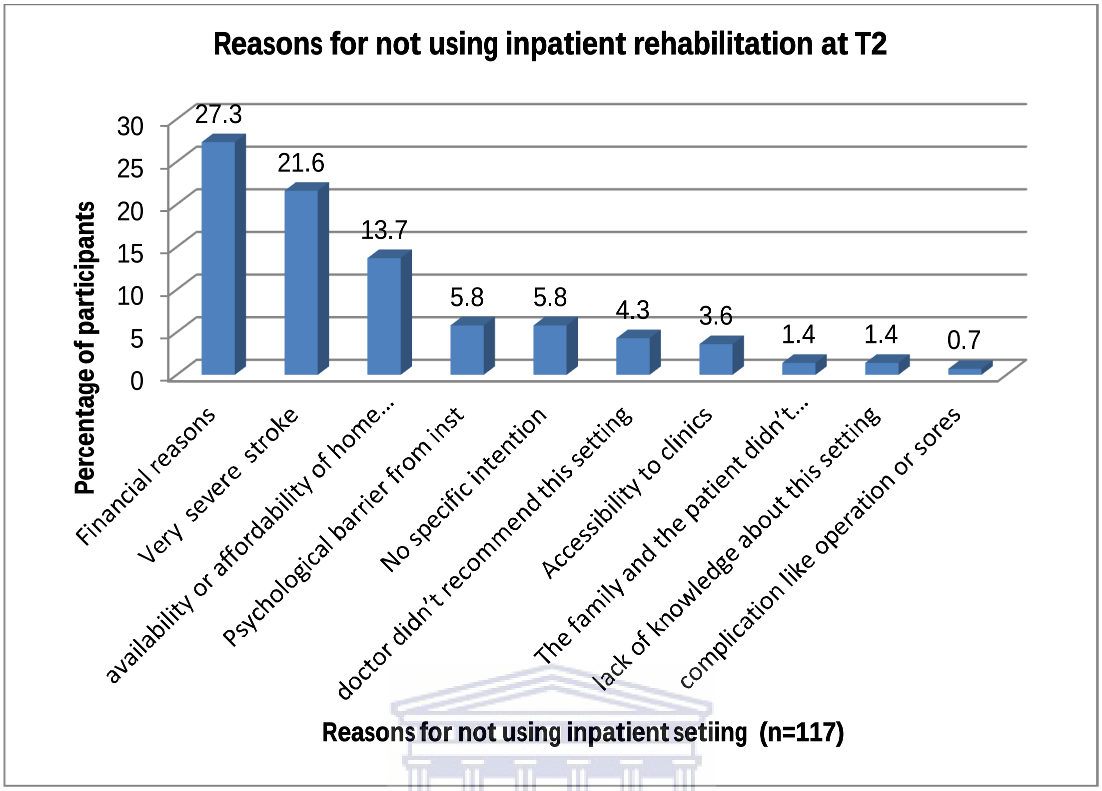



**Figure 4.13 Reasons for not choosing inpatient rehabilitation settings at T2**

At T3, the financial barrier represented the biggest challenge against using inpatient rehabilitation settings (29.5%). Other patients (11.5%) did not have any reason why they did not use this specific setting and 10.1% thought that the stroke was so severe that patients would not benefit from an inpatient rehabilitation setting (See Figure 4.14).

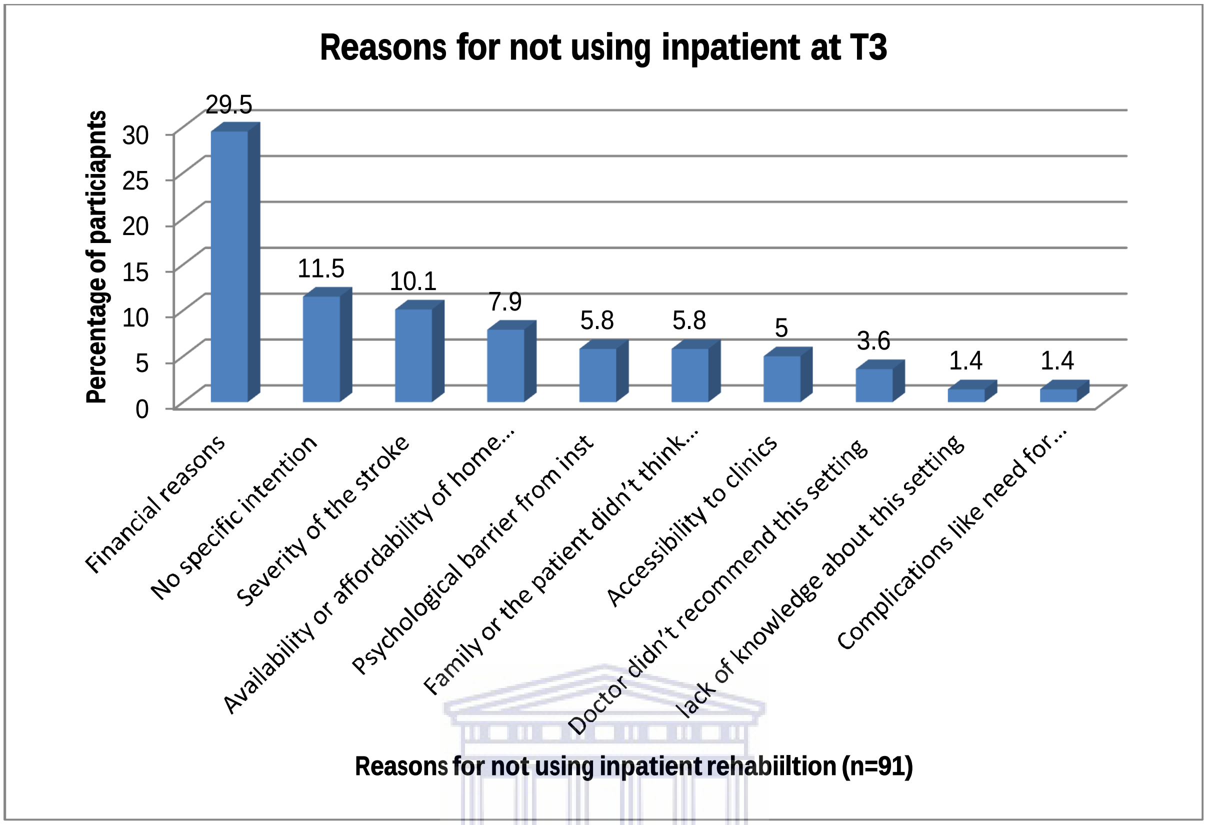



**Figure 4.14 Reasons for not using inpatient rehabilitation settings at T3**



#### *4.4.2.2 Participants' motivation behind using or not using home rehabilitation setting*

The main reasons for using the home rehabilitation setting at T2 was a doctor's recommendation (59.4%), followed by a therapist's recommendation (34.8%), and 2.9% used it because they thought that this was the best rehabilitation setting. At the T3 period, 16.7% of those patients who used the home rehabilitation setting used it based on doctor's recommendations. The rest of the patients used this setting motivated strongly by therapist's recommendations (83.3%).

As shown in Figure 4.15, the main reasons patients did not use home rehabilitation at T3 were: the severity of stroke (37.1%), financial reasons (18.6%), no specific intentions (12.9%) and accessibility to outpatient clinics (11.4%). Availability of caregivers (5.7%) and doctors who did not recommend this setting (5.7%) were also factors.

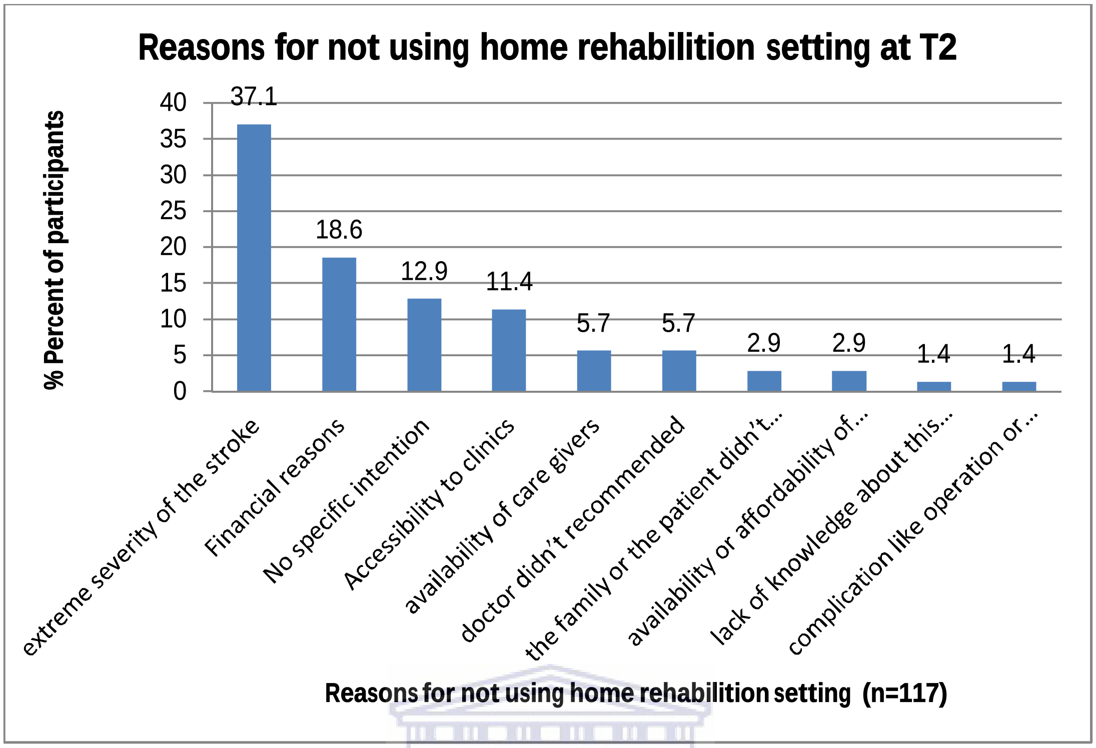



**Figure 4.15 Patient's reasons for not using home rehabilitation setting at T2**

Financial limitations was the main reason for not using home rehabilitation at T3 (36.8%), followed by non-specific reasons (17.5%) and 11.5% thought that the patient had a severe stroke and would not benefit from a rehabilitation programme at home (see Figure 4.16).

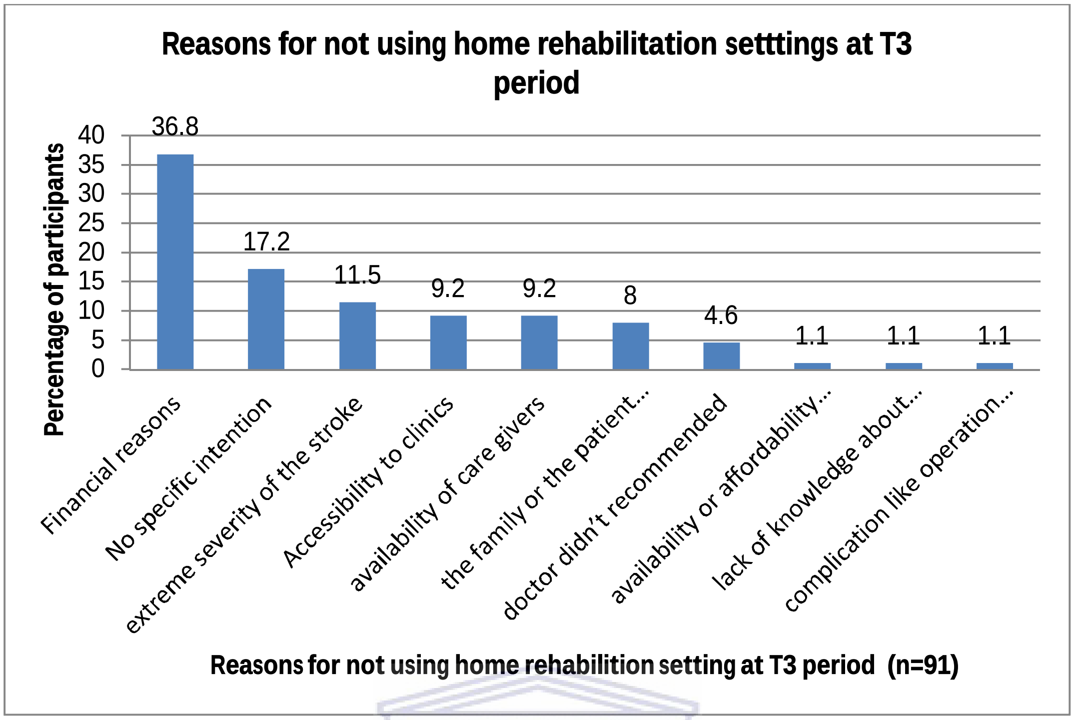



**Figure 4.16 Patient's reasons for not using home rehabilitation setting at T3 period**

#### *4.4.2.3 Participants' motivation for using or not using an outpatient setting*

For the patients who used the outpatient rehabilitation setting at T2 rehabilitation, a therapist's recommendation was the strongest motivation (53.3%), the remainder of the patients (46.7%) used this setting based on doctors' recommendations. At T3, for patients who used outpatient settings, 81% of them did so based on therapists' recommendations, the rest (19%) were motivated by doctors' advice.

Figure 4.17 shows that patients who did not use the outpatient setting at T2, mainly did not use it due to difficulty of transporting patients to and from the outpatient clinic (66.9%). 10.5% did not use this setting because of no specific reason and 6.5% did not use it for financial reasons.

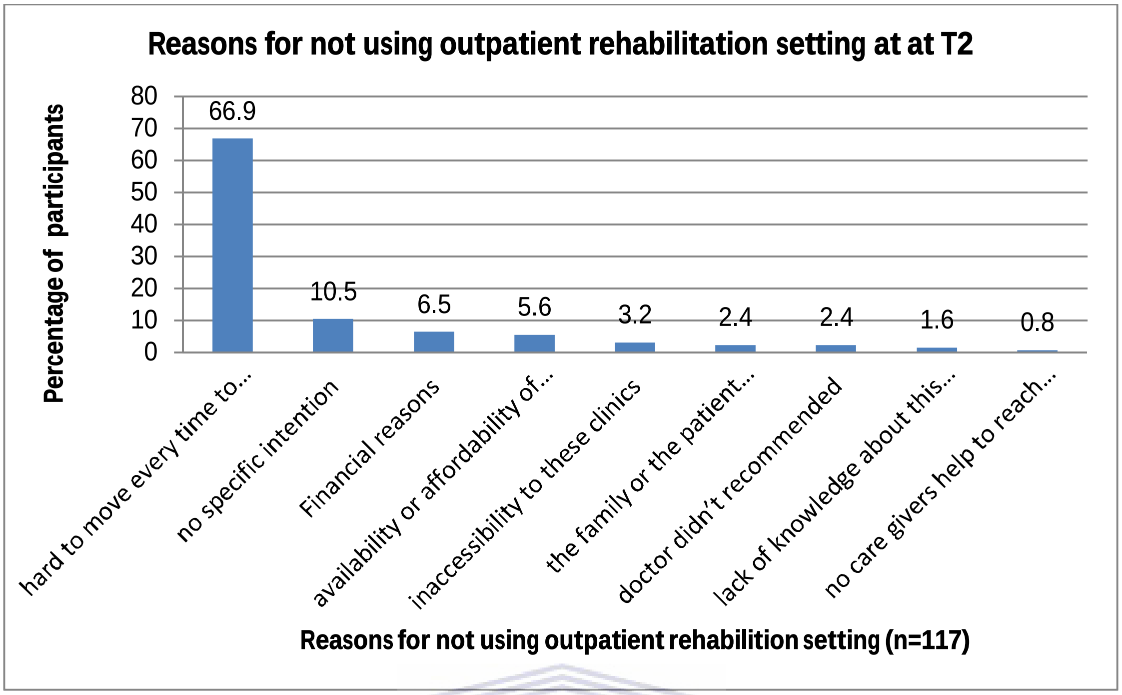



**Figure 4.17 Patients' reasons for not using an outpatient rehabilitation setting at T2**

At T3, of the majority of patients who did not use an outpatient rehabilitation setting, 51% did not use it due to the difficulty of moving the patient (Figure 4.18), 16.7% did not give any reason why they did not use this setting, and 94% did not use this setting due to financial reasons.

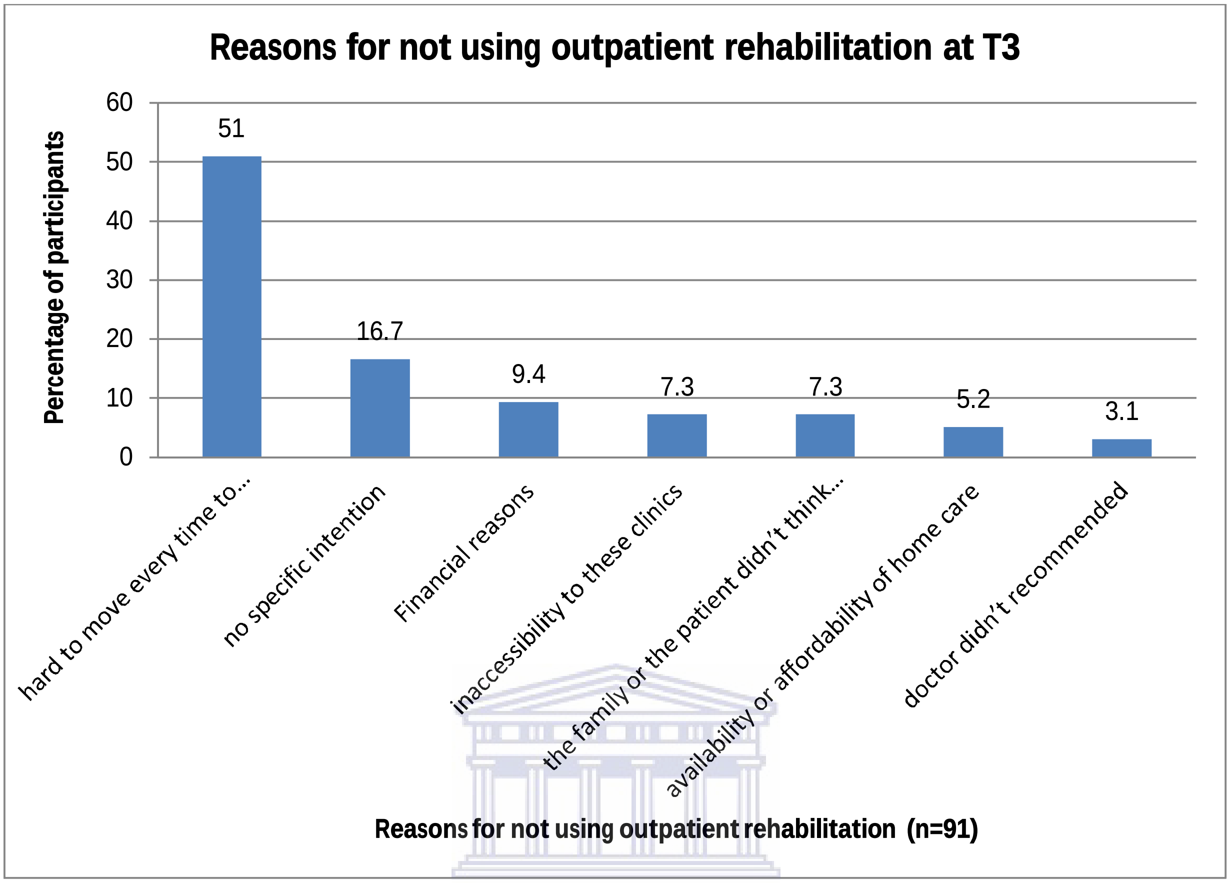



**Figure 4.18 Patients' reasons for not using outpatient rehabilitation setting at T3**



### 4.4.3 The rehabilitation services received by the participants in the different settings and at the different assessment points or periods

#### *4.4.3.1 Total rehabilitation services*

In Figure 4.19, it seems that the inpatient rehabilitation setting provided the highest intensity of the four rehabilitation services (physical, occupational, and speech therapy, and psychological counselling), followed by the home setting and then outpatient setting. Speech therapy, psychological counselling, and occupational therapy seem to be provided only at the inpatient rehabilitation setting. Physiotherapy was provided in the three rehabilitation settings.

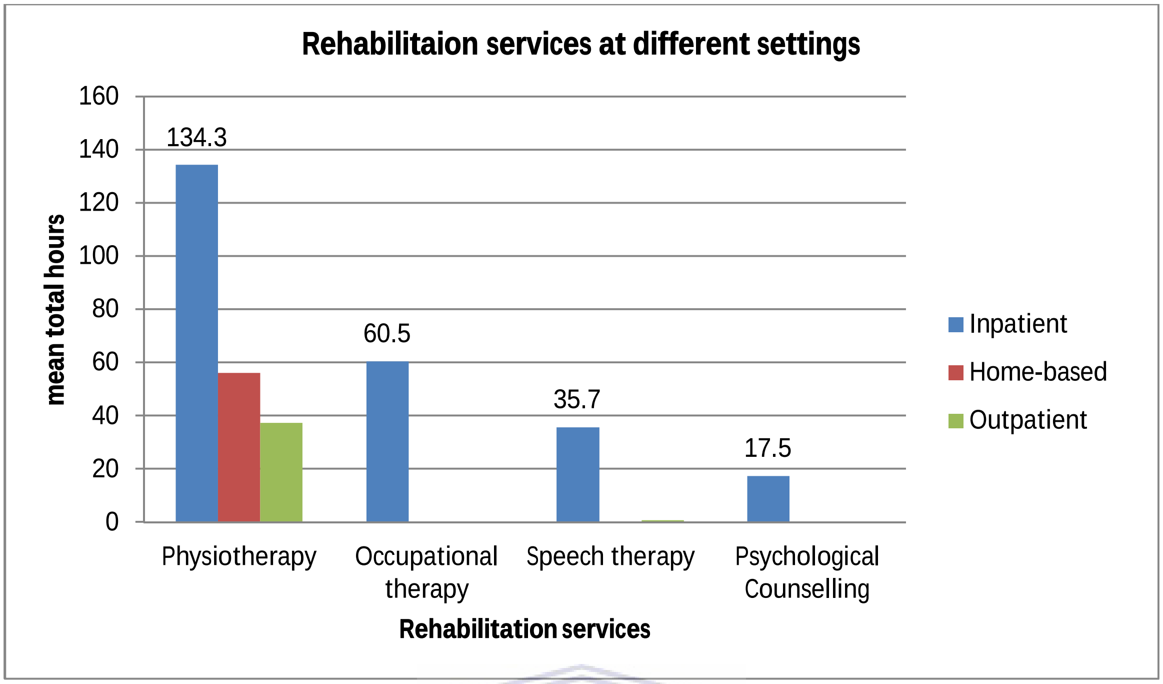



**Figure 4.19: Mean total hours of different rehabilitation services at different settings during the six months after a stroke**



#### *4.4.3.2 Participants' use of physiotherapy services according to setting, assessment points and intensity*

Table 4.17 and Table 4.18 shows that physiotherapy intensity was less in home and inpatient settings at T3, compared to T2, but more in outpatient setting, where mean total hours of physiotherapy at T3 was more than T2 (19.6 vs.17.7) respectively. Patients who used an inpatient rehabilitation setting had an average of 86.3 hours of physiotherapy at T2, compared to about half of that (48.0 hours of physiotherapy) at T3. In the home rehabilitation settings, patients received an average of 32.4 hours of physiotherapy at T2 that decreased to an average of 23.7 hours at T3.

**Table 4.17: Physiotherapy services in T2 period**

| | T2 | | | | |
|---|---|---|---|---|---|
| **Setting** | **Period in weeks** | **Frequency / week** | **No. of Sessions / day** | **Length of session / h** | **Total Hours** |
| Inpatient | 6.1 | 6.7 | 1.9 | 1.1 | 86.3 |
| Home | 7.2 | 4.3 | 1.0 | 1.0 | 32.4 |
| Outpatient | 5.9 | 2.7 | 1.0 | 1.3 | 17.7 |

**Table 4.18: Physiotherapy services in T3**

| | T3 | | | | |
|---|---|---|---|---|---|
| Setting | Period in weeks | Frequency / week | No. of sessions / day | Length of session / h | Total hours |
| Inpatient | 3.5 | 6.0 | 1.7 | 1.3 | 48.0 |
| Home | 8.9 | 3.1 | 1.0 | 1.0 | 23.7 |
| Outpatient | 7.5 | 2.4 | 1.0 | 1.1 | 19.6 |

#### *4.4.3.3 Participants' use of occupational therapy according to setting, assessment points and intensity*

The average occupational therapy hours received by patients at home at T2, was minimal (0.3), and at T3, there was no occupational therapy in either home or outpatient rehabilitation settings. However, in the inpatient rehabilitation setting, patients received an average of 46.5 hours of occupational therapy at T2. This time decreased to an average of 14 hours at T3 (See Table 4.19 and Table 4.20).

**Table 4.19:** ***Occupational therapy at T2 in all rehabilitation settings***

| | T2 | | | | |
|---|---|---|---|---|---|
| Setting | Period in weeks | Frequency / week | No. of sessions / day | Length of session / h | Total hours |
| Inpatient | 5.8 | 5.7 | 1.2 | 1.0 | 46.5 |
| Home | 0.1 | 0.0 | 0.0 | 0.0 | 0.3 |
| Outpatient | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Table 4.20:** ***Occupational therapy at T3 in all rehabilitation settings***

| | T3 | | | | |
|---|---|---|---|---|---|
| Setting | Period in weeks | Frequency / week | No. of sessions / day | Length of session / h | Total hours |
| Inpatient | 2.3 | 4.0 | 0.7 | 0.7 | 14.0 |
| Home | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Outpatient | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### *4.4.3.4 Participants' use of speech therapy services according to setting, assessment period and intensity*

No speech therapy sessions were reported at either home or outpatient rehabilitation settings at T2; similarly at T3 for home rehabilitation setting. A minimal average of 1.7 hours was recorded at outpatient settings at T3. At the inpatient setting an average of 27.7 hours at T2 and 8 hours at T3 was recorded (See Table 4.21 and Table 4.22).

**Table 4.21:** ***Speech therapy service at T2***

| | T2 period (1-3 months) | | | | |
|---|---|---|---|---|---|
| **Setting** | **Period in weeks** | **Frequency / week** | **No. of sessions / day** | **Length of session / h** | **Total hours** |
| Inpatient | 4.4 | 4.0 | 0.7 | 0.7 | 27.7 |
| Home | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Outpatient | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Table 4.22:** ***Speech therapy service at T3***

| | T3 | | | | |
|---|---|---|---|---|---|
| **Setting** | **Period in weeks** | **Frequency / week** | **No. of sessions / day** | **Length of session / h** | **Total hours** |
| Inpatient | 1.3 | 2.0 | 0.3 | 0.3 | 8.0 |
| Home | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Outpatient | 0.6 | 0.3 | 0.1 | 0.1 | 1.7 |



#### *4.4.3.5 Psychological counselling according to assessment period, time and intensity*

From Table 4.23 and Table 4.24 it can be seen that there was an average of 9 hours of psychological counselling at T2, which declined to an average of 8 hours at T3, at the inpatient setting only. No psychological counselling service was given for patients at home, or outpatient rehabilitation settings at both assessment points.

**Table 4.23:** ***Psychological counselling at T2***

| | T2 period (1-3 months) | | | | |
|---|---|---|---|---|---|
| **Setting** | **Period in weeks** | **Frequency / week** | **No. of sessions / day** | **Length of session /** | **Total hours** |
| Inpatient | 2.0 | 1.0 | 0.2 | 0.2 | 9.5 |
| Home | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Outpatient | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Table 4.24:** ***Psychological counselling at T3***

| Setting | T3 | | | | |
|---|---|---|---|---|---|
| | Period in weeks | Frequency / week | No. of sessions / day | Length of session / h | Total hours |
| Inpatient | 1.3 | 2.0 | 0.3 | 0.3 | 8.0 |
| Home | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Outpatient | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### *4.4.3.6 Personal and family contribution to the rehabilitation process*

42% of the participants reported performance of regular self-assisted exercises at both assessment points T2 and T3. The extent and type of those exercises were not captured in this study. The regular use of affected upper extremity in functional activities was reported in 42% of the patients at T2, and increased to 58.1% at T3.

In terms of family involvement in the rehabilitation process, 20.6% of family members gave exercises for the patient at the T2 assessment point and this did not change by the T3 assessment point. The type of exercises and length of training that the family performed was not captured in this study.



### 4.4.4 Summary of the section

At T2 (three months after stroke), the home rehabilitation setting was the most used by stroke patients at Hebron, Palestine (49.6%), followed by the inpatient rehabilitation setting (14.4%), with outpatient rehabilitation setting being least used (10.8%). At T3 (six months after the stroke), the home rehabilitation setting was again the most used setting (59.53%), the decrease in the use of inpatient rehabilitation setting was notable (2.2%), and there was an increase in the use of outpatient rehabilitation setting (15.1%).

The main motivation behind choices of setting in general, were financial reasons, doctors' and therapists' recommendations, severity of the case, medical insurance, and difficulty to transport the patient to outpatient settings. There was little to no speech- or occupational therapy provided at the home and outpatient rehabilitation settings. Meanwhile, inpatient rehabilitation settings provided a more comprehensive rehabilitation service with higher intensity.

## 4.5 STROKE REHABILITATION OUTCOME AT THREE MONTHS (T2) AND SIX MONTHS (T3)

In this section the research presents the outcome of stroke rehabilitation in terms of motor function impairment (measured by RMA), functional activity limitations (measured by BI), and participation restriction (measured by Modified Rankin Scale). Changes through the three assessment points were highlighted in figures. The statistical analysis of significance of the difference of mean outcome measures at each assessment point was presented.

### 4.5.1 Motor function impairment outcome at the three assessment points

#### *4.5.1.1 Descriptive presentation of the change of motor function mean over the three assessment points*

Impairment in motor function showed a statistically significant increase by 7.69 points (p=0.00) in mean RMA (see Figure 4.20) between T1 (1.76 ± 4.681) and T2 (9.45 ± 10.203) assessment points and statistically significant improvement between T2 and T3 (14.8 ± 13.457) assessment points by 4.63 points (p = 0.00). Overall improvement in mean RMA between baseline and six months (T3) was increased by 12.32 points (p = 0.00).

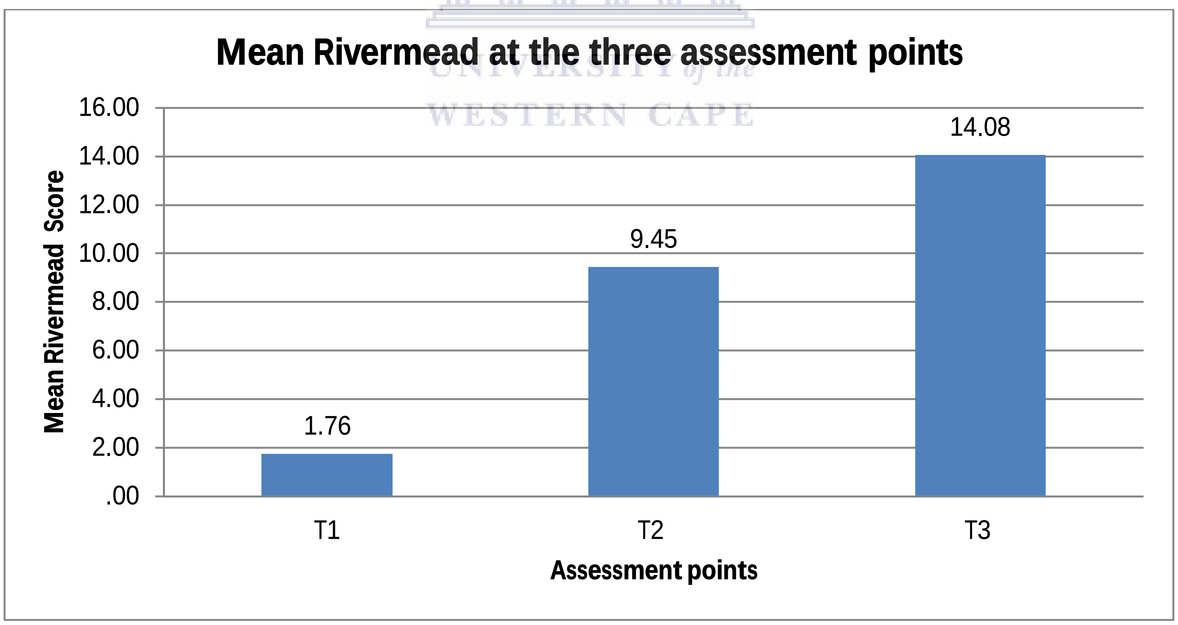



**Figure 4.20 Mean Rivermead Motor Assessment at three assessment points**

Table 4.25 shows a difference between mean scores of the three parts of the RMA at the three different assessment points. The difference of the three parts between (T1, and T2), (T2 and T3) and (T1 and T3) was statistically significant ($p < 0.01$).

**Table 4.25: Changes in the mean scores of three parts of (RMA) motor function at different assessment points**

| RMA part | T1 | T2 | T3 | Dif. | P |
|---|---|---|---|---|---|
| **Mean Gross function (RMA-G)Total** | | | | | **0** |
| T1 - T2 | .41 | 3.03 | | 2.62 | 0 |
| T2 - T3 | | 3.03 | 4.98 | 1.95 | 0 |
| T1 - T3 | .41 | | 4.98 | 4.57 | 0 |
| **Mean Leg and Trunk (RMA-LT)Total** | | | | | **0** |
| T1 - T2 | .77 | 3.51 | | 2.72 | 0 |
| T2 - T3 | | 3.51 | 4.57 | 1.6 | 0 |
| T1 - T3 | .77 | | 4.57 | 3.78 | 0 |
| **Mean Arm (RMA-A) Total** | | | | | **0** |
| T1 - T2 | .56 | 2.44 | | 1.88 | 0 |
| T2 - T3 | | 2.44 | 4.49 | 2.05 | 0.002 |
| T1 - T3 | .56 | | 4.49 | 3.93 | 0 |



#### *4.5.1.2 Bivariate analysis of variables with significant difference of motor function mean at three months (T2)*

The following variables presented in Table 4.26 represents the variables that had a significant difference of mean motor function of participants, as measured by RMA at three months (T2).

**Table 4.26: Categorical variables with significant difference of mean (RMA) motor function at 3 months (T2)**

| Rivermead 2 | yes | no | Mean Dif. | P |
|---|---|---|---|---|
| **Stroke related variables** | | | | |
| Incontinence | 7.86 | 19 | -11.14 | 0.004 |
| Dysarthria | 6.8 | 15.24 | -8.44 | 0.000 |
| Swallowing problems | 5.27 | 12.69 | -7.42 | 0.000 |
| Visual problems | 6 | 11.6 | -5.6 | 0.000 |

| | | | | |
|---|---|---|---|---|
| **Rehabilitation settings** | | | | |
| T2 Out | 18.8 | 8.19 | 10.61 | 0.000 |
| **Personal effort in rehabilitation** | | | | |
| T2 EX. | 14.02 | 5.92 | 8.1 | 0.000 |
| T2 Hand use | 16.47 | 4.1 | 12.37 | 0.000 |
| T2 Family | 12.96 | 8.49 | 4.47 | 0.000 |

#### *4.5.1.3 Bivariate analysis of variables with significant correlation with motor function at three months (T2)*

The following variables, presented in Table 4.27 represent those variables that had a statistically significant correlation with motor function at three months (T2).

**Table 4.27: Variables significantly correlated with (RMA) motor function at 3 months (T2)**



| Variable | r | P |
|---|---|---|
| Baseline NIHSS score | -.605** | .000 |
| Baseline Barthel Index Score | .565** | .000 |
| Rivermead leg and trunk total At T1 | .512** | .000 |
| Baseline Rivermead score | .503** | .000 |
| Rivermead arm total at T1 | .445** | .000 |
| Rivermead Gross Function total at T1 | .443** | .000 |
| Baseline Modified Rankin Score | -.404** | .000 |
| Age of the participant | -.267** | .003 |
| Number of days spent in out rehabilitation setting at T2 | .257** | .004 |
| Total hours of physiotherapy at home T2 | .244** | .006 |
| Total exercise hours by family given for the patient At T2 | .216* | .015 |

#### *4.5.1.4 Predictors of motor function outcome at three months (T2)*

The predictors of overall motor function at three months; were the patient reporting the regular use of the hand in functional activities (cof. = 8.171), and baseline RMA_A score (cof. = 1.294). The predictor of less motor function assessed by RMA, was the severity as measured by baseline NIHSS (cof. = -0.355). The model presented in Table 4.28 explains around 52% of variance of motor function impairment at three months after stroke (adjusted $R^2$= 0.5225).

**Table 4.28: Multivariate analysis of predictors of (RMA) motor function at 3 months (T2)**

| Predictors of Rivermead 2 | Cof. | t | P |
|---|---|---|---|
| Using the hand in functional activities | 8.171 | 5.51 | 0 |
| Rivermead Arm Total at baseline | 1.394 | 3.73 | 0 |
| Baseline NIHSS | -0.355 | -3.98 | 0 |
| _cons | 19.262 | 12.42 | 0 |

#### *4.5.1.5 Bivariate analysis of categorical variables with significant difference of mean motor function at six months (T3)*

The following variables presented in Table 4.29 represents the categorical (nominal) variables that had a significant difference of mean motor function of participants, as measured by the RMA at six months (T3).

**Table 4.29: Categorical variables with significant difference of mean (RMA) motor function at 6 months (T3)**

| Rivermead T3 | Yes | No | Mean Dif. | P |
|---|---|---|---|---|
| **Stroke variables** | | | | |
| Incontinence | 12.67 | 22.89 | -10.22 | 0.000 |
| Dysarthria | 10.84 | 21.93 | -11.09 | 0.000 |
| Swallowing problems | 7.05 | 19.93 | -12.88 | 0.000 |
| Visual problems | 10.29 | 15.9 | -5.61 | 0.028 |
| **Rehabilitation settings** | | | **0** | |
| T2 Inpatient rehabilitation setting | 69.25 | 43.24 | 26.01 | 0.010 |
| T2 Home rehabilitation setting | 58.38 | 36.21 | 22.17 | 0.002 |
| T2 Outpatient rehabilitation setting | 85.33 | 42.28 | 43.05 | 0.000 |
| T3 Home rehabilitation setting | 72.41 | 40.05 | 32.36 | 0.000 |
| T3 Outpatient rehabilitation setting | 87.38 | 39.55 | 47.83 | 0.000 |
| **Personal effort in rehabilitation** | | | **0** | |
| T2 patient performing self-assisted EX | 22.4 | 7.99 | 14.41 | 0.010 |
| T2 Hand use in functional activities | 25.11 | 6 | 19.11 | 0.002 |
| T2 Family involvement in exercises | | | 0 | 0.000 |
| T3 Patient performing self-assisted EX | 22.96 | 8.61 | 32.87 | |
| T3 Hand use in functional activities | 34.33 | 1.46 | 14.35 | 0.000 |
| **Socio-demographic variables** | | | **0** | |
| Employed at the time of stroke | 20.53 | 13.42 | 7.11 | 0.048 |

#### *4.5.1.6 Bivariate analysis of variables with significant correlation with motor function at six months (T3)*

The following variables, presented in Table 4.30 represent the variables that had a statistically significant correlation with motor function at six months (T3)

**Table 4.30: Variables significantly correlated with (RMA) motor function at 6 months**

| Variable | r | P |
|---|---|---|
| Baseline NIHSS score | -.535** | .000 |
| Number of days spent in out rehabilitation setting at T2 | .362** | .000 |
| Grand total hours of physiotherapy at outpatient clinic | .352** | .000 |
| Age of the participant | -.326** | .000 |
| Total hours of physiotherapy at home T2 | .322** | .000 |
| Baseline Barthel Index Score | .318** | .000 |
| Number of days spent in outpatient rehabilitation setting at T3 | .314** | .000 |
| Leg and Trunk Total at T1 | .269** | .002 |
| Gross Function Total at T1 | .255** | .003 |
| Baseline Rivermead Score | .235** | .007 |
| Total hours of physiotherapy at outpatient setting at T3 | .231** | .008 |
| Grand total hours of physiotherapy hours at Home | .221* | .011 |
| Total hours of physiotherapy at home T3 | .215* | .014 |
| Total hours occupational therapy at rehabilitation institution in hours 2 | .198* | .024 |
| Number of days spent in home rehabilitation setting at T2 | .197* | .025 |
| Grand total hours of occupational therapy hours at institution | .190* | .031 |
| Total hours of physiotherapy at home T2 | .185* | .035 |
| Baseline Modified Rankin Score | -.183* | .037 |
| Number of days spent in home rehabilitation setting at T3 | .183* | .037 |
| Total exercise hours by family given for the patient At T3 | .176* | .011 |

Key: *= strong statistically significant correlation ; **= very strong statistically significant correlation

#### *4.5.1.7 Predictors of motor function outcome at six months (T3)*

The predictors of motor function at six months were the total hours of family exercises (cof. = 0.1159), total physiotherapy hours at outpatient setting (cof. = 0.144), and patients reporting the regular effort to use the affected hand in functional activities. The predictors of lower motor function at six months were the age of patient (cof. = -0.139), and the baseline swallowing problems (cof. = -7.58). The model presented in Table 4.31, explained 62.7% of the variance of motor function at six months (adjusted $R^2 = 0.6272$).

**Table 4.31: Multivariate analysis of predictors of (RMA) motor function at 6 months (T3)**

| Rivermead 3 | Cof. | t | P |
|---|---|---|---|
| Total hours of family exercises | 0.1159 | 3.55 | 0.001 |
| Total physiotherapy at outpatient settings | 0.144332 | 2.18 | 0.031 |
| Patient using the affected hand in functional activity | 17.8524 | 10.71 | 0.000 |
| Swallowing problem | -7.582721 | -4.79 | 0.000 |
| Age | -0.13894 | -2.16 | 0.033 |
| _cons | 30.12062 | 6.49 | 0.000 |

#### *4.5.2.8 Improvement on severity measured by National Institute of Health Stroke Scale (NIHSS)*

The improvement represented in the decrease of the mean score of the NIHSS was statistically significant, between T1 (17.39 ± 8.86) and T2 (14.68 ± 8.45) (P < 0.01). The mean change in NIHSS showed a non-statistically significant increase between T2 and T3 assessment points (19.04 ± 8.17) (P >0.05) **(See Figure 4.21).**



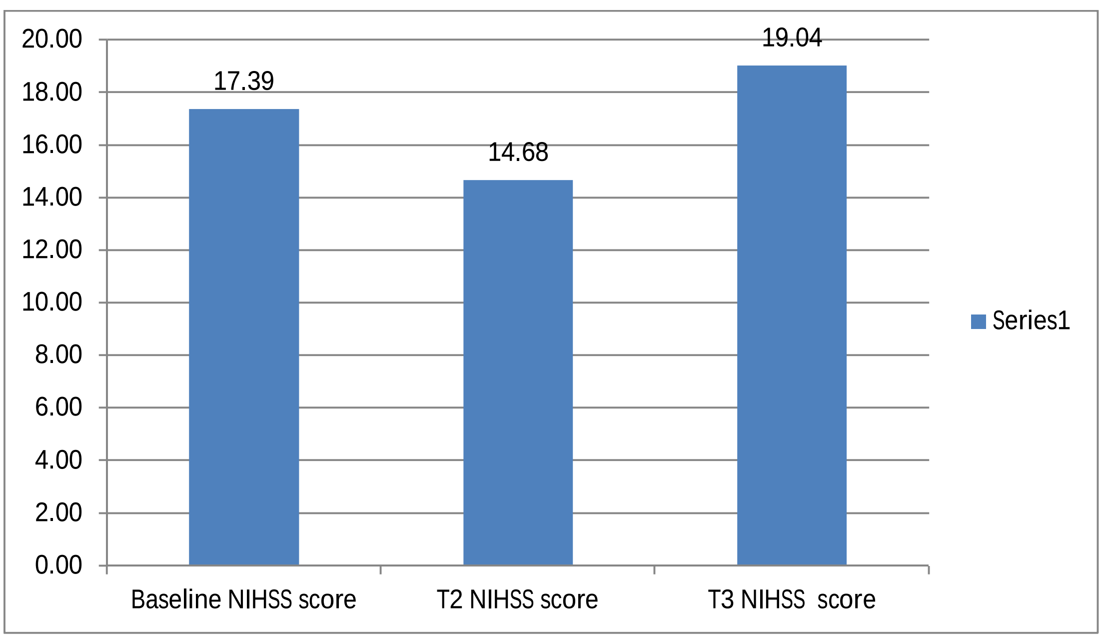



**Figure 4.21 Improvement of severity measured by NIHSS on the three assessment points**

### 4.5.3 Functional outcome in participants

#### *4.5.3.1 Functional outcome at the three assessment points, as measured by Barthel Index*

Figure 4.22 shows that there was a statistically significant increase in the Barthel Index mean score between T1 (10.11 ± 18.65) and T2 assessment periods (38.2 ± 32.41) by 28.21 points (P=0.000). A similar pattern could be seen at T3 (47.21 ± 41.631), where there was a statistically significant increase of 8.89 points of the Barthel Index mean score, between T2 and T3 assessment points (p = 0.000). Overall improvement on mean Barthel Index between baseline and T3, was 37.1 points (p = 0.000). At T2 assessment the percentage of patients having achieved the Barthel Index of 60 and above was 30.5%, and the percentage of patients achieving BI equal to or greater than 95 at T2 was only 6.1%. Those percentages remained the same on the T3 assessment, though there was an increase in the general mean of BI by around 9 points.

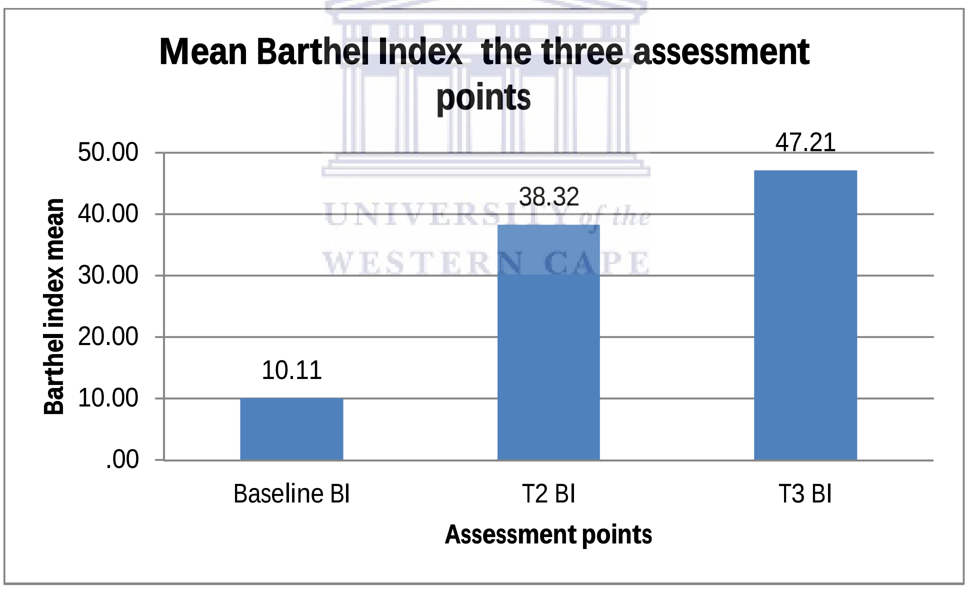



**Figure 4.22 Mean Barthel Index at the three assessment points**

#### *4.5.3.2 Functional activity outcome, as measured by Nottingham Extended Activities of Daily Living (NEADL), at the three assessment points*

Figure 4.23 shows that the NEDAL mean score at T2 showed improvement on functional activities measured between T1 (1.12 ± 6.15) and T2 (6.7 ± 12.79) (p= 0.001). In addition, the improvement on mean NEADL was significant between T2 and T3 (10.62 ± 16.61) (p= 0.000).

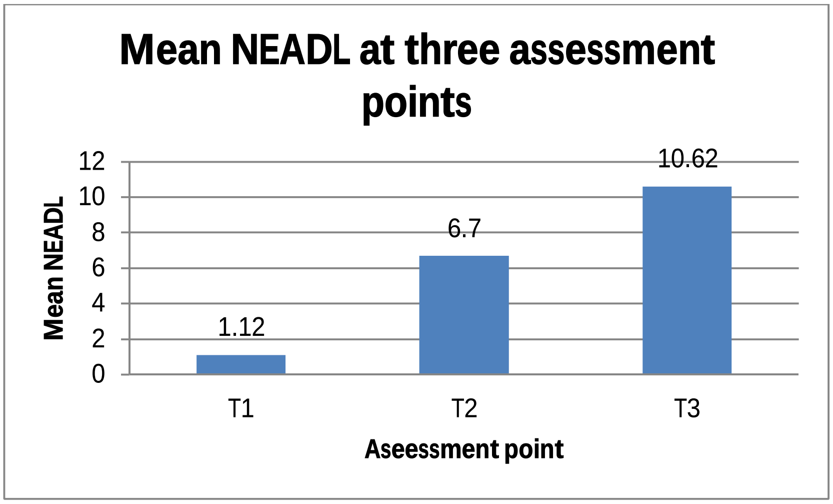



**Figure 4.23 Mean NEADL at the three assessment points**

#### *4.5.3.3 Bivariate analysis of variables with significant difference of functional activity mean at three months (T2)*

The following variables presented in Table 4.32 represent the variables that had a significant difference of mean functional activity of participants, as measured by the Barthel Index at three months (T2).

**Table 4.32: Categorical variables with significant difference of mean (BI) functional activities at 3 months (T2)**

| Barthel Index 2 | Yes | No | Mean Dif. | P |
|---|---|---|---|---|
| **Stroke complications variables** | | | | |
| Incontinence | 33.45 | 68.89 | -35.44 | 0.000 |
| Dysarthria | 28.56 | 61.46 | -32.9 | 0.000 |
| Swallowing problems | 22.97 | 50.9 | -27.93 | 0.000 |
| Visual problems | 29.5 | 42.7 | -13.2 | 0.017 |
| **Rehabilitation settings** | | | **0** | |
| T2 Inpatient | 55.25 | 35.27 | 19.98 | 0.010 |
| T2 Home | 46 | 30.76 | 15.24 | 0.006 |
| T2 Out | 69.67 | 43.27 | 26.4 | 0.000 |
| **Personal effort in rehabilitation** | | | **0** | |
| T2 EX. | 60.09 | 22.57 | 37.52 | 0.000 |
| T2 Hand use | 64.73 | 19.21 | 45.52 | 0.000 |
| T2 Family | 56.48 | 33.61 | 22.87 | 0.000 |
| **Socio-demographic variables** | | | **0** | |
| Education | 75.71 | 36.21 | 39.5 | 0.016 |

#### 4.5.3.4 *Bivariate analysis of variables with significant correlation with functional activity at three months (T2)*

The following variables, presented in Table 4.33 represent those variables that had a statistically significant correlation with functional activities at three months.

**Table 4.33: Variables significantly correlated with (BI) functional activities at 3 months (T2)**

| T2 Barthel Index Score | r | P |
|---|---|---|
| Baseline NIHSS score | -.668** | .000 |
| Baseline Barthel Index Score | .573** | .000 |
| Leg and Trunk Total at T1 | .557** | .000 |
| Baseline Rivermead Score | .489** | .000 |
| Baseline Modified Rankin Score | -.453** | .000 |
| Gross Function Total At T1 | .416** | .000 |
| Arm Total at T1 | .386** | .000 |
| Total exercise hours by family given for the patient at T2 | .331** | .000 |
| Total hours of physiotherapy at home T2 | .321** | .000 |
| Number of days spent in out rehabilitation setting at T2 | .320** | .000 |
| Age of the participant | -.317** | .000 |
| Period of family involvement in exercises in weeks T2 | .251** | .004 |
| Number of days spent in home rehabilitation setting at T2 | .220* | .011 |
| Total hours of physiotherapy at home T2 | .208* | .017 |
| Total hours occupational therapy at rehabilitation institution in hours at T2 | .194* | .026 |

#### 4.5.3.5 *Predictors of functional activity outcome at three months (T2)*

Table 4.34 shows that better functional ability (BI) at three months was predicted by the fact of patients reporting they were performing self-assisted hand exercises on a regular basis (cof. = 11.136), baseline T1 leg and trunk RMA-LT (cof. = 4.663), using the hand in functional activities (cof. = 25.025) and family total hours of exercise (cof. = 0.160). Lower functional activities at three months were predicted by NIHSS at baseline (cof. = -1.02), and by the patient being not educated (cof. = –18.646). The model explains 67.44% of variance in the functional activity at three months (adjusted $R^2$ = 67.44).

**Table 4.34: Multivariate analysis of predictors of (BI) functional activities at 3 months (T2)**

| Predictors of Barthel Index at three months | Cof. | t | P>t |
|---|---|---|---|
| Performing exercise at first 3 months | 11.136 | 2.45 | 0.016 |
| T1 leg and trunk Rivermead score | 4.663 | 4.02 | 0 |
| Using the hand in functional activities in the first three months | 25.025 | 5.39 | 0 |
| Family total hours of exercise | 0.160 | 2.02 | 0.045 |
| Baseline NIHSS | -1.02 | -4.36 | 0 |
| Being not educated | -18.646 | -2.47 | 0.015 |
| _cons | 92.882 | 10.57 | 0 |

#### *4.5.3.6 Bivariate analysis of categorical variables with significant difference of mean functional activity (BI) at six months (T3)*

The following variables presented in Table 4.35 represents the variables that had a significant difference of mean functional activities of participants, as measured by the Barthel Index at six months (T3).

**Table 4.35: Categorical variables with significant difference of mean (BI) functional activities at 6 months (T3)**

| Barthel Index T3 | Yes | No | Mean Dif. | P |
|---|---|---|---|---|
| **Stroke variables** | | | | |
| Incontinence | 41.95 | 80.28 | -38.33 | 0.000 |
| Dysarthria | 35.92 | 74.63 | -38.71 | 0.000 |
| Swallowing problems | 24.83 | 65.56 | -40.73 | 0.000 |
| Visual problems | 35.6 | 52.7 | -17.1 | 0.028 |
| **Rehabilitation settings** | | | **0** | |
| T2 Inpatient rehabilitation setting | 69.25 | 43.24 | 26.01 | 0.010 |
| T2 Home rehabilitation setting | 58.38 | 36.21 | 22.17 | 0.002 |
| T2 Outpatient rehabilitation setting | 85.33 | 42.28 | 43.05 | 0.000 |
| T3 Home rehabilitation setting | 72.41 | 40.05 | 32.36 | 0.000 |
| T3 Outpatient rehabilitation setting | 87.38 | 39.55 | 47.83 | 0.000 |
| **Personal effort in rehabilitation** | | | **0** | |
| T2 Patient performing self-assisted EX | 69.25 | 43.24 | 26.01 | 0.010 |
| T2 Hand use in functional activities | 58.38 | 36.21 | 22.17 | 0.002 |
| T2 Family involvement in exercises | 85.33 | 42.28 | 43.05 | 0.000 |
| T3 Hand use in functional activities | 72.41 | 40.05 | 32.36 | 0.000 |
| T3 Family involvement in exercises | 87.38 | 39.55 | 47.83 | 0.000 |

#### 4.5.3.7 *Bivariate analysis of variables with significant correlation with functional activity at six months (T3)*

The following variables presented in Table 4.36, had a statistically significant correlation with functional activities at six months (T3).

**Table 4.36: Variables significantly correlated with (BI) functional activities at 6 months (T3)**

| Variable | r | P |
|---|---|---|
| Baseline NIHSS score | $-.549^{**}$ | .000 |
| Grand total hours of physiotherapy at outpatient clinic | $.431^{**}$ | .000 |
| Number of days spent in out rehabilitation setting at T3 | $.421^{**}$ | .000 |
| Baseline Barthel Index score | $.377^{**}$ | .000 |
| Rivermead leg and trunk total at T1 | $.364^{**}$ | .000 |
| Number of days spent in outpatient rehabilitation setting at T2 | $.357^{**}$ | .000 |
| Total exercise hours by family given for the patient At T3 | $.355^{**}$ | .000 |
| Total hours of physiotherapy at home T2 | $.334^{**}$ | .000 |
| Period of family involvement in exercises in weeks T3 | $.332^{**}$ | .000 |
| Total hours of physiotherapy at outpatient setting at T3 | $.327^{**}$ | .000 |
| Grand total hours of physiotherapy hours at home | $.321^{**}$ | .000 |
| Age of the participant | $-.320^{**}$ | .000 |
| Total exercise hours by family given for the patient At T2 | $.315^{**}$ | .000 |
| Total hours of physiotherapy at home T3 | $.314^{**}$ | .000 |
| Baseline Modified Rankin score | $-.307^{**}$ | .000 |
| Number of days spent in home rehabilitation setting at T2 | $.291^{**}$ | .001 |
| Baseline Rivermead score | $.282^{**}$ | .001 |
| Number of days spent in home rehabilitation setting at T3 | $.277^{**}$ | .001 |
| Rivermead Gross Function total at T1 | $.272^{**}$ | .002 |
| Total hours of physiotherapy at home T2 | $.271^{**}$ | .002 |
| Grand total hours of occupational therapy hours at institution | $.228^{**}$ | .009 |
| Total hours occupational therapy at rehabilitation institution in hours T2 | $.227^{**}$ | .009 |
| Period of family involvement in exercises in weeks T2 | $.211^{*}$ | .016 |
| Grand total hours of physiotherapy hours at institution | $.181^{*}$ | .038 |
| Total hours of physiotherapy at rehabilitation institutionT2 | $.180^{*}$ | .040 |

#### *4.5.3.8 Predictors of functional activity outcome at six months (T3)*

Table 4.37 shows predictors of functional activity at six months where the patient reporting the use of the hand in functional activities (cof. = 42.99), total physiotherapy hours at home rehabilitation setting at T2 and T3 (cof. = 0.220) and total occupational therapy at inpatient rehabilitation setting at T2 and T3 (cof. = 2.48). Less functional activity at six months was predicted by age of patient (cof. = -0.461), and swallowing problems at baseline (cof. = -19.959). The model explains 64.21% of the functional activity at six months (Adjusted $R^2 = 64.21$).

**Table 4.37: Multivariate analysis of predictors of (BI) functional activities at 6 months (T3)**

| **Barthel3** | **Cof.** | **t** | **P** |
|---|---|---|---|
| Patient using the hand in functional activity at T2 | 42.9895 | 8.97 | 0.00 |
| Total physiotherapy hours at home in T2 and T3 | 0.220302 | 2.99 | 0.003 |
| Total physiotherapy hours at outpatient T2 and T3 | 0.574837 | 2.84 | 0.005 |
| Total occupational therapy hours at inpatient T2 and T3 | 0.247636 | 2.35 | 0.02 |
| Age | -0.46151 | -2.37 | 0.02 |
| Having a swallowing problem | -19.95931 | -4.11 | 0.00 |
| _cons | 83.08888 | 5.96 | 0.00 |



### 4.5.4 Participation outcome in participants, as measured by Modified Rankin Scale (MRS)

Participation outcome was assessed by the Modified Rankin Score (MRS), applied at the three assessment points. The MRS is a 5-point scale (0-5), where 0 is normal and 5 represents the most severe stroke. People who died were assigned the score of (MRS = 6) (Christensen *et al*., 2009; Leys *et al*., 2002).

#### *4.5.4.1 Participation at three assessment points*

Figure 4.24 that there was a statistically significant increase of (0.33) between MRS mean at T1 (4.85 ± 0.375) and MRS mean at T2 (4.52 ±1.048) (p = 0.00). Also there was a statistically significant increase in mean MRS between T2, and MRS mean at T3 (4.29 ± 1.453) by (0.23) points (p = 0.011). The overall change of mean MRS between baseline and mean MRS at T3 was 0.56 points, which was also statistically significant (p = 0.00). 93% of the patients did not reach the favourable outcome represented in MRS of ≥ 2 (Christensen *et al*., 2009).

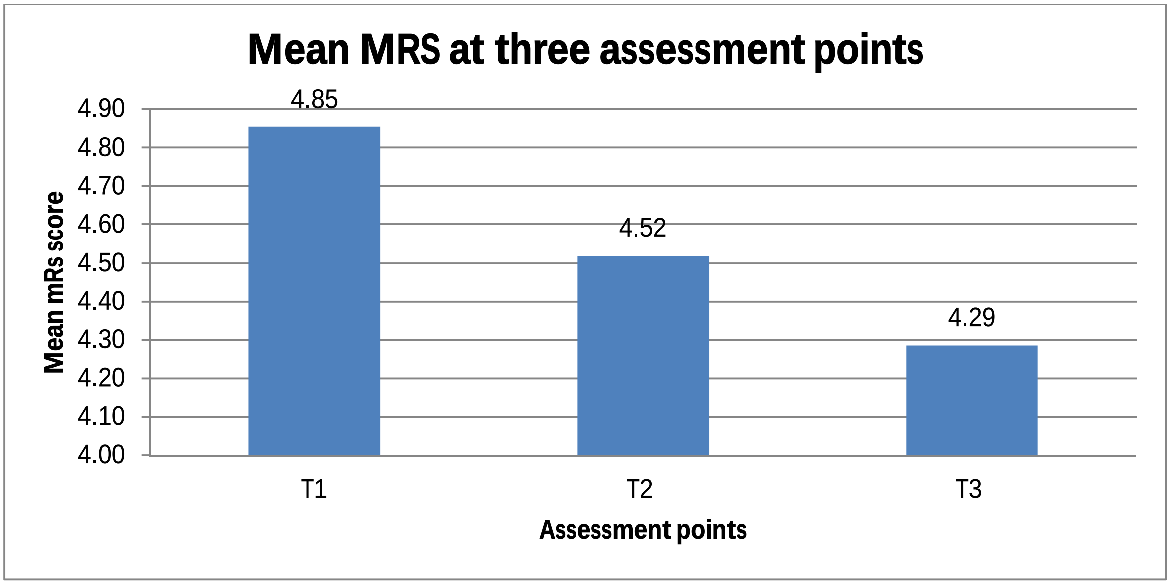



**Figure 4.24 Mean Modified Rankin Scale at three assessment points**

The change in the participation sub-items of the Modified Rankin Scale at the three assessment points is presented in Table 4.38. Only 4.3% (n = 6) of the 14.4% (n = 20, working before the stroke) managed to return to work 6 months after stroke. Around 8% (n = 11) of 62.6% (n = 87) managed to return to participate in family responsibilities, at six months after stroke. On the social and leisure activities level, 7.91% (n = 11) reported a return to participation in these activities, of the 82.7% (n = 115) of patients who were participating in this aspect before the stroke.

**Table 4.38: Participation items measured by (MRS) Modified Rankin Scale at 3 assessment points**

| | | **Change in role after stroke n (%)** | **reduce level of role n (%)** | **unable to perform role n (%)** | **Return to role n (%)** | **DEAD n (%)** |
|---|---|---|---|---|---|---|
| Work | T1 | 20 (14.4) | 1 (0.7) | 19 ( 13.7 ) | 0 (0) | 0 (0) |
| | T2 | 19 (13.7) | 2 (1.4) | 16 (11.5) | 1 (0.7) | 1(0.7) |
| | T3 | 12 (8.6) | 2 (1.4) | 10 (7.2) | 6 (4.3) | 2(1.4) |
| Family responsibilities | T1 | 87 (62.6) | 2 (1.4) | 84 (60.4) | 0(0) | 0 (0) |
| | T2 | 74 (53.2) | 11 (7.9) | 63 (45.3) | 4 (2.87) | 9 (6.47) |
| | T3 | 48 (34.5) | 23 (16.5) | 25 (18.0) | 11 (7.91) | 28(20.14) |
| Social activities | T1 | 115 (82.7) | 2 (1.) | 113 (81.3) | 0 (0) | 0 (0) |
| | T2 | 96 (69.1) | 32 (23.2) | 65 (46.8) | 4 (2.87) | 14 (10.07) |
| | T3 | 70 (50.4) | 42 (30.22) | 28 (20.1) | 11 (7.91) | 26 (18.71 ) |

#### *4.5.4.2 Bivariate analysis of variables with significant difference of mean participation (mean MRS) at three months (T2)*

The following variables presented in Table 4.39 represent the variables that had a significant difference of mean participation level of participants as measured by the MRS at three months (T2).

**Table 4.39: Categorical variables with significant difference of mean (MRS) participation level at 3 months (T2)**

| Mean difference of Modified Rankin Scale at T2 | Yes | No | Mean Dif. | P |
|---|---|---|---|---|
| **Stroke variables** | | | | |
| Incontinence | 4.67 | 3.56 | 1.11 | 0.000 |
| Dysarthria | 4.85 | 3.76 | 1.09 | 0.000 |
| Swallowing problems | 4.97 | 4.15 | 0.82 | 0.000 |
| **Rehabilitation settings** | | | | |
| T2 Inpatient | 4.04 | 4.6 | -0.56 | 0.029 |
| T2 Home | 4.32 | 4.71 | -0.39 | 0.033 |
| T2 Out | 3.8 | 4.61 | -0.81 | 0.004 |
| **Personal effort in rehabilitation** | | | | |
| T2 EX. | 3.87 | 4.99 | -1.12 | 0.000 |
| T2 Hand use | 3.69 | 5.12 | -1.43 | 0.000 |
| T2 Family | 3.85 | 4.69 | -0.84 | 0.001 |



#### *4.5.4.3 Bivariate analysis of variables with significant correlation with participation level at three months (T2)*

The following variables presented in Table 4.40, had a statistically significant correlation with participation level at three months (T2).

**Table 4.40: Variables significantly correlated with (MRS) participation level at 3 months (T2)**

| Variable | r | P |
|---|---|---|
| Baseline NIHSS score | .712** | .000 |
| Baseline Barthel Index score | -.580** | .000 |
| Baseline Rivermead leg and trunk total | -.535** | .000 |
| Baseline Rivermead score | -.510** | .000 |
| Baseline Modified Rankin score | .507** | .000 |
| Baseline Rivermead Gross Function total | -.461** | .000 |
| Baseline Rivermead arm total | -.425** | .000 |
| Total exercise hours by family at T2 | -.343** | .000 |
| Age of the participant | .298** | .001 |
| Period of family involvement in exercises at T2 | -.293** | .001 |
| Number of days spent in outpatient setting at T2 | -.215* | .014 |
| Total hours of physiotherapy at home at T2 | -.209* | .017 |
| Number of days spent in home rehabilitation setting at T2 | -.172* | .049 |

#### *4.5.4.4 Predictors of participation at three months (T2)*

According to Table 4.41, the three main predictors of participation at three months after stroke were the Baseline Modified Rankin score (B= 0.563), baseline NIHSS score (cof. = 0.049) and the reporting of the patient of performing regular self-assisted hand exercises (cof. = -0.812). The model explained 64.93% of the participation variance at three months as measured by MRS (adjusted $R^2 = 64.93$).

**Table 4.41: Multivariate analysis of predictors of (MRS) participation level at 3 months (T2)**

| Rankin at T2 | Cof. | t | P |
|---|---|---|---|
| Baseline Modified Rankin Scale | 0.563 | 3.47 | 0.001 |
| Baseline NIHSS | 0.049 | 6.47 | 0 |
| Patient performing self-assisted hand exercise at the T2 | -0.812 | -6.16 | 0 |
| _cons | 0.456 | 0.61 | 0.542 |

#### *4.5.4.5 Bivariate analysis of categorical variables with significant difference of mean (MRS) participation at six months (T3)*

The following variables presented in Table 4.42 represents the variables that had a significant difference of mean participation of participants, as measured by MRS at six months (T3).

**Table 4.42: Categorical variables with significant difference of mean (MRS) participation level at 6 months (T3)**

| Modified Rankin Scale T3 | yes | No | Mean Dif. | P |
|---|---|---|---|---|
| **Stroke variables** | | | | |
| Incontinence | 4.84 | 3.11 | 1.73 | 0.001 |
| Dysarthria | 4.64 | 3.44 | 1.2 | 0.000 |
| Swallowing problems | 4.95 | 3.76 | 1.19 | 0.000 |
| **Rehabilitation settings** | | | **0** | |
| T2 Inpatient rehabilitation setting | 3.55 | 4.42 | -0.87 | 0.013 |
| T2 Home rehabilitation setting | 3.98 | 4.58 | -0.6 | 0.002 |
| T2 Outpatient rehabilitation setting | 3.07 | 4.45 | -1.38 | 0.001 |
| T3 Home rehabilitation setting | 3.55 | 4.5 | -0.95 | 0.000 |
| T3 Outpatient rehabilitation setting | 3.1 | 4.52 | -1.42 | 0.000 |
| **Personal effort in rehabilitation** | | | **0** | |
| T2 patient performing self-assisted EX | 3.38 | 4.96 | -1.58 | 0.010 |
| T2 Hand use in functional activities | 3.18 | 5.11 | -1.93 | 0.002 |
| T2 Family involvement in exercises | 3.67 | 4.45 | -0.78 | 0.009 |
| T3 Patient performing self-assisted EX | 3.27 | 4.92 | -1.65 | 0.000 |
| T3 Hand use in functional activities | 3.29 | 5.41 | -1.65 | 0.000 |
| T3 Family involvement in exercises | 3.59 | 4.41 | -2.12 | 0.017 |
| **Socio-demographic variables** | | | **0** | |
| Living with spouse | 4 | 4.64 | -0.64 | 0.012 |

#### *4.5.4.6 Bivariate analysis of variables with significant correlation with participation at six months (T3)*

The following variables presented in Table 4.43 had a statistically significant correlation with participation level at six months (T3).

**Table 4.43: Variables significantly correlated with (MRS) participation level at 6 months (T3)**

| Variables | r | P |
|---|---|---|
| Baseline NIHSS score | .507** | .000 |
| Baseline Barthel Index score | -.428** | .000 |
| Grand total of hours of physiotherapy at outpatient clinic | -.416** | .000 |
| Leg and Trunk total at T1 | -.406** | .000 |
| Gross Function total at T1 | -.394** | .000 |
| Age of the participant | .377** | .000 |
| Number of days spent in outpatient rehabilitation setting at T3 | -.375** | .000 |
| Baseline Rivermead score | -.363** | .000 |
| Number of days spent in outpatient rehabilitation setting at T2 | -.361** | .000 |
| Total hours of physiotherapy at home T2 | -.353** | .000 |
| Total exercise hours by family given for the patient at T3 | -.348** | .000 |
| Baseline Modified Rankin score | .334** | .000 |
| Period of family involvement in exercises in weeks T3 | -.320** | .000 |
| Grand total hours of physiotherapy hours at home | -.295** | .001 |
| Total hours of physiotherapy at outpatient setting at T3 | -.293** | .001 |
| Total hours of physiotherapy at home T3 | -.288** | .001 |
| Total exercise hours by family given to the patient at T2 | -.279** | .001 |
| Total hours of physiotherapy at home T2 | -.248** | .005 |
| Number of days spent in home rehabilitation setting at T2 | -.237** | .007 |
| Number of days spent in home rehabilitation setting at T3 | -.234** | .008 |
| Arm total at T1 | -.232** | .008 |
| Total hours occupational therapy at rehabilitation institution in hours | -.229** | .009 |
| Period of family involvement in exercises in weeks T2 | -.218* | .013 |
| Grand total hours of occupational therapy hours at institution | -.210* | .017 |
| Total hours of physiotherapy at rehabilitation institutionT2 | -.205* | .020 |
| Grand total hours of physiotherapy hours at institution | -.204* | .020 |



#### *4.5.4.7 Predictors of participation at six months (T3)*

At six months assessment (T3), as shown in Table 4.44, the main predictors of less participation at six months (higher MRS) were age of the patient (cof. = 0.019), and the baseline NIHSS score (cof. = 0.023). The main predictors of a better participation level at six months (lower MRS) were; total physiotherapy hours at home (cof. = -0.007), baseline RMA-A (cof = -0.262); baseline RMA-G (cof. = -0.454), patient reporting performing regular self-assisted hand exercises (cof. = -0.877), the patient reporting using the hand in functional activities (cof. = -1.082) and the total family exercises (cof. = - 0.007). The model explained 63.13% of variance of participation restriction at six months (adjusted $R^2$ = 63.19).

**Table 4.44: Multivariate analysis of predictors of (MRS) participation level at 6 months (T3)**

| Rankin3 | Cof. | t | P |
|---|---|---|---|
| Age | 0.019552 | 2.72 | 0.007 |
| Grand total physiotherapy at home | -0.00647 | -2.32 | 0.022 |
| Baseline NIHSS | 0.023029 | 2.08 | 0.04 |
| Rivermead arm total at baseline | -0.262383 | -3.35 | 0.001 |
| Patient performing personal assisted exercise at T3 period | -0.87704 | -4.54 | 0.00 |
| Rivermead total gross function at baseline | -0.45374 | -4.68 | 0.00 |
| Using the hand in functional activities at T2 period | -1.082255 | -5.3 | 0.00 |
| Family total exercise hours at T2 | -0.007314 | -2 | 0.048 |
| _cons | 2.384343 | 4.62 | 0.00 |

### 4.5.5 Summary of this section

There was a statistical significant improvement in the mean scores of functional activity measured by BI, motor function measured by RMA, and participation level measured by MRS, between the three assessment points (T1, T2 and T3). At six months after the stroke, predictors of better motor function (RMA) were total hours of family exercises, total physiotherapy hours at outpatient setting, and patients reporting the regular effort use of the hand in functional activities. Predictors of functional activity were the patient reporting the use of hand in functional activities, total physiotherapy hours at home rehabilitation setting at T2 and T3 and total occupational therapy at inpatient rehabilitation setting at T2 and T3. Better participation level was predicted by the functional activity scores as measured by BI through the total physiotherapy hours at home, baseline RMA-A, baseline RMA-G, patient reporting performing regular self-assisted hand exercises, the patient reporting using the hand in functional activities, and the total family exercises .

# CHAPTER 5: The characteristics of OF THE RESULTS

In the following chapter, the results of the study will be discussed. Firstly, a discussion of the profile of the sample will be described, followed by the results of the epidemiological study and lastly a discussion of the results of the stroke rehabilitation outcome study. Limitations of the study and summary of overall discussion will also be presented at the end of this chapter.

## 5.1 BASELINE SOCIO-DEMOGRAPHIC PROFILE OF STROKE PATIENTS IN HEBRON, PALESTINE

In this section of the chapter, the socioeconomic data (age, gender, employment, and marital status) and the characteristics and variables of stroke will be discussed.

The average age of the sample was 67.6 years, which compares well with population samples of other studies. Lower averages of age have been reported from China (64 years by Li *et al*., 2008), in Arab Gulf countries (58.9 years by Deleu *et al*., 2011) and higher averages in India (68.6 years, by Sridharan *et al*., 2009) and in a literature review by Appelros *et al*. (2009). Females were on average 1.06 years older than males, which support the results found by the review of Appelros *et al*., 2009.



In the current study more stroke patients were female which is in contradiction to the bulk of the literature in this issue (Appelros *et al*., 2009; Spengos & Vemmos, 2010; Thorvaldsen *et al*., 1995). One of the reasons behind this difference of percentage of females compared to males might be that the females had higher scores on other factors. They were one year older than males, they had a 20 cm higher waist circumference than males, which is considered a clinically significant difference in terms of obesity and had been suggested to have a strong association with increased incidence of strokes (Barclay, 2010; Lee *et al*., 2008; Suk *et al*., 2003). The other factors that might influence results indicated that 83% of the females in this sample had hypertension compared to 67.3% males; more elevated cholesterol, more cardiac diseases, and 9% more prevalence of diabetes, which means that the risk cluster seems to be more intense in females and may have justified the increase in incidence of stroke among Palestinian females more than in males. This is despite the fact that the male percentage in the Palestinian population is more than the female percentage (50.8% VS. 49.2% respectively) (Palestinian Central Bureau of statistics (PCBS), 2012).

The majority of the participants were not working at the time of the stroke (86.6%), which is not surprising for a group of participants with average age of 67.6 years old, which is two years above the retirement age of 65 in Palestine. The impact also comes from the finding that 43% of those who did not do formal work were housewives. With the exception of one female, the 14.4% people who were working at the time they suffered the stroke, were males. 2.2% of them were formally employed and the rest were self-employed. Furthermore, 40% of those who had a basic education and 50% of those who had BA degrees were still working, compared to 3.9% of those who had no education at the time of the stroke. The level of education of the sample was low, in that 54.7% had not even had a school education. This is most likely because basic education was limited in their youth and there were no universities in the whole country at that time. A higher education level has been emphasized by Putman *et al*., (2007a) who underlined the importance of educational level as an independent predictor of stroke outcome. It seems that a higher intellectual level may be associated with higher cognitive abilities and help the patient to be more motivated to participate actively in rehabilitation and may increase social participation. Its importance has been highlighted by a number of researchers (Kwakkel *et al*.,1996; Shaughnessy ,1996; Weir *et al*., 2005).

The average number of children of participants who lived in a household was three persons, which means that despite the fact that Palestinians have big families; the children are not necessarily living with their parents. Palestinian families are big families in general, especially in previous decades, when a woman could have more than 8 children (Khawaja, 2000). This may be an important factor in the rehabilitation of the stroke survivor, as the family can play a large role in the financial and social support of the patient (Holmqvist *et al*., 1998; Kwakkel *et al*., 1996). In Palestine, the social system is built on the basis that elderly people are the centre of the family, and the resources of the children, even those who do not live in the same household, are usually available to the parents.

The majority of the sample was struggling financially, with 56.9% of participants meeting their monthly expenses with difficulty or with great difficulty and 35.2% with some difficulty. Income is an important factor that may affect the rehabilitation outcome (Putman *et al*., 2007a). Furthermore, the choice of rehabilitation setting may also be influenced by the patient's financial status. Another issue is that children can be a motivated, affordable and available source of rehabilitation assistance, if they were educated and motivated to play a significant role in the rehabilitation process, as mentioned by Holmqvist *et al*. (1998) in the early supported discharge study.

## 5.2 EPIDEMIOLOGY OF STROKES IN HEBRON, PALESTINE

### 5.2.1 Stroke types and diagnosis

In Palestinian hospitals, scanning of the brain when a stroke is suspected is a stroke management protocol and only 2.2% of patients that were diagnosed clinically were not scanned. They were assessed during a period when there was a technical problem with the CT scan at Alia Hospital. One could then say that, in theory, the method of stroke diagnosis in Palestine follows the appropriate medical protocol as highlighted by the AHA (2011) and Schellinger *et al*. (1999). Most strokes were diagnosed as ischemic strokes (80.6%), followed by haemorrhagic strokes (19.4%), which is close to the percentages reported from Europe as 10-15% haemorrhagic strokes reported by Sudlow and Warlow (1997) and within the range of the percentages of haemorrhagic strokes in Asian countries that were reported as 17 - 33% (A.A.S.A Panel, 2000). This ratio of haemorrhagic to ischemic strokes seems consistent also with the ratio of 20% to 80% reported in other Arab countries (Benamer & Grosset, 2009).

### 5.2.2 Associated stroke risk factors

There was a significant difference in the prevalence of diabetes, being diagnosed in almost 70% of the case group compared to less than 25% of the control group. In the current study, diabetes is third after obesity and hypertension on the list of most common risks and is a number one risk in the multivariate risks analysis model, and number two in terms of risks most associated with strokes in the bivariate analysis of the Odds Ratio (OR=6.939). These findings strongly support the results of Ottenbacher *et al*. (2004), Ho *et al*. (2003) and Tuomilehto *et al*. (1996) and support the findings that consider diabetes as an equivalent risk to cardiovascular disease. However, one negative aspect of this study is that it did not differentiate between the two types of diabetes in terms of risk, as in the study of Davis *et al*. (1999), and Alajbegovic *et al.* (2009), information that could have contributed to a better understanding about the actual relationship between stroke incidence and the subtype of diabetes. It can be argued that the results of this study are consistent with most of the literature in terms of the high association of diabetes with strokes, and this study even highlights this relationship as the strongest predictor of a stroke.

Hypertension was found to be the second strongest predictor of a stroke in the multivariate analysis, with a prevalence of nearly 80% for the stroke patients compared to nearly 54% of the controls. Although this seems to be a high prevalence in both groups, it must be kept in mind that both populations were elderly people whose average age was 66.4 years. In another study on the prevalence of cardiovascular risk factors in Palestine, a similar prevalence was established in the whole population (Husseini *et al*., 2009). The current study's findings are consistent with Suzuki *et al*. (2011) and Takahashi *et al*. (2011), who both proposed hypertension as a significant risk factor for a stroke. Bener *et al*. (2006) proposed hypertension as a predictor of strokes, which matches the status of hypertension in this study as a second predictor of strokes in the multivariate analysis. One of the things that should also be highlighted is the indirect relationship of hypertension to other risks such as atherosclerosis, which in turn increases the vulnerability to strokes among at risk patients. Therefore, any future preventative plan should look at hypertension as a priority in terms of diet and regular compliance with medications. This is confirmed by the study of Baune *et al*. (2004), showing that non-compliance with hypertensive medications in Palestinian patients is associated with risk of strokes. Public awareness should be addressed as demonstrated by the findings of Papadopoulos and Papademetriou (2006) in terms of the importance of hypertension management in any prospective stroke preventive plan.

Consumption of a fatty diet was found to be the third strongest predictor of strokes. This is not strange as this type of food is culturally a regular component of the daily menu, especially in the rural areas of Palestine (39% of the research sample), where animal fat oil is used in cooking, and butter and milk products are part of the daily menu of the Palestinian rural community. These are often home-made products from the family's goats, sheep or cows. Consumption of fatty foods was higher in the case group than the control group (56.8% vs. 38.8) respectively; and it formed the 7$^{th}$ strongest stroke risk factor on the list of strength of bivariate association with strokes (OR= 2.07), and 4$^{th}$ in order on the list of the most prevalent risk factors in the case group. Prevalence of fatty diet consumption is high in both control and stroke groups and although the control group had higher cholesterol and triglyceride results, despite their lower use of a fatty diet, the whole community should be made aware of the risk of cardiovascular diseases that could predispose them to strokes.

One other important factor is the level of physical activity that cannot be separated from the total lipids profile in both groups since physical activity leads to better energy consumption, which decreases the possibility of extra lipids storage (Goran *et al*., 1999). In the control group, only 10.5% reported zero days of physical activity. The rest of the group was relatively physically active, which could in turn mitigate the effect of such a diet on cardiovascular health. Physical inactivity was found to be the fourth strongest predictor of strokes in the multivariate analysis of stroke risks. Physical activity was defined as 30 minutes of physical activity (3 times per week) that increases breathing and heart rate (American Dietary Guidelines for Americans, 2005). In the control group only 11 participants, compared to 37 in the case group were inactive for seven days of the week, making it the 4th strongest risk in terms of strength of association with stroke incidence in the bivariate OR analysis (OR= 5.80), and the 9th on the list of most prevalent risk factors. These findings regarding the difference in physical activity between the groups support the results of other studies in the literature about the importance of physical activity as a preventive measure against the incidence of stroke (Blair & Sierverdes, 2010; Diep *et al*., 2010; Goldstein, 2010; Mostofsky *et al*., 2011; Sattelmair *et al*., 2010; Willey *et al*., 2009).

Stress was found to be the fifth predictor of strokes in the multivariate logistic regression model. Stress was investigated in this study, using a nominal scale (Yes/No), asking if any stressful event happened the week preceding the stroke, such as loss of close family or friends, a significant amount of assets, or a significant problem, that did not exist before that week of stroke. It was found that half of the cases answered positively, compared to 22% in the control group, making it the 6th on the list of risk in terms of strength of association, and the 5th on the list of most prevalent risks in the case group. The effect of stress on cardiovascular function and hypertension is well-known, mainly chronic stress on the development of cardiovascular diseases, and acute stress on patients that already has cardiovascular disease (mainly hypertension). So adding a new stressful event to the accumulative stress of a population living under occupation and in a war zone has shown in this study to be increasing the Odds Ratio of developing a stroke. It also showed that stress was a predictor of strokes on a multivariate analysis model, where stress was associated with double the risk of stroke, compared to those who did not report having any new stresses in their last week. These results do not differ from the conclusions drawn by other researchers such as Harmsen *et al*. (1990), Truelsen *et al*. (2003), and Tsutsumi *et al*. (2009), except that it demonstrated stress as a statistically significant risk and predictor of strokes, which was not demonstrated in studies such as that of Truelsen *et al*. (2003), who assessed the role of stress on stroke incidence in a Scandinavian community, and did not find stress as a predictor of strokes. This variance in stress role is probably because the Palestinian community lives under occupation and communities living in Scandinavia enjoy high socio-economic status.

This study did not demonstrate any significance of well-known risks such as family history of stroke, triglycerides, cardiac valve pathology, being a current smoker (regardless of intensity of smoking), and hypercholesterolemia. Cholesterol was not found to be associated with any increased risk of stroke in this study. This contradicts the findings of many researchers such as Hankey *et al*. (2010) and Tirschwell *et al*. (2004). At the same time the results of this study support some other studies such as Nago *et al*. (2011), who found a negative correlation between mortality and serum cholesterol levels, and Athyros *et al*. (2010) who did not find any relation between serum cholesterol and risk of haemorrhagic stroke. These results demonstrate that there is really a variable distribution in terms of stroke risk factor priorities in different places of the world. An investigation of low density and high-density lipoprotein could be done, rather than total cholesterol alone, despite the negative association found in this study (that may be attributed to this study limitation of not specifying the type lipoprotein). This does not underestimate the findings of many other researchers, who showed a decrease in stroke incidence associated with cholesterol reduction drugs (Amarenco *et al*., 2009; Fitchett *et al*., 2008; Huxley *et al*., 2009). Triglycerides were not found to have any statistically significant relation with strokes in this study, despite its non-statistical correlation with strokes, it was prevalent among 40.9% of the sample (8$^{th}$ prevalent risk on the list). However, it was even more so in the controls (42.5%), which contradicts the findings of many researchers like Freiberg *et al*. (2008), and Bonaventure *et al*. (2010), who found that abnormal triglycerides affect stroke incidence, its high level being associated with ischemic strokes and its low level with haemorrhagic strokes. The current results are also in harmony with a systematic review by Labreuche *et al*. (2009), who found that only 11 studies of 38 really supported the association between triglyceride levels and the risk of strokes. It should also be taken into consideration that 62.6% of the cases reported continuous physical activity of more than 30 minutes a day, which has a buffering action of the risk of high TRG levels in serum blood tests.



Obesity (defined in this study as WHtR ≥ 0.5, as by Browning *et al*. (2010) was the 9th risk factor associated with strokes in terms of the bivariate Odds Ratio. It was prevalent in 71.2% (second in the most prevalent risks list) of cases compared to 59.5% of the control group. Both groups are obese with more than half of them crossing the limit of 0.5. This is one of the characteristics of elderly people in the Middle East, where obesity is linked to a lifestyle of fatty food that depends on unhealthy oil in cooking. The culture of fitness activities and sport, such as running or attending a gym, is not acceptable for older people. Despite the fact that obesity was listed as the ninth strongest risk factor in terms of the Odds Ratio and association with risk of stroke, it is also linked to the more direct risks of strokes, such as diabetes and hypertension and cardiac diseases in the majority of published literature in this field. The results of this study are in harmony with the findings of similar research investigating the effect of obesity on risk of stroke (Kurth *et al*., 2003; Suk *et al*., 2003; Winter *et al*., 2008; Yatsuya *et al*., 2010).

There was a statistically significant difference between the control and case group in the history of smoking. The Odds Ratio of developing a stroke was in favour of the non-smokers. This result is misleading when it stands alone as it refera to participants who had “ever-smoked” regardless of amount or time spent smoking, or time of current or previous episodes of smoking. For example, if someone had previously smoked 2 cigarettes daily for 3 months but quit 40 years ago, they were included as having a positive risk on this particular question, which is not practically and clinically sound enough to build up the risk, or the complications that will be sufficient to develop a stroke. However, when history of quitting smoking is considered, the results become clearer, as it can be seen that 30.9% of the control group quit smoking compared to 15.15% of the case group. This indicates that more smokers in the control group quit smoking and smoked less than the case group, which in turn underlines the positive effect of quitting smoking on the prevention of potential smoking consequences.

The most interesting finding was the statistically significant difference in number of current cigarettes smoked between cases and control, which is 23 for the case group and 16 for the control group. At the same time, median number of cigarettes smoked by the case group was more by 4.5 cigarettes. It seems that being a current smoker was not significantly increasing the odds of developing a stroke, nor was the total years of smoking. What really increased the odds of a stroke incidence was the intensity of current smoking. The results found in this study support the bulk of the literature in this field, which has highlighted the intensity rather than the fact of smoking itself as a risk of stroke, as is the case in Gill *et al*. (1989), Kelly *et al*. (2008), Mannami *et al*. (2004) and Wolf *et al*. (1988).

Alcohol consumption was not found to be significant in either of the case or control groups, which indicates the risk profile difference in terms of cultural and religious variations in Palestine. In many other studies, alcohol was considered a risk for both types of stroke (Gill *et al*., 1991) or a risk for haemorrhagic strokes for heavy consumers (Daniel & Bereczki, 2004). Alcohol was irrelevant to the sample of this study. Even those who might drink alcohol would consume very low amounts and most likely, would not report it in a highly conservative Muslim community.

None of the cardiac diseases were significant predictors of strokes in this study. Information about cardiac disease was taken from the medical files, to be sure of an accurate diagnosis. After the pilot study, data was subdivided into five cardiac diseases namely, atrial fibrillation, ischemic heart disease, heart failure, cardiomyopathy and cardiac valve pathologies. None of these diseases proved to be a predictor of stroke incidence on the multivariate analysis, and this might be due to their low prevalence. On the bivariate analysis, cardiomyopathy and cardiac valve pathology did not show a statistically significant correlation with the incidence of stroke. However, the other cardiac pathologies showed a positive statistical association with stroke risk, such as heart failure, atrial fibrillation and ischemic heart disease being first, third, and eighth in order respectively in terms of most associated risks with stroke incidence. Despite their strong association with strokes, cardiac diseases on the bivariate analysis were the least prevalent risk in the case group. For all cardiac risks, ischemic heart disease was the highest (13.7%) and valve pathologies were the lowest (3.6%) in terms of prevalence.

These results in the study confirm the results of other researchers in terms of atrial fibrillation and ischemic heart disease (Chien *et al*., 2010; Crandall *et al*., 2009; Yuan *et al*., 1998). A combination of the above risk factors seems to increase the risk for strokes. In the current study, 79 of the case group participants had a combination of cardiac disease and hypertension, compared to 32 in the control group. It seems that the difference of risk prevalence may have contributed to the fact that the control has not developed a stroke (up to now). the high prevalence of these risks in the stroke group was highlighted in addition to the results of multivariate analysis that has showed the strength of association between these risks and the occurrence of strokes.



### 5.2.3 Negative predictors of strokes

The current study identified three factors that were associated with a lower risk for strokes, namely previous transient ischemic attacks (TIA), being younger than 60 years old, and being a male person. For the last two predictors it was not surprising as being female has been associated with a higher risk for strokes than being male (Appelros *et al*., 2009), and older age has been associated with greater risk of stroke in the literature in most of the studies (Béjot *et al*., 2010).

Another issue is that age itself is associated with most of the risks of strokes, as hypertension, diabetes mallets and cardiac diseases may be a “natural” aging processes of body systems. Blood vessels are also included in this aging process and this in itself contributes, together with other complications, to this finding.

TIA was not found to be a predictor of strokes, as there was more history of TIA in the control group than in the case group in the current study. This is in contrast with other studies (see justification further down), which concluded that those patients who sustained TIA had reached the risk credit that qualifies them for a potential stroke (Gladstone *et al*., 2004; Hart, 2006).

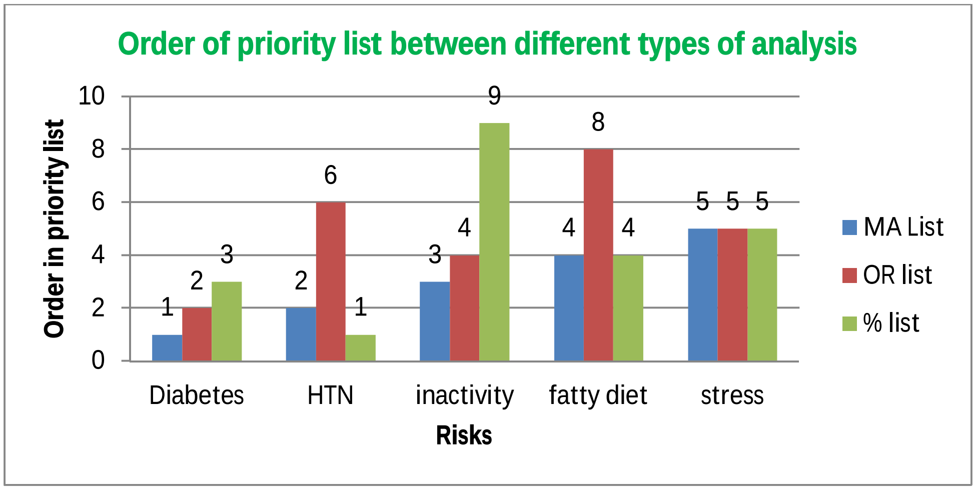
Another interesting finding was that even though the family history of stroke was more in the cases than in the control group, the risk was not significant in any of the models of association with stroke (neither multi- nor bivariate analysis).

Therefore, the findings of this study did not match the results of other studies related to family history with increased incidence of strokes (Hsu *et al*., 2009; Kim *et al*., 2004; Kubota *et al*., 1997; Mvundura *et al*., 2009). It may, however, be considered that these controls may still be future candidates for strokes, and this is why a five year follow-up (for example) of the current study, would provide good information in terms of drawing conclusions about their ultimate risk of developing a stroke in relation to TIAs.

This difference to other studies may be due to lifestyle changes, the control group had adopted after the two events (family member sustaining a stroke, and experiencing TIA). This suggests that both family history of stroke and previous TIA, made the controls more aware of the risks of stroke, and led to them adopting preventive behaviour, which is an aspect that was not stressed in the literature. Further investigation is, however, required to assess the effect of knowledge in both groups, on changing modifiable risks of stroke.



In conclusion, when calculating the levels of risk factors for strokes in a priority list, the multivariate analysis of priority of stroke predictors seems to be the most qualified basis for a future intended preventive plan or health promotion campaign to decrease the incidence of stroke in Southern Palestine. As the strength of association and contribution of a given risk is always relative to other risk factors where gender, age and other coexisting comorbidities might all be present, it is likely to be the complex of multidimensional interaction between the pool of risk factors and personal socioeconomic variables that may actually be the most accurate predictive factors for stroke. As can be seen in Figure 5.1, the risk priorities really differ between different types of analysis, for instance univariate analysis (% of prevalence of risks), bivariate (Odds Ratios), and multivariate analysis (logistic regression). If a preventive plan bases its priorities on bivariate analysis it could be inaccurate and that is the main criticism of many studies that made stroke prevention recommendations based on a weak basis of univariate and bivariate analysis.




**Key: MA=** multivariate analysis **OR=**bivariate analysis **%=** prevalence per cent

**Figure 5.1 Priority risk factors presented in different statistical calculations**

## 5.3 REHABILITATION PROCESSES AFTER A STROKE

In this section of the discussion, the length of hospital stay, rehabilitation settings (inpatient, outpatients, and home rehabilitation), and rehabilitation services (physiotherapy, occupational therapy, speech therapy, and psychological counselling) will be discussed.



### 5.3.1 Hospital stay

Length of hospital stay was different for the two hospitals used in the study. Alia Hospital (a free governmental hospital with a high occupancy rate) admitted conscious patients for an average of four days, compared to seven or more days at Al-Ahli Hospital, depending on how much the family could afford the extra days of admission to that hospital. Length of hospital stay in California (USA) decreased to 4.26 from 7 days, after implementation of an acute stroke programme (Wentworth & Atkinson, 1996). This is far less than the average length of stay in Taiwan (12 days) or the Netherlands, where hospital stay after a stroke could reach up to 28 days (Chang *et al*., 2002; Van Straten *et al*., 1997). The longer the length of stay in the hospital, the more expensive the stroke management will be in terms of costs for the stroke patient's family, and in terms of financial calls on the national economy. However, a shorter stay in the hospital can have consequences on the future recurrence and mortality of stroke patients. The aim of a hospital stay after a stroke is to stabilise the risk factors associated with a stroke, and manage the outcome of the stroke. This is especially so for the more severe patients who are in need of more medical attention to overcome the consequences of impairments after stroke, such as swallowing problems that appear and a need arises for nasogastric tubes and intravenous nutrition, or for incontinent stroke patients, where there might be a need for catheterisation. In this study, there was a positive relation between NIHSS score and the patient's length of stay, which supports the findings of Chang *et al*. (2002) who reported on the positive relation of NIHSS and the length of stay in Taiwan. The more severe the stroke, the longer the hospital length of stay. Early discharge from acute care may facilitate an early start of the post-acute rehabilitation programme that is associated with a better outcome (Hu *et al*., 2010; Cifu & Stewart, 1999).

### 5.3.2 Rehabilitation settings

One of disturbing findings of the current study was that almost 40% of the case group participants did not get any type of rehabilitation services during the first three months after the stroke, the most important phase of stroke rehabilitation (Wade, Wood, & Hewer, 1985). The average was around five days of hospitalisation during which the patients did not receive rehabilitation services, as the scope of acute management of the stroke was more medical than rehabilitation-orientated. At the third assessment (T3), this percentage of participants not getting any rehabilitation services increased to almost 70% of the group. Rehabilitation after 3 months would have contributed to a better prognosis (Wade *et al*., 1985) as the findings of Kotila *et al*. (1984) indicated that the improvement of stroke patients continued up to 12 months after the stroke. This implies that the outcome from the rehabilitation process should not be limited to the first three months of a stroke as in our participants' situation where only around 30% continued their rehabilitation process until the sixth month after their stroke.

In the current study, only 14.4% of the whole group had inpatient rehabilitation during the first – third months post-stroke and only 2.2% at four - six months post-stroke. This is in contrast to studies done in developed countries. Lee *et al*. (1996) reported on a USA study that 73% of older American stroke survivors aged over 65 had received institutional or ambulatory rehabilitation care. Lee *et al.* (2010) also reported that 34% of stroke patients had been admitted to an inpatient rehabilitation institution. In the current study, the strongest reason for not using inpatient rehabilitation facilities was due to financial constraints. This highlights the need for financial support to cover inpatient rehabilitation, especially in a group of patients reporting having difficulty to meet their household expenses. Another reason for not using inpatient rehabilitation services was that the caregivers thought that the patient's case was too severe to benefit from rehabilitation. This finding highlights the importance of education of caregivers by therapists and doctors, because this is in contrast to Lee *et al.* (2010) who stated that the main reason for the patients choosing inpatient rehabilitation was the severity of the stroke. These findings also raise questions about development of complications with severe stroke patients left at home, as 47% of the case group was classified as severe (NIHSS>17) and the average length of stay in hospital was 5.6 days. These patients may be subjected to complications such as deep vein thrombosis (DVT), bedsores, aspiration, respiratory problems and urinary tract infections (Kalra, Yu, Wilson & Roots, 1995; Kelley, Vibulsresth, Bell & Duncan, 1987).

The main motivation for participants to use the inpatient setting was a referral from a doctor (50%), followed by lack of medical insurance covering these rehabilitation expenses (45%). The results of the current study showed that the average length of stay (LOS) in inpatient settings was 43.4 days in the first three months post-stroke (T2), and 24.67 days at the 4- 6 months post-stroke (T3). This is slightly better if compared to the average presented by Miller *et al*. (2010), who reported an average LOS in inpatient rehabilitation of 25 days, and others who reported LOS to be 30 days (Anderson *et al*., 2000; Holmqvist, von Koch, & de Pedro-Cuesta, 2000).

Home rehabilitation was used by half of the stroke patients. At the T2 assessment point (three months post-stroke) home rehabilitation was accessed for about 51 days on average, and by a fifth of the patients at T3 (six months after stroke) for about 60 days. Home-based care thus seems to be the preferred rehabilitation setting inpatients used for care. On the other hand, the main reason for not choosing the home as a rehabilitation setting was financial as many are unable to afford the expenses of home rehabilitation. The second reason for not using home-based rehabilitation was the severity of the stroke. The family might have considered the poor prognosis and decided that the potential outcome was not worth the investment (as was reported by caregivers). This differs from the conclusion of Lai *et al*. (1998) who reported that neurological deficit (severity), age and language problems were the main reasons for not discharging the stroke patient. It is therefore important that caregivers are trained by therapists to apply basic rehabilitation techniques such as changing positions, hygiene and maintenance of body movement. At T3 assessment, home-based rehabilitation declined to one fifth of patients using it. The main reasons reported for not using this setting were financial reasons, severity of stroke, lack of availability of clinics and lack of availability of caregivers ready to assist in patient care. This may indicate a lower expectation of further improvement beyond the first three months. These findings also stress the issues of affordability of the service, knowledge of potential benefits of further rehabilitation and the possible complications associated with ceasing rehabilitation. This emphasises the findings of O'Mahony *et al*. (1997)

about the knowledge deficit in advice given to stroke patients about their stroke-related concerns, including the knowledge about stroke management services available.

Outpatient rehabilitation was used by 10.8% of the group, with a mean period of 44 days in the first three months (T2). This percentage increased to 15% in T3 (at 6 months). The percentage of patients who used this setting is considered low when compared to percentages reported in the study done by the Center for Disease Control and Prevention CDC (2007) which found that 30.7% of stroke survivors in 21 districts in the USA received care in out-patient settings. Outpatient clinics in Hebron are available and affordable, compared to the costs of inpatient and home rehabilitation settings. However, the extra costs and effort of transporting patients to an outpatient clinic may have played a role in this decrease of use of outpatient rehabilitation. It was clear in this study, that 67% did not use the outpatient setting due to difficulty of transport of patients to the outpatient setting. This may have been the reason behind the increase in the percentage of patients using this setting at T3 compared to T2, as patients may have improved in a way that allowed easier transfer of the patient. On the other hand, in the current study the main reason for choosing this setting was therapist's recommendation (81%), which would be based on the therapists' decision about the suitability of the patient's functional ability for daily transfer to the outpatient clinic.



### 5.3.3 Rehabilitation services

Patients who had been admitted to inpatient rehabilitation received 2.6 times more physiotherapy hours than patients at home, and around five times more physiotherapy than the patients taking their rehabilitation at outpatient settings. The average length of physiotherapy sessions at inpatient settings was one hour, which is more than the average length of such a session in Europe, which was ranged from 33 to 46 minutes, with a mean session length of 41.7 minutes (De Wit *et al*., 2006).

Physiotherapy services in the outpatient setting continued for an average of 5.9 weeks at T2, and an average of 7.5 weeks at the T3 period, with mean length of session of 1 hour and average frequency per week of 2.7 sessions per week at T2, and 2.4 sessions per week at T3. The reported length of sessions is similar to the average length of sessions reported by Werner and Kessler (1996), but lower in frequency of per week sessions reported by Werner & Kessler (1996) as four sessions per week, and definitely less in terms of the number of weeks, which was reported as 12 weeks (Werner & Kessler, 1996).

It seems that the average number of weeks of rehabilitation for Palestinian stroke patients is much less, compared to the ideal number of weeks presented in the study by Werner and Kessler (1996). One factor that will decrease the ultimate intensity of physiotherapy service that may affect outcome was emphasised by Teasell *et al*. (2009), where the effect of intensity of physiotherapy on the functional outcome was highlighted by an improvement of stroke patients' gait. The effect of the therapy intensity on outcome was stressed by Kwakkel *et al*. (1997) who highlighted the positive significant effect of intensity of therapy on clinical outcome of stroke.

The decrease in the weekly frequency of sessions and the fewer weeks of rehabilitation should be highlighted as an outcome threat. This should be negotiated with therapists, caregivers and patients to emphasise the negative effect of the decreased intensity of rehabilitation services on stroke outcome. Also it is important to support this discussion with the evidence of positive effect of rehabilitation intensity on the outcome of strokes emphasized in the studies of Bode *et al*. (2004); Hesse *et al*. (2011) and Kotila *et al*. (1984).

The average physiotherapy session length was higher than occupational therapy sessions (1 hour vs. 0.7 hours respectively). The average total intensity of physiotherapy sessions were 86.3 hours, compared to 46.5 hours of OT at T2 and 48 hours physiotherapy compared to 14 hours OT at T3. These findings confirmed those by Putman *et al*. (2006) who reported higher use of time by physiotherapists compared to occupational therapists. At the inpatient setting the patients received occupational therapy with an average length of one hour at T2 that declined to 0.7 hours at T3. This is longer than the average length of OT sessions reported by Putman *et al*. (2006) who found the average OT session length was 35 minutes. The results in the current study are satisfactory within the inpatient rehabilitation setting when compared to the literature in terms of intensity, weekly frequency and period of time in inpatient rehabilitation setting.



On the other hand, an important observation from the data that should be taken into consideration is that patients who received rehabilitation at an inpatient setting were almost the only patients who received occupational therapy, speech therapy or psychological counselling (14.4% at T2, and 2.2% at T3). There were almost no occupational therapy, speech therapy, and psychological counselling utilised at home or outpatient rehabilitation settings during both rehabilitation periods (T2 and T3). Taking into consideration that only 14.4% of patients attended inpatient rehabilitations settings at T2, and 2.2% at T3, that means that 83.4% did not receive occupational therapy, speech therapy, or psychological counselling.

The shortage of important rehabilitation services within the rehabilitation process could be due to a number of reasons. The first reason is lack of finances. This reason appeared every time the patients expressed their reasons for not using any rehabilitation setting or the reason for patients to stop using a certain rehabilitation setting that they might have used at T2 or T3 assessment points. The second reason is the lack of availability of those specialisations (occupational therapy, speech therapy, and psychological counselling) in the community-based rehabilitation setting (home-based and outpatient). The third possible reason may be caregivers and patients' lack of knowledge about the importance of those rehabilitation services for outcomes. This study investigated the reasons behind choosing or not choosing a certain rehabilitation setting, but did not investigate the reasons behind choosing or not choosing certain rehabilitation services. Such an investigation would be a useful topic for future research that would also evaluate availability.

The percentage of patients who did not receive any occupational therapy, speech therapy or psychological counselling might be considered high. However, it might be that not all patients were in need of all therapies, as in this research sample there was 12.2% with mild stroke (NIHSS < 8). Despite that fact, the lack of important services from the rehabilitation process is a very serious finding, for this high percentage of patients (more than 80%) who did not receive these services may have serious implications for stroke rehabilitation outcome. The lack of psychological counselling might lead to further depression and lack of psychological adaptation to the new functional status after a stroke, as it was emphasised by many researchers (Burvill *et al*., 1995; Clark *et al*., 2003; Kneebone & Dunmore, 2000; Kotila *et al*., 1998; White & Johnstone, 2000). The outcome of fine motor, upper extremity functional abilities and the ability of the patient to use the upper extremity in daily functional activities is likely to be negatively affected by a lack of OT. The role of occupational therapy in improving independence and functional outcome of stroke patients had been well-documented by researchers (Govender & Kalra, 2007; Legg *et al*., 2006; Rowland *et al*., 2008; Schabrun & Hillier, 2009; Steultjens *et al*., 2003). At the same time the lack of speech therapy in the rehabilitation process might affect the development of speech and communication of stroke patients suffering from aphasia or dysarthria and will ultimately affect the patients' social participation and psychological status after a stroke (Bhogal *et al*., 2003; Teasell *et al*., 2009). These findings also show the importance of including basic occupational therapy techniques and exercises in future family and caregivers' training to compensate for this shortage and to investigate the reasons behind the not including speech therapy in the community-level rehabilitation services received by stroke patients in Palestine.

On the subject of exercises performed by the patient, results showed that it was a very important element in the rehabilitation process. It's positive effect on functional and participation outcome when the patient performs regular exercise, or continuously tries to use his hand in functional activities is a continuation of the rehabilitation process given by professionals. A new window of motor learning by trial and error, based on the new functional potential of the patient will continue the specific task training, as reported by Hubbard *et al*. (2009). This will help in the progression of fine motor movements that are important in the performance of functional activities (Welmer *et al*., 2008). The importance of exercises performed by patients was highlighted by Bütefisch *et al*. (1995), who emphasised the role of selective isolated movements in the functional outcome of strokes.

Family exercise was given to patients by around 20% of families. Reasons behind family participation (or not) in the rehabilitation process were not captured. Furthermore, it was noticed that the percentage of families participating at T2 did not change at T3. In this thesis, the particular role of patients' families in the rehabilitation process appeared clearly in the variables that predicted a positive outcome in terms of functional ability and participation outcome of stroke patients. It might be that family members might benefit from the advice of a motivated health provider. When effort is made by therapists to educate and empower families to be active participants in the rehabilitation process of stroke patients, there is a positive effect on stroke outcome. These findings confirm the findings of Holmqvist *et al*. (1998), who emphasised the importance of family support in the rehabilitation process, concentrating on the education and involvement of the spouses in the rehabilitation process of the stroke patients.



The researcher highlights the importance of following the published guidelines and evidence-based practice in rehabilitation and management of strokes. In order to achieve the best stroke rehabilitation outcome, those guidelines include the Australian clinical guidelines for stroke management (2010) and the British national clinical guidelines for strokes (2008), (Duncan *et al*., 2005; Teasell *et al*., 2010; Van Peppen *et al*., 2004).

## 5.4 STROKE REHABILITATION OUTCOME

In this section, the research presents the discussion in parts. Part one discusses the outcome of strokes (impairment, functional activity and participation) at the three assessment points, (baseline, three months and six months) against published literature. Part two discusses possible explanations for the different outcome scores and possible reasons behind potential variation form the literature. Part three discusses the predictors of outcome of impairment measured by the Rivermead Assessment (RMA), functional activity measured by the Barthel Index (BI) and participation level measured by the Modified Rankin Scale (MRS).

### 5.4.1 Stroke outcome at the three assessment points

#### *5.4.1.1 Stroke impairment outcome*

Around half of the patients presented with severe strokes at baseline, 41% presented with moderate strokes, and 12.2 % presented with mild strokes. This supports the findings of Jorgensen *et al*. (2000) who suggested that 46% of stroke patients presented with severe neurological impairment. The mean NIHSS score at baseline (n=139) was 17.39, which is consistent with the conclusions of a systematic review of 90 stroke trials conducted by Uchino *et al.* (2001) in which the author stated that 22 studies reported a baseline NIHSS score of 5 – 19. The mean NIHSS scores changed from T1 to T2 in this study from 17.39 to 14.86 respectively, which is higher than those reported by Sinha *et al*. (2009), 10.62 ± 8.86 and 3.12 ± 4.71 at the same assessment points. Possible reasons might be that in the study of Sinha *et al*., (2009), the researcher had a sample of mild to moderate stroke patients, where 55% reported an NIHSS score of <8, compared to around 12% of the current study's sample that had been reported to have the same NIHSS category of mild strokes. The reported NIHSS mean at baseline and six months in this thesis was higher than the average of NIHSS reported by Kameshwar *et al*. (2011) who reported baseline NIHSS as 11.38 at baseline and 4.48 at six months. One possible reason for the difference might be that Kameshwar *et al*. (2011) did not include people who had died in the outcome results analysis (there was no intention to treat analysis in their study, as it had been adopted in this thesis). This deletion of the data of participants who died during the analysis prevented the NIHSS scores from being elevated by giving maximum negative scores to those participants (Christensen *et al*., 2009; Leys *et al*., 2002). Inclusion of those who died during the study, would increase the mean of the NIHSS at follow-up assessments, especially as there were 22 deaths at T2 (three months), and 26 deaths at T3 (six months) assessment points and both contributed to the variation of higher NIHSS in this study than some reported literature.

Participants in this study had more reported swallowing problems at baseline (45%) compared to other countries as reported by Putman *et al*. (2007b). Swallowing problems prevalent at baseline was 18% in Belgium, 30% in the UK, 14% in Switzerland and 17% in Germany. Palestinian patients have 15% higher percentage of patients suffering from swallowing problems as compared to UK, which had the highest prevalence of swallowing problems in the four European countries studied (Putman *et al*., 2007b). This highlights a global variation of percentages of different impairments that might be directly related to differences in severity of neurological impairment in strokes of those countries.

The level of motor function (impairment) outcome, as measured by the mean Rivermead Motor Assessment at the three assessment points, was 1.71 at baseline, 9.45 at three months, and 14.8 at six months. These scores were lower than the mean RMA scores of other studies, such as Soyuer and Soyuer (2005), who reported that the mean total Rivermead RMA at baseline was 13.75 (±1.22), and at three months 21.30 (± 1.20). This difference might be linked to the level of neurological deficit in the Palestinian stroke patients group that was shown to be more severe than reports of other studies. Explorations of possible reasons for these differences are discussed against current literature after the presentation of the other outcomes (Section 5.4.2).

#### *5.4.1.2 Stroke functional activity outcome*

Functional activity in stroke patients, as measured by the mean Barthel Index at baseline was 10.11, which is 20% less than the mean BI reported by Pan *et al*. (2010) and 27% less than baseline BI reported by Hsiu-Chen *et al.* (2009). At three months (T2), the mean BI increased by 24%, and the mean Barthel Index at T2 was 38.32, which is around 37% less than the 3-month mean BI reported by Hsiu-Chen *et al*. (2009) in India. At six months, the mean BI gained an extra 9% improvement (mean BI at T3 was 47.21), which is around 50% less than the mean Barthel Index at six months, reported in China by Pan *et al*. (2010), and 24% less than 6 months reported BI by Hsiu-Chen *et al*. (2009). Baseline severity at the different reported BI studies may be associated with the lower BI score at three and six months in the current study, as in the other studies patients started from a better functional status at baseline that was reflected in their better outcome on follow-up assessments of BI.

This change in the mean of BI was clear in the percentage of patients who had achieved BI scores of 95 or greater at three months, defined as a favourable outcome by El-Shater and Yassin (2008). Patients who achieved a 95 or greater BI increased from 0.7% at baseline to 6.1% at three months, while around 94% scored BI of 9-94. This was a higher percentage of patients than any country reported by Christensen *et al*. (2009). They reported that the percentage of patients scoring 0 - 94 on BI at three months was 67% in the Netherlands, 73% in

Finland, 66% in Canada, 65% in Israel , 57% in Australia , 62% in the USA, 75% in Italy, 63% in Germany, 51% in France, 62% in China, 46% in Sweden, 50% in Denmark, and 80% in Singapore.

Sulter *et al*. (1999) defined the limit of poor functional outcome as a BI score of less than 60, the percentage of patients who had a score higher than 60 was 3.1% at baseline, which increased to 30.5% at three months. This represents a 10% lower BI score when compared to the minimum reported percentage of patients having their mean BI score of sixty and above, as reported by Uchino *et al*. (2001). In their systematic review of studies describing outcome, they concluded that 40-71% of the patients in 10 studies reported that BI mean at three months was equal 60 or above.

Although the change of mean above between T2 and T3 was significant at both follow-up assessment points, there was not a breakthrough in the percentage of independent patients between the T2 and T3 assessment points. Despite the increase of around 9% in the BI at that period, the percentage of independence measured by a BI equal to or greater than 95, or equal to or greater than 60 did not change in the last three months of follow-up (T3).

A high percentage of stroke patients (92.8%) in this study needed assistance in eating (as measured by BI) at baseline, which was slightly higher than the percentage of those who needed assistance in eating reported by Medin *et al*. (2011). They found that the percentage of patients in Sweden who presented with eating difficulties was 81.7%.

In terms of walking ability, the majority of stroke patients had difficulty in independent walking, or could not walk at all. Only 0.7% of the stroke patients could walk independently immediately after their stroke, which is also higher than the percentage of patients having difficulty walking in the Copenhagen study, reported by Jorgensen *et al*. (2000) in which 63% reported an inability to walk independently. Similar findings regarding urinary and faecal incontinence that were reported in more than 50% of patients in the Copenhagen study compared to this study that reported 75.5% of the sample as having problems with bowel function and 87.1% having problems with urination during the first two days after the stroke.

In terms of the Nottingham Extended Activities of Daily Living test, the mean at six months was 10.62, which is also around 6 points less than the median NEADL score reported by Walker *et al*. (1999), who reported that the median NEADL score was around 16 in the case group that had been participating in an occupational therapy programme and was 12 in the control group that was not receiving any occupational therapy. From this it can be seen that the control group in their study had a lower level of functional activity and that the median NEADL of the control group in Walker's study is close to the mean NEADL of this sample, in which around 80% of them also did not have any OT after their stroke.

#### *5.4.1.3 Stroke participation level (Modified Rankin Scale)*

The mean score of MRS was 4.86 (SD= 0.37) which is higher than the baseline MRS reported by Sinha *et al*. (2009) as 4.01. At three months after the stroke (T2), the mean MRS was 4.52, with 0.33 points significant improvement. This score is higher than the MRS mean reported by Sinha *et al*. (2009) of 1.07 as the mean MRS at 3 months. In the study of Sinha, the patients in their sample had mild to moderate strokes as measured by the NIHSS at six months. At the T3 assessment point, the mean MRS was 4.29 with 0.22 improvements from the mean MRS at T2. This is 1.52 points more than the mean reported by Kameshwar *et al*. (2011), who reported that the mean MRS was 3 at the six months assessment point.

At the end of three months follow-up, 93.4% were still unable to reach the favourable outcome defined as MRS≥ 2 as discussed by Christensen *et al.* (2009). This percentage of patients reaching this level of MRS was similar to the results from Spain (Christensen *et al*., 2009) where the percentage of patients achieving this favourable outcome in MRS was 93%. At the same time, the percentage in this study is less than that of Finland (96%) and Israel (100%). Meanwhile, it was higher than percentages of other countries such as the Netherlands (74%), Canada (81%), Australia (86%), USA (80%), Italy (80%), Germany (74%), France (81%), China (65%), Sweden (75%), Denmark (77%) and Singapore (85%), with overall countries mean percentage of 81%.



Only 0.7% (n=1) managed to work again at three months, and at six months 4.3% (n=6) managed to return to work. All of them were self-employed before the stroke, which meant that they owned their own businesses. This might have facilitated their returning to work, together with potential improvement in functional activities. This percentage of patients returning to work is less than the percentage of stroke patients returning to work reported by Alaszewski *et al*. (2007), who pointed out that more than a third of the participants younger than 60 years had returned to work. An age above 60 years was not a predictor of returning to work in the current study.

### 5.4.2 Discussion of variation of outcome from literature

In comparing the outcome measure results and scores at three and six months with other published results from other studies, it was noticeable that Palestinian patients were left with more impairment, functional limitations and ultimately less participation. The studytried to highlight some of the variables that could have contributed to this outcome, compared to findings of other studies mentioned in the previous part of this section. The factors predicting the outcome in this particular group of participants will be discussed in the next section of this chapter (5.4.3). Different factors were identified that might justify the difference of scores in outcome measures in this study, than those reported in the literature. These factors include time of baseline assessment, mortality, stroke recurrence, lack of rehabilitation for some patients, lack of some rehabilitations services for other patients, variations of inclusion criteria and interventions in the published literature and finally, the presence of socio-demographic and economic factors that might have affected the study's participant outcome .

It is important to indicate that there is a global variation in stroke-related outcome that has been reported by many authors in terms of impairment, activity, and participation. Putman *et al*. (2007b) showed different prevalence of impairments such as dysarthria and urinary incontinence between four European countries. This variation may have been due to many reasons, including differences of neurological impairment in the different samples that would have led to different functional presentation in stroke patients (Salter *et al*., 2007). Based on this, the lower outcomes in this sample could be partially explained by the normal variation of outcome among different countries and groups.

Prevalence of published predictors of poor outcome from other studies might also explain the poor outcome of strokes in the sample. As mentioned, this sample was composed of more females (60.4 %) and the female gender had been associated with worse baseline severity and stroke outcome (Roquer *et al*., 2003; Sturm *et al*., 2004; Vibo *et al*., 2007).

One other reason that may have affected the lower baseline scores may be related to the large percentage of stroke patients who suffered different levels of unconsciousness (around 43%). This may have contributed to many zeros in the positive directed outcome measures such as BI and RMA assessments. Another issue that might have decreased the baseline scores in this study was that baseline assessments in this study were done within an average of 2 days after the stroke. In the opinion of the researcher, assessment should be postponed to one week at least. There was a reported difference in outcome between the first 3 days to one week in the study of Sinha *et al*. (2009), where 4 points difference in mean NIHSS was reported, between 6 - 76 hours of stroke onset, compared to one-week assessments. It is not known if it represents an early recovery or a more realistic finding of baseline after the patient has realised his/her potential.

At the follow-up assessment, stroke patients who died during the study were 15.8%, (n=22) at T2 and 18.7% (26 patients) at T3 and they had all been assigned the maximum negative score (Christensen *et al*., 2009; Leys *et al*., 2002), as intention to treat was adopted in the analysis of this thesis. These scores affected the mean score of outcome measures used in this study. When the results are compared with results from other studies, it worth noting that patients who died were excluded from their final outcome analysis (Whiting *et al*., 2011). At the same time, the recurrent strokes also contributed to the decrease in T2 and T3 mean outcome scores, since the percentage of patients that were identified with recurrent strokes, were 21.6% (n = 30) at T2, and 16.5% (n = 23) at T3.

As has been reported in the rehabilitation process section (5.3), around 40% did not get any type of rehabilitation, which may have deprived those stroke patients of all the benefits of rehabilitation, represented in a reduction of impairment, enhancement of functional recovery, and adaptation to residual disabilities as indicated by Duncan *et al*. (2005). On the other hand, the fact that 80% did not use the inpatient rehabilitation setting means that this percentage of patients did not receive any occupational therapy, speech therapy, or psychological counselling, since those services were given only in the inpatient setting, and that might have affected the stroke rehabilitation outcome, as has been mentioned earlier ( 5.3.2).



It should also be noted that the data about stroke outcome in other studies came from clinical trials that involved intervention that most of the time was associated with better outcome when compared to control groups, while this study was observational without any intervention. For example, in the study by Sinha *et al*. (2009), better outcomes were associated with the administration of the Edaravone medication and in Walker *et al*. (1999) patients received an intensive course of occupational therapy. All these are factors that could have assisted in raising the mean outcome scores reported by these authors.

Other reasons why there were differences in reported different assessment scores in this study from those in literature are that characteristics of stroke patients in literature vary. As different types of strokes were investigated in different outcome studies, it might have affected the outcome of those studies and contributed to the variation of the results in the mean scores of the outcome measures. For example, Christensen *et al*. (2009) reported on stroke outcome in haemorrhagic strokes, which according to Paolucci *et al*., (2003) is associated with better outcome compared to ischemic strokes.

In addition, different inclusion criteria in other studies may have affected outcomes. As Duncan *et al*. (1998), who reported on patients with mild to moderate stroke severity, and Kameshwar *et al*. (2011) reported outcome on patients that were selected on the basis of NIHSS 7-20, and BI less than 55. Arsava *et al*. (2009) reported stroke outcome in a young category of 15 - 45 years old. All those factors can affect outcome as they represent different severities at baseline and different age categories, which are factors known to be associated with different stroke outcomes (Kwakkel *et al*., 2010; Saposnik *et al*., 2008b). One other point about the studies in the literature is that part of the mentioned studies came from an ideal rehabilitation setting. It has been suggested that better stroke outcome is associated with stroke units (Walsh *et al*., 2008) and early supported discharge (Thorsén *et al*., 2005) which does not exist in Palestine.

### 5.4.3 Predictors of outcome

In this section, the research discusses factors that predicted the outcome in terms of the three ICF domains (impairment, functional activity, participation), against international literature and within the Palestinian context.



#### *5.4.3.1 Family involvement in rehabilitation*

More than 50% of participants' rehabilitation occurred in a home-based environment. Family involvement in the rehabilitation process through providing exercises to the stroke patients predicted better motor function at six months (T3) as measured by the RMA. It also predicted more participation at six months (T3) as measured by (less) the MRS and better functional activity at three months (T3) as measured by the BI. This is a very important finding for the success of the process of rehabilitation, as family members may be described as motivated, available and an affordable source of rehabilitation. Those motivated enough to help a father or a mother provide an affordable (no costs) service for patients, expressed financial difficulties as the main reason for abstaining from admission to a rehabilitation institution (27.3% at T2 and 29.5% at T3) or home rehabilitation (18.6% at T2, and 36.8% at T3). More time is available at home and there is no need for transportation to access a rehabilitation centre. This positive effect of family involvement on stroke outcome supports the findings of many studies (Holmqvist *et al*., 1998; Hadjis *et al.*, 2000) that have highlighted the family support role in increasing the functional outcome of strokes. Holmqvist *et al.* (1998) referred to the effect of home rehabilitation on functional outcome, when the authors provided extra education about the stroke to the spouse. This was considered to have played a major role in the functional achievement of the stroke patients in the home group, that matched the achievements of other stroke patients admitted to expensive inpatient rehabilitation. The results of this study also support the findings of Tsouna-Hadjis *et al*. (2000) who highlighted the effect of social family support on the process of recovery of first-ever stroke patients where there was better functional status, less depression and better social status of the stroke patient at six months after stroke compared to those who did not have this asset (social and family support). The findings of this study are also consistent with the findings of Glass *et al.* (1993) who concluded that patients with a strong family social support were significantly better in functional activities as measured by the Barthel Index, compared to stroke patients with the same severity but with less social support. Duncan *et al*. (1998) found that home rehabilitation improved lower extremity function, which affects mobility and thus improving participation. Home-based rehabilitation, which is composed of family surroundings, home environment, efforts of care-givers and extensive care that might be provided at home settings, may contribute to better stroke outcome, especially when the family members are empowered and the home environment is adapted.

Despite the fact that one cannot compare the results of this observational cohort study with results of clinical trials, information obtained in clinical trials in the field of family support provides information about the effect of family support on stroke outcomes. Results of this study oppose the conclusions of Kalra *et al*. (2004) who found that family carers' training was associated with less carer anxiety and stroke burden but did not influence the stroke patient's ability as measured by the Barthel Index at one year. One of the possible reasons for this difference is that the training of the caregivers, as defined by Kalra *et al*. (2004) is one thing, and the actual fulfilment of the commitment of training of stroke patients are not necessarily the same. The extent of commitment of the family members who were trained to help stroke patients in Kalra's study is not clear, which may have affected the ultimate functional status of the stroke patient.

The results presented in this study and the opposing results of Kalra *et al*. (2004) raise two important issues in the field of stroke patients' family training and involvement in the rehabilitation process. Firstly, the extent of education that the caregivers and family members receive is an important aspect of the effectiveness of family involvement. Education should be provided by a rehabilitation specialist, focusing on basic interventions like handling techniques to prevent shoulder complications for example, basic exercises that prevent complications at the impairment level and help in functional activities such as standing for patients who need assistance to stand, or sitting for stroke patients who need minimal support in this position. This education should be gradual and continuous with actual feedback from the therapist on performance. There is a need for commitment of the family members to pursue their involvement with the stroke patient's caregiving and exercises. Within the author's experience, family members are more involved in the first month after a stroke, and that consistency of effort and time tends to decrease with time. Unfortunately, the type of effort and exercises that the family reported was not captured within the scope of this study. It could be an area for future study to investigate the effect of quantified and controlled family specific training on stroke rehabilitation outcome, as the status of the underlying causality between a rehabilitation variable and outcomes is beyond the methodology of this observational cohort study. This study may highlight the theory behind this difference of improvement that could be proven or refuted by future clinical trials.

#### *5.4.3.2 Patients' personal contribution to rehabilitation*

The results of this study provided information about the relationship between the patient's role and the stroke rehabilitation outcomes. The effort and the continuous activity of the patient to use his/her affected hand in functional activities, even with diminished or decreased motor function or assistance with the unaffected hand could positively influence the outcome. The continuous effort of the stroke patient to apply self-assisted exercises for the upper extremity also with the help of the other intact hand also affects the outcome. The role of the patient is often ignored in outcome research as literature mostly focuses on the actual stroke impact on body function, functional activity, rehabilitation settings and techniques provided within the different rehabilitation services. The important role of the patient, as the centre of the rehabilitation process, is often ignored. This role does not stop after having defined priorities and setting rehabilitation goals. The role of the patient should extend beyond that point, to continue as long as the rehabilitation process is ongoing and therefore, to preserve and improve a patient's functional gains in the rehabilitation process. Most of the literature about the use of the affected hand comes from constraint-induced movement therapy trials, where the other hand is restrained to prevent it from being used during the period of the intervention (Dromerick, Edwards, & Hahn, 2000; Miltner, Bauder, Sommer, Dettmers, & Taub, 1999). This is in contrast to the results of the current study, where the unaffected-hand assisted the paretic hand (as discussed below).

Performing regular self-assisted exercises, predicted (on a multivariate analysis) a better functional activity as measured by the Barthel Index (BI) and a higher participation level at three months (T3) indicated by a lower score on the Modified Rankin Scale (MRS). This rehabilitation process also predicted a higher participation level at six months, measured by the MRS. The results of this study support the finding of a study by Barker *et al*. (2007) who emphasised the importance of exercise and amount of exercises on functional outcome and highlighted the importance of patients' knowledge of progression. Knowledge of the patient about progression may have to do with the motivation to continue in the rehabilitation process. The patient performing regular self-assisted exercises is a type of repetitive training, which predicts better stroke outcome. This supports the findings of Bütefisch *et al*. (1995) who pointed out that selected isolated movements predicted better function, which could allow better participation.

Regular and continuous use of the affected hand in regular functional daily activities such as catching, eating and drinking, even with assistance of the other hand, was found to be associated with better motor functional level at three and six month post-stroke, as measured by RMA. Additionally, the use of the affected hand also predicted better functional ability at three and six months and better participation at six months, as measured by the lower MRS. These results support other research studies on the effect of constraint-induced therapy on hand function. These studies aimed to evaluate the effect of using the paretic arm in functional activities and that was shown to be associated with better motor function and functional use of the paretic hand compared to before the intervention (Dromerick *et al*., 2000; Miltner *et al*., 1999; Wolf *et al*., 2006).

In the current study, continuous effort to use the hand in regular functional activities was shown to be a predictor of a better participation level at the end of the follow-up stage of 6 months post-stroke, which might be simulating training by repeated task performance. This was demonstrated to be predictor of a better functional activity (Holmqvist *et al*., 2000) that might ultimately lead to better participation level. The benefit of personal training on performance of functional activities may be that it enhances the ability of implicit motor learning through personal performance of that function, which has been associated with a favourable outcome in functional activity (Boyd & Winstein, 2006). Furthermore, the results of this study support the findings of Holmqvist *et al*. (2000) who stressed the importance of using goal-directed functional activities identified by the patient himself in stroke rehabilitation that demonstrated improvement in motivation and interest of the patient to keep performing those activities as part of his rehabilitation process.

#### *5.4.3.3 Age*

Age was found to be a predictor of lower motor function at six months (T3) as measured by the RMA, lower functional activity as measured by the BI at six months (T3) and (higher) worse participation level at six months (T3) as measured by the MRS. These findings are supported by the bulk of literature that highlighted age as a predictor of worse outcome (Chen *et al*., 2006; Huang *et al*., 2008; Kwakkel *et al*., 1996; Masiero *et al*., 2007; Meijer *et al*., 2003; Van de Port *et al*., 2006; Vibo *et al*., 2007). Other researchers referred to age as a factor that is negatively associated with a favourable outcome, rather than a predictor highlighted by a bivariate level of statistical analysis in studying the relation of age with stroke outcome (Black-Schaffer & Winston, 2004; Denti *et al*., 2010; Kotila *et al*., 1984; Milinaviciene *et al*., 2007; Saposnik *et al*., 2008b).

One of the possibilities why age is a strong predictor of the three domains of ICF (impairment, functional activity and participation) is that it may be related to the amount of comorbidities collected at a later age. Berlowitz *et al*. (2008) justify the strong effect of age on stroke rehabilitation outcome by the predictive power of age increasing when comorbidities were added to the model that was predicting outcome. This might present age as a co-factor of the effect of other sub-cofactors like comorbidities between years that might actually be affecting outcome.



#### *5.4.3.4 Baseline swallowing problems*

Baseline swallowing problems have been captured by the impairments part of the Modified Rankin Scale. The participants in this study were shown to have more swallowing problems than in other studies, which is also a factor associated with poor outcome (Meijer *et al*., 2003). Swallowing problems at baseline predicted less motor function as measured by the Rivermead Motor Assessment at six months and less than six months functional activity as measured by the Barthel Index at (T3). This supports the findings of Meijer *et al*. (2003) who found that swallowing problems predicted less functional activities. However, it is not the swallowing problem itself that affects the items of walking or mobility on the Barthel Index, but swallowing problems seem to be another way of reflecting the severity of the stroke. This study was associated with higher NIHSS scores, which may affect the functional activities through reflecting more impairment of body functions needed to perform those functional activities captured by the Barthel Index. Both impairment of body function (assuming that swallowing is another way of reflecting its level) and impaired functional activities are enough to decrease the level of participation at the end of the rehabilitation. What makes the swallowing problem a potential negative sign for expected prognosis is due to its association with severity of the stroke.

#### *5.4.3.5 Level of education*

Stroke participants in this study were characterised by low educational levels, with more than 90% without any basic schooling. Low educational level is associated with less functional activities at three months post-stroke (BI). This result supported the findings of Putman *et al*. (2007a) who found that education predicted better functional independence and RMA in stroke patients. Education may reflect a better cognitive and intellectual ability that might help the patient to be a better active participant in his/her rehabilitation programme, and build on his/her own particular needs. It was also associated in this research with better employment chances at the time of the stroke, the fact that means that patients who are educated will have a bigger chance to be working, which means that people that are still physically active before the stroke are living at a higher pre-stroke participation level, which might all be a motivation towards achieving a better outcome. The low level of education that was associated with less chance to find a work was also reflected in the challenging financial status reported by participants, with more than 80% of the participants reporting variant degrees of difficulty to meet their monthly household expenses.



#### *5.4.3.6 Severity of stroke (NIHSS)*

At three month's assessment (T2) severity measured by NIHSS predicted both lower motor function (RMA) and lower functional activity (BI). A higher baseline NIHSS score also predicted less participation as measured by a higher MRS score at 3 and 6 months post-stroke. The NIHSS score portrays many aspects of the patient's body function, including consciousness, language, upper extremity and lower extremity activity, which all affect functional activity. The results of this study about the negative relation of stroke severity with stroke outcome in different domains (impairment, functional activity and participation) supports many researcher's findings, which highlighted this inverse relation of NIHSS and stroke outcome (Hendricks *et al*., 2002; Kwakkel *et al*., 1996; Milinaviciene *et al*., 2007; Vibo *et al*., 2007).

At the same time, severity-wise the baseline assessment showed that 46.8% had severe strokes (based on NIHSS >17). This may also have contributed to a poor stroke outcome, which supports the finding of many other studies in literature (Jorgensen *et al*., 1999; Kwakkel *et al*., 2010; Vibo *et al*., 2007). Another indicator of severity may be also the high percentage of patients suffering incontinence at baseline, which was reported as a predictor of poor outcome by many studies (Kwakkel *et al*., 1996).

One of the reasons why there was a decrease on the mean NIHSS score at three months is that there were 22 participants who died and they had been assigned the worse score on NIHSS. In addition to that, 30 patients (21.6%) reported recurrent strokes. Those factors might have contributed to the decrease in overall mean of NIHSS.

#### *5.4.3.7 Baseline participation (MRS)*

A higher baseline participation level, as measured by MRS, predicted a lower participation level at three months. This was also demonstrated by other studies (Hendricks *et al.*, 2002; Milinaviciene *et al*., 2007; Vibo *et al*., 2007). One of the issues that the researcher would like to highlight is that MRS at baseline is a good tool to understand the participation level before a stroke. However, post-stroke baseline MRS in the first week of a stroke is too early to indicate patients' participation level at family, social and work at this early stage after the stroke.

#### *5.4.3.8 Baseline motor function (RMA)*

The three sub-parts of the Rivermead Motor Assessment predicted different domains of stroke-related outcome at different assessment points, as shown in the following part of this section.



A higher score in the gross function part of the RMA (RMA-G) predicted better participation at six months post-stroke. The items of the RMA-G is crucially important for participation in activities such as sitting, transfer, walking and stairs climbing, which might justify this power of prediction of participation level. Van de Port *et al.* (2006) reported better a functional outcome from good baseline sitting balance, which is only one item of the RMA-G.

Better baseline scores in the leg and trunk part of the RMA (RMA-LT) predicted better functional ability at three months, as measured by the BI, which covers mobility activities such as walking, stairs, and toileting. If the patient's leg and trunk are less affected then the possibility of walking is much better (Hendricks *et al*., 2002; Milinaviciene *et al*., 2007). Trunk stability is crucial for the function of the extremities and is, thus, a predictor of better functional outcome (Verheyden *et al*., 2007).

A high score on the arm part of the RMA (RMA-A) predicted better motor function at three months post-stroke. As the RMA-A is a major part of the RMA (15 points) its score will contribute to a better total RMA. The worse this score is, the worse the functional outcome will be (Kwakkel *et al*., 1996; Vibo *et al*., 2007). Also RMA-A at baseline predicted a better participation level at six months post-stroke (MRS). This is again considered as a recurrent cycle of improvement because the participation items of the MRS (leisure activities, family responsibilities, and return to work) all require hand optimum motor function. A higher RMA-A score at six months, could thus predict a higher level of six months post-stroke participation.

#### *5.4.3.9 Total hours of physiotherapy at outpatient settings*

Total hours (intensity) of physiotherapy at outpatient clinics was associated with better six months' motor function (RMA) which supports the results highlighted by Barker *et al*. (2007) and Cifu and Stewart (1999) regarding the total hours (intensity) and its association with better outcomes. As the word total refers to the summation of all hours of physiotherapy received from multiplying the period in weeks, with the frequency of sessions per week with the length of a session to get the total number of hours (intensity). The outpatient setting as a predictor of better outcome supports many other studies that have associated the outpatient rehabilitation setting with a better outcome (Gladman & Lincoln, 1994; Werner & Kessler, 1996). However, it must be remembered that patients who are mobile or need minimal assistance in this study, were those who got the privilege using an outpatient setting. The main reason for not using this setting was the difficulty of transferring the patient to the outpatient clinic. It is not clear if the benefit that has been seen here is an outcome of the service of physiotherapy at an outpatient clinic or the outpatient clinic users being a functionally privileged category of the whole sample. This contributed to the final increase in their outcome score, which might be justifying this prediction relationship.

#### *5.4.3.10 Total physiotherapy at home*

Better six months' functional ability, as measured by the Barthel Index, was predicted by total physiotherapy received at home at T2 and T3. This implies three variables in rehabilitation as physiotherapy refers to a service, which is very functional activity-orientated. Putman *et al.* (2006) described physical therapy sessions as standing, balancing, ADL activities and ambulation as the major content of the physiotherapy session. All these are items on the Barthel Index for functional activity.

Home is a rehabilitation setting, which was highlighted as a predictor of better functional outcome. Duncan *et al*. (1998), who also highlighted this setting, reported that home-based therapeutic exercises were associated with a better functional outcome. The word total implies the intensity of rehabilitation, which supports the findings emphasized by Cifu and Stewart

(1999), Kwakkel *et al*. (1997) and Hesse *et al*. (2011) in terms of the positive association of intensity with stroke rehabilitation outcome.

At the same time, total physiotherapy hours at home predicted better participation measured by the Modified Rankin Scale at six months (T3). This supports the conclusions of Holmqvist *et al*. (1998) who found similar results reporting better social activity outcome of patients treated at home and many other researchers who found positive effects of home rehabilitation on functional outcome (Anderson *et al.*, 2000; Holmqvist *et al*., 2000).

Anderson *et al.* (2000) and Holmqvist *et al*. (2000) supported home rehabilitation as the setting of choice based on its decreased hospitalisation, more satisfaction, and similar functional outcome when compared with the inpatient rehabilitation setting. These results also support the studies that emphasised the effect of home rehabilitation on functional outcome within the scope of early supported discharge (Mayo *et al*., 2000; Thorsén *et al*., 2005).

One of the positive characteristics of being at home is that the patient is trained to adapt to his own environment within his new functional abilities. The training on ADL activities is negotiating actual daily challenges at home (bed height, kitchen width, bathroom environment), challenges that the patient will be facing in the coming months after the stroke. Not being trained in a home environment (in a rehabilitation institution, patients have to adapt for two changes. The first change is negotiating ADL within a diminished functional level after a stroke and the other change is that the patient has to adapt to the inpatient setting adapted environment, compared to his own home environment that might lead to difficulty in adaptation to real life.

#### *5.4.3.11 Total occupational therapy at inpatient setting at T2 and T3*

A better six months functional activity (as measured by the BI) was predicted by total occupational therapy hours at an inpatient rehabilitation setting. Occupational therapists concentrate more on the pre-functional activities preparation of the patients in relation to performance of ADL (Smallfield & Karges, 2009). These results can be seen as a product of a programme directed towards functional independence. This association between better functional outcome and occupational therapy has also been demonstrated in other studies (Govender & Kalra, 2007; Legg *et al*., 2006; Steultjens *et al.*, 2003). Furthermore, Saxena *et al*. (2006) and Keren *et al*. (2004) supported the intensity aspect represented in total hours as a positive predictor of ADL. One of the positive aspects of occupational therapy at an inpatient setting may be the potential use of the variety of occupational therapy instruments available at these institutions together with skilled and trained occupational therapists, as the inpatient rehabilitation centre that the patients used in this study is a stroke and head injury orientated institution, which may be associated with stroke rehabilitation with skilled, experienced and trained rehabilitation professionals.

As the patients in this study had varying degrees of different outcome domains, it seems that the severity, rehabilitation setting where the patient received his rehabilitation (total OT in inpatient, and total PT in outpatient and home rehabilitation  settings), family involvement in rehabilitation, patient's own effort in the rehabilitation programme and effort in using the affected hand in functional activity, together with the intensity of rehabilitation (physiotherapy mainly) seems to have a  contribution to the variation compared in the outcome of participants in this study

## 5.5 LIMITATIONS OF THE STUDY

The researcher identified some limitations in the study that are highlighted in this section of the discussion.

1. Follow-up of the study should have continued up to the one year point, rather than only to six months, where the patient could have developed his plateau in residual impairments, functional activities and participation level after a stroke, or continued to improve.
2. The dropout of participants in the study was high, represented in 48/139 (34.5%) dying in the first six months after a stroke, which might have affected the outcome since the intention to treat analysis was followed in the final outcome analysis.
3. The activities and exercises of patients and the caregivers should have been investigated to highlight the effect of the variables associated with family and personal contribution of stroke patient to the stroke outcome.
5. Poor reliability of some medical files in some cases may have hindered a proper data collection process in some cases, where sometimes the handwriting of the doctors was difficult to read, in other cases relevant important tests were not performed, which may be added to the limitations of this study.
6. The outcome measures used in this study seemed to be the most used in literature during the early thesis proposal-writing phase.  This  seems to be one of the limitation of this study, since other outcomes should have been included, which would have

been used in further comparison with other studies, as for example,  the use of FIM, stroke impact scale that seems to be frequently  used in other similar studies.

# CHAPTER 6: SUMMARY, CONCLUSION, SIGNIFICANCE OF THE STUDY, AND RECOMMENDATIONS

In this section, the research presents a summary of findings, discussion of the significance of the study, draws conclusions and makes recommendations based on the findings and conclusion of different sections' results of this study. These can be used by stakeholders and decision-makers in the field of stroke prevention and management and researchers in future stroke outcome relevant research.

## 6.1 SUMMARY

This study managed, through a descriptive study, to enrich the literature by describing the socioeconomic and demographic characteristics of stroke patients in Palestine. In this context, age of stroke patients was found to be close to what is published in the literature. Female stroke patients were more than males, in contrast to the literature and around one year older. The study also indicated that the stroke diagnosis in Palestine is within the recommended international guidelines, where the vast majority have been diagnosed based on imaging within the first day of stroke. Haemorrhagic to ischemic stroke ratio was within the average published in literature (20%/80%). The majority of Palestinian stroke patients were neither working (85.6%), nor well-educated, with relatively big families in general (average of 8 children), and an average of 3 children still living at home. The majority of Palestinian stroke patients reported difficulty in meeting the monthly cost of living.

By implementing a case-control study, the risk factors of strokes were investigated through multivariate logistic regression. This revealed the Palestinian stroke risk profile, which differs from what has been published in terms of priority of risk factors predicting a stroke in Palestine and possible attributes from the different diet, lifestyle, and genetic variances**.** The risks listed by power of prediction of strokes were diabetes, hypertension, physical inactivity, stress and high consumption of a fatty diet. Previous TIA, age less than 60 and being a male were associated with a lower likelihood to develop a stroke compared to patients with no history of TIA, patients over 60 years of age and female patients. The study also showed a cascade of preventative measures adopted by TIA patients that decreased the risk of strokes in this group, which was an empowerment of knowledge in the field of stroke prevention measures. This outcome was also different from the international literature.

In this longitudinal study the frequency with which stroke patients use the various rehabilitation settings (home care, outpatient or inpatient rehabilitation institutions) in Palestine was described. Results showed that a small percentage of patients use the inpatient rehabilitation (16.6%) and less used the outpatient setting (10.8% at T2 and 15.1% at T2). The home rehabilitation setting was the main rehabilitation setting used by stroke patients in Palestine, as it was used by 49.6% of the patients in the first three months and by 21.6% at four to six months after stroke.

Through a longitudinal descriptive design, factors influencing the choice of setting were determined in this study. Regarding access to inpatient settings, the main factors affecting the choice of setting were the insurance covering the treatment and the doctor's recommendation. The main factors contributing to not using this setting were the lack of financial abilities and the caregivers doubting the potential recovery of a severe stroke patient. In terms of the home rehabilitation setting, the main reason for choosing this setting was the doctors' and therapists' recommendation, and the main reasons for not using this setting was the financial inability to afford its costs. The main reason for choosing the outpatient setting was the therapists' recommendation, and the main reasons for not using this setting was the financial inability to afford the costs or the difficulty to transport the patient to the outpatient clinics and facilities.



In the same descriptive longitudinal study, patients' use and intensity of use, of the different rehabilitation services (physiotherapy, occupational therapy, speech therapy, and psychological counselling) was identified. It revealed that less than half of the patients did not get any type of rehabilitation throughout the six months after their stroke. It also underlined the fact that the vast majority of patients did not receive any occupational or speech therapy, or psychological counselling, as those services were confined to the patients who used inpatient settings (16.6%) only. It also showed that for those who have had a rehabilitation services such as physiotherapy at home, most stopped or discontinued this service after three months post-stroke.

Stroke and stroke rehabilitation outcome in Palestinian stroke patients, were described at baseline, three, and six months, and highlighted a difference to that published in the literature. It identified a more severe impairment and functional deficit of stroke patients at baseline (47% of patients were classified with a severe stroke NIHSS >17), 41% moderate, and 12.% mild strokes with NIHSS<8 ), and worse residual impairment, functional ability and participation level of Palestinian stroke patients compared to studies from other countries at three and six months follow-up post-stroke.

Socio-demographic and rehabilitation process factors associated with the stroke rehabilitation outcomes were investigated in a descriptive longitudinal study. Some factors published in literature were confirmed as predictors of stroke outcome (age, baseline severity, intensity of rehabilitation, swallowing problems and level of education). Other factors were highlighted in addition to the previously mentioned factors that were not mentioned in the literature, such as patients' self-assisted exercises, patients' use of affected hand in functional activities and the participation of family members in stroke patient exercises.

## 6.2 CONCLUSIONS

The majority of the participants presented with severe or moderate stroke. There were more female stroke patients than male, and average age was similar to what was published in the literature. The main risk factors predicting stroke in Palestine were; diabetes, hypertension, physical inactivity, consumption of a fatty diet and stress.

More than a third of the stroke patients did not receive any rehabilitation during the first three months post stroke, this had increased to more than two thirds not having any rehabilitation services between the third and the sixth months post stroke. For those who received rehabilitation services, the home was the most common setting. Rehabilitation services besides physiotherapy were not or minimally provided at home and outpatient rehabilitation settings. The main motivations for using or not using rehabilitation services, were financial reasons, medical insurance (inpatient setting), doctors' and therapists' recommendations (home rehabilitation setting) and transport difficulties and patient mobility (outpatient setting).



At six months post stroke, Motor function (Rivermead motor assessment) predictors were; total hours of family-performed exercises, total physiotherapy hours at the outpatient setting, and patients' reports about the regular use of the affected hand in functional activities. Predictors of lower motor function at six months were; age of the patient, and the baseline swallowing problems. Functional activity (Barthel index) Predictors at six months were; total physiotherapy hours in the home rehabilitation setting at T2 and T3, and the total occupational therapy hours in the inpatients setting at T2, and T3. Lower level of functional activity at six months predictors were; the age patient and swallowing problems at baseline. Participation (MRS) Predictors at six months were; total physiotherapy hours in home rehabilitation setting , patient report of performance of regular self-assisted hand exercises, patient report of use of the hand in functional activities, Baseline arm part of Rivermead (RMA- A), Gross function of

Rivermead(RMA-G), and the total family-performed exercises. Lower levels of participation were predicted by age of the patient, and baseline NIHSS score.

### 6.3 SIGNIFICANCE OF THE STUDY FINDINGS

According to the knowledge of the researcher, this study is the first one to present a holistic view of strokes in Palestine, as it aimed to identify the main characteristics, risk factors, rehabilitation processes and rehabilitation outcome of stroke patients in Palestine.

This study described the stroke patients in Palestine for the first time in terms of socio-demographic and personal variables, and highlighted the problem of strokes in Hebron and exposed the lack of rehabilitation.

This research identified a list of stroke risk factors that is unique to Palestine and differs in some aspects from international literature from other countries. This list can be used as a basis for national stroke preventive campaigns. Knowledge of risk factors that have been proven to be the most powerful in prediction of stroke incidence in Palestine can be used to decrease stroke incidence among patients with high stroke risk profiles.

At the same time, this study revealed the presence of a group of preventive measures that were adopted by patients with a history of TIA that may have contributed to decreasing the risk of developing a stroke. These could be used as examples of success to patients with a positive history of TIA and a high-risk profile in terms of the ability to decrease the risk of strokes in vulnerable patients.



This study filled a gap in knowledge about the process of rehabilitation in Palestine, in term of rehabilitation settings and services used and referral processes. In addition, it revealed major differences in the rehabilitation process in Palestine compared to literature about levels of intensity of rehabilitation services and percentages of use of different rehabilitation settings. It also added to the knowledge in this field, related to the motivation for use of different rehabilitation settings by stroke patients.

Through the six months follow-up of Palestinian stroke patients,  this study has revealed that Palestinian stroke patients have a more severe stroke impairment at baseline compared to other countries and that Palestinian stroke patients are left with more impairment, less functional activities and lower participation levels at three and six months post-stroke.

This study added to the wealth of literature on significant aspects and factors associated with stroke rehabilitation better outcome. This highlighted the effect of the patient's own contribution as an active role player in the rehabilitation process, through continuous use of the affected hand in functional activities and by regular personal assisted exercises.

This study also underlined the positive effect of family-performed exercises with to the stroke patients, in predicting better outcome at three and six months post-stroke, in addition to confirmation of other published stroke outcome predictors.

Based on these findings, the researcher developed a possible model of rehabilitation (see Appendix 6). This was built with consideration of the findings of the current Palestinian rehabilitation process, facts and the predictors of better outcome revealed in this study. The elements of this suggested model were based on most used, affordable and available rehabilitation settings and services linked to empowerment of patients and carers through education. This model could be subjected to further investigation, through future trials.

## 6.4 RECOMMENDATIONS

Based on the results of this study, the researcher suggests the following recommendations. These are presented in four major categories, recommendations on the epidemiological section for healthcare authorities, recommendations on the rehabilitation process, and recommendations on outcome and rehabilitation process sections for rehabilitation clinicians and recommendation for future research in the field of stroke rehabilitation outcome.

### 6.4.1 Recommendations on epidemiology of stroke for health care authorities

Based on the findings in the epidemiological section of this study, the researcher recommends the following:

1. Adopting a primary stroke prevention programme that could include:
    a. Building up a database of patients with high risk, from the files of the primary health care centres and involving them in primary prevention programmes such as health education programmes and regular follow-up, to make sure that patients at risk understand the risk of stroke development and the measures to be taken to prevent and decrease this risk.
    b. Enhancement of the role of the primary health care centres in terms of health screening. This screening would inform management of modifiable risk factors

of strokes through secondary prevention programmes. Medication and lifestyle modifications would be promoted to prevent the occurrence of a stroke.

c. Highlight the main associated and prevalent risks in a future preventive plan. This plan would concentrate on diabetes, hypertension, physical activity, less fatty food consumption, managing obesity, best-practice medication and healthy lifestyle promotion, through media, posters, and education.

d. Continuing with quit smoking campaigns targeting smoking intensity and starting with those campaigns from early teenager levels in schools.

e. Addressing stress as an important risk and offering psychological assistance for those who have a high stress profiles.

2. Highlighting the shift of risk magnitude in victims of TIA that was demonstrated in the current study as opposed to other studies where TIA was mentioned as a significant risk
3. Building up a stroke database in hospitals that includes a checklist of all risk factors that might exist in stroke patients coming to those hospitals, to be the basis for future research towards better understanding of a dynamic stroke risk profile.
4. Planning and conducting a public awareness and health promotion campaign using the public media to introduce people to the main modifiable risks and early symptoms of strokes that could help patients come to hospital before brain insult has occurred.



### 6.4.2 Recommendations on the rehabilitation process of stroke patients in Palestine

Based on the findings of the use of the rehabilitation process section, the researcher recommends the following:

1. Informing the family and the community about the importance and possibilities of rehabilitation settings available within the capacity of families before the patient is discharged from hospital through formal training programmes given to care givers of the stroke patient.
2. Emphasising to the government and non-governmental charitable organisations the importance of financial aid to stroke patients to meet the relatively high financial demands of the rehabilitation process. This emphasis should discuss the right to free rehabilitation services for financially unable stroke patients.
3. Stressing to caregivers the importance of longer care for very severe stroke patients to prevent further complications.

4. Minimising the percentage of patients who do not receive rehabilitation services through emphasising the role of rehabilitation services in prevention of further complications and the possible use of the existing community-based rehabilitation programmes to assist in this field.
5. Encouraging outpatient rehabilitation by therapists in later stages of rehabilitation, as it might increase their patients' participation and improved outcome, through highlighting to the therapists the benefits of outpatient rehabilitation association with better stroke rehabilitation outcome.
6. Empowering the caregivers to be active participants in the rehabilitation process through basic training and education.
7. Emphasising the role of the rehabilitation team integration in the community-based rehabilitation, where OT, speech- and psychological counselling should be integrated into this level of rehabilitation.
8. Encouraging the Palestinian Physiotherapy Association to establish support groups and a website that would serve as a support centre for stroke patients, caregivers and rehabilitation specialists with the aim of providing information and best evidence-based practices in the field of stroke rehabilitation.

### 6.4.3 Recommendations on stroke rehabilitation outcome in Palestine

Based on the findings in the rehabilitation outcome section, the researcher recommends the following:

1. Palestinian Ministry of Health and Rehabilitation unions should start working on a Palestinian rehabilitation policy and guidelines, based on evidence-based practices and the findings of this study in relation to the rehabilitation process in Palestine.
2. Integrating major modifications in the policy and policy application of community-based rehabilitation towards more participation of the stroke patient and his/her family in the process of rehabilitation through empowerment and training.
3. Continuation of the period of rehabilitation for longer than three months, and educating families and the patients about the importance of continuation of rehabilitation and explaining its positive effect on outcome.
4. Integration of occupational therapy, speech therapy, and psychological counselling at the community level of stroke rehabilitation

### 6.4.4 Recommendations for further stroke-related research

1. The researcher recommends conducting further stroke outcome research in Palestine that would take the following points into consideration:
   a. Excluding the patients who die or sustain a recurrent stroke from the follow-up of analysis of recovery outcome, and using their data for setting different results related to predictors of mortality and recurrence.
   b. To investigate using a clinical trial, the effect of family members as caregiver on stroke outcome, after education and empowerment were provided.
   c. Study the extent and type of self-assisted exercises performed and highlight their effect on stroke rehabilitation outcomes.
   d. Collect data of baseline assessment, after at least one week post-stroke so that the patient can show his/her best potential in the assessment.
   e. Study the content of different rehabilitation settings that might justify positive changes in each setting and which could also be used by other therapists in the future.
   f. Applying longer periods of follow up, that assess the patient at one year after stroke.
   g. Apply the research on a bigger sample, which will enable the inclusion of a wider spectrum of predictors, for the sake of statistical multivariate analysis.
   h. Stroke symposiums, and conferences, should discuss the advantages of unifying future protocol for outcome studies, in terms of outcome measures in the three domains of ICF, and the methodologies associated with future, cohort or observational studies.
2. On the level of epidemiology of stroke research, the researcher recommends the following:
   a. To encourage further research, with preference of a cohort study that will monitor risk profile changes in people of over 40 years of age and investigate the threshold of eliciting a first-ever stroke, and to make sure that subcategories of diabetes types and high and low cholesterol density, are addressed.
   b. To study the effect of a motivated monitored preventive plan on the decrease of stroke incidence in the future.

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**APPENDIX 1**

**Baseline questionnaire**

# Baseline Questionnaire

**(Administered at first week of stroke (T1), strictly confidential, names are not used during reporting of data.**

Research. Code DATE

**A. Socio – Demographic**

1. Name
2. Date of birth
3. Age
4. Hospital file NO
5. Hospital — 1. Alia — 2. Alahli
6. Gender — 1. Male — 2. Female
7. Inclusion in the research — 1. Yes — 2. No

A. Reason of exclusion

1. TIA — 1. Recurrent stroke — 3. Geographical reasons — 4. Both Geographical reasons and recurrent stroke

B. If excluded for recurrent stroke, when was the last Stroke in months?

C. If excluded for recurrent stroke, is it on the same side? — 1. Yes — 2. No

8. Address

9. Home telephone Number : ___________________________

10. Mobile Number : ___________________________

## B. Stroke Medical history

1. Date of stroke

2. Date of admission

3. Days between stroke and admission



4. Date of discharge ( if discharged )

5. Number of days spent in hospital

6. Days between stroke and assessment

7. Method of stroke diagnosis

1. CT scan | 2. MRI | 3. Clinical

_______________________________________________________________________
______
_______________________________________________________________________
______

8. Date of imaging if done.

9. Days between admission and imaging , (give 0 if on the same day )

10. Type of stroke

1. Ischemic
2. Hemorrhagic
3. Indeterminate

11. Region of stroke in the brain ( if applicable , confirmed by CT or MRI report )

1. Basal ganglia
2. Cerebellum
3. Diencephalon
4. Brain stem
5. Sub Arachnoid
6. Thalamus
7. Occipital
8 Parietal
9. Frontal
10. Temporal
11 .Cerebral l
12. Others_____



12. Vascular involvement if applicable

13. Size of the stroke if reported by CT, or MRI report in $CM^3$

14. Side of stroke in the brain

1. Right
2. Left
3. Both

15. Side of impairment

1. Right
2. Left
3. Both

16. What is your highest functional independent position

| Walking alone | Walking with assistance | Standing alone | Standing with assistance. | Sitting alone | Sitting with assistance | 7. Bed Ridden |
|---|---|---|---|---|---|---|

17.

18. Do you have any swallowing problems

1. Not at all | 2. Often | 3. Frequently | 4. Always

## C. Stroke Risk factors (from the patient or relatives or the file if possible)

Patient's knowledge: Have you been ever diagnosed as having?

19. High blood pressure — 1. Yes — 2. NO

20. Diabetes — 1. Yes — 2. NO

21. Triglyceride — 1. Yes — 2. NO

22. High cholesterol — 1. Yes — 2. NO

23. Heart disease — 1. Yes — 2. NO



READINGS FROM FILE

From the file at admission

24. High blood pressure at admission — 1. Yes — 2. NO — ☐

25. Blood sugar at admission — 1. Yes — 2. NO — ☐

26. Triglyceride at admission — 1. Yes — 2. NO — ☐

27. Cholesterol at admission — 1. Yes — 2. NO — ☐

28. Heart disease

1. Yes 2. NO

If yes, specify

a. Valves pathology 1. Yes 2. NO

b. Cardiomyopathy 1. Yes 2. NO

c. Atrial fibrillation 1. Yes 2. NO

d. Ischemic heart disease 1. Yes 2. NO

e. Heart failure 1. Yes 2. NO

F. other, specify



29. Do you have a history of prior TIA? 1. Yes 2. NO

30. Did any of your close relatives have a stroke before? 1. Yes 2. NO

31. If yes, was it?

1. Mother 2. Father 3. Sister 4. Brother 5. Uncle 6. Aunt

32. Have you ever smoked? 1. Yes 1. No

33. Were you smoking at the time of stroke? 1. Yes 2. NO

a. If yes what was the average of cigarettes you smoked at time of stroke?

b. If yes, what are the total years of smoking?

34. Have you been a smoker and quit in the past? 1. Yes 2. NO

a. If yes what was your daily average number of cigarettes?

b. If yes when did you stop smoking?

c. How many years did you smoke in total?

35. If the high fat and cholesterol diet is represented in fatty meat, butter...) do you consider consumption of such food?

1. None 2. Mild 3. Moderate 4. High



36. Before the stroke, in a normal period of 7 days, how many days were you **physically active** for a total of at least 30 minutes per day? (Add up all the time you spent in any kind of physical activity that increases your heart rate and makes you breathe hard some of the time.)

| | | |
|---|---|---|
| (1) 0 Days | (2)1 Day | (3) 2 Days |
| (4) 3 Days | (5) 4 Days | (6) 5 Days |
| (6) 5 Days | (7) 6 Days | (8) 7 Days |

37. **Obesity** :

a. Waist circumference in cm at Umbilical level

**b.** Hight in cm

38. Do you drink Alcohol? 1. Yes 2. NO

A. If yes what is the average of the daily drinking in ml?

B. For how many years have you been drinking?

39. Have you used oral contraceptives before? 1. Yes 2. NO

- If yes, then for how long did you use them?

40. Have you been going through special **stressful** event/s the week before the stroke 1.Yes 2.No

41. Medications at the time of stroke

| No | Name of medication | notes |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |



42. Do you have any chronic history of the following problems? (put a circle around the applicable problems)

1. Hearingproblems 2.Joints arthritis 3. G.I. problems 4. Lung

5. Liver 6. Vision problems 7. Others--------------------)

43. Was a relative involved in answering the questionnaire? 1. Yes 2. No

44. If yes, what is the relation to the patient?

1. Son | 2. Daughter | 3. Spouse | 4. Brother | 5. Sister | 6. Parents

7. other, specify ________________

**D. Socio economic data**

45. Marital status.

1. Married | 2. Widow | 3. Widower | 4. Divorced | 4. Never married

**46.** Level of education

1. None | 2. Elementary | 3. Preparatory | 4. Secondary

5. Basic | 6. Diploma | 7. BA | 8. Postgraduate



47. Were you working at the time of stroke? (If yes please answer questions a-d, if not please answer question 13)

1. Yes | 2. NO

A. If working, what is your occupation?

B. If working, what kind of work are you doing?

1. Formally employed | 2. Self employed

C. If you were working what was your type of work )

1. Office

2. Physical

3. Both physical and office

D. If working, what best describes your working hours.

1. Full time

2. Irregular hours

3. Part time

4. Contract worker (weekly hours average)

5. Other (specify) --------------------------------------------------------------------------------

48. If you were not working, which of the following describes best the reason for not working?

1. Unemployed Preferred not work

2. Unemployed looking for

3. Unemployed due to illness or

4. Retired



5. Other reasons: please specify

49. Number of all children, those who live in or outside the home?

50. Number of Family members living in the household with the spouse, and their ages (brothers, sisters, daughters, sons, others).

Total

51. List all members living in household

| ***NO*** | ***Relation*** | ***Age*** | ***Gender*** |
|---|---|---|---|
| | | | |
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| | | | |
| | | | |



52. General household income in New Israeli Shekel (NIS)?

1. No income at all
2. Less than 2000
3. 2001- 4000
4. 4001- 6000
5. 6001- 8000
6. 8001 - above

53. Do you make ends meet with the total monthly disposable income?

1. with great difficulty
2. with difficulty
3. with some difficulty
4. Fairly easily
5. Easily
6. Very easily

## APPENDIX 2

## CONSENT FORM

**Rehabilitation outcomes of Palestinian stroke patients in Hebron, Palestine**

The study has been described to me in language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way, and that the data will be used for scientific and research purposes only.

Participant's name……………………….. Participant's signature……………………………….

Witness name ............................................... Witness signature ......................................

Date………………………

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

**Akram Amro, Hebron Po Box 94, West bank. Palestine Mobile No 0599889695, Email aamro@uwc.ac.za or contact**

**Postgraduate coordinator, Physiotherapy department, University of the Western Cape. Private Bag X17, Belville 7535, Telephone: (0027) (021) 959- 2542 email jfrantz@uwc.ac.za**

**Akram Amro** ____________________

**APPENDIX 3**

**Assessment book**

# Stroke Rehabilitation Outcome - Hebron

## Assessment Book

Barthel index. *Rivermead Motor* Assessment, NIHS stroke scale, Modified Rankin Scale, NEADL - Nottingham Extended Activities of Daily Living



**Name of the Participant**

**Subject's Code**

**Date T1** ____________________

**Date T2** ____________________

**Date T3 ____________________**

**Appendix 3a**

**Barthel Index**

| Item | Scoring | T1 | T2 | T3 |
|---|---|---|---|---|
| **1. FEEDING** | 0= unable<br>5= needs help cutting, spreading butter, etc., or requires modified diet<br>10= independent | | | |
| **2. BATHING** | 0= dependent<br>5= independent (or in shower) | | | |
| **3. GROOMING** | 0= needs help with personal care<br>5= independent face/hair/teeth/shaving (implements provided) | | | |
| **4. DRESSING** | 0= dependent<br>5= needs help but can do about half unaided<br>10= independent (including buttons, zips, laces, etc.) | | | |
| **5. BOWELS** | 0= incontinent (or needs to be given enemas)<br>5= occasional accident<br>10= continent | | | |
| | 0= incontinent, or catheterized and unable to manage alone | | | |

| | | | | |
|---|---|---|---|---|
| **6. BLADDER** | 5= occasional accident<br>10= continent | | | |
| **7. TOILET USE** | 0= dependent<br>5= needs some help, but can do something alone<br>10= independent (on and off, dressing, wiping) | | | |
| **8.TRANSFERS (BEDTO CHAIR AND BACK)** | 0= unable, no sitting balance<br>5= major help (one or two people, physical), can sit<br>10= minor help (verbal or physical)<br>15= independent | | | |
| **9.MOBILITY (ON LEVEL SURFACES)** | 0= immobile or < 50 yards<br>5= wheelchair independent, including corners, > 50 yards<br>10= walks with help of one person (verbal or physical) > 50 yards<br>15= independent (but may use any aid; for example, stick) > 50 yards | | | |
| **10.STAIRS** | 0= unable<br>5= needs help (verbal, physical, carrying aid)10= independent | | | |
| **Total** | | | | |

## Appendix 3b

## NIH Stroke scale

| Item | Scoring | T1 | T2 | T3 |
|---|---|---|---|---|
| **Level of Consciousness:**<br>The investigator must choose a response if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, or tracheal trauma/bandages. A 3 is Scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation. | **0 Alert;** keenly responsive.<br>**1 Not alert;** but arousal by minor stimulation to obey, answer, or respond.<br>**2 Not alert;** requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make Movements (not stereotyped).<br>**3** Responds only with reflex motor or autonomic effects, or totally unresponsive, flaccid, and reflexes. | | | |
| **LOC Questions:**<br>The patient is asked the month and his/her age. The answer must be correct — there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable To speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier, or any other problem not secondary to aphasia are given a 1. It Is important that only the initial answer be graded and that the examiner not "help" the patient with verbal or non-verbal cues. | **0 Answers** both questions correctly.<br>**1 Answers** one question correctly.<br>**2 Answers** neither question correctly. | | | |
| **LOC Commands:**<br>The patient is asked to open and close the eyes and then to grip and release The non-paretic hand. Substitute another one-step command if the hands Cannot be used. Credit is given if an unequivocal attempt is made but not Completed due to weakness. If the | **0 Performs** both tasks correctly.<br>**1 Performs** one task correctly.<br>**2 Performs** neither task correctly. | | | |

| | | | | |
|---|---|---|---|---|
| patient does not respond to command,<br>The task should be demonstrated to him or her (pantomime), and the result scored (i.e., follows none, one, or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored. | | | | |
| **Best Gaze:**<br>Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored, but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score<br>Will be 1. If a patient has an isolated Peripheral nerve paresis (CN III, IV, or VI), score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visual acuity or fields should be tested with reflexive movements, and a choice<br>Made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of partial gaze palsy. | **0 Normal**.<br><br>**1 Partial gaze palsy;** gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present.<br><br>**2 Forced deviation**, or total gaze paresis is not overcome by the oculocephalic maneuver. | | | |
| **Visual:**<br>Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat, as appropriate. Patients may be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantanopia, is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is | **0 No visual loss.**<br><br>**1 Partial hemianopia.**<br><br>**2 Complete hemianopia.**<br><br>**3 Bilateral hemianopia** (blind including Cortical blindness). | | | |

| | | | | |
|---|---|---|---|---|
| performed at this point. If there is extinction, patient receives a 1, and the results are used to respond to item 11. | | | | |
| **Facial Palsy:**<br>Ask — or use pantomime to encourage — the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape, or other physical barriers obscure The face, these should be removed to the extent possible. | **0 Normal** symmetrical movements.<br><br>**1 Minor paralysis** (flattened nasolabial Fold, asymmetry on smiling).<br><br>**2 Partial paralysis** (total or near-total Paralysis of lower face).<br><br>**3 Complete paralysis** of one or both Sides (absence of facial movement in the upper and lower face). | | | |
| **Motor Arm:**<br>The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine). Drift is scored if the arm falls before 10 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious<br>Stimulation. Each limb is tested in turn, Beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder, the examiner should record the score as untestable (UN) and clearly write the explanation for this choice. | **0 No drift;** limb holds 90 (or 45) degrees For full 10 seconds.<br><br>**1 Drift;** limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; Does not hit bed or other support.<br><br>**2 Some effort against gravity;** limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, But has some effort against gravity.<br><br>**3 No effort against gravity;** limb falls.<br>**4 No movement.**<br>**UN Amputation** or joint fusion, explain | | | |
| **Motor Leg:**<br>The limb is placed in the appropriate position: hold the leg at 30 degrees (always tested supine). Drift is scored if the leg falls before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime but<br>Not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic leg. Only in the case of amputation or joint fusion at the hip, the examiner should | **0 No drift;** leg holds 30-degree position for full 5 seconds.<br><br>**1 Drift;** leg falls by the end of the 5- second period but does not hit the bed.<br><br>**2 Some effort against gravity;** leg falls To bed by 5 seconds but has some effort against gravity.<br><br>**3 No effort against gravity;** leg falls to | | | |

| | | | | |
|---|---|---|---|---|
| record the score as untestable (UN) and clearly write the explanation for this choice. | Bed immediately.<br>**4 No movement.**<br>**UN Amputation** or joint fusion, explain: | | | |
| **Limb Ataxia:**<br>This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose- finger and heel-shin tests are performed on both sides and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion, the examiner should record the score as untestable (UN) and clearly write the explanation for this choice. In case of blindness, test by having the patient touch nose from extended arm position. | **0 Absent.**<br><br>**1 Present in one limb.**<br><br>**2 Present in two limbs.**<br><br>**UN Amputation** or joint fusion, explain: | | | |
| **Sensory:**<br>Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body<br>Areas [arms (not hands), legs, trunk, face] as needed to accurately check for hemisensory loss. A score of 2, “severe or total sensory loss,” should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients<br>Will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 1a=3) are automatically given a 2 on this item. | **0 Normal;** no sensory loss.<br><br>**1 Mild-to-moderate sensory loss;** patient feels pinprick is less sharp<br>Or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched.<br><br>**2 Severe or total sensory loss;** patient<br>Is not aware of being touched in the face, arm, and leg. | | | |
| **Best Language:** | | | | |

| | | | | |
|---|---|---|---|---|
| A great deal of information about Comprehension will be obtained during the preceding sections of the examination. For this scale item, the patient is asked to describe what is happening in the attached picture, to name the items on the attached picture, to name the items on the attached Naming sheet, and to read from the attached list of sentences. Comprehension is judged from responses here, as well as to all of the Commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The Intubated patient should be asked to write. The patient in a coma (item 1a=3) will automatically score 3 on this item. The examiner must choose a score for the patient with stupor or limited cooperation, but a score of 3 should Be used only if the patient is mute and follows no one-step commands. | **0 No aphasia;** normal**.**<br><br>**2 Mild-to-moderate aphasia;** some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided materials Difficult or impossible. For example, in conversation about provided materials, Examiner can identify picture or naming card content from patient's response.<br>**2 Severe aphasia;** all communication is Through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient Response.<br>**3 Mute, global aphasia;** no usable speech or auditory comprehension. | | | |
| **Dysarthria:**<br>If patient is thought to be normal, an Adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the<br>Patient is intubated or has other physical barriers to producing speech, the examiner should record the score as untestable (UN) and clearly write the explanation for this choice. Do not tell the patient why he/she is being tested. | **0 Normal**.<br><br>**1 Mild-to-moderate Dysarthria;**<br>Patient slurs at least some words and, at worst, can be understood with some difficulty.<br><br>**2 Severe Dysarthria;** patient's speech is so slurred as to be unintelligible in the absence of or out of Proportion to any dysphasia, or is mute/anarthric.<br>**UN Intubated** or other physical barrier, explain: | | | |
| **Extinction and Inattention (formerly Neglect):**<br>Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss | **0 No abnormality.**<br><br>**1 Visual, tactile, auditory, spatial, or personal inattention,** or extinction to Bilateral simultaneous stimulation in one of | | | |

| | | | | |
|---|---|---|---|---|
| preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable. | the sensory modalities.<br><br>**2 Profound hemi-inattention or extinction to more than one modality;** does not recognize own hand or orients to only one side of space. | | | |
| **Total** | | | | |


JAR

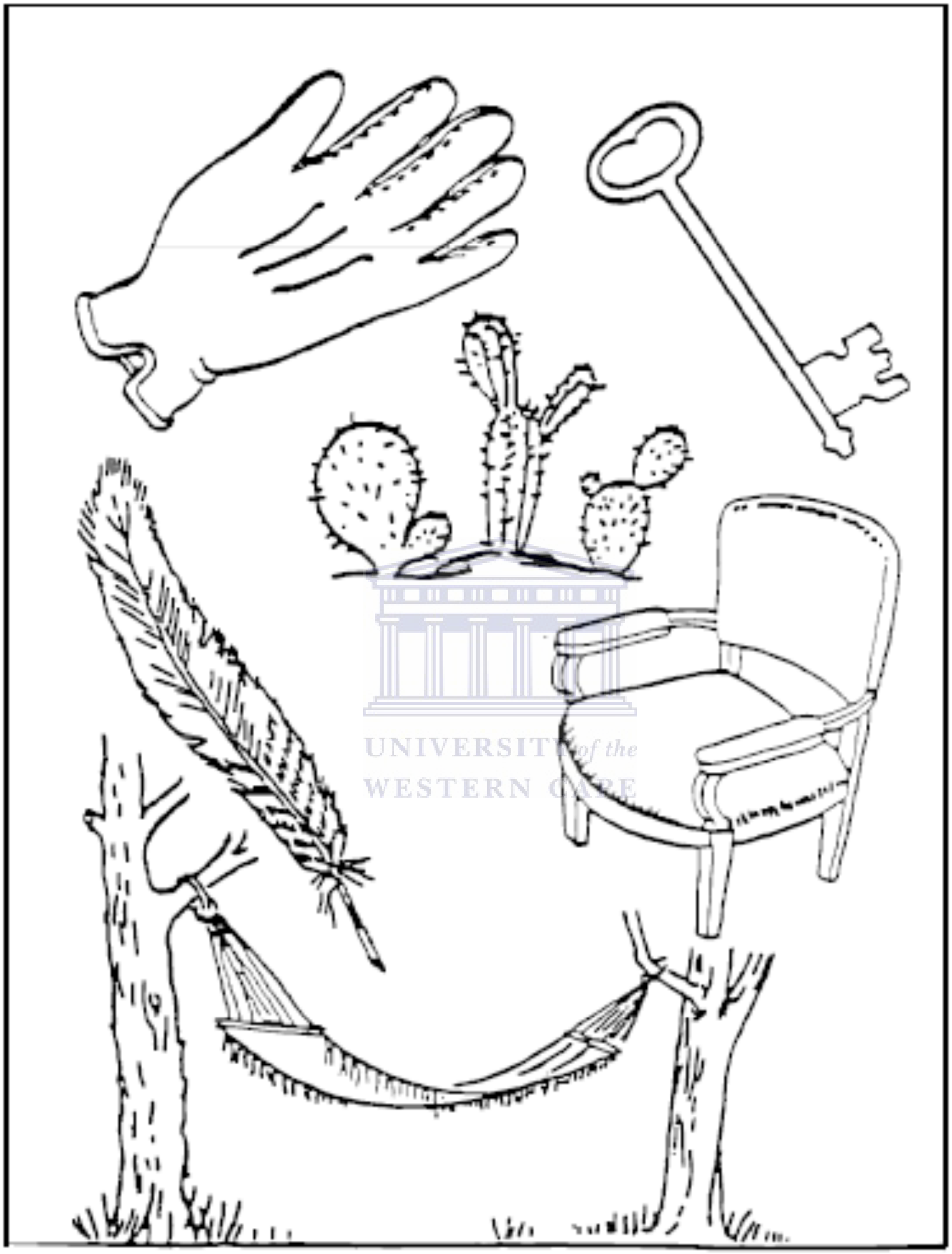
You know how.

Down to earth.

I got home from work.

Near the table in the dining room.

They heard him speak on the radio last night.



MAMA

TIP – TOP

FIFTY – FIFTY

THANKS

HUCKLEBERRY

BASEBALL PLAYER



**Appendix 3c**

**Rivermead motor assessment**

| No | Scoring | T1 | T2 | T3 |
|---|---|---|---|---|
| **Section A** | | | | |
| **1.** | Sit unsupported without holding on, on edge of bed, feet unsupported. | | | |
| **2.** | Lying to sitting on side of bed using any method. | | | |
| **3.** | Sitting to standing. May use hands to push up. Must stand up in 15 sec and stand for 15 sec, with an aid if necessary | | | |
| **4.** | Transfer from wheelchair to chair towards unaffected side<br>May use hands. | | | |
| **5.** | Transfer from wheelchair to chair towards affected side<br>May use hands. | | | |
| **6.** | Walk 10 m indoors with an aid<br>Any walking aid. No stand-by help. | | | |
| **7.** | Climb stairs independently<br>Any method. May use banister and aid--must be a full flight of stairs. | | | |
| **8.** | Walk 10 m indoors without an aid<br>No stand-by help. No caliper, splint or walking aid. | | | |
| **9.** | Walk 10m, pick up bean bag from floor, turn and carry back<br>Bend down any way, may use aid to walk if necessary. No stand-by help. May use either hand to pick up bean bag | | | |
| **10.** | Walk outside 40 m<br>May use walking aid, caliper or splint. No stand-by help. | | | |
| **11.** | Walk up and down four steps<br>Patient may use an aid if he would normally use one, but may not hold on to rail. This is included to test ability to negotiate curb or stairs without a rail. | | | |

| | | | | |
|---|---|---|---|---|
| **12.** | Run 10 m<br>Must be symmetrical. | | | |
| **13.** | Hop on affected leg five times on the spot<br>Must hop on ball of foot without stopping to regain balance. No help with arms. | | | |
| **Total** | | | | |
| **Section B** | | | | |
| **1.** | Roll to affected side<br>Starting position should be lying, not crook lying. | | | |
| **2.** | Roll to unaffected side<br>Starting position should be lying, not crook lying. | | | |
| **3.** | Half-bridging<br>Starting position - half-crook lying. Patient must put some weight through affected leg to lift hip on affected side. Therapist may position leg, but patient must maintain position even after movement is completed. | | | |
| **4.** | Sitting to standing<br>May not use arms-- feet must be flat on floor--must put weight through both feet. | | | |
| **5.** | Half-crook lying: lift affected leg over side of bed and return it to the same position.<br>Affected leg in half-crook position. Lift leg off bed on to support; for example, box, stool, floor, so that hip is in neutral and knee at 90 degrees while resting on support.<br>Must keep affected knee flexed throughout movement. Do not allow external rotation at hip. This tests control of hip and knee. | | | |

| | | | | |
|---|---|---|---|---|
| **6.** | Standing, step unaffected leg on and off block<br>Without retraction of pelvis or hyperextension of knee. This tests knee and hip control while weight bearing through the affected leg. | | | |
| **7.** | Standing, tap ground lightly five times with unaffected foot<br>Without retraction of pelvis or hyperextension of knee. Weight must stay on leg.<br>This again tests knee and hip control while weight bearing through the affected leg but is more difficult than in 6. | | | |
| **8.** | Lying, dorsiflex affected ankle with leg flexed<br>Physiotherapist may hold affected leg in position, knee at 90 degrees. Do not allow inversion. Must have half range of movement of unaffected foot. | | | |
| **9.** | Lying, dorsiflex affected ankle with leg extended<br>Same conditions as in 8, with leg extended. Do not allow inversion or knee flexion.<br>Foot must reach plantigrade (90°). | | | |
| **10.** | Stand with affected hip in neutral position, flex affected knee. Therapist may not position leg. This is extremely difficult for most hemiplegic patients, but is included to assess minimal dysfunction. | | | |
| **Total** | | | | |
| **Section C** | | | | |
| **1.** | Lying, protract shoulder girdle with arm in elevation<br>Arm may be supported. | | | |
| **2.** | Lying, hold extended arm in elevation (some external rotation) for at least 2 sec Therapist should place arm in position and patient must maintain | | | |

| | | | | |
|---|---|---|---|---|
| | position with some external rotation. Do not allow pronation. Elbow must be held within 30 degrees of full extension. | | | |
| **3.** | Flexion and extension of elbow, with arm as in 2 above<br>Elbow must extend to at least 20 degrees full extension. Palm should not face out during any part of movement. | | | |
| **4.** | Sitting, elbow into side, pronation and supination<br>Three-quarters range is acceptable, with elbow unsupported and at right angles. | | | |
| **5.** | Reach forward, pick up large ball with both hands and place down again. Ball should be on table so far in front of patient that he has to extend arms fully to reach it. Shoulders must be protracted, elbows extended, wrist neutral or extended, and fingers extended throughout movement. Palms should be kept in contact with the ball. | | | |
| **6.** | Stretch arm forward, pick up tennis ball from table, release on affected side, return to table, then release again on table. Repeat five times. Shoulder must be protracted, elbow extended and wrist neutral or extended during each phase. | | | |
| **7.** | Same exercise as in 6 above with pencil<br>Patients must use thumb and fingers to grip. | | | |
| **8.** | Pick up a piece of paper from table in front and release five times<br>Patient must use thumb and fingers to pick up paper and not to pull it to edge of table.<br>Arm position as in 6 above. | | | |
| **9.** | Cut putty with a knife and fork on plate with non-slip mat and put pieces into container at side of plate, Bite-size pieces. | | | |
| **10.** | Stand on spot, maintain upright position, pat large ball on floor with palm of hand for 5 continuous bounces | | | |
| **11.** | Continuous opposition of thumb and each finger more than 14 times in 10 sec,. Must do movement in consistent sequence. Do not allow thumb to slide from one finger to the other. | | | |

| | | | | |
|---|---|---|---|---|
| **12.** | Supination and pronation on to palm of unaffected hand 20 times in 10 sec. Arm must be away from body, the palm and dorsum of hand must touch palm of good hand. Each tap counts as one. This is similar to 4 above, but introduces speed. | | | |
| **13.** | Standing, with affected arm abducted to 90 degrees with palm flat against wall. Maintain arm in position. Turn body towards wall and as far as possible towards arm, i.e. rotate body beyond 90 degrees<br>Do not allow flexion at elbow, and wrist must be extended with palm of hand fully in contact with wall. | | | |
| | Place string around head and tie bow at back<br>Do not allow neck to flex. Affected hand must be used for more than just supporting string. This tests function of hand without help of sight. | | | |
| | 'Pat- a-cake' seven times in 15 sec, Mark crosses on wall at shoulder level. Clap both hands together (both hands touch crosses.) Each sentence counts as one. Give patients three tries. This is a complex pattern which involves co-ordination, speed, and memory, as well as good arm function | | | |
| Total | | | | |

## Appendix 3d

## Modified Rankin Scale

### Interview

Please mark (X) in the appropriate box. Please record responses to all questions (unless otherwise indicated in the text), including those concerning status before stroke. See guidelines on the facing page for further information.

| 1 CONSTANT CARE | | | | |
|---|---|---|---|---|
| Constant care means that someone needs to be available at all times. Care may be provided by either a trained or an untrained caregiver. The patient will usually be bedridden and may be incontinent. | Before stroke | T1 | T2 | T3 |
| 1.1 Does the person require constant care? | Yes<br>No<br>(5) | Yes<br>No<br>(5) | Yes<br>No<br>(5) | Yes<br>No<br>(5) |

2 ASSISTANCE TO ATTEND TO BODILY NEEDS/ FOR WALKING

| | | | | |
|---|---|---|---|---|
| Assistance includes physical assistance, verbal instruction, or supervision by another person | Before stroke | T1 | T2 | T3 |
| | Yes<br>No<br>(4) | Yes<br>No<br>(4) | Yes<br>No<br>(4) | Yes<br>No<br>(4) |
| 2.1 Is assistance essential for eating?<br>(Eating without assistance: food and implements may be provided by others). | YES<br>No | yes<br>no | yes<br>no | yes<br>no |
| 2.2 Is assistance essential for using the toilet?<br>(Using toilet without assistance: reach toilet/commode; undress sufficiently; clean self; dress and leave). | YES<br>No | yes<br>no | yes<br>no | yes<br>no |
| 2.3 Is assistance essential for routine daily | | | | |

| | | | | |
|---|---|---|---|---|
| hygiene?<br>(Routine hygiene: washing face, doing hair, cleaning teeth/ fitting false teeth. Implements may be provided by others and this should not be considered assistance). | YES<br>No | yes<br>no | yes<br>no | yes<br>no |
| 2.4 Is assistance essential for walking?<br>(Walking without assistance: Able to walk indoors around house or ward, may use any aid (e.g. stick/ cane, walking frame/ walker), however not requiring physical help or verbal instruction or supervision from another person). | YES<br>No | yes<br>no | yes<br>no | yes<br>no |

3 ASSISTANCE TO LOOK AFTER OWN AFFAIRS

| Assistance includes physical assistance, or verbal instruction, or supervision by another person. | before stroke<br>Yes<br>No<br>(3) | T1<br>Yes<br>No<br>(3) | T2<br>Yes<br>No<br>(3) | T3<br>Yes<br>No<br>(3) |
|---|---|---|---|---|
| Is assistance essential for preparing a simple meal?<br>(For example, able to prepare breakfast or a snack) | YES<br>No | yes<br>no | yes<br>no | yes<br>no |
| Is assistance essential for basic household chores? (For example, finding and putting away clothes, clearing up after a meal. Exclude chores that do not need to be done every day, such as using a vacuum cleaner.) | YES<br>No | yes<br>no | yes<br>no | yes<br>no |
| Is assistance essential for looking after household Expenses? | YES<br>No | yes<br>no | yes<br>no | yes<br>no |
| Is assistance essential for local travel? (Patients may drive or use public transport to get around. Ability to use a taxi is | YES | yes | yes | yes |

| | | | | | |
|---|---|---|---|---|---|
| sufficient, provided the person can phone for it themselves and instruct the driver.) | No | no | no | no | |
| 3.5 Is assistance essential for local shopping? (Local shopping: at least able to buy a single item) | YES<br><br>No | yes<br><br>no | yes<br><br>no | yes<br><br>no | |

USUAL DUTIES AND ACTIVITIES. The next sets of questions are about how the patient usually spends his/her day.

4.1 Work

| | |
|---|---|
| 4.1.1 | Before stroke, was the person working or seeking work (or studying □ Yes □ No<br>As a student)? If the person was not employed or seeking work before stroke, or the person was retired then indicate 'No' and go to 4.2) |
| 4.1.2 | Since stroke has there been a change in the person's ability to Work or study? (change in ability to work or study includes loss of employment or reduction in level of responsibility; change in education or problems with study).<br>If 'Yes', how restricted are they? (2)<br>Reduced level of work e.g. changes from full-time to part-time or changes in level of responsibility. □ (2)<br>Currently unable to work. □ (2) |

| T1 | T2 | T3 | |
|---|---|---|---|
| Yes<br><br>No (2) | Yes<br><br>No (2) | Yes<br><br>No (2) | |



4.2 Family responsibilities

| | |
|---|---|
| 4.2.1 | Before stroke was the person looking after family at home? □ Yes □ No<br>(If this was not a major role before stroke, indicate 'No" and go to 4.3) |

| | |
|---|---|
| 4.2.2 | Since stroke has there been a change in their ability to look after family at home?<br><br>If 'Yes", how restricted are they?<br>Reduced responsibility for looking after family. □ (2)<br><br>(b) Currently unable to look after family. □ (2) |

| T1 | T2 | T3 | |
|---|---|---|---|
| Yes<br><br>No (2) | Yes<br><br>No (2) | Yes<br><br>No (2) | |

4.3 Social & leisure activities

| | |
|---|---|
| 4.3.1 | Before stroke did the person have regular free-time activities? □ Yes □ No<br>(If the person had very restricted social & leisure activities before stroke then indicate 'No' and go to 4.4 |
| 4.3.2 | Since stroke has there been a change in their ability to participate in these activities?<br><br>If 'Yes', how restricted are they?<br>Participate a bit less: at least half as often as before the stroke. □ 2<br><br>Participate much less: less than half as often. □ (2)<br><br>Unable to participate: rarely, if ever, take part. □ (2) |

| T1 | T2 | T3 | |
|---|---|---|---|
| Yes<br><br>No (2) | Yes<br><br>No (2) | Yes<br><br>No (2) | |



4. USUAL DUTIES AND ACTIVITIES. ….Contd.

4.4 Family & Friendships

| 4.4.1 Since the stroke has the person had problems with relationships or become isolated? | T1 | T2 | T3 | |
|---|---|---|---|---|
| If 'Yes', what is the extent of disruption/strain? | Yes | Yes | Yes | |
| Occasional – less than weekly □ 2 | No | No | No | |
| Frequent – once a week or more, but tolerable □ (2) | (2) | (2) | (2) | |
| Constant – daily & intolerable □ (2) | | | | |
| 4.4.2 Before stroke were any similar problems present? □ Yes □ No | | | | |



SYMPTOMS AS A RESULT OF THE STROKE

| "Does the patient have any symptoms resulting from stroke?" (Record spontaneous answer to the question from respondent) | Before stroke | T1 | T2 | T3 |
|---|---|---|---|---|
| | Yes | Yes | Yes | Yes |
| | No | No | No | No |
| | (1) | (1) | (1) | (1) |

| 5.2 SYMPTOM CHECKLIST | Before stroke | T1 | T2 | T3 |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 5.2.1 Does the person have difficulty reading or writing? | YES No | yes no | yes no | yes no |
| Does the person have difficulty speaking or finding the right word? | YES No | yes NO | yes no | yes no |
| **5.2.2 Does the person have problems with balance or coordination?** | YES NO | Yes NO | yes NO | yes No |
| **5.2.4 Does the person have visual problems?** | YES No | yes No | yes NO | Yes NO |
| 5.2.5 **Does the person have numbness (face, arms, legs, hands, and feet)?** | YES NO | yes No | yes No | yes No |
| 5.2.6 **Has the person experienced loss of movement (face, Arms, legs, hands, and feet)?** | YES NO | Yes No | yes NO | yes No |
| **5.2.7 Does the person have difficulty with swallowing?** | YES No | yes No | yes No | yes No |
| **5.2.8 Any other symptoms?** (Please record: ……………………………………….) | YES NO | yes NO | yes No | yes No |

Rankin Grade T1=

Rankin Grade T2=

Rankin Grade T3=

## Appendix 3e

### Nottingham Extended Activities of Daily Living

The following questions are about everyday activities. Please answer by ticking ONE box for each question. Please record what you have ACTUALLY done in the last few weeks. Please make your answers based on the following rating

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| **Not at all** | **With help** | **On your own with difficulty** | **On your own** |

**DID YOU…**

| | T1 | T2 | T3 |
|---|---|---|---|
| 1. Walk around outside? | | | |
| 2. Climb stairs? | | | |
| 3. Get in and out of a car? | | | |
| 4. Walk over uneven ground? | | | |
| 5. Cross roads? | | | |
| 6. Travel on public transport? | | | |
| 7. Manage to feed yourself? | | | |
| 8. Manage to make yourself a hot drink | | | |
| 9. Take hot drinks from one room to another? | | | |
| 10. Do the washing up? | | | |
| 11. Make yourself a hot snack? | | | |
| 12. Manage your own money when you were out? | | | |
| 13. Wash small items of clothing? | | | |
| 14. Do your own housework? | | | |
| 15. Do your own shopping? | | | |
| 16. Do a full clothes wash? | | | |
| 17. Read newspapers or books? | | | |
| 18. Use the telephone? | | | |
| 19. Write letters? | | | |
| 20. Go out socially? | | | |

| | | | |
|---|---|---|---|
| 21. Manage your own garden? | | | |
| 22. Drive a car? | | | |
| **Total Nottingham Scale** | | | |

**APPENDIX 4**

**Follow up and use of CARE DATA gathering sheet**

## Stroke Rehabilitation Outcome in Hebron, Palestine

# Follow up and use of care Data gathering sheet

**Used at T2 after 3 months, and T3 after 6 months. Strictly confidential, names are not used during reporting of data.**

**Patient's name**

**Patient's code**

**Date**

D /M / Y

**Test: (T2) (T3)**

**A. Medical History**

1. Is the patient still alive — 1.yes 2.No
   a. If no , indicate the cause of death if possible
   b. If no, indicate the date of death
   c. Days between stroke and death
2. Length of stay at hospital :
   a. Date of Admission, at the onset of stroke
   b. Date of discharge
   c. Total length of stay in days
3. Have you been readmitted to hospital — 1. Yes 2. No

a. Number of hospital readmissions

b. Total days of stay in hospital readmissions

c. Main Cause/s of readmission ( please circle more than one if necessary) other than recurrent stroke

1. Regular medical follow up
2. Deterioration of patient's case
3. Increase in hypertension
4. Cardiac problems
5. Decrease in patients level of consciousness
6. Causes unrelated to stroke

4. Have you had another stroke?

1.Yes | 2.No

a. If yes what date? Number of Days after stroke



b. What side did you have the recurrent stroke?

1. Same side | 2. Other side | 3. Both

5. What is your highest functional independent position?

1. Walking alone | 2. Walking with assistance | 3. Standing alone | 4. Standing with assistance

5. Sitting alone | 6. Sitting with assistance | 7. Confined to bed | 8. Dead

**B. Rehabilitation institution setting**

6. Had you been admitted to a rehabilitation institution?

1. Yes | 2. No

7. If not, then why didn't you use this setting?

1. Accessibility to | 2. Financial reasons | 3. Psychological barrier from inst.

4. No specific intention)

5. Others ____________________________________________

8. Date of admission ______ Date of discharge ______

9. Length of Stay in this setting in days ______

10. What is the main reason that made you choose this setting?

1. Doctors

2. Therapist recommendation

3. Health insurance

4. Thinking that it is best

5. No care givers at home

6. Others ______________

| Type of service | Period/ weeks | Frequency in a week | Daily Intensity | Length of session | Total hours |
|---|---|---|---|---|---|
| 11. PT | | | | | |
| 12. OT | | | | | |
| 13. Speech | | | | | |
| 14. Psy. counseling | | | | | |



**D. Home Rehabilitation setting**

15. Did you receive a home rehabilitation program by community therapists

1. Yes

2. No

16. If not then why didn't you use this setting

1. Accessibility to clinics

2. Financial reasons

3. Availability of care givers

4. No specific intention

5. Others ____________________________________________

17. If yes :

a. what is the Date of starting home rehabilitation?

b. date of stopping it

18. Length of home rehabilitation in days

19. Why did you choose this setting?

1. Doctors

2. Therapist

3. Financial reasons

4. Thinking that it is best

5. No care givers at home

6. Health insurance

6. Others

| Type of service | Period / week | Frequency in a week | Daily Intensity | Length of session | Total hours |
|---|---|---|---|---|---|
| 20. PT | | | | | |
| 21. OT | | | | | |
| 22. Speech | | | | | |
| 23. Psych. counseling | | | | | |



## E. Outpatient Rehabilitation

24. Did you receive any outpatient rehabilitation services?

1. Yes

2. No

If not then why didn't you use this setting?

1. Inaccessibility to these clinics

2. Financial reasons

3. No care givers help to reach there

4. Hard to move every time to there (severity of the stroke)

5. No specific intention)

6. Others

25. If yes

a. What is the Date of starting?

b. Date of discharge

c. Length of outpatient rehabilitation period in days (No of treatment days)

26. The choice of this setting was based on :

1. Doctors recommendation

2. Therapist recommendation

3. Financial reasons (cheapest)

4. Thinking that it is best option

5. Health insurance

6. Others

| Type of service | Period weeks | Frequency in a week | Daily Intensity | Length of session | Total hours |
|---|---|---|---|---|---|
| 27. PT | | | | | |
| 28. OT | | | | | |
| 29. Speech | | | | | |
| 30. Psych. counseling | | | | | |

**F. <u>Medical follow up</u> (from the patient and the care givers)**

31. How many times did you visit or have you been visited by doctors?

32. What is the reason for these visits please circle more than one if necessary)

1. Regular follow up
2. Deterioration of patient's case
3. Increase in hypertension
4. Heart problems
5. Decrease in consciousness
6. Causes unrelated to stroke

**G. Patient's personal efforts in rehabilitation (from the patient and the care giver)**

33. Were you trying to use hand in activities of daily living?

(1) No | (2) Sometimes | (3) Most of the time | (4) Always)

34. Was the patient trying to perform personal assisted exercise?

(2) No | (2) Sometimes | (3) Most of the time | (4) Always



**H. Family involvement**

35. On average, did the patient receive any family involvement in exercise?

1. No | 2. Sometimes 1-3times /week | 3. Most of the time 4-5 times/ week | 4. Always 6-7 times/week or more

| Period in weeks | Frequency / week | Daily int. | Length of session | Total hours of family PT |
|---|---|---|---|---|
| | | | | |

**I : Stroke Risk factors at 3 and 6 months post stroke**

(From the patient or relatives or the file if possible, for blood tests if possible to make it, if not 3 weeks back test is accepted)

File readings

36. High Blood pressure (tested by the therapist ) 1. Yes 2. NO

37. Blood sugar 1. Yes 2. NO

38. Triglyceride 1. Yes 2. NO

39. Cholesterol 1. Yes 2. NO

40. Have you currently been diagnosed as having any heart disease?

1. Yes ........................................ 2. NO

41. Smoking

   a. Is the patient smoking now or during the last 3 months

   1. Yes 2. No

   b. daily average of cigarettes

42. If the high fat and cholesterol diet is represented in white meat, butter, do you consider yourself?

0. None 1. Mild consumer 2. Moderate consumer 3. High consumer

43. On average, within the period of the last 7 days, on how many days were you physically active for a total of at least 30 minutes per day? (Add up all the time you spend in any kind of physical activity that increases your heart rate and makes you breathe hard some of the time.)

(1) 0 Days | (2)1 Day | (3) 2 Days

(4) 3 Days | (5) 4 Days | (6) 5 Days

(6) 5 Days | (7) 6 Days | (8) 7 Days

44. Obesity :

a. Waist circumference in cm. at Umbilical level

b. length in cm

45. Do you drink alcohol now, or during the last 3 months?

1. Yes 2. No

a. If yes what is the average of the daily drinking in ml.



47. Have you been going through special stressful event/s the week before the stroke

1. Yes 2. No

48. Medications : mention the medications that the patient is taking now

| No | Name of medication | notes |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

| 5. | | |
|---|---|---|

**J. Socio-economic status after 3 and 6 months**

49. Marital status.

1. Married | 2. Widow | 3. Widower | 4. Divorced | 5. Never

50. Level of education

1. Elementary | 2. Preparatory | 3. Secondary | 4. Basic

5. Diploma | 6. BA | 7. Postgraduate | 8. None degree



51. Are you working now ? (If yes please answer the following questions A-C if not please answer question 52) 1. Yes | 2. NO

a. If now working what is your work?

b. If working, what kind of work are you doing?

1. Formally employed | 2. Self employed

c. If you were working what was your type of work ?

1. Not working at all

2. Office

3. Physical

4. Both physical and office

d. If working, what best describes your intensity of work?

1. Full time

2. Irregular hours

3. Part time

4. Contract worker (H/week) how many? ________

5. Other (specify) -----------------------------------------------------------------------

52. If you were not working, which of the following describes best the reason for not working?



1. Unemployed Preferred not work

2. Unemployed looking for

3. Unemployed due to illness or

4. Retired

Other reasons: please specify

53. Number of Family members living in the household with the spouse, and their ages (brothers, sisters, daughters, sons, others). total number

54. List of all members living in household

| NO | Relation | Age | Gender |
|---|---|---|---|
| 54. | | | |
| 55. | | | |
| 56. | | | |
| 57. | | | |
| 58. | | | |
| 59. | | | |
| 60. | | | |
| 61. | | | |
| 62. | | | |
| 63. | | | |



55. General household income

1. No income at all
2. Less than 1000
3. 1001 - 2000
4. 2001-4000
5. 4001- 6000
6. 6001- 8000
7. 8001 - above

56. Do you make ends meet with the total monthly disposable income?

1. with great difficulty
2. with difficulty
3. with some difficulty
4. Fairly easily
5. Easily
6. Very easily

57. Was any relative involved in the answering the questionnaire (partially or fully)?

1. Yes    2. NO

58. If yes, what is the relation with the patient?

| | | | | | |
|---|---|---|---|---|---|
| 1. Son | 2. Daughter | 3. Spouse | 4. Father | 5. Mother | 6. Brother or sister |

**APPENDIX 5**

**Random list of control file numbers**

Random 154 file number, out of the 350 files number list, From Al-Quds University stroke risk factors campaign, of people over 60 years old. To serve as controls for the epidemiological study section.

1 Set of 154Unique Numbers Per Set

Range: From 1 to 350 -- Sorted from Least to Greatest

**Set #1:**

p1=**1**, p2=**3**, p3=**4**, p4=**5**, p5=**6**, p6=**7**, p7=**8**, p8=**13**, p9=**17**, p10=**20**, p11=**21**, p12=**22**, p13=**25**, p14=**26**, p15=**31**, p16=**34**, p17=**37**, p18=**42**, p19=**45**, p20=**46**, p21=**53**, p22=**54**, p23=**61**, p24=**62**, p25=**65**, p26=**67**, p27=**71**, p28=**72**, p29=**74**, p30=**76**, p31=**79**, p32=**80**, p33=**82**, p34=**84**, p35=**85**, p36=**86**, p37=**87**, p38=**89**, p39=**91**, p40=**92**, p41=**93**, p42=**94**, p43=**97**, p44=**98**, p45=**102**, p46=**103**, p47=**106**, p48=**108**, p49=**109**, p50=**110**, p51=**111**, p52=**117**, p53=**118**, p54=**121**, p55=**125**, p56=**127**, p57=**129**, p58=**130**, p59=**136**, p60=**139**, p61=**140**, p62=**142**, p63=**143**, p64=**147**, p65=**149**, p66=**150**, p67=**151**, p68=**152**, p69=**154**, p70=**155**, p71=**156**, p72=**159**, p73=**161**, p74=**165**, p75=**166**, p76=**169**, p77=**170**, p78=**171**, p79=**173**, p80=**175**, p81=**182**, p82=**183**, p83=**184**, p84=**187**, p85=**188**, p86=**189**, p87=**192**, p88=**194**, p89=**197**, p90=**201**, p91=**207**, p92=**210**, p93=**213**, p94=**214**, p95=**215**, p96=**219**, p97=**220**, p98=**222**, p99=**230**, p100=**231**, p101=**234**, p102=**239**, p103=**242**, p104=**243**, p105=**245**, p106=**246**, p107=**247**, p108=**249**, p109=**250**, p110=**259**, p111=**262**, p112=**263**, p113=**267**, p114=**268**, p115=**270**, p116=**271**, p117=**272**, p118=**273**, p119=**274**, p120=**275**, p121=**277**, p122=**278**, p123=**281**, p124=**283**, p125=**284**, p126=**287**, p127=**291**, p128=**293**, p129=**294**, p130=**296**, p131=**299**, p132=**302**, p133=**303**, p134=**304**, p135=**305**, p136=**306**, p137=**308**, p138=**311**, p139=**312**, p140=**316**, p141=**318**, p142=**321**, p143=**325**, p144=**326**, p145=**329**, p146=**332**, p147=**334**, p148=**337**, p149=**339**, p150=**341**, p151=**345**, p152=**346**, p153=**348**, p154=**349**

## APPENDIX 6

**(proposed Palestinian adapted Rehabilitation model)**

| Characteristics | Requested Changes | | A Community based rehabilitation model | | Characteristics | Requested Changes |
|---|---|---|---|---|---|---|
| Available source of rehabilitation | Systematic participation in exercises (20) minutes , twice per day | | | | | More time with family (20%) training= family members hand on patient |
| Affordable, with no costs | Systematic participation on functional activates for the patient (20 minutes) twice per day | | | | Less cost than in patient | More training for patient (20%). Self-performance with feedback. Knowledge for patients<br>_Assigning Regular functional oriented activities, towards a participation goal<br>_Training on self-assisted exercises |
| Motivated to help a relative | Reporting to and updating the therapist | Family | Patient | Community therapist | Acceptable provider | Regular session: function oriented =(60%) therapist's hand on patient |
| | | | | | Most likely available | OT: at least once a week , following same directions |
| | | | | | | Less weekly frequency and longer rehab. Period. (3 times /W)for 3-6 months, depends on affordability) |

**Patient**

| Characteristics | Requested Changes |
|---|---|
| Center of rehabilitation process<br>Setting | Performing self-assisted exercises. Gradable upon progress (20) minutes 4 times per day |
| participation goal of interest | Using the affected hand in functional activities upon possible potential |

**Home**

| characteristics | Requested Changes |
|---|---|
| Represents known environment to the patient | Adding simple equipment (ball,<br>Using home furniture, stairs, mattresses |
| | Train ADL on home based facilities (kitchen, bath) |
| Actual future challenge | Move to outpatient when possible |

**Proposed home based rehabilitation model based on results of the stroke rehabilitation outcome in Palestine**

| **Input**<br>Characteristics | **Process**<br>Description | **Outcomes.** |
|---|---|---|
| **A. Client = Patient**<br>Center of the rehabilitation process | 1. Acceptance of rehabilitation and commitment to participate as a center of the rehabilitation process | Patient satisfaction ; QL status ; less cost |
| **B. Service provider :**<br>**1. Community Health professional.**<br>Should be professionally integrated, Might be OT and OT at least, and ST if needed. Ready to be a (family and patient) facilitator and educator rather than just health service provider. | 1. Evaluation and re-evaluation of the patients<br>2. Rehabilitation services according to guidelines, and patients evaluation (60%) of the session.<br>3. Training and empowering of the family members (20% session)<br>4. Training the patient on performing self-assisted exercises / functional tasks (20%)of the session<br>5. Longer period (6 months), less weekly frequency (3 sessions per week), might be 2 PT and 1 OT | **Three ICF outcome measures, within the aims of the three service providers**<br>1. **Impairment**: NIHSS and Rivermead<br>2. **Function** : FIM or Barthel<br>3. **Participation** : Modified Rankin Scale , or Palestinian |

| | | |
|---|---|---|
| **2. Family members.**<br>Therapy providers, rather than care givers only.<br>Affordable, motivated, and available source of rehabilitation. | 1. Performing functional activities (that patient cannot do alone) twice a day for 20 minutes each<br>2. Performance of functional exercise (that patient needs assisting with) twice a day for 20 minutes | adapted participation questionnaire<br>4. Stress measures / service and provider satisfaction<br>5. Independence measures (Barthel Index )<br>6. Change towards set goals at beginning of the rehabilitation<br>7. Improvement in certain aspects as distance or speed of walking (6 minutes / ten meters walking test) |
| **3. Patient**<br>The fact of being a passive recipient to an active provider in the rehabilitation process | 1. Goals setting with therapist partnership<br>2. Performance of self-assisted exercises, and functional activities taught by the therapist, at least 4 times a day for 20 minutes each time.<br>3. Commitment of continuous trial to use the affected hand with the support of the non-affected when needed. According to the therapist's instruction | |
| **C. Setting = Patients home**<br>Original and real environmental. future, challenges of the new declined functional level | **Processes that might take place in the setting**<br>1. Adapting stairs and bathroom if possible<br>2. Adding some equipment, like Physio-ball, slings<br>3. W.H and handles at home if needed | 1. Less cost than inpatient rehabilitation<br>2. Suitability for living. No need for hard patient transfer to therapy |



THE END