FACTORS ASSOCIATED WITH STROKE RECURRENCE, THE FACILITATORS AND BARRIERS TO MEDICATION ADHERENCE AND RISK FACTOR CONTROL AMONG STROKE SURVIVORS

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BY
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IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF

DOCTOR OF PHILOSOPHY

2020

CERTIFICATE BY THE STUDENT

I **Shani S D** hereby certify that I had personally carried out the work depicted in the thesis entitled, **"Factors associated with stroke recurrence, the facilitators and barriers to medication adherence and risk factor control among stroke survivors"**.

No part of the thesis has been submitted for the award of any other degree or diploma prior to this date.

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The thesis entitled, **"Factors associated with stroke recurrence, the facilitators and barriers to medication adherence and risk factor control among stroke survivors"** was carried out under my direct supervision. No part of the thesis was submitted for the award of any degree or diploma prior to this date.

Clearance was obtained from the Institutional Ethics Committee for carrying out the study

Signature of the Guide

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APPROVAL OF THESIS

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In all your ways acknowledge Him, And He will make your paths straight: Proverbs 3:6

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ABBREVIATIONS

SCTIMST	- Sree Chitra Tirunal Institute for Medical Sciences and Technology
IBM SPSS	- International Business Machines Corporation Statistical Package for The Social Science
OR	- Odds Ratio
CI	- Confidence Interval
ASA	- American Stroke Association
ADA	- American Diabetes Association
NCEP	- National Cholesterol Education Program
LDL	- Low Density Lipoprotein
HDL	- High Density Lipoprotein
TC	- Total Cholesterol
SBP	- Systolic Blood Pressure
DBP	-Diastolic Blood Pressure
MHR	- Mantel Haenszel Ratio
NIHSS	- National Institute Health Stroke Scale
mRS	- modified Rankin Score
WC	- Waist Circumference
PAF/ PAR	- Population Attributable Fraction/ Population Attributable Risk
TIA	- Transient Ischemic Attack
AIS	- Acute Ischemic Stroke
NPCDCS	- National Program for Prevention and Control of Cancer, Diabetes, Cardio Vascular Disease and Stroke
NCD	- Non-Communicable Diseases
NRHM	- National Rural Health Mission
NTCP	- National Tobacco Control Programme
NPHCE	- National Programme for Health Care of Elderly
ASHA	- Accredited Social Health Activist

WHO	- World Health Organization
HR	- Hazard Ratio Complementary and alternative medicine
QALY	- Quality Adjusted Life Years
CS-SRM	- Common Sense Self-Regulation Model
CAM	- Complementary and Alternative Medicine
MARS	- Medication Adherence Rating Scale
BMQ	- Brief Medication Questionnaire.
MMAS-8	- Morisky Medication Adherence scale
MAQ	- Medication Adherence Questionnaire
RCT	- Randomized Control Trials
SMS	- Short Messaging Service
OCSP	- Oxfordshire Community Stroke Project
TOAST	- Trial of ORG 10172 in Acute Stroke Treatment
CHD	- Coronary Heart Disease
OHA	- Oral Hypoglycaemic agents
BP	- Blood Pressure
RBS	- Random Blood Sugar
HbA_1C	- Glycosylated Haemoglobin
AB PMJAY	- Ayushman Bharat Pradhan Mantri Jan Arogya Yojana

SYNOPSIS

Survivors of first ever stroke have an increased chance of stroke recurrence. The pooled cumulative risk of stroke recurrence was 11.1% at 1 year; 26.4% at 5 years; and 39.2% at 10 years. Studies have shown that effective prevention of secondary stroke is associated with an 80% reduction in the risk of early recurrent strokes. But one out of every four strokes are recurrent, suggesting inadequate secondary stroke prevention strategies or lack of adherence to it. Nonadherence to medication and poor risk factor control were associated with poor patient out come and stroke recurrence. Adherence to pharmacological therapy and strict control of risk factors are essential for prevention of recurrent strokes. This study tries to find out the factors associated with stroke recurrence, medication adherence, risk factor control and facilitators and barriers to medication adherence among stroke survivors. This study results may have implications in stroke care in the community to prevent stroke recurrence and can help in planning intervention to improve medication adherence.

Objectives of the study are

To identify the factors associated with recurrence of stroke after first episode

To find out the medication adherence among survivors of first episode of stroke within a post stroke period of three months to one year.

To find out the control of risk factors among survivors of first episode of stroke within a post stroke period of three months to one year.

To find out the facilitators and barriers to medication adherence among survivors of first episode of stroke within a post stroke period of three months to one year.

Methods used are:

Incident pair matched case control study was done to meet the first objective. The remaining objectives were achieved through cross sectional survey among survivors of first episode of stroke between three months to one year.

Case control study

Hypothesis: The hypothesis put forward for this study was, poor risk factor control, medication non adherence, sociodemographic factors, index stroke related factors and health behaviour are associated with stroke recurrence.

Sample size: Sample size was calculated with fixing α error =0.05, power =0.80, anticipated proportion of discordant pairs- 0.5, anticipated odd ratio= 3 (medication nonadherence) and for a two-sided test. The number of matched pairs was estimated to be 61. Considering probability of nonresponse, 70 matched pairs were recruited for this study.

Setting: The eligible incident cases of recurrent strokes were recruited from stroke clinic. The age (±3 years) and post stroke period (±2weeks) matched controls were recruited from stroke registry. Data were collected from medical records and by visiting their homes.

Sample size: The number of matched pairs recruited for this study was 70

Inclusion criteria: Incident cases of recurrent strokes beyond one month after the index stroke, aged 18 and above within one month of stroke recurrence, were taken as cases. Index stroke should be ischemic stroke, haemorrhagic stroke or transient ischemic stroke with evidence of acute infarct. Controls were stroke survivors without stroke recurrence, pair matched to age and post stroke period (Age ±3 years, post stroke period ±2 weeks).

Exclusion criteria: Early recurrence within one month were excluded from the study. Stroke survivors who are comatose, severely disabled (modified Rankins Scale score 5 and above), having multiple coexisting diseases and having life expectancy less than six months were excluded from the study.

Data collection tools and techniques: Pretested structured interview schedule was used to collect sociodemographic and clinical details. Clinical information sheet was used collect information on radiographic, imaging and clinical details of index stroke from medical records. Standard instruments were used to measure height, weight and blood pressure. Medication adherence and compliance with other recommended health advice like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption just prior to recurrence period were also assessed.

Data management: Data entered in excel and analysis for pair matched case control study was done using R statistical software (2015). Univariate and bivariate analysis were done. All significant variables ($p<0.1$) on bivariate analysis were considered for multivariate analysis. Hierarchical binary conditional binary logistic regression analysis was done to find out e factors associated with stroke recurrence. Attributable risk was calculated for the significant variables in the final model.

Cross sectional survey

Sample: A total sample of 240 were recruited for this study

Setting: Stroke clinic of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram. Data were collected during their follow up visit to stroke clinic.

Inclusion criteria: Survivors of first episode of stroke, aged 18 and above within a period of three months to one year were recruited for the cross-sectional survey during the period of February 2019 to August 2019.

Exclusion criteria: Comatose, severely disabled (modified Rankin Scale score 5 and above) and having multiple coexisting diseases with life expectancy less than six months were excluded from the study.

Data collection tools and techniques: Pretested structured interview schedule was used to collect data. The interview schedule included sections to collect sociodemographic data, family support, financial support for medications, health care seeking behaviour, access to health care and relationship with health care provider. Details regarding stroke survivor's belief about treatment and disease and presence of anxiety and depressive mood were also assessed. Compliance with other recommended health advice like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption were also assessed. Clinical information sheet was used to collect information from medical records. Standard instruments were used to measure height, weight, waist circumference and blood pressure. Data collected during their follow up visit to stroke clinic.

Data management: Data entered in excel and analysed in IBM SPSS Statistics for windows version 21. Univariate and bivariate analysis were done. All significant variables ($p<0.1$) on bivariate analysis were considered for multivariate analysis. Sequential step wise logistic regression analysis was done to find out the factors associated with medication adherence. Average attributable fraction which is the plausible estimate of population attributable fraction was calculated for significant variables in the final model of case control study adopting Ruckinger method of sequential logistic regression analysis using R statistical software (2015).

Major findings of the study

Case control

Patients who were not adherent to medication (OR=7.46, 95% CI 1.67-33.28) and did not receive discharge advice (OR=10.79, 95%CI 2.38-49.02) were at increased risk of stroke recurrence whereas lacunar stroke (OR=0.08, 95% CI 0.67-0.99) and greater number of days of hospitalization during index stroke (OR=0.82, 95% CI 0.01-0.59) were associated with less chance of recurrence. Nearly 86% of the excess risk for recurrent stroke among the non-adherent can be attributed to medication non adherence and around 90% of the excess risk among those who had not received discharge education at the time of index stroke hospitalisation can be attributed to not getting discharge education.

Cross sectional survey

Medication adherence was 43. 8% among stroke survivors. Availability of medicine in the nearest medical shop (OR=2.36, 95% CI 1.23-4.52), having a daily routine

(OR=2.81, 95% CI 1.5-5.26) and perceived poor state of health (OR=2.65, 95% CI 1.3- 5.4) were facilitators and memory issues (OR=0.34, 95% CI 0.16-0.71), minimum neurological deficits at recruitment (OR=0.19, 95% CI 0.05-0.73) and experiencing side effects (OR=0.22, 95% CI 0.10-0.46) were barriers to medication adherence.

Only 26%, 36.2% had their diabetic and hypertension status under control. Lipid control was achieved by 72.9%. The diabetic control, hypertension control and lipid control were independently associated with adherence to corresponding category of medication.

The 21.24% and 20.93% of the excess risk of stroke recurrence in the population over a post stroke period of 5 years can be attributed to medication non adherence and not receiving discharge education respectively. Similarly, 30.35% and 19.6% of the excess risk of stroke recurrence in the population over a post stroke period of 5 years can be attributed to other than lacunar type of index stroke and number of days of hospitalization <7 at the time of index stroke admission respectively.

Significance and implications of the findings

The findings of this study have implications for developing strategies for recurrent stroke prevention and improving stroke care in the community. Increasing patient awareness by planned individualised discharge education regarding stroke, recurrence risk, medication adherence, healthy lifestyle and risk factor control can reduce stroke recurrence risk. Continuous access and availability of medications is prerequisite for uninterrupted consumption. Relevant policy decisions can be made to ensure continuous access and availability of medication locally. Since

forgetfulness is the common reason identified in almost all the settings, periodic reminders in the form of care giver reminding or through text messages can help. Another major area of intervention is forming strong habit of medication intake. Incorporating medication intake into daily routines can enhance adherence. At every clinic visit people should be screened and asked for side effects. Misconceptions about side effects of medications should be corrected by awareness programs. Positive behaviours should be incorporated and maintained as a new life style in-order to avoid recurrent strokes. Incorporating the modifiable risk factors identified through this thesis a discharge planning and education guideline is developed, it can be used in the clinical area to plan and implement individualised discharge education for stroke survivors at the time of index stroke.

Chapter 1

INTRODUCTION

1.1 Background of the problem

I.1.1 Stroke recurrence

Survivors of first ever stroke have an increased chance of stroke recurrence: 11.1% at 1 year; 26.4% at 5 years; and 39.2% at 10 years (Mohan et al, 2011). Studies have shown that effective secondary stroke prevention is associated with an 80% reduction in risk of early recurrent strokes (Rothwell et al, 2007). However, one out of every four strokes are recurrent (Di Carlo, 2009). The risk of stroke recurrence varies from 7.4% at three months (Moroney et al 1998), 5.1 at six months (Lee et al, 2004) and 11.1% at 1 year (Mohan et al, 2011). High recurrence rate suggests inadequate secondary stroke prevention strategies or lack of adherence to it.

1.1.2 Factors associated with stroke recurrence

Most of the time the factors associated with index stroke (the first episode of stroke), and recurrent strokes are different. The etiologic subtype of index stroke is associated with stroke recurrence. Large artery atherosclerosis is associated with increased risk of stroke recurrence whereas cardioembolic and undetermined cause have a lower risk of recurrence. (Lovett, 2004; Kauw et al, 2018). Patients treated in a hospital maintaining a stroke unit at index stroke had a reduced risk of recurrence (HR= 0.84; 95% CI 0.72–0.99) (Lee et al, 2004).

Presence of risk factors such as diabetes, hypertension, dyslipidaemia, atrial fibrillation is associated with increased risk of recurrence (Anderson, 2015; Rong Fu et al 2015; Lee et al, 2014; Leoo et al, 2008; Waters et al, 2016). Stroke survivors have unrecognized risk factors (Brenner et al, 2010), poor medication adherence and risk factor control (Brewer et al 2015; Kocaman 2015; Wangqin et al, 2017; Shani et al 2020). Nonadherence to statin was associated with increased risk of stroke recurrence (HR, 2.4; 95% CI, 1.1-5.2; P = .03). (Waters et al, 2015). It is estimated that for each 10% increase in adherence, an additional 6.7% fatal and non-fatal

cerebrovascular events can be prevented (Virginia et al, 2015). People suffering a recurrent stroke have poorer outcomes, increased disabilities, additional hospitalisation costs than with a first-ever stroke (Jerrgenson,1997, Samsa G P, 1999, Lopez, 2006). Adherence to pharmacological therapy and strict control of risk factors are essential for prevention of recurrent strokes.

1.1.3 Risk factor control

Strict risk factor control is integral to prevention of stroke recurrence. The target levels of blood pressure, blood sugars and lipid values are given by the American Stroke Association (ASA), American Diabetes Association (ADA) and National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III guidelines. The stroke survivors have unrecognized hypertension (18.7% vs 13.5%), unrecognized Stage 2 hypertension (4.4% vs 2.2%), and unrecognized diabetes (4.2% vs 3.2%) (Brenner et al, 2010). The disability caused by stroke may affect the initiation of secondary stroke prevention strategies by the patients. Stroke patients with more severe disability (Barthel score $\leq$ 14) were less likely to receive appropriate secondary prevention than those with mild or no disability (Barthel score 15 to 20) (Rudd A G, 2004). Poor risk factor control is associated with increased risk of stroke recurrence (Brewer et al 2015; Wangqin et al, 2017).

1.1.4 Medication adherence

Adherence to medication is important in the management of chronic diseases and is a mediator between the treatment and patient outcome. Over 30 -50% of medicines prescribed for long term illnesses are not taken as directed (Burkhart & Sabaté, 2003). It is a major problem in both developing and developed countries and medication adherence varies from 40- 85% among stroke survivors (Sappok et al, 2001; Khan et al, 2010; Kronish et al, 2013; Al Shaik et al, 2016; Albright et al, 2017; Cheiloudaki & Alexopoulos, 2019). The lowest ranges are from studies conducted in China and United States among low income under- privileged groups (Al Shaik et al, 2016; Chen et al, 2017). Medication nonadherence is associated with poor control of risk factors (Thorogood, 2004) and risk of death (OR=7.99; 95% CI 6.28 - 10.18) when compared to adherent group (Perreault et al, 2013). Adherence to

antihypertensives after stroke have been shown to reduce the incidence of cardiovascular events (Mayor, 2013), hospitalisations and health care costs (Sokol et al, 2005; Cutler, 2018).

1.1.5 Facilitators and barriers to medication adherence

Studies on factors associated with medication adherence among stroke survivors are mainly from developed countries. They have identified factors like difficulties in taking medications, fear of over medication, lack of knowledge on stroke and medication benefits and perceived discrimination from health care setting as the barriers (Glader et al, 2010; Souter et al, 2014; Bauler et al, 2014; Ruksakulpiwat et al, 2020). Support from caregivers and healthcare professionals, fear of recurrence, advanced age, following daily routines, fixed dose combination and counselling were facilitators for treatment adherence (Sappok et al 2001; Glader et al, 2010; Bauler et al, 2014; Banerjee, 2016; Jamison 2017). The use of alternate medicine is also a reason for stopping modern medicine among stroke survivors especially in Asian countries (Durai Pandian et al, 2012).

1.2 Statement of the research problem

In order to prevent stroke recurrence, the factors associated with stroke recurrence need to be identified. Nonadherence to medication and poor risk factor control were associated with poor patient out come and stroke recurrence is postulated by many authors (Kronish et al. 2013; Lummis et al, 2008; Alshaikh et al, 2016; Jamison et al, 2016) but the nature of relationship is not yet studied. Studies on stroke recurrences are mostly retrospective and they have studied the prevalence of cardiovascular risk factors in relation to stroke recurrence. Even though some studies looked up the stroke subtype, clinical and imaging predictors of stroke recurrence, there is lack of prospective study having a comprehensive assessment of clinical, imaging, life style, risk factor control and medication adherence. Identifying the factors associated with stroke recurrence has important implications for planning secondary prevention strategies to reduce the disease burden. There is no prospective study which had done a comprehensive assessment of medication adherence and cardiovascular risk factor control among stroke survivors. Causes of non-adherence

to treatment are multifactorial and studies exploring multidimensional indicators of adherence to medications intended to prevent recurrent strokes are lacking especially in low and middle income settings. Prospective assessment of risk factors of stroke recurrence through an incident case control study and a cross sectional exploration of medication adherence, risk factor control and facilitators and barriers to medication adherence is the major task of this thesis. The knowledge gained can improve the stroke care to prevent stroke recurrence in the community.

1.3 Objectives

1. To identify the factors associated with recurrence of stroke after first episode
2. To find out the medication adherence among survivors of first episode of stroke within a post stroke period of three months to one year.
3. To find out the control of risk factors among survivors of first episode of stroke within a post stroke period of three months to one year.
4. To find out the facilitators and barriers to medication adherence among survivors of first episode of stroke within a post stroke period of three months to one year.

1.4 Hypothesis

For the first phase of the study the hypothesis put forward was poor risk factor control, medication adherence, sociodemographic factors, index stroke related and other health behaviour related variables are associated with stroke recurrence. The hypothesis put forward for the second phase of the study was poor medication adherence and risk factor control among stroke survivors. Sociodemographic factors, stroke, treatment and other health behaviour related factors will be the facilitators and barriers to medication adherence.

1.5 Chapter Schemes

This thesis is divided into six chapters. The first chapter is the introductory chapter followed by chapter two which is review of literature. The review of literature provides a comprehensive review of current literature regarding the background of the study. It is divided into six major sections namely stroke recurrence, factors

associated with stroke recurrence, risk factor control, medication adherence among stroke survivors and facilitators, barriers to medication adherence and methods used in this study. The third chapter describes the methodology of the study. This study had two phases so the chapter is divided into two major sections. The first section elaborates the methodology of the first phase of the study that is the incident pair matched case control study. The second section details the methods by which the second phase of the study- cross sectional survey was done. The fourth chapter describes the results of the study. It has two sections namely results of case control study and results of cross sectional survey. The fifth chapter is the discussion on the study findings. The first section of this chapter describes the relevance of this research in comparison with available study reports on factors associated with stroke recurrence. The second section discusses the results on medication adherence, risk factor control and facilitators and barriers to medication adherence of the cross sectional survey in comparison with the existing literature. Chapter six is the conclusion and recommendation in view of the study findings. In the appendix section guideline for discharge planning and education and a check list for the same is attached. A discharge education module was also appended for health care workers. A discharge self education reading material for stroke patients in Malayalam language for prevention of stroke recurrence, risk factor control and medication adherence, prepared in view of this study findings is also appended. The study tools and patient information sheet and consent forms in English and Malayalam languages also included in the appendix.

Chapter 2

REVIEW OF LITERATURE

Literature review is the systematic search of all published and grey literature to identify and summarise a range of good quality references relevant to a specific topic. This study explores the factors associated with stroke recurrence after first ever stroke, medication adherence and its predictors and risk factor control among stroke survivors. Literature review was done systematically by searching all published and grey literature to identify studies relevant to the current study. The data base searched included *Pubmed, Google scholar*, internet source of *Cochrane library* and physical data base at Sri Chitra Tirunal Institute for Medical Sciences and Technology. The search key words included 'stroke recurrence', 'medication adherence among stroke survivors' 'facilitators and barriers to medication adherence among stroke survivors' and 'risk factor control among stroke survivors'. The articles published in English language between 1950 – 2020 were the search criteria. On initial search 17807 articles were obtained. Based on relevance 162 articles were included for final review. The result of literature review is summarised in five sections; Secondary stroke prevention, stroke recurrence and factors associated with stroke recurrence, medication adherence; concept, theories, facilitators and barriers to medication adherence and conceptual frame work for the study. A brief review about the research designs and the analysis methods used in this study is included in the last part of this chapter.

2.1 Section I: Secondary stroke prevention

2.1.1 Stroke prevalence and burden

Stroke is the second leading cause of death worldwide accounting for more than 6.7 million deaths annually (WHO, 2018). There is an increase in trend in the incidence and prevalence of stroke in developing countries. The secular trend shows contrast between the 40% reduction in incidence of stroke in the developed countries to a more than 100% increase in stroke incidence in the developing countries (Towfighi and Saver, 2011). The report on stroke burden in terms of mortality and

DALY from developed nations to developing countries showed, the developing countries had 4.85 million stroke deaths and 91.4 million DALYs annually compared to 1.6 million deaths and 21.5 million DALYs in developed nations (Moran et at, 2013). The demographic transition, increasing ageing population and life style changes are more likely to increase the incidence and prevalence of stroke in the developing nations (Amuna and Zotor, 2008; Bosu, 2010; Moran et at, 2013; Owolabi et al, 2015). Prospective community based surveys reported the annual incidence of stroke in United States, Australia and European countries which varies from 90-110/100,000 person years (Thrift et al, 2000; Heuschmann et al, 2009; Roger et al 2010), while in India it is 123/100,000 person years (Das et al, 2007) and in Kerala it is 135/100,000 person years (Sridharan et al 2009). The prevalence of stroke in India shows a wide variation of 147-922/100,000 across diverse community-based studies (Banerjee et al, 2005, Das et al, 2007, Dalal et al 2008). According to the India stroke factsheet updated in 2012, the estimated age-adjusted prevalence rate for stroke ranges between 84-262/100,000 in rural and 334-545/100,000 in urban areas (Tayler & Kumar, 2012). The prevalence of stroke in developed countries are higher compared to India and other developing countries due to the higher proportion of aged population in developed countries (Johnston et al 2003). Stroke accounts for 40 million disability adjusted life years (DALYs) (Truelsen et al, 2006). The economic and social burden caused by stroke is mounting (Evers, 2004).

2.1.2 Aetiology of stroke

Atherosclerotic disease of the major cerebral blood vessel is the major aetiology of Acute Ischemic Stroke (AIS). The atherosclerosis of the blood vessel ranges from mild narrowing of the vessel lumen to varying degree of vessel occlusion, which leads to the reduced blood flow resulting in ischemic stroke. Blood clot can form inside the damaged blood vessels. The blood clot gets enlarged and block the blood flow or part of the clot can embolise and block a distant blood vessel. Middle cerebral artery is the vessel commonly affected (Navarro-Orozco D & Sánchez-Manso, 2020). The other arteries like basilar artery, internal carotid artery and internal vertebral arteries also get affected. Large artery atherosclerosis is the

common cause of stroke and stroke recurrence. It is more prevalent in Asian, South Africans and Hispanics (Banerjee & Chimowitz, 2017). The atherosclerotic disease is caused by the modifiable risk factors such as diabetes, hypertension, dyslipidaemia, physical inactivity, unhealthy diet, cigarette smoking and metabolic syndrome. The stroke caused by other cerebral small vessel diseases are also attributed to chronic diabetes, hypertension and advanced age (Mehndiratta et al, 2012; Rafieian-Kopaei et al, 2014; Matos Casano et al 2020).

The major cause of haemorrhagic stroke, in which a blood vessel bleed into brain is caused due to uncontrolled hypertension. An ischemic stroke can eventually turn in to haemorrhagic stroke; haemorrhagic transformation due to advanced age, result of anticoagulant or thrombolytic therapy or due to other systemic illness and risk factors (Larrue, 1997). Sometimes cerebral small vessel diseases cause bleeding deep into brain structures, the cause is again attributed to uncontrolled diabetes and hypertension, resultant of un healthy life style (Rymer, 2011). The other subtype of stroke, Transient Ischemic Attack (TIA) caused due to an embolus originated from the heart or other blood vessel inside or outside the brain. It has recurrence chance of 10% in one month and the recurrence risk can be prevented by effective secondary stroke prevention strategies (Coutts, 2017).

2.1.3 Ischemic stroke subtypes

Ischemic stroke may occur as a result of a number of vascular diseases leading to the thromboembolic occlusion of the blood vessel. Identifying the exact cause of the disease is crucial in planning secondary stroke prevention strategies. For this purpose, the ischemic stroke is classified into five major etiologic subtypes (Adams et al, 1993; Adams HP & Biller J, 2015). The subtypes are Large artery atherosclerosis, Small vessel disease, Cardio embolism, other determined causes (coagulopathies and vasculopathies) and undetermined causes (incomplete evaluation, negative evaluation and more than two conflicting causes). In large artery atherosclerosis subtype, the patient has infarction affecting the cerebral cortex or both deep and cortical structures, the brain stem, or cerebellum and there is evidence for risk factors for accelerated atherosclerosis or symptomatic atherosclerotic

diseases like (coronary artery disease, aortic disease, and peripheral arterial disease) in other anatomic locations. Patients with deep infarct of less than 1.5mm in the basal ganglia, thalamus or internal capsule is considered as having the subtype of small artery occlusion. These patients should have evidence of arterial hypertension or diabetes mellitus, which are recognized risk factors for this arterial cause of stroke. For cardioembolic subtype there should be evidence of heart disease (Adams et al, 1993; Adams HP & Biller J, 2015). This classification is commonly used in clinical purpose and epidemiological studies.

Another classification of ischemic stroke is the Oxfordshire Community Stroke Project (OCSP) classification (Kobayashi et al, 2009) which explains the vascular territory involved helps in prognostication and predicting outcome. The classification is based on the vascular territory involved; total anterior circulation stroke, partial anterior circulation stroke, posterior circulation stroke and lacunar stroke (Kobayashi et al, 2009). Occlusion of small deep penetrating branches of the cerebral vessels from the circle of Willis leads to lacunar stroke (Dickman & Muller, 1985). This occlusion of small vessels is due to underlying medical conditions like long standing diabetes, hypertension and advanced age (Shah & Cole, 2010). The other types of strokes are caused due to large vessel disease, resultant of un healthy life style and cardiovascular risk factors like diabetes, hypertension and dyslipidaemia (Mehndiratta et al 2012; Rafieian-Kopaei et al ,2014; Matos Casano et al, 2020). The probable risk factor of stroke can be predicted from the OCSP stroke category (Subramanian G et al, 2009). This helps in etiologic evaluation and planning secondary stroke prevention strategies.

2.1.4 Stroke prevention

The primary prevention of stroke aims at identifying the persons who are at high risk of stroke and initiating interventions to reduce the risk of developing an event in the future. The primary prevention strategies are mainly targeting the physiological risk factors such as obesity, hypertension, dyslipidaemia and diabetes. All the patients who are attending health care services should be screened for these risk factors. Outreach community screening activities can also be planned. The secondary

prevention strategies for stroke include early diagnosis and prompt treatment which can be achieved by community education regarding the early warning signs of stroke, capacity building of the health professionals and infrastructure development for diagnosis and treatment (Miller & Spiker, 2003; Rothwell, 2004). Tertiary prevention strategies emphasise on case management and rehabilitation. Stroke outcome in the form of disability and social and economic burden has to be minimised. The other important area of stroke tertiary prevention is preventing stroke recurrence, because 30% of strokes are secondary (Di Carlo, 2009). Secondary stroke prevention is the challenging area which requires a collaborative approach from the patient, family, community and the health care system. Stroke prevention requires a life course approach. Most of the stroke prevention programs target adults ages 25 years or older but the social and genetic risk factors begin to act in the foetal, child hood and adolescent periods. Studies have shown that the atherosclerotic process may begin in the ages as early as 15 years (Oberman et al, 1994).

2.1.5 Secondary stroke prevention

Strict adherence to medication and risk factor control are integral to secondary stroke prevention. A comprehensive evidence-based guideline is issued by the ASA for recurrent stroke prevention. Compliance to this guideline can lead to an 80% reduction in recurrent stroke risk. A brief overview of secondary stroke prevention strategies includes the following; antiplatelet medications such as aspirin and clopidogrel to be initiated within 24 hours of a minor ischemic stroke or TIA and continued for 90 days. Antihypertensives medications to be initiated to achieve a systolic pressure <140 mm Hg and a diastolic pressure <90 mm Hg. Statin therapy with intensive lipid-lowering effects is recommended to maintain LDL-C level less than 100 mg/dL. After an ischemic stroke, all patients should be screened for diabetes and glycaemic control. Counselling should be given for lifestyle modification, diet, exercise and weight loss. Advise patients to engage in aerobic physical activity, average 40 minutes per session, 3-4 days a week. Strong advice to be given to quit smoking. Patient should eliminate or reduce alcohol consumption. Sodium intake should be reduced to less than ≈2.4 g/day. Further reduction to <1.5

g/day should be advised for BP reduction. Mediterranean type of diet instead of a low-fat diet can be followed. The Mediterranean type diet emphasizes vegetables, fruits, and whole grains and includes low-fat dairy products, poultry, fish, legumes, olive oil, and nuts. It limits intake of sweets and red meats (Kerman et al, 2014).

The secondary stroke prevention guidelines include medications to reduce thrombosis risk and control vascular risk factors like diabetes, hypertension, dyslipidaemia. It strongly insists behavioural modification in the form of medication adherence and adopting new life style such as healthy diet, physical activity, smoking cessation and limiting alcohol consumption. Studies have shown that the serious disability caused by stroke may have an impact on secondary stroke prevention. Rudd et al showed that stroke patients with more severe disability (Barthel score $\leq$ 14) were less likely to receive appropriate secondary prevention than those with mild or no disability (Barthel score 15-20) (Rudd A G, 2004). Cryptogenic stroke accounts for 13-50% strokes, which challenges secondary stroke prevention. It necessitates to carry out an exhaustive workup to exclude potential stroke mechanisms that may need a change in treatment of patients with strokes (Gutierrez et al, 2015). Stroke workup is expensive. The stroke units are predominantly located in the urban and private hospitals. Facilities for monitoring risk factor control and drug levels at the community level are not uniform throughout India. Recurrent stroke prevention medication is costly and the local availability is always in question. Non adherence to medication compounds the problem (Pandian & Sudhan, 2013). There is lack of uniformity and standardization of secondary and tertiary stroke care (Gutierrez et al, 2015).

2.1.6 Stroke prevention and Control program

The stroke prevention and control is included under an umbrella program-National Program for Prevention and Control of Cancer, Diabetes, Cardio Vascular Disease and Stroke (NPCDCS) as a government of India initiative from 2014. It is implemented as a pilot program in 100 districts across twenty-one states. Under 12th five year plan it was extended to all states around 640 districts. Presently, there are 665 District NCD (Non Communicable Diseases) Cells, 637 District NCD Clinics,

4472 Community Health Center NCD Clinics, 181 Cardiac Care Units and 218 Day Care Units functional in the country. The rationale behind combining all these diseases together is that the risk factors for all these diseases are unhealthy diet, physical inactivity, obesity, alcohol use and smoking. Various activities are planned at the state, district, community health centre, primary health centre and subcentre level and technical and financial support is being provided through this program. The Non-Communicable Disease (NCD) cells are created to ensure implementation and supervision of the programme activities related to health promotion, early diagnosis, treatment and referral and encourage partnership with private laboratories to help early diagnosis. NCD cells in collaboration with National Rural Health Mission (NRHM), National Tobacco Control Programme (NTCP), and National Programme for Health Care of Elderly (NPHCE) etc to create undertake activities to increase stroke awareness in terms of prevention, early detection, treatment strategies and appropriate referrals as indicated. It also monitors and evaluate the public health activities. The Accredited Social Health Activists (ASHA) are trained on prevention and control of non communicable diseases (DGHS, 2020).

The NPCDCS is undertaken as Amritham Arogyam program in Kerala state ant is functional throughout the state covering all the 5400 subcentres. Stroke acre is covered under Stroke Management (SIRAS- Stroke Identification Rehabilitation Awareness and Stabilisation Program) program. At various level it works providing services ranging from acute stroke care to rehabilitation and screening services at the periphery. Stroke intensive care units with facilities for CT scan and thrombolytic therapy are currently available in 9 district hospitals and the rest were completing. Teleradiology services are also available (Arogya Keralam, 2020).

The Division for Heart Disease and Stroke Prevention (DHSP) of Centers for Disease prevention and control (CDC) support several public health programs and efforts to prevent and control stroke in population of United States. It is one of the successfully implemented models to prevent stroke and heart disease. They have program at the state level, local level, Programs for tribal population, program for women and program in collaboration with Young Men’s Christian Association (YMCA)

The state level program activities include promote reporting of data on treatment and clinical data of patients with high blood pressure and high blood cholesterol, promote the use of evidence based guidelines to promote team based care, create community-clinical links for referrals, self-management and lifestyle changes and increase medication adherence

The local programs track and monitor proven clinical measures to improve the quality of health care. It also identifies patients with high blood pressure and high blood cholesterol and implement team-based care for testing for patients with high blood pressure and high blood cholesterol. It engages non-physician team members and link community resources and clinical services to foster bi-directional referrals. The tele health and mobile health technology are utilised to promote rehabilitation programs in the traditional and community settings and including home-based settings.

The third component of the program is WISEWOMAN (Well-Integrated Screening and Evaluation for Women Across the Nation) to serves the low-income, uninsured, and underinsured women aged 40 to 64 years. The YMCA of the USA (Y-USA) promote self monitoring of blood pressure and other heart health activities among adults with high blood pressure. It also teaches proper measuring techniques, give individualized support and nutrition education for blood pressure control. Patients measure blood pressure two times a month and get two appointments with the physician and participate in monthly one nutrition education.

The tribal program includes a cooperative agreement for American Indians and Alaska Natives that allows grantees to develop and work on strategies to improve the health of tribal communities. This cooperative agreement supports the following activities: work on effective community-chosen and culturally adapted strategies, provide leadership, technical assistance, training, and resources to tribes and villages, in consultation with or at the request of, tribes, tribal organizations, and urban Indian organizations.

Association of State and Territorial Health Officials (ASTHO), with the support of CDC, created and refined a new system change model for public health. The collaborative group across state and local communities including public health agencies, health care, quality improvement organizations, health information technology experts, payers, and community-based organizations was created to develop, expand, and sustain efforts to improve hypertension prevention, detection, and control. ASTHO brought state teams together to share insights and tools to help strengthen and transform blood pressure control across the nation and achieved greater improvement in hypertension and other chronic disease control (CDC, 2020).

The stroke and other chronic noncommunicable prevention and con control program need multidisciplinary approach, support from voluntary organizations, self help groups and other influential people in the society for its successful implementation and outcome. The governmental agencies can supervise, control and issue guidelines regarding the functioning and strategies.

2.2 Section 2: Stroke recurrence and factors associated with stroke recurrence

2.2.1 Recurrent stroke

A recurrent stroke is defined as a stroke with clinical evidence of sudden onset of a new focal neurological deficit with no apparent cause other than that of vascular origin (i.e., the deficit could not be ascribed to a concurrent acute illness, epileptic seizure, or toxic effect) occurring any time after the index stroke (Chinese acute stroke trial, 1997). Recurrent strokes can occur any time after the index stroke. The factors related to early and late recurrences are different. In the present study recurrent stroke beyond one month after first episode among survivors of first episode of ischemic stroke, haemorrhagic stroke or transient ischemic attack with evidence of acute infarct within one month of stroke recurrence were the selected participants. Recurrence beyond one month was selected because early recurrences may often be confused with progression of index stroke and the factors of interest to us are related to life style and health behaviour.

Despite the evidence-based strategies to prevent recurrent strokes, the recurrence rate is high. One out of every four strokes are recurrent. The recurrence rate varies from 2.2- 25.4% at first year (Chin et al, 2018). Around 50% of the stroke survivors develop a recurrent event within seven days of index stroke and is associated with uncontrolled blood pressure and large vessel disease (Arsava et al, 2016 & Elnady et al, 2020). The recurrence rate at one month was 2.7%. At three months, the reported rate varies from 3.9-16.1% (Moroney et al 1998; Mohan et al, 2011; Wangqin et al, 2017). The stroke recurrence risk at two years was 12.9% and the cumulative recurrence risk at five year was 16% (Mohan et al 2011). The stroke recurrence rate is high among Asian population especially Chinese, Japanese and Koreans compared to western population (Kim et al, 2016). No study from India reported the incidence or prevalence of stroke recurrence (Chin et al, 2018). People suffering a recurrent stroke have poorer outcomes, increased disabilities, additional hospitalisation costs than with a first-ever stroke (Jorgensen, 1997; Samsa G P, 1999; Lopez, 2001).

2.2.3 Factors associated with stroke recurrence

The causes of stroke recurrence are multifactorial and studies have reported contrasting findings. The type of index stroke and recurrent strokes are often different, often the etiologic subtype may also differ (Hillen et al, 2003; Shamsaee et al, 2012). Change in etiologic subtype happened between 45.5% of index and recurrent strokes (Hillen et al, 2003). This necessitates exploration of various factors which are associated with stroke recurrence.

The incidence of stroke recurrence was highest during the first year after an initial ischemic stroke (12.8%). In the subsequent years the recurrence risk declines but never reaches to zero (Buenaflor, 2017). The early recurrence within one year is mainly attributed to atherosclerotic disease of the large blood vessels (Lovett et al 2004), but in the subsequent years recurrences are mainly attributed to cardiovascular risk factors such as diabetes, hypertension, dyslipidaemia and coexisting diseases (Sacco et al, 1994; Petty et al, 1998; Hankey et al 2000).

Advancing age as a risk factor for recurrence stroke is shown by studies but gender difference shows inconsistent results (Lee et al, 2003; de la Camera A G,

2014; Zao et al, 2017). One study found increased risk for stroke recurrence among urban residents (Rafie et al, 2019). None of the previous studies assessed the effect of other sociodemographic factors like education and occupation on stroke recurrence.

Nonadherence to medication and poor risk factor control were associated with poor patient out come and stroke recurrence (Anderson, 2015, Rong Fu et al 2015, Lee et al, 2014, Leoo et al, 2008, Waters et al, 2016). Stroke survivors have unrecognized risk factors (Brenner et al, 2010), poor medication adherence and risk factor control (Brewer et al 2015, Kocaman 2015, Wangqin et al, 2017, Shani et al 2020). Previous studies showed poor risk factor control among stroke survivors and is associated with stroke related medical complications (Wang et al, 2016). Patients with stroke related medical complications, post stroke depression and physical disability (Brenner et al 2010) were less likely to get and follow preventive measures (Wang et al, 2016; Wu et al, 2019). Post stroke depression is independently associated with stroke recurrence and is due to poor medication adherence compliance to other secondary stroke prevention strategies (Morgenstern et al, 2011; Wu et al, 2019).

The etiologic subtype of index stroke is an important factor which predicts stroke recurrence with large artery atherosclerosis having increased risk of recurrence whereas small vessel stroke has a lower risk of recurrence (Lovett et al 2004; Kauw et al, 2018). Cardioembolic stroke is associated with increased risk of stroke recurrence (Lovett et al, 2004; Wolf et al, 2013; Kauw et al 2018). Ischemic type of stroke is associated with high recurrence risk compared to haemorrhagic stroke and TIA (Kauw et al, 2018). The index stroke related variables like high NIHSS score is associated with high recurrence risk (Lee et al, 2004). Patients treated in a hospital maintaining a stroke unit at index stroke had a reduced risk of recurrence (Lee et al, 2004). Meta analysis on imaging predictors of stroke recurrence showed multiple lesions and multiple territory lesions associated with greater risk of recurrence (Kauw et al, 2018), whereas lacunar stroke being associated with less risk of recurrence.

Presence of risk factors such as diabetes, hypertension, dyslipidaemia, ischemic heart disease and atrial fibrillation was associated with increased risk of stroke recurrence (Anderson, 2015; Rong Fu et al, 2015; Lee et al, 2014; Leoo et al, 2008; Waters et al, 2016; Shamsaee et al 2012; Emerging risk factors collaboration, 2010) Only few studies explored the risk factor control status and stroke recurrence but have yielded inconsistent results on risk factor control and stroke recurrence (Cheng et al, 2014; Kim et al, 2016; Wanquin et al, 2017; Turan et al, 2017; Kocaman et al, 2015). The other risk factors like obesity and lack of physical activity are also associated with stroke recurrence. (Xu et al, 2007; Turan et al 2017; Kono et al, 2014). The dietary habit and stroke recurrence were not assessed in any studies. Smoking is associated with stroke recurrence (Xu et al, 2007) but none of the studies assessed alcohol intake and stroke recurrence.

Starting therapy with oral anticoagulants (HR: 0.390; p=0.003) and clopidogrel use (HR: 0.318; p=0.01) (Leoo et al, 2008) is associated with reduced risk of stroke recurrence. Similarly, nonadherence to statin was associated with increased risk of stroke recurrence (HR, 2.4; 95% CI, 1.1-5.2; P = 0.03). (Waters et al, 2016). Adding therapy with metformin for diabetes reduce the risk of stroke among stroke patients (Cheng et al, 2014). It is estimated that for each 10% increase in adherence, an additional 6.7% fatal and non-fatal cardio vascular events can be prevented (Virginia et al, 2015). Complementary and alternative medicine is commonly used by persons with stroke throughout the world, particularly in Asia. Ludhiana stroke registry showed it is exclusively used by 13.3% stroke patients. This may be the reason for noncompliance to allopathic treatment (Pandian et al, 2012).

2.2.3 Attributable fraction of stroke recurrence

Inorder to accurately estimate the risk associated with a particular exposure to cause the disease, the epidemiologists often rely on multiple methods. While the odds ratio estimates the associated with the exposure, the attributable fraction estimates the excess risk among the exposed to get the diseases or the risk attributable to a particular exposure. Attributable fraction for stroke recurrence was

not commonly reported in most of the studies. Hillen et al. in 2003 found out the attributable fraction of stroke recurrence for diabetes 36.93% (95% CI, -3 to 62.63) and to atrial fibrillation 19.68 % (95% CI, -34.4 to 52.0) during the first year after the index stroke among stroke survivors (Hillen et al, 2003). Even though it was a large prospective follow up study of more than 1600 stroke survivors, they have reported attributable fraction using a statistically non significant hazard ratio for diabetes and atrial fibrillation. But none of the other variables were studied and reported. Large population surveys conducted among general population reported the attributable fraction for incidence of first ever stroke with hypertension being the top most one with an attributable fraction of 23.6% (Park et al, 2015) another study showed a highest attributable fraction of 45% for smoking (Yi et al, 2020). The INTERSTROKE study reported an attributable fraction of total 88.1% for the risk factors hypertension, diabetes, physical inactivity, smoking, alcohol use, waist to hip ration, apolipoproteins ratio, depression and stress in that study also hypertension ranked one (O'Donnell et al, 2010).

The population attributable risk (PAR) is another method of estimating risk which explains the added risk in the exposed population. It considers the excess risk associated with the exposure and the prevalence if risk factor in the population. The Population Attributable Fraction (PAF) is the proportion of cases in the population that can be attributed to the exposure in the population. PAF is an efficient tool for public health perspective, yet underutilised. After considering the value of PAR for selected risk factors, the one with higher value may be most important for planning interventions. While interpreting PAR for risk factors the modifiable nature of the risk factor need to be considered. PAR can be used in program planning to estimate the impact of intervention in the population. The PAR calculated from the 2x2 table is un adjusted for other variables so the total risk for the different risk factors can add to more than hundred. There are regression models in which PAF can be directly calculated adjusted for other variables (Greenland & Drescher, 1998; Ruckinger et al, 2009). Hillen et al. in 2003 reported population attributable fraction of stroke recurrence for diabetes 9.1% (95% CI, -2.0 to 20.2) and atrial fibrillation 4.9% (95% CI, -7.3 to 17.2) among stroke population over a period of one year after index

stroke (Hillen et al, 2003). The overall adjusted population attributable fraction of first ever stroke for the risk factors hypertension, hyperlipidaemia, diabetes mellitus, coronary heart disease, smoking, heavy episodic alcohol consumption, low physical activity and obesity was reported as 78.9% in a large nation wide age and sex matched case control study in Japan (Aigner et al, 2017).

The population attributable fraction is calculated using data from multiple sources which makes uncertainty in the estimation. This estimation depends on time, population and quality of the data on exposure and risk. The data on exposure to risk factor in the population is obtained from population surveys which may have the selection biases and participation biases (Shield & Rehm, 2012; Groves 2004). The report on exposure information may be subject to comprehension of question, recall bias, purposeful non reporting due to social unacceptability (Strack & Martin, 1987). There are methods to adjust and match, the exposure information from surveys to population level exposures (Rehm et al, 2010). those modalities can be utilised have a better estimation of PAF.

The secondary stroke prevention requires individualised education for patients and care givers on medication adherence and risk factor control. Planned discharge with a discharge education can ensure that patient and care givers get adequate information on stroke recurrence prevention. A check list can be used to plan and implement discharge education. Various studies have shown that the education interventions given by doctors, nurses or physiotherapists are equally effective in behaviour modification (Ellis et al, 2005; Hohmann et al, 2009).

Studies on stroke recurrences are mostly retrospective and have looked at the prevalence of risk factors and stroke subtype in relation to stroke recurrence. There is lack of prospective study with a comprehensive assessment of life style, behavioural factors, risk factor control and medication adherence stroke recurrence. None of the studies assessed the effect of medication adherence and following other health recommendation on risk factor control and stroke recurrence. Identifying these factors has important implications in planning secondary prevention strategies to reduce the stroke burden.

2.2.4 Medication adherence

The World Health Organization (WHO) defined adherence as "The extent to which a person' s behaviour—taking medication, following a diet, or making healthy lifestyle changes—corresponds with agreed-upon recommendations from a health-care provider" (WHO, 2003). Attributes of medication adherence are: knowing and agreeing to the medication, communicating and negotiating the regimen and active, continuous involvement and appraisal of the treatment effect. The identified antecedents of medication adherence include a valid prescribed medication regimen, cognitive and action abilities in her / his role as a patient and a level of preparation for medication treatment. The consequences of medication adherence are improving symptom control, decreasing re-hospitalizations and mortality, reducing medical care costs and restoring self-esteem (Bissonnette et al, 2008).

Medication adherence is a cluster of behaviours simultaneously affected by multiple factors. According to WHO there are five interacting dimensions of medication adherence (figure 1). Each dimension will have many factors and many of the factors are not exclusive to one dimension rather they may overlap each other. One or more dimensions can contribute to patients' non adherence. The five dimensions are—health-care system or team, patient, therapy, condition, or social and economic factors. Improved adherence requires the successful interplay between the patient and those involved in managing his care (Sebateb, 2003).

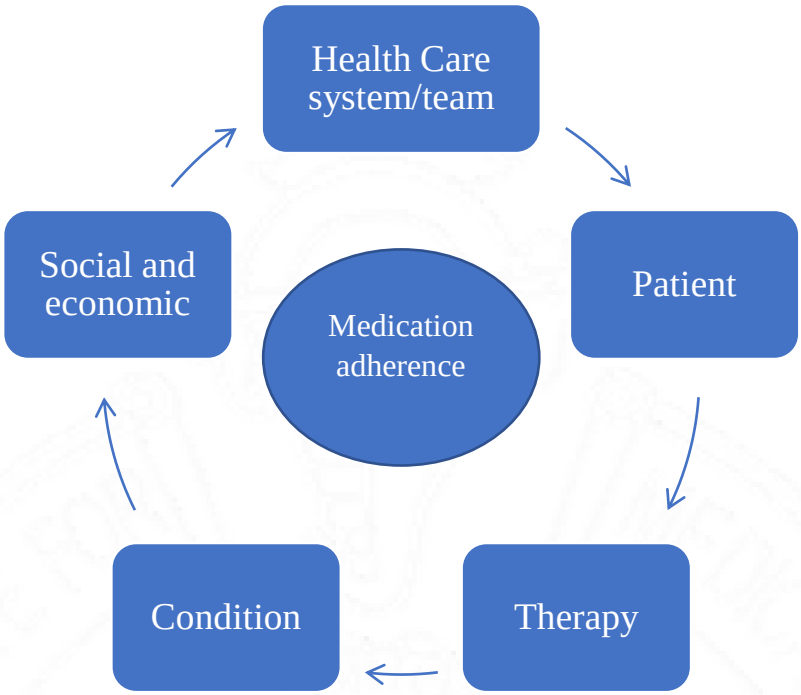


Figure 1: Five Interacting Dimensions of Medication Non-Adherence

Poor adherence encompasses much more than patients not taking their medicines as directed. The healthcare seeking behaviour, following protocols for changing behaviour, all these involve provider recommendations and patient decisions. The issues surrounding medication use are often very different from those involving dietary adherence, adherence to follow-up appointments, or adherence to diagnostic testing recommendations (Bissonnette JM, 2008). Poor adherence compounds the challenges of improving health of the poor population, and result in waste and underutilisation of already limited treatment resources. These consequences impair the ability of the health care system around the world to achieve population health goals. Increasing effectiveness of adherence interventions have far greater impact on health of the population than any improvement in specific medical treatment (Sebateb, 2003). It is estimated that for each 10% increase in adherence, an additional 6.7% fatal and non-fatal cerebrovascular events can be prevented with an incremental cost effectiveness ratio of £8200 per QALY (Quality Adjusted Life Years) gained (Virginia et al, 2015).

2.2.5 Types of medication nonadherence

Adherence is not a dichotomy. Wide variety of pattern of medication use (WHO, 2003).

- Nonfulfillment or primary non adherence:

In this case, providers have made recommendations about a course of therapy that the patient ultimately does not initiate.

- Non persistence:

In which patients decide to stop taking a medication after starting it, without being advised by a health professional to do so. Non persistence can happen, at any point in time and is rarely unintentional (e.g., when patients and providers miscommunicate about therapeutic plans).

- Nonconforming:

Which encompasses a variety of ways in which medications are not taken as prescribed; this behaviour can range from skipping doses, to taking medications at incorrect times or at incorrect doses, to even taking more than prescribed.

- Full adherence:

A medication must be appropriately prescribed, filled, initiated, continued, and taken as intended.

2.2.6 Theories of medication adherence

Different theoretical perspectives can be used to explain the behaviour of adherence-biomedical, behavioural, communication, cognitive and self –regulatory etc. Several general theoretical frameworks from the literature in social psychology are useful in understanding adherence (Semin,1997; Coreil, 2001). The intrapersonal models use mental construct about a health related domain. Emphasis of these models is on cognitive and behavioural factors such as knowledge, attitude, perception, intention, and expectancies. Examples of intrapersonal models are health belief model, theory of planned behaviour, trans- theoretical model and self-

regulatory model. They emphasize the active role of the person. Inter personal models argue that social context of people influences their health e.g. social cognitive theory, common sense self regulation model etc.

Common sense self-regulation model (CS-SRM) takes the most comprehensive approach to representing the concepts that are proposed to influence adherence behaviour (Semin, 1997; Pillips L A, 2011; Coreil, 2001; Quinn, 2001). CS-SRM also has the potential to be the most successful at predicting adherence behaviour over a longer period. This theory incorporates the basic concepts of other theories such as severity, susceptibility specific to that illness, ability to perform the treatment and treatment efficacy specific to the illness, experienced symptoms of that illness of a particular patient. Illness identity, causes, timeline, consequences and control belief affect the initial phase of adherence behaviour development. It also incorporates two constructs which are relevant for behaviour maintenance beyond its initiation. As the patient becomes aware of the health threat, forms belief about treatment and his abilities which is influenced by the conflicting information he receives from his environment, his own personal experiences and other resources. Based on the belief formed they intent to adhere or non-adhere. The specific health belief formed into cognitive representation integrate feedback from time to time. If the performance of the behaviour results in evidence that it works, it confirms the patient's belief and it became coherent. Feedback from behavioural performance motivate behavioural repetition, repetition leads to routinization and the person acquires a strong behavioural habit. This may motivate multiple behaviour repetition also. The potential barriers to this phase are tempting behavioural alternatives, cost, time, physical limitations, low motivation, too varied daily routine etc (Coreil 2001). The diagrammatic representation of this theory is shown in figure 2.

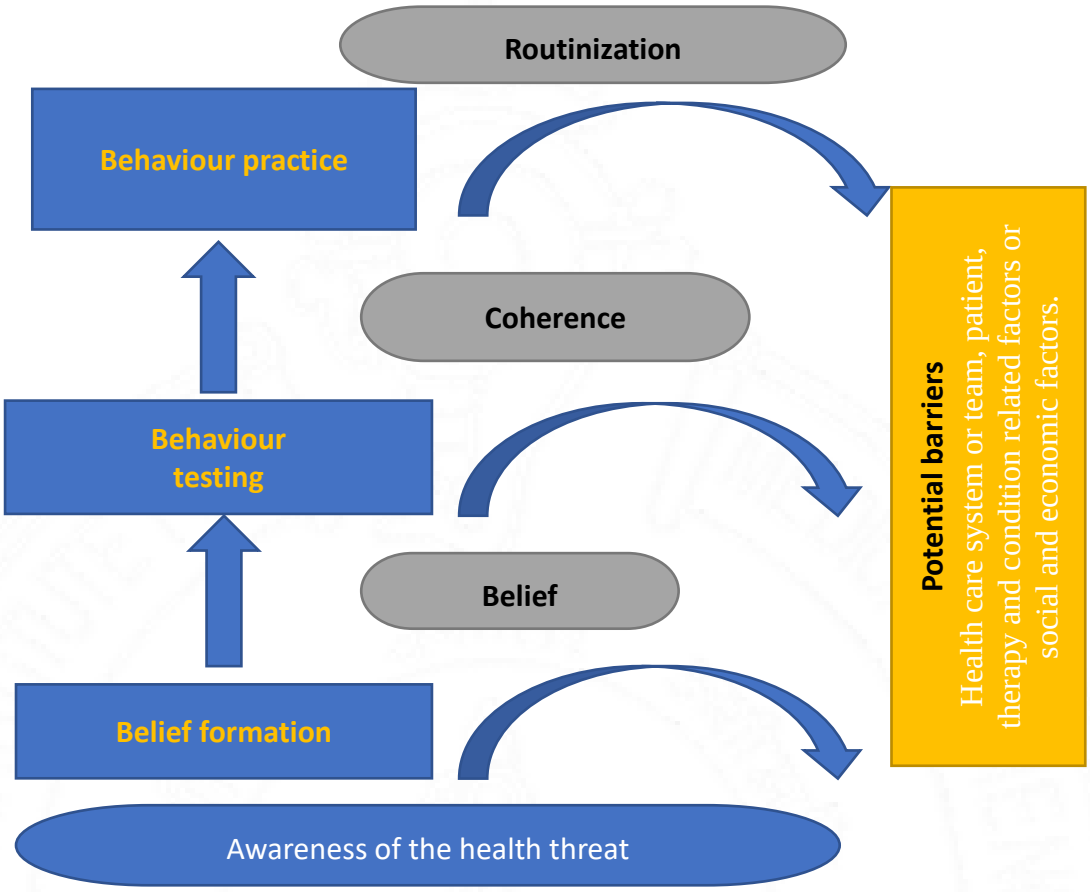


Figure 2: Common sense self- regulation model explaining medication adherence behaviour (Phillips L A, 2011).

2.2.7 Facilitators and barriers to medication adherence

Health Care team/system factors include issues related to health-care delivery or patient-provider relationship such as communication skills, knowledge of health literacy issues, lack of empathy, lack of positive reinforcement, access to care, continuity of care, patient education material not written in plain language. Patient factors include stress of health-care visits, discomfort in asking questions to providers, patient's belief or understanding, patient's forgetfulness or carelessness, stressful life events, lack of immediate benefit of therapy. Condition or therapy related factors include complexity of medication, frequent changes in regimen, treatment requiring mastery of certain techniques, unpleasant side effects, duration of therapy, lack of immediate benefit of therapy, number of comorbid conditions and number of medications needed per day. Social and economic factors include Inability to access or difficulty accessing pharmacy, lack of family or social support, unstable living conditions and medication cost. The patient's abilities and resources will become the actual barriers and patient can go for unintentional non adherence. Patient believes and motivations become perceived barriers and they can go for intentional non adherence (WHO, 2003).

There are more than 150 factors identified to influence medication adherence among patients (WHO, 2003). Physical disability, dependence, swallowing difficulty, size of medication, memory loss, depression, job loss, financial problems, alternative therapies, believes psychological factors like denial, stubborn refusal – these factors pose additional burden for stroke patients. The effect of gender, income and education on medication adherence was inconsistent and varied in studies conducted in different settings. Studies done among low income group had identified high cost of medication and difficulties to access health care as barriers to medication adherence (Burkhart & Sabaté,2003; Crayton et al, 2017). A study done in a developed country among stroke survivors also found out no effect of income on medication adherence (Sjo¨lander et al, 2016). A systematic review of 21 studies showed almost similar level of poor medication adherence among patients with free medication and with different payment schemes (Aziz et al, 2016).

Qualitative study conducted in France among stroke survivors found out that difficulties in taking medications, lack of knowledge on stroke and medication benefits, fear of over medication are the barriers for adherence in stroke patients (Bauler S, 2014). Care givers expressed that, doubts about generic drugs, lack of knowledge and absence of clinical symptoms as barriers. Support from caregivers and healthcare professionals were found as a facilitator for compliance in all participants. Patients and caregivers expressed that fear of recurrence was a facilitator for treatment compliance (Bauler S, 2014). Complementary and alternative medicine (CAM) is commonly used by persons with stroke throughout the world, particularly in Asia. About 36.3% of stroke survivors sought complementary and alternative medicine and 13% exclusively used it. They have identified lack of transportation, care giver time and personal and philosophical belief as the reasons for discontinuing treatment (Pandian et al, 2012).

A systematic review of 25 studies to find out the health care system barriers and facilitators to adherence to secondary prevention medication for cerebrovascular disease found out that full prescription coverage, reduced co-payments, fixed dose combination and counselling may be effective in improving adherence. Prescribing a complex regimen is independently associated with poor adherence (Banerjee A et al, 2016). Adherence to oral anticoagulants at one year post stroke was fairly good (80%) in a study conducted in Germany and disability at one year was independent predictor of poor adherence (Luger et al, 2015). Another systematic review conducted to find out the adherence to secondary stroke prevention medication and factors associated with medication adherence commented that 27 out of 29 included studies have high risk of bias. The nonadherence level was 30.9% (95% CI 26.8%–35.3%). Commonly reported factors included concerns about treatment, lack of support with medication intake, polypharmacy, increased disability, having more severe stroke and absent history of atrial fibrillation (Alshaikh et al, 2016). A study conducted in Sweden revealed that the proportion of patients who were persistent users of drugs prescribed at discharge from hospital declined progressively. At 2 years adherence became 74.2% for antihypertensive drugs, 56.1% for statins, 63.7% for antiplatelet drugs, and 45.0% for warfarin. For most drugs, advanced age,

comorbidity, good self-perceived health, absence of low mood, acute treatment in a stroke unit, and institutional living at follow-up were independently associated with persistent medication use (Glader et al, 2010). Other factors found to be associated with medication adherence among stroke survivors are increased concerns about medications, low trust in their personal doctor, problems communicating with their doctor due to language, perceived discrimination from the health system, difficulty accessing health care and inadequate continuity of care (Banerjee et al, 2013, Kronish et al, 2013), advanced age (Sappok,2001, Lummis et al, 2008), stroke severity on admission, cardioembolic cause (Sappok,2001), post-traumatic stress disorder (Kronish et al, 2012), disability prior to stroke, high cost (Lummis et al, 2008).

A systematic review of psychological determinants of medication adherence revealed perceived medication necessity is a major facilitator to medication adherence (Crayton et al, 2007). Following daily routine facilitated medication adherence (Jamison et al, 2017). Qualitative study findings showed difference in medication adherence among those have care giver support or not (Thorogood, 2004 & Bauler, 2014).

A qualitative thematic analysis was conducted from post stroke patients and their caregivers in an online forum of United Kingdom stroke association to find out barriers and facilitators of medication adherence in patients with stroke along with their caregivers. Forty-nine stroke patients and 33 care givers participated. Perceptions reducing the motivation to adhere included dealing with medication side effects, questioning doctors' prescribing practices and negative publicity about medications, especially in regard to statins. Caregivers faced difficulties ensuring medications were taken while respecting the patient's decisions not to take tablets. Not experiencing side effects, attributing importance to medications, positive personal experiences of taking tablets and obtaining modification of treatment to manage side effects were facilitators of adherence. Key practical barriers included difficulties with swallowing tablets, dealing with the burden of treatment and drug cost. Using medication storage devices, following routines and getting help with medications from caregivers were important facilitators of adherence (Jamison et al,

2017). A qualitative study conducted among stroke survivors reported practical barriers to medication adherence after stroke include forgetting medication, difficulty in swallowing tablets and difficulties in handling packaged medications (Souter et al, 2014).

Ability of the patient to follow treatment can be compromised by more than one barrier but there is a tendency to focus on patient related factors. Health care environment in which patient receives care have more impact on adherence behaviour than any other factors. The reasons for nonadherence are often multifactorial. There is conflicting evidence in these studies. Despite of extensive knowledge base, the effort to deal with the problem has been fragmented. Methodologically sound, multidisciplinary approach is needed to identify the barriers and facilitators to medication adherence. In the present study a comprehensive literature search was conducted to include all the relevant variables.

2.2.8. Measurement of medication adherence

There is no gold standard for measuring adherence. Self-reported nonadherence has a high negative predictive value. The widely accepted definition of medication adherence is at least consumption of more than 80% of their medications prescribed. This is the cut off accepted by the clinical trials to calculate drug efficiency. The subjective and objective measurements of adherence indicate different aspect of adherence behaviour. The subjective measures determine the belief and barriers to adherence while the objective measures describe how the patient performs the medication regimen. The methods of pill count and electronic devices do not ensure the ingestion of medication by the patient. The questionnaires such as Hill-Bone Compliance Scale, Medication Adherence Rating Scale (MARS) and Brief Medication Questionnaire are validated for specific health conditions (Lam & Fresco,2015). Morisky Medication Adherence scale (MMAS-8) and Medication Adherence Questionnaire (MAQ) have good sensitivity and specificity and are recommended to use in validated conditions with outcome data. Morisky Medication Adherence scale (MMAS-8) questionnaire is not in the public domain and not validated for stroke. But the permission request to use and validate in stroke was

denied. The other direct and indirect methods of measuring medication adherence are:

- Direct methods

  Drug levels in biological fluids

  Direct observation

- Indirect methods
  - Patient surveys [validated questionnaires MMAS-8, MAQ, Hill-Bone Compliance Scale and MARS]
  - Pill count
  - Biologic markers
  - Electronic monitoring device
  - Prescription claims data

2.2.9. Prevalence of medication nonadherence among stroke survivors

Medication non adherence is a major problem in both developing and developed countries. WHO report on non-adherence, estimated that over 30 -50% medicines prescribed for long term illnesses are not taken as directed. A study of over 3,000 patients in Germany, reported that 84% were still taking aspirin at one year post stroke, 77% oral anticoagulants, but only 61% who were prescribed clopidogrel at discharge were still taking it one year later (Hamann et al., 2003). The reported medication adherence varies widely from 40- 85% among stroke survivors (Sappok et al, 2001; Khan et al, 2010; Kronish et al, 2013; Al Shaikh et al, 2016; Albright et al, 2017). The lowest ranges are from studies conducted in China and United States among low income under- privileged groups (Kronish et al, 2013; Chen et al, 2018). There is no published study from India on medication adherence among stroke survivors that could be identified.

2.2.10. Interventions to improve medication adherence

Ability to follow treatment is compromised by more than one barrier but tendency to focus on patient related factors. Health care environment in which patient receives care have more impact on adherence behaviour than any other factors. Unimodal interventions have been less successful than multimodal interventions, because the reasons for nonadherence are often multifactorial. Multimodal interventions have shown the most promise and have improved adherence and outcomes.

The ultimate goal of adherence interventions is to improve patients' medication taking behaviour. The interventions should target health care providers, patients and family, health system, technology, policy or combination of these dimensions. Interventions may be delivered face-to-face, by telephone, with print materials, by computer, or by a DVD, video, or CD/audio or can be more than one mode of delivery. Education of illiterate people, assessment of social needs and family preparedness are reported to be effective interventions. Social and peer support were also found to be effective in increasing adherence. Participation in patients' organisations and support of community health professionals have been shown to be effective in promoting and maintaining adherence (Ruggieron L et al,1997; MacLean D & Lo R, 1998; Broadhead et al, 2002).

Meta-analysis of 15 randomized control trials (RCT) on efficacy of financial reinforcement interventions for medication adherence, found out reinforcement interventions significantly improved adherence comparing to control conditions with an overall effect size of 1.77 (95% CI = 1.70–1.84) (Nancy et al, 2012). Education, motivational interviewing, risk communication, behavioural interventions like telephonic and electronic reminders, habit training were associated with increased adherence. Self-management interventions are effective in improving outcomes in people with long-term conditions (Barlow et al, 2002). Patient re-enforcement, reminding, patient information and education were the most promising type of interventions (Tuldra, 2000; O'Carrol et al, 2012). Reminders through Short Text Messages (SMS) have been shown to decrease the rate of non-adherence by 24–26%

(Liu, 2008; Kamal 2015). Various studies have shown that the education interventions given by doctors, nurses or physiotherapists are equally effective in behaviour modification (Ellis et al, 2005; Hohman et al, 2009).

The major limitations of these studies include the fact that outcome measure was not specified or not supplemented or even adherence not measured; only the risk factor levels were monitored. In most of the studies the content and method of delivery of interventions were not mentioned. Interventions are not targeted to causes of nonadherence. In case of multicomponent interventions, there is infrequent justification of the relevance of certain interventions in improving adherence. There is no theoretical framework in framing the studies and this precludes development of understanding of the phenomenon of adherence/nonadherence.

2.3. Conceptual framework for this study

The key objectives of the thesis were to find out the factors associated with stroke recurrence, medication adherence and risk factor control among stroke survivors and explore the facilitators and barriers to medication adherence. This framework uses theoretical concepts such as patients believes about stroke and treatment, besides a priori expectations and other factors and insights provided by the literature.

The secondary stroke prevention guidelines intended to prevent stroke recurrences among survivors of first episode of stroke is developed based on the known risk factors of stroke recurrence. The secondary stroke prevention guidelines include medications to reduce thrombosis risk and control risk factors like diabetes, hypertension, dyslipidaemia. It strongly insists behavioural modification in the form of medication adherence and adopting new life style such as healthy diet, physical activity, smoking cessation and limiting alcohol consumption. Early initiation of treatment for secondary stroke prevention is associated with an 80% reduction in risk of early recurrent stroke.

The clinical and treatment factors related to the index stroke, sociodemographic factors, mental and behavioural factors, access to health care,

presence and control of risk factors and medication adherence can affect stroke recurrence risk.

The a priori assumption was that there is poor medication adherence and risk factor control among stroke survivors. A cross sectional survey was designed to find out the medication adherence and facilitators and barriers to medication adherence among stroke survivors. The targets for risk factor control was defined as per guidelines and compared.

The variables for facilitators and barriers to medication adherence was selected from theories of medication adherence and insights given by literature. The variables were categorised into five dimensions as per the WHO classification such as- sociodemographic, access to health care, stroke related, life style and patients' belief about disease and treatment.

As the patients accept the disease and potential chance to recurrence, they will initiate the medications. After the initiation of medication adherence behaviour, the factors in the sociodemographic, access to health care, stroke related, life style and patients' belief about disease and treatment domains may facilitate or act as a barrier for continuing the adherence behaviour. Good medication adherence with following other health recommendations may help achieve the intermediate outcome of risk factor control. The intermediate outcome of medication adherence was defined as attaining the targeted BP, RBS, HbA_1C, LDL and HDL. As the patient experience the good outcome of continuing the adherence behaviour, it acts as an incentive to continue the same behaviour. Repetition of same behaviour leads to routinisation and helps develop a strong behaviour habit. The intermediate outcome of following a healthy life style was to follow a healthy diet, following recommended physical activity, quit smoking and reduce the intake of alcohol. The conceptual frame work of this study is given in figure 3.

2.4. Research designs used in this thesis

This research used two types designs to achieve the objectives. The first phase of the study used case control design and the second phase used cross sectional survey design. The pros and cons of these research designs are briefly explained in this section.

2.4.1. Case control design

In case control study the participants are recruited based on the presence or absence of the outcome or the disease as cases and control respectively. The exposure to suspected etiological factors are identified from both cases and controls through recall using self-administered or interviewer administered questionnaires, historical records or through blood markers. The past exposure to etiological agents is compared between cases and controls to get the odds ratio for getting the disease (Setia, 2016; Rothman et al, 2008). The diagrammatic representation of case control study design is shown in figure 4.

Cases can be identified through proper and suitable case definition, otherwise selection bias can arise. The cases can be recruited from hospital or community. Hospital recruitment is influenced by the presence of disease as well the severity and other factors. Incident cases as well as prevalent cases can be recruited. Incident cases are ideal as the factors identified through prevalent case control study may be related to the cause of the disease and survival till date (Rothman et al, 2008).

The controls should be similar to the cases except for the presence of the disease They can be selected from the same population from where the cases are recruited so that they have same exposure characteristics as that of cases but their recall of exposure may not be comparable with that of cases. The other source of control is from the hospitalised patients with other diseases. But their exposure may not be representative to the population and sometimes the risk factors may be common to both diseases. In that situation a condition which is proven to be un related disease of interest can be selected or controls from multiple sources can be selected. When cases and controls are freely available equal number of cases and

controls can be selected. For rare diseases more controls can be selected per cases to increase the precision of estimate (Setia, 2016 & Rothman et al, 2008).

Potential confounders can be identified and controlled at the measuring time itself or can be adjusted at the analysis level. Confounders are variables associated with both the exposure and outcome. In cases control study, controls can be matched to cases on an individual or group basis to reduce confounding yet to be controlled at the analysis level (Pearce, 2008). Usually matched variables are not assessed as risk factor (Lewellen & courtright, 1998). Over matching create difficulties in recruiting controls.

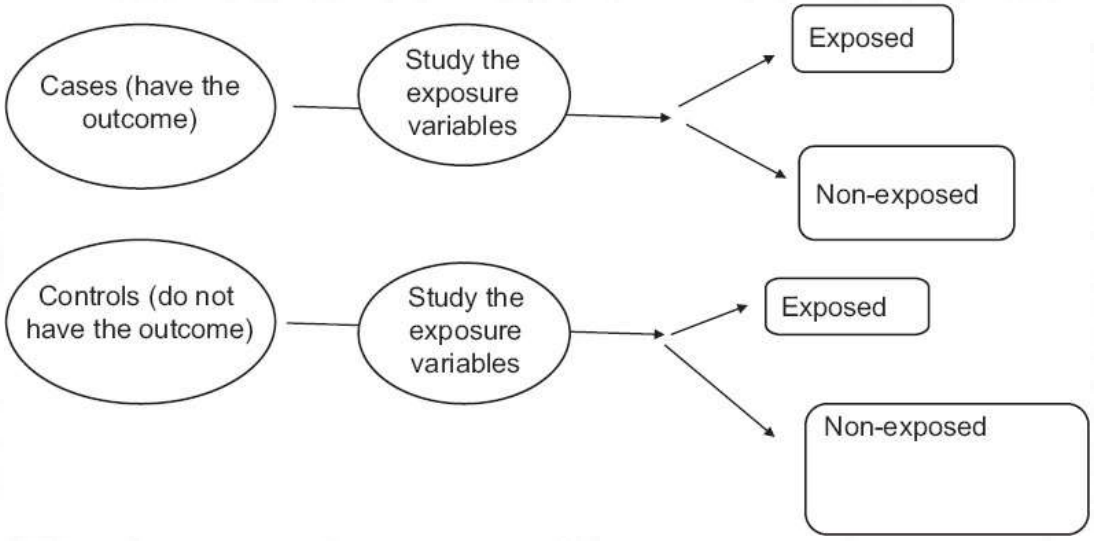


Figure 4: Diagrammatic representation of case control design (Setia, 2006).

Case control studies can be conducted without much expense and results can be obtained quickly. It is efficient to study rare diseases and multiple exposures can be studied. Generally, requires small sample size. The major disadvantages; rare exposures cannot be studied, incidence and prevalence cannot be estimated, we can study only one disease or outcome at a time and temporality cannot be established.

The case control studies are prone get selection bias and recall bias (Setia, 2016 & Rothman et al, 2008).

We can calculate odds ratio from case control study. Odds ratio approximate to risk ratio under rare disease assumption. Further analysis can be done using regression models.

2.4.2. Cross sectional design

In cross sectional study the investigator does not alter the outcome or exposure but studies the outcome and exposure in the same population, at the same time and find out the relationship between them. Participants are selected based on the inclusion criteria. The prevalence of outcome among the survey population and odds ratio as a measure of association can be calculated in cross sectional surveys (Setia, 2016 & Rothman et al, 2008). The schematic representation of the cross sectional survey design is given in figure 5.

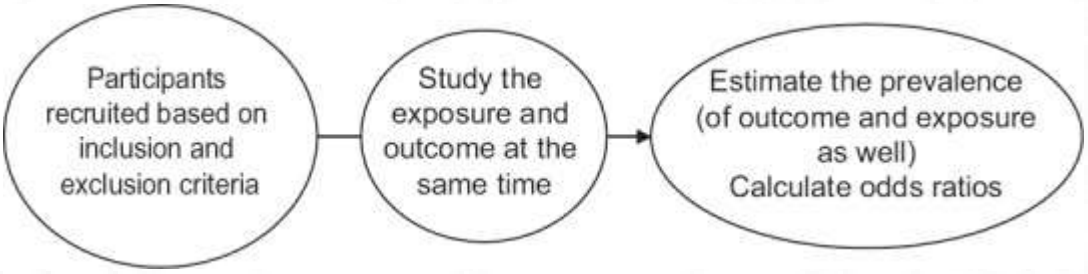


Figure 5: Diagrammatic representation of cross sectional design (Setia, 2006).

Cross sectional surveys can be conducted faster compared to cohort study with less expenditure. This study will give prevalence of exposure or outcome which helps in planning cohort or case control studies. This study design is useful in planning, monitoring and evaluation of public health activities.

Since the data collection is done at a single pint of time, the causal relationship cannot be established in this study design. Trends in the incidence of the disease in the population cannot be studied as the prevalence depends on both the incidence and duration of the disease.

2.5. Analysis methods used in this study

2.5.1. Matched analysis

Matching of sociodemographic or other variables is done in case control studies to remove confounding caused by the matched variables. The matched case control studies are conventionally analysed using matched analysis techniques using paired t test, Mc Nemar Ch^2 test and Mantel Haenszel techniques for multivariate analysis (Rothman; Greenland, 1998). The matched case control study does not always require a matched analysis. The standard matched analysis of conditional logistic regression can be done to avoid the concern of sparse data. However matched case control study requires controlling of the matched variable at the analysis level because some time matching can result in over matching, that is not only for the matched variables but also in terms of exposure status also. If there is no problem of sparse data unmatched analysis can also be used for matched case control studies. The matched and unmatched analysis yield similar odds ratio, with unmatched analysis yield more precision (Pearce, 2008; Chia Ling, 2018).

2.5.2. Hierarchical regression models

In studies which explore the determinants of disease the complex hierarchical interrelationship between the variables is lost when all the variables are included in a single step regression analysis. Failure to notice this results in underestimation of the effects of distal determinants. Conceptualizing the relationship, including the variables categorized based on the proximity of relationship to the outcome based on literature review, clinical significance and assumptions and building hierarchical models can result in representation of proximal and distal variables more accurately in the final model than any other methods (Victoria et al, 1997).

2.5.3. Sequential regression models

It is a useful tool for multiple regression analysis if there are large number of explanatory variables, put forward by Efroymson in 1950 and still remain unbeatable in big data analysis. In this method the significant variables to be included into regression analysis will be grouped into candidate variables and through each step the candidate variables are evaluated for statistical significance using appropriate statistical methods. Then forward selection of backward elimination method or bidirectional stepwise method can be used to until there is no statistically insignificant variable in the final model (Efroymson, 1960). The major criticism is that for big data analysis with too large number of explanatory variable this method results in selection of nuisance variables rather than true variables resulting in the creation of a model fit to the data rather than fitting to the sample. Larger the number of explanatory variables, the more misleading will be the results (Smith, 2018).

2.5.4. Average attributable fraction

The population attributable fraction (PAF) is more important from public health point of view because it gives excess risk for a particular risk factor in the population. It incorporates both individual association of risk and prevalence of risk factor in the population. The conventional method of estimation of PAF is using Levine's formula (Levine, 1943) with an adjusted or unadjusted Odds Ratio (OR). But the conventional method of calculation of PAF using Levine's formula with adjusted and unadjusted odds ratios are often overestimation of the risk because it does not consider potential confounders and adds to more than 100. Calculation of PAF directly from the regression model gives more accurate results and the sum of the risk will not exceed 100. The risk factor is coded dichotomously and removed from the population by classifying as unexposed and exposed and predicted probabilities are calculated through logistic regression analysis. The sum of all predicted probabilities is the adjusted number of cases of the disease that would be expected if the risk factor was absent in the population. Attributable fraction is then calculated by subtracting the expected cases from the observed cases. The procedure is repeated for all the possible sequence of logistic regression with sequential removal of risk factors and subsequent averaging to get average attributable fraction

which give a plausible estimation of population attributable risk (Greenland & Drescher, 1998; Ruckinger et al, 2009).

Chapter 3

METHODOLOGY

The study had two concurrent phases.

Phase 1: An incident pair matched case control study to find out the factors associated with stroke recurrence after first ever stroke.

Phase 2: Cross sectional survey to find out the medication adherence, facilitators and barriers to medication adherence and risk factor control among survivors of first episode of stroke.

3.1 Phase 1

3.1.1 Study design

Phase one of the study was a pair matched incident case control study, conducted from February 2019 to December 2019 in the stroke clinic of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) Trivandrum. The target population included survivors of first episode of stroke from the south and central Kerala. The source population was those who approached SCTIMST.

3.1.2 Setting

Sree Chitra Tirunal Institute of Medical Science and Technology (SCTIMST), Thiruvananthapuram is a tertiary level referral hospital which admit patients of neurology and cardiology specialities. It is a situated in the city centre and has more than 10 stroke admissions per week from South Kerala and central Kerala region. It has an acute stroke care unit, is maintaining a stroke registry and the patients are followed up in stroke clinic. The stroke registry maintained in SCTIMST is based on the WHO STEPS Stroke Manual.

Incident cases of recurrent strokes were recruited from stroke clinic. Data were collected from medical records and by visiting patient's homes. Controls were recruited from stroke registry who were individually matched for age as well as post-

stroke-period and data collected by visiting home and from medical records. There was one control matched to each case of stroke recurrence.

3.1.3 Sample size

Sample size for pair matched case control study was calculated using sample size tables for clinical studies software. Sample size was calculated fixing α error =0.05, power =0.80, anticipated proportion of discordant pairs- 0.5, anticipated odds ratio= 3 (medication non adherence) and for a two-sided test. The number of matched pairs was estimated to be 61. Considering probability of nonresponse, 70 matched pairs were recruited for this study.

3.1.4 Sample selection procedure

The incident cases of recurrent stroke were recruited as they came to stroke clinic with stroke recurrence after first episode of stroke, during data collection period till the calculated sample size was reached. The total sample size of 70 was recruited from February 2019 to December 2019. As one incident recurrent stroke case was recruited, an age and post stroke period matched control were recruited from stroke registry. The stroke registry data was examined to get a closest pair of (Age ±3, post stroke period ±2 weeks) stroke survivor without stroke recurrence, as control. From the matched pair list, 2 were removed as they had recurrence. One had expired due to haemorrhagic stroke and 3 patients were not able to locate as per the address given. In those conditions next eligible control from the list was selected.

3.1.5 Sampling criteria

Sampling criteria with rationale for cases and controls is given in table 1.

Table 3.1: Sampling criteria with rationale for cases and controls

		Criteria	Rationale
Cases	Inclusion Criteria	Incident cases of stroke recurrence beyond one month after first episode, presented within one month of stroke recurrence.	Incident cases were selected to avoid survival bias. Recurrences beyond one month were selected because often the early recurrences were confused with progression of index stroke and the factors of our interest were related to life style and health behaviour.
		Index stroke should be ischemic stroke, haemorrhagic stroke or transient ischemic attack with evidence of acute infarct.	We have taken all types of strokes because the factors of our interest have implication in all the three types.
		Aged 18 and above	Stroke below 18 years of age were mostly not related to life style factors.

	Exclusion Criteria	Early recurrence within one month. Stroke survivors who are comatose, severely disabled (mRS≥5), having multiple coexisting diseases.	Recurrences beyond one month were selected because often the early recurrences were confused with progression of index stroke. There is no implication in assessing life style and health behaviour in moribund patients.
Controls	Inclusion criteria	Controls were stroke survivors of first ever stroke without stroke recurrence, pair matched to age and post stroke period (Age ±3 years, post stroke period ±2 weeks).	Stroke recurrence is the event of interest. Age and post stroke period were associated with recurrence risk. We were not interested to study those variables.
	Exclusion criteria	Stroke survivors who are comatose, severely disabled (mRS≥5), having multiple coexisting diseases. Aged 18 and above	There is no implication in assessing life style and health behaviour in moribund patients. Stroke below 18 years of age were mostly not related to life style factors.

3.1.6 Research process

Phase 1 of this study was an incident pair matched case control study. The schematic representation of the research process is shown in figure 6.

Incident cases of recurrent strokes were selected as cases. A recurrent stroke is defined as a stroke with clinical evidence of the sudden onset of a new focal neurological deficit with no apparent cause other than that of vascular origin (i.e., the deficit could not be ascribed to a concurrent acute illness, epileptic seizure, or toxic effect) occurring any time after the index stroke (Chinese acute stroke trial, 1997). Case was defined as the incident case of recurrent stroke among survivors of first episode of ischemic stroke, haemorrhagic stroke or transient ischemic attack with evidence of acute infarct within one month of stroke recurrence**.**

Control was defined as age and post stroke period matched survivors of first episode of ischemic stroke, haemorrhagic stroke and transient ischemic attack with evidence of acute infarct without a recurrent stroke. Age and post stroke period matched controls were recruited from stroke registry. The stroke registry data was examined to get a list of close pair of stroke survivor without stroke recurrence, as control. The age matching of controls pair was done within an age ±3 years of that of the cases. The post stroke period of controls pair was matched within a post stroke period of ±2 weeks of that of cases. The controls were the closest pair from the list.

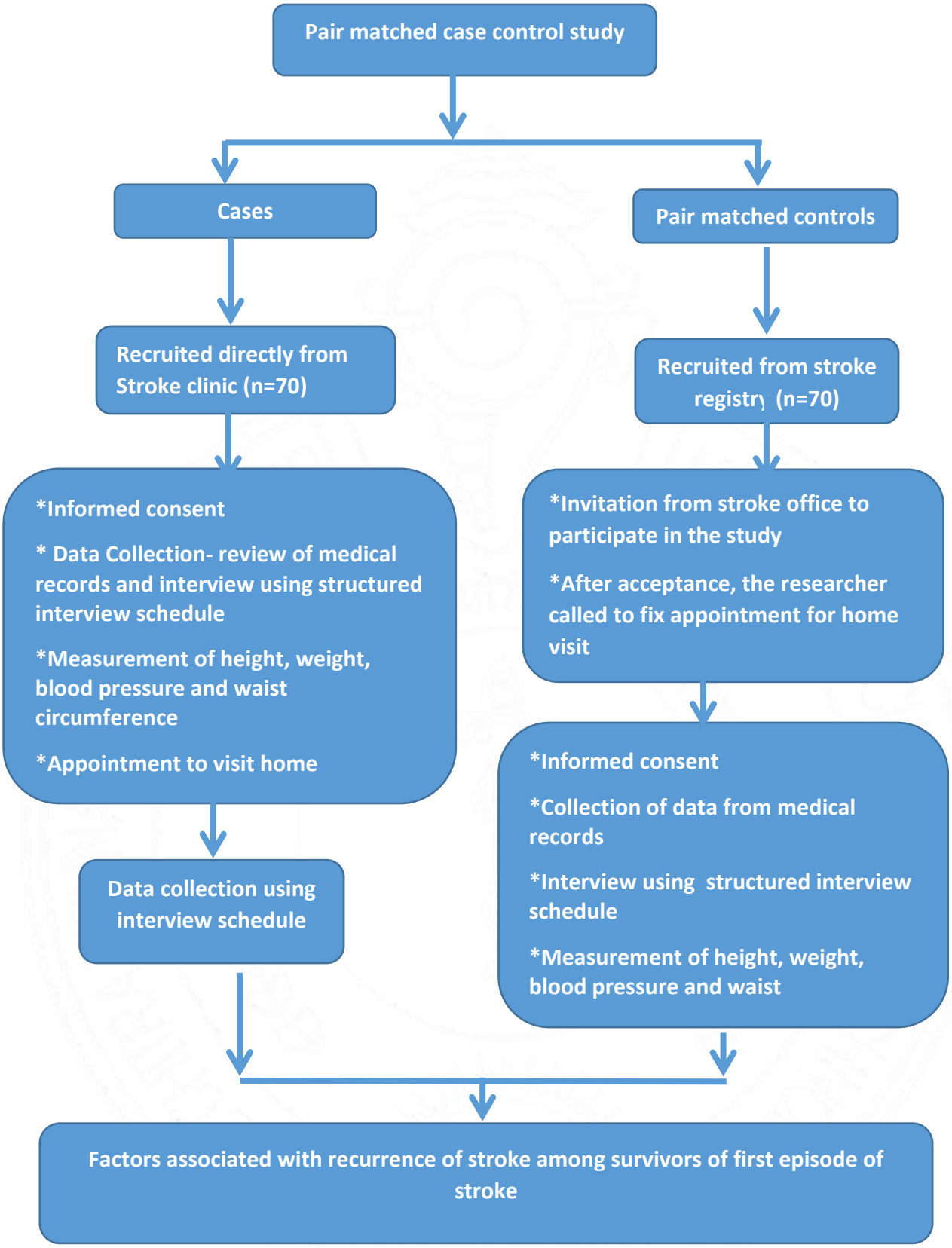


Figure 6: Schematic representation of the research process in phase 1

3.1.7 Data collection tools and techniques

Data collection tools and techniques used in the first phase of the study are shown in table 3.2.

Table 3.2: Data collection tools and techniques- case control study

Phases	Techniques	Tools
2	1.Interview among cases and controls 2. Review of medical records 3. Measurement of height and weight, waist circumference and blood pressure	1.Locally translated pretested structured interview schedule (annexure) 2.Clinical information sheet (annexure) 3.Calibrated weighing scale, measuring tape, BP apparatus and clinical information sheet

70 cases were recruited over a period of 11 months in 2019. Controls were taken concurrently as and when a case was recruited. Pretested structured interview schedule was used to collect sociodemographic and clinical details. Clinical information sheet was used collect information on radiographic, imaging and clinical details of index stroke from medical records. Standard instruments were used to measure height, weight and blood pressure. Medication adherence and compliance with other recommended health advice like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption just prior to recurrence period were also assessed.

The variables were categorized into sociodemographic, clinical and imaging variables, treatment of index stroke related variables mental and emotional factors and health care seeking behaviour. The variables studied in sociodemographic category included sex, education of the patient, monthly household income, place of residence, religion, caste, occupation of the patient, nature of occupation of the patient, marital status and type of civil supply card. The clinical and treatment related variables included the characteristics of index stroke. The clinical variables

included type of index stroke, number of ischemic lesions, areas of bleed in haemorrhagic stroke, blood vessel affected, nature of lesion, severity of stenosis, presence of microbleeds, the Oxfordshire Community Stroke Project (OCSP) classification, Trial of ORG 10172 in Acute Stroke Treatment (TOAST) classification, modified Rankins Scale score (mRS) and National Institute Health Stroke Scale Score (NIHSS). The treatment of index stroke related variables included shifted from one hospital to another, treatment done, number of days hospitalised, treated in hospital having stroke unit and received a comprehensive discharge education. Self reported presence of anxiety and memory problems were included in the mental and emotional factors. Presence of depression was identified by the presence of medication for depression. The last visit to health care facility was included to identify the health care seeking behaviour. Current functional ability was measured using mRS score to identify the ability to follow secondary stroke prevention strategies.

Self-reported medication adherence was defined as consumption of more than 80% of their medications for last two weeks, based on their last prescription. The data on medication adherence was collected by interviewing the patient and primary care giver regarding the medication intake history of two weeks. Medication adherence was calculated for five categories of medication; antiplateletes, antihypertensives, antidiabetics, statin and anticoagulants. Overall adherence was defined adherence to all the categories of medication prescribed.

A healthy diet was defined as consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets and fried foods (Kerman et al, 2014 & WHO, 2005). Recommended physical activity was at least 30 minutes of moderate physical activity like walking for at least 3 days a week (Kerman, 2014). Self-reported medication adherence was defined as consumption of at least more than 80% of their medications, based on their last prescription.

History of medical conditions being the risk factor for stroke recurrence were diabetes, hypertension, Coronary Heart Disease (CHD), carotid disease, valvular

heart disease, atrial fibrillation, thyroid dysfunction was included. History of smoking and alcohol use was collected. The data on blood sugar, lipid levels prior to recurrence period were also collected from lab reports. The risk factor control is defined as achieving the desired levels of blood pressure, blood sugar and cholesterol. The targets for risk factor control were taken from National Cholesterol Education Program (NCEP) ATP III guidelines (NCEP, 2001) for Cholesterol (LDL<100 mg/dl and TC<200 mg/dl), American diabetes Association guidelines (FBS 70-130mg/dl and HbA_1C <7) for Diabetes control (ADA, 2019) and ASA secondary stroke prevention guidelines (Kerman et al, 2014) for blood pressure (SBP <140 mm of Hg and DBP<90 mm of Hg).

3.1.8 Data analysis

Analysis for pair matched case control study was done using R statistical software (R core team, 2015). Mc Nemar χ^2 test was done for dichotomous variables and paired t test was done for continuous variables to find out the relationship between variables and stroke recurrence. Mantel Haenszel Ratio (MHR) with 95% Confidence Interval (CI) was reported. Those variables had statistical significance <0.1 were considered for multivariate analysis. Hierarchical conditional binary logistic regression models (Victoria et al, 1997) were built using R statistical software by classifying the significant variables into different groups based on the existing knowledge of proximity of association to stroke recurrence. The distal group was sociodemographic variables, then risk factors, thirdly life style and proximal index stroke related variables. More distal variables were put into the model initially and new variables were added to significant variables in each step for further analysis.

Model 1 was built with age, sex and nature of income category as independent variables and stroke recurrence as dependent variables.

Model 2: The Variables included in this model were medication adherence, glycosylated haemoglobin, lipid control, history of valvular heart disease, intracranial vessel disease and significant variables in the model 1.

Model 3: The variables were following recommended physical activity, healthy diet and significant variable in the model 2.

Final model was created using significant variables in model 3 and National Institute Health Stroke Scale (NIHSS) score of index stroke, number of days of hospitalisation of index stroke, presence of discharge advice, cardioembolic subtype, lacunar stroke, presence of depression, anxiety and memory issues.

The attributable fraction is defined as the extent to which the exposure in question accounts for the occurrence of disease among exposed people who get the disease. The attributable risk of stroke recurrence for the significant variables was calculated using the formula OR-1/OR; where OR is the odds ratio ((Rothman & Greenland 1998; Gordis, 2009).

3.2 Phase 2

The second phase of this study was a cross sectional survey.

3.2.1 Study design

Cross sectional survey among hospital-based stroke survivors of first episode of stroke within a post stroke period of three months to one year.

3.2.2 Setting

This phase of the study was conducted the stroke clinic of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram, which is a tertiary level referral hospital. The comprehensive stroke care unit admits 450-500 patients per year. The patients are followed up in the stroke clinic on an outpatient basis.

3.2.3 Population and sample

Stroke is defined as “Rapidly developing 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” (Warlow, 1998). Survivors of first episode of stroke refers to the survivors of diagnosed cases of ischemic stroke, haemorrhagic and transient ischemic attack with evidence of

acute infarct. The study population for this cross sectional survey were the survivors of first episode of stroke within a post stroke period of three months to one year.

The risk factor control is defined as achieving the desired levels of blood pressure, blood sugars and cholesterol. The targets for risk factor control were taken from National Cholesterol Education Program (NCEP) ATP III guidelines (NCEP, 2004) for Cholesterol (LDL<100 mg/dl and TC<200 mg/dl), American diabetes Association guidelines (FBS 70-130 mg/dl and HbA_1C <7) for Diabetes control (ADA, 2019) and ASA secondary stroke prevention guidelines (Kerman et al, 2014) for blood pressure (SBP <140 mm of Hg and DBP<90 mm of Hg).

3.2.4. Sample size

Sample size for this study was determined based on the following formula:

$n=z_\alpha^2\ p\ (1-p)/d^2$, where z_α = 1.96 at 95% confidence interval, p= prevalence of medication adherence among stroke survivors; taken as 40% (Kronish et al, 2013) and d = absolute precision of 7%. A sample size of 185 was calculated using Open Epi Software. Considering a non-response rate of 20%, the total sample size came out to be 222 participants. To round up, the total sample size estimated for this study was 240 participants.

3.2.5 Sampling criteria

Survivors of first episode of stroke, aged 18 and above within a period of three months to one year were recruited for the cross sectional survey during the period of February 2019 to August 2019. Comatose, severely disabled [modified Rankins Scale score (mRS)≥5], having multiple coexisting diseases were excluded from the study.

3.2.6 Data collection tools and techniques

Locally translated pretested structured interview schedule (annexure) was used to collect data. The interview schedule was developed through the following steps

- Creation of item pool

In depth interview among selected stroke survivors, care givers of stroke survivors and health care team workers and review of literature was conducted to generate an item pool for the tool.

- Items were prioritized by circulating it through experts in the field. Highest ranked items were selected
- Translation and back translation were done and checked for consistency
- The developed tool was circulated among experts for feasibility, readability, consistency of style and formatting and the clarity of the language used.
- Pre testing was done by administering the tool to 10 stroke survivors and cognitive interview was done to know their feedback.
- The tool was administered to the same subjects after 10 days for test retest reliability.
- Fine tuning of the tool was done by incorporating the changes.

The interview schedule included sections to collect sociodemographic data, family support, financial support for medications, health care seeking behaviour, access to health care and relationship with health care provider. Details regarding stroke survivor's belief about treatment and disease and presence of anxiety and depressive mood were also assessed.

The sociodemographic variables were age, sex, place of residence, religion, caste, education of patient, occupation of patient, house hold monthly income, number of family members, living with spouse, education of the care giver, nature of occupation of the care giver, presence of medical insurance, nature of insurance, financial support for medication and nature of civil supply card. The variable included under access to health care were system of medicine followed for treatment of stroke, place where usual check up is done, visit by ASHA worker, last visit to doctor, availability of medicine in the nearest pharmacy, distance to nearest pharmacy, distance to nearest clinic, medicine out of stock in pharmacy, buying medicine for one month, reasons for not buying medicine for one month, cost of medicine or one week, any communication problem with the doctor and presence of discharge education. The variables selected under stroke related were type of stroke, post stroke period, NIHSS at ictus, NIHSS at review, mRS score, memory problem

and depression. Life style factors are following a healthy diet, continuing physiotherapy, doing regular physical activity and routine life style. The factors related to patient's belief about treatment included perceived poor state of health, anxiety about stroke, awareness about recurrence risk, perceived need of medicine, believes that medicine prevent recurrence, fear of dependence, belief about treatment regimen, satisfaction with the treatment, ability to read and understand medicine name, confidence in taking medication as per prescription, family help, family reminders and history of treatment default.

Compliance with other recommended health advice like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption were also assessed. A healthy diet was defined consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets and fried foods. Recommended physical activity was at least 30 minutes of moderate physical activity like walking for at least 3 days a week.

Standard instruments were used to measure blood pressure, weight, height and waist circumference (WC). Clinical information sheet was used to collect data from medical records which included stroke related data, history of diabetes, hypertension, dyslipidaemia, their treatment and blood investigation results of fasting blood sugar, glycosylated haemoglobin, low density lipoprotein and total cholesterol. Modified Rankin scale was used to measure physical disability at the time of follow up.

Self-reported medication adherence was defined as consumption of at least more than 80% of their medications for last two weeks, based on their last prescription. Medication intake history of previous 14 days prior to recruitment was collected through face to face interview with patients and their primary care giver. The last given prescription from our hospital was used to identify the medications prescribed for the patients. The patients and the care givers were asked to fill the check list of medication intake prior to 14 days of recruitment to study. The check list included the name of medication and frequency. Medication intake history was

taken for antiplatelets, antihypertensives, antidiabetics, statin and anticoagulants. This medication intake history was compared with the prescription and medication adherence was calculated for each category of medication. If they have consumed more than 80% of their prescribed category of medication, they are said to be adherent to particular category. Over all adherence was defined as adherence to all the category of medication prescribed for the patient. The self-reported reasons for non-adherence were also collected from non-adherers.

3.2.7 Research process

Survivors of first episode of stroke within a period of three months to one year were recruited for the cross sectional survey from stroke registry of SCTIMST. Data collected from them during their follow up visit to stroke clinic in SCTIMST after getting written informed consent. The Schematic representation of research process is given in diagram 7.

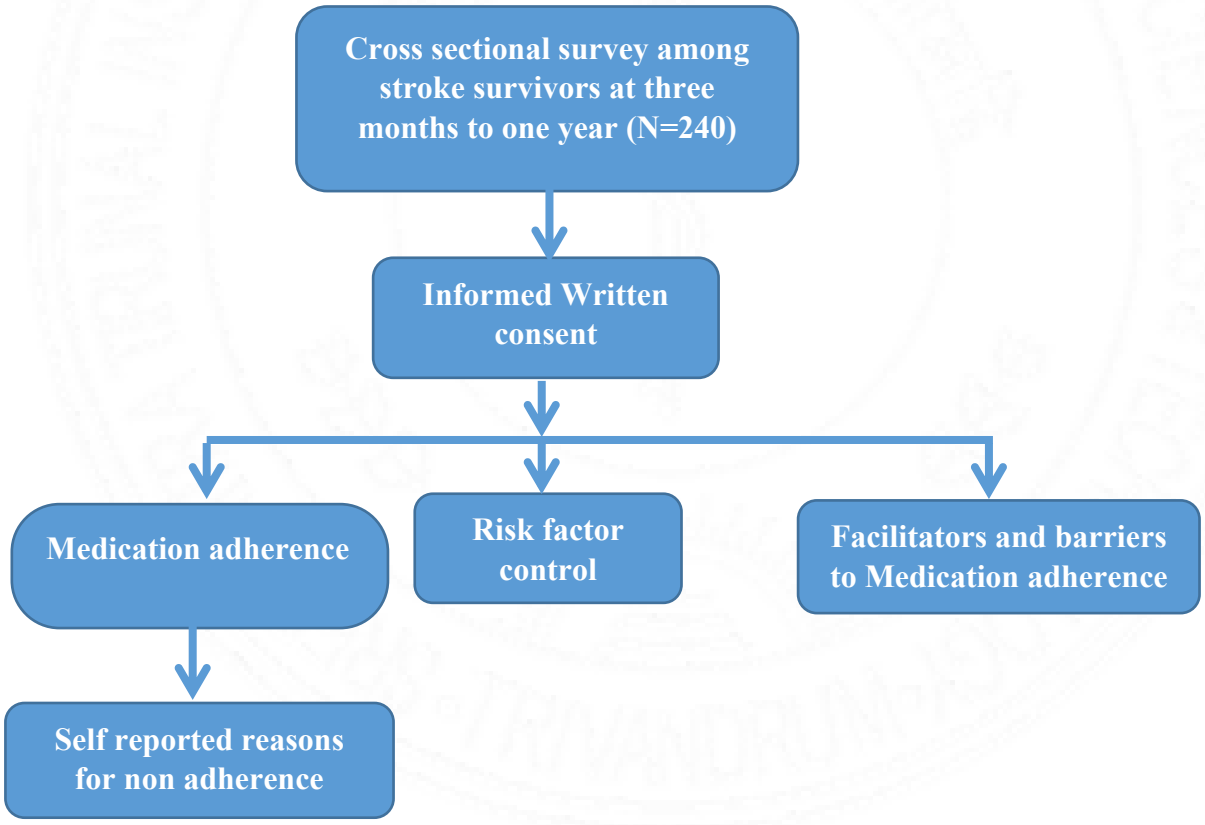


Figure 7: Schematic representation of the research process in phase 2

3.2.8 Analysis

For meeting the first objective, the proportion of patients who had consumed at least >80% of their medications for last two weeks, based on their last prescription was reported.

To find out the risk factor control, the proportion of patients who achieved the targeted level of diabetic control, hypertension control and dyslipidaemia control were analysed. Separate models were created to find out the effect of medication adherence on risk factor control, adjusted for the following: physical activity, healthy diet, current smoking and alcohol use. Adjusted odds ratio and 95% confidence interval were reported.

Bivariate analysis with medication adherence as outcome variable and patients' characteristics was done to find out facilitators and barriers to medication adherence. Odds Ratio (OR) with 95% Confidence Interval (CI) was reported. Those variables have statistical significance <0.1 were considered for regression analysis. Sequential stepwise logistic regression analysis (Efroymson, 1960) was done in the following steps.

Step1- The variables were categorized into five groups. Sociodemographic variables included age, sex, ownership of vehicle, belongs to poor households and place of residence. The second category of variables were treatment access, availability of medicine in the nearest medical shop and buying medicines for one month were the variables. Stroke related variables included stroke severity at ictus, stroke severity at recruitment, presence of memory issues and mRS score. Variables related to patient's belief about treatment and disease were perceived need of medication, experiencing side effects, fear of dependence to medications, belief that medicine prevents recurrence, simple treatment regimen and perceived poor state of health. The last group of variables were related to other health behaviour such as continuing physiotherapy, following a healthy diet, following recommended physical activity and having a daily routine. Separate logistic regressions were built including age and sex in each model, corresponding to each group of predictors resulting in five

models. Those variables having significance level <0.1 in each model were considered for the second step.

Step2- Those variables having significance level <0.1 from each category were selected for regression analysis at second step. The variables were availability of medicine in the nearest medical shop, buying medicines for one-month, continuing physiotherapy at home, having a daily routine, NIHSS<4 at review, presence of memory problem, experiencing side effects, belief that medicine prevents recurrence and perceived poor state of health. A multiple logistic regression model was created including all the variables plus age and sex.

Step3- Final model was created by backward elimination from step 2, with alpha level set to 0.05.

The population attributable risk (PAR) was defined as the percent reduction in the incidence of disease if the exposure was removed from the population compared to its current exposure pattern (Rothman & Greenland 1998; Gordis, 2009).The prevalence of medication nonadherence and not receiving discharge advice during index stroke obtained through the cross sectional survey was considered as the population prevalence for the same and population attributable risk of stroke recurrence was calculated using the formula P_e (OR-1)/1+P_e (OR-1) (where Pe is the prevalence of exposure in population and OR is the corresponding odds ratio) for medication non adherence and not receiving discharge advice at index stroke (Levine, 1953). The prevalence of lacunar stroke and proportion of patients having above the mean days of hospitalisation was taken from two studies done in different setting (Somasundaram & potty, 2020; Sheedy et al, 2020) and population attributable risk was calculated. Population attributable risk was calculated with adjusted and crude odds ratios.

In order to have a more precise estimate of population attributable fraction, sequential logistic regression analysis was done with significant risk factors in the final model of case control study adopting the method suggested by Ruckinger et al in 2009 and average attributable fraction was reported (Ruckinger et al, 2009).

3.3 Ethical considerations

The study was undertaken after obtaining clearance from Institutional Ethics Committee (Appendix) of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala (SCT/IEC-1327/November-2018). The participant information sheet (Appendix) was distributed and written informed consent (Appendix) was obtained after clearing doubts from all the participant before the survey.

Privacy was maintained in all interactions with the respondents. Interviews were conducted providing adequate privacy by ensuring that the respondent and the interviewer only was present at the time of interview. The confidentiality of the information was protected under all circumstances. The data collected is stored in a safe manner and saved as a computer file with password. The raw data will be with the custody of the principal investigator for 3 years and after that it will be destroyed.

Chapter 4

RESULTS

This chapter has two sections corresponding to the methods applied in the two phases of the study:

Section I: Results of pair matched incident case control study

Section II: Results of cross sectional survey

4.1 Section I: Results of pair matched incident case control study

4.1.1 Characteristics of the study participants

4.1.1.1. Demographic characteristics of the study participants

Seventy incident cases of recurrent strokes and 70 age and post stroke period matched controls were recruited for the study. The mean age of cases was 60.79±11.54 years and that of controls was 60.29±11.38 years. The females constitute 18.6% of cases and 32.9% of controls. The mean stroke recurrence period for cases was 49.53±53.35 months and that of control was 50.09±53.03 months. The median stroke recurrence period was 65.5 months. The difference in age and post stroke period between cases and controls were not statistically significant (p=0.48 and p=0.29 respectively). The demographic characteristics of the cases and controls are given in the table 4.1.

Table 4.1: The demographic characteristics of the participants

Variable	Characteristics	Case		Control	
		N	%	N	%
Age	<= 45	10	14.3	9	12.9
	46 - 55	11	15.7	13	18.6
	56 - 65	23	32.9	22	31.4
	66 - 75	22	31.4	23	32.9
	>75	4	5.7	3	4.3
Sex	Male	57	81.4	47	67.1

Variable	Characteristics	Case		Control	
		N	%	N	%
	Female	13	18.6	23	32.9
Education of patient	Below 10th	27	38.6	22	31.4
	10-12th	35	50	41	58.6
	Graduate and above	8	11.4	7	10
Monthly income	<= 1500	13	18.6	13	18.6
	1501 - 5000	40	57.1	33	47.1
	5001+	17	24.3	24	34.3
Area of residence	Rural	45	64.3	46	65.7
	Urban	25	35.7	24	34.3
Religion	Hindu	47	67.1	57	81.4
	Christian	14	20	5	7.1
	Muslim	9	12.9	8	11.4
Caste	SC	0	0	2	2.9
	ST	1	1.4	0	0
	OBC	45	64.3	40	57.1
	Others	24	34.3	28	40
Occupation of patient	Clerical	5	7.1	7	10
	Manual labourer	22	31.4	20	28.6
	Professional	4	5.7	2	2.9
	Home maker	10	14.3	17	24.3
	Unemployed	9	12.9	6	8.6
	Self employed	17	24.3	11	15.7
	Retired	3	4.3	7	10
Nature of occupation of patient	Sedentary	26	37.1	28	40
	Non sedentary	21	30	14	20

Variable	Characteristics	Case		Control	
		N	%	N	%
	nual labourer	14	20	11	15.7
	ne making	9	12.9	17	24.3
rital status	rried	64	91.4	63	90
	arated	1	1.4	1	1.4
	lowed	5	7.1	6	8.6
il supply card	low	3	4.3	0	0
	k	17	24.3	8	11.4
	e	23	32.9	34	48.6
	ite	27	38.6	28	40

SC-Scheduled Caste; ST-Scheduled Tribe; OBC-Other Backward Caste

4.1.1.2 Characteristics of index and recurrent strokes

The mean stroke recurrence period was 50.09±53.03 months and controls were pair matched to post stroke period ±2 weeks of that of corresponding cases. The comparison of index and recurrent stroke is given in table 4.2.

Table 4.2: Characteristics of index and recurrent strokes

Characteristics		Index stroke n (%)	Recurrent stroke n (%)
	Ischemic	131(93.6)	56(80)
Stroke	Haemorrhagic	4(2.9)	10(14.3)
type	TIA	5(3.6)	4(5.7)
OCSP	Lacunar	22(15.7)	0.0 (0)
	Partial anterior	65(25)	39(65.0)
	circulation	15(10.7)	1(1.6)
	Total anterior	34(24.3)	20(33.4)
	circulation		
	Posterior circulation		

Characteristics		Index stroke n (%)	Recurrent stroke n (%)
mRS	≤2	35(25)	8(11.4)
	>2	105(75)	62(88.6)
NIHSS	≤4	54(38.6)	23(32.9)
	>4	86(61.4)	47(67.1)

OCSP- The Oxfordshire Community Stroke Project Classification; TOAST- Trial of ORG 10172 in acute stroke treatment classification; TIA- Transient Ischemic attack; mRS- modified Rankins Scale; NIHSS- National Institute Health Stroke Scale

4.1.1.3 The radiographic and imaging characteristics of index stroke

The radiographic and imaging characteristics of index stroke is given table 4.3. Majority of the cases and controls had ischemic stroke subtype. The blood vessels more commonly affected in cases are intracranial part of carotid artery where are majority of the controls had pathology in the middle cerebral artery. The etiologic subtype of index stroke showed majority of the cases had cardioembolic subtype while the proportion of small vessel disease stroke is more among controls.

Table 4.3: The radiographic and imaging characteristics of index stroke

Variables	Characteristics	Case		Control	
		N	%	N	%
Type of index stroke	Ischemic	63	90	68	97.1
	TIA	3	4.3	2	2.9
	Haemorrhagic	4	5.7	0	0
Ischemic lesion	single	44	66.7	44	62.9
	Multiple	22	33.3	26	37.1
Blood vessel affected	Intracranial ICA	12	18.2	10	12.9
	ACA	0	0.0	1	1.4
	MCA	11	16.7	17	24.3
	PCA	1	1.5	1	1.4

Variables	Characteristics	Case		Control	
		N	%	N	%
	Basilar	3	4.5	4	5.7
	Extracranial ICA	4	6.1	8	11.4
	Vertebral	6	9.1	4	5.7
Nature of lesion	stenosis	18	27.3	21	30
	Occlusion	15	22.7	20	28.6
Severity of stenosis	Mild	2	11.1	4	19.0
	Moderate	8	44.4	10	47.6
	Severe	8	44.4	7	33.4
Presence of Micro bleeds	Yes	4	6.1	6	8.6
OCSP	Lacunar	7	10.6	15	21.4
	Partial anterior circulation	34	51.5	31	44.3
	Total anterior circulation	4	6.1	11	15.7
	Posterior circulation	21	31.8	13	18.6
TOAST	Large artery atherosclerosis	24	35.3	26	37.1
	Cardio embolism	15	22.1	5	7.1
	Small artery atherosclerosis	11	16.2	17	24.3
	Undetermined	14	20.6	20	28.6
	Other determined	4	5.9	2	2.9

OCSP- The Oxfordshire Community Stroke Project Classification; TOAST- Trial of ORG 10172 in acute stroke treatment classification; TIA- Transient Ischemic attack; ICA- Internal carotid artery; ACA- Anterior communicating artery; MCA- Middle cerebral artery; PCA- Posterior cerebral artery;

4.1.1.4 The treatment characteristics of index stroke

The average time to reach hospital during index stroke for cases was 12.65± 25.86 hours and that of control was 17.49±40.33 hours. The average number of days of hospitalization during index stroke for cases was 5.04± 4.25 days whereas the controls had an average of 7.47± 6.42 days of hospitalisation during index stroke. The other index stroke related characteristics are given in table 4.4.

Table 4.4: The treatment characteristics of index stroke

Variable	Characteristics	Case		Control	
		N	%	N	%
Shifted to another hospital during index stroke	Yes	32	45.7	50	71.4
	No	38	54.3	20	28.6
mRS index	<2	18	25.7	17	24.3
	>2	52	74.3	53	75.7
NIHSS index	<4	26	37.1	28	40
	>4	44	62.9	42	60
Treatment done for index stroke	Thrombolysis	3	4.3	6	8.6
	Mechanical Thrombectomy	3	4.3	2	2.9
	Surgery	1	1.4	5	7.1
	Medical	63	90	57	81.4
Received discharge education	Yes	38	54.3	62	89.9
	No	32	45.7	7	10.1
Treated in stroke unit during index stroke	Yes	36	51.4	50	71.4
	No	34	48.6	20	28.6
Number of days hospitalized	≤7	57	81.4	44	62.9
	>7	13	18.6	25	35.7

mRS-modified Rankins Scale; NIHSS- National Institute Health Stroke Scale

4.1.1.5 History of cardio vascular risk factors

The prevalence of cardiovascular risk factors among the participants is given in table 4.5. Valvular heart disease was more prevalent among cases than controls. The prevalences of other cardiovascular risk factors were almost equal among both cases and controls.

Table 4.5: Prevalence of risk factors among the participants

Risk Factor	Case		Control	
	N	%	n	%
Diabetes Mellitus	42	60	45	64.3
Hypertension	55	78.6	58	82.9
Dyslipidaemia	56	80	54	77.1
Coronary artery disease	11	15.7	9	12.9
Carotid disease	15	21.4	15	21.4
Valvular heart disease	10	14.3	3	4.3
Atrial fibrillation	7	10	6	8.6
Thyroid dysfunction	6	8.7	8	11.4
Ever smoked >100 cigarettes over life time	36	51.4	27	38.6
Alcohol use	9	12.9	7	10

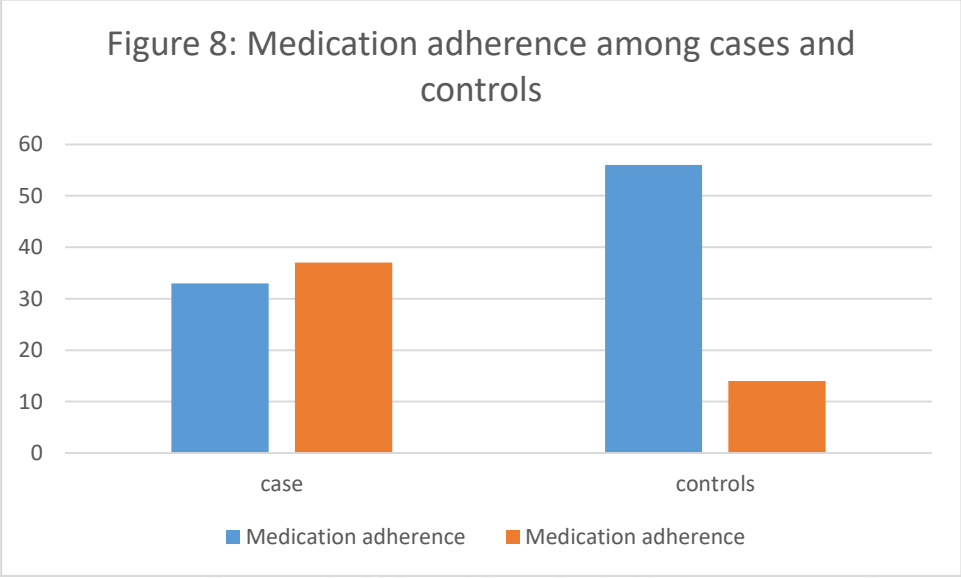
4.1.1.6 Mental and emotional status and health behaviour of the of the cases and controls prior to recurrence period

Mental and emotional status and health behaviour of the cases and controls prior to recurrence period is given in table 4.6. The cases expressed more anxiety and memory problems compared to controls. Comparing to controls, depression was more prevalent among cases. Medication adherence prior to recurrence period among cases and controls is given in figure 6. Controls were more adherent to medication (80%) compared to cases (40.7%).

Table 4.6: Mental and emotional status and health behaviour of the of the cases and controls prior to recurrence period

Variable	Characteristics	Case		Control	
		N	%	N	%
Anxiety	Yes	45	64.3	34	48.6
	No	25	35.7	36	51.4
Depression	Yes	27	38.6	9	12.9
	No	43	61.4	61	87.1
Memory problem	Yes	14	20	4	5.7
	No	56	80	66	94.3
Medication adherence	Yes	33	47.1	56	80
	No	37	52.9	14	20
Last visit to health care	<1 month	20	28.6	15	21.4
facility	>1 month	50	41.4	55	78.6
mRS score	≤2	51	72.86	55	78.57
	>2	19	27.14	15	21.43

mRS – modified Rankin Scale



4.1.1.7 Status of risk factor control prior to recurrence period

The mean total cholesterol of cases was 159.34±41.74 mg/dl and that of controls was 149.13±27.2mg/dl. The mean low density lipoprotein value of cases

was 91.76±36.03 mg/dl and that of controls was 79.79±19.65mg/dl. The average fasting blood sugar value was 129.19±33.72 mg/dl for cases and that of controls was 121.02±41.18mg/dl. The average glycosylated haemoglobin for cases was 7.47±1.91gm/dl and that of controls was 6.86±1.28gm/dl. The status of risk factor control at the time of recurrence period is given in table 4.7.

Table 4.7: Risk factor control status prior to recurrence period

Variables	Characteristics	Case		Control	
		N	%	N	%
Alcohol Use	Yes	9	12.9	7	10
	No	61	87.1	63	90
Current smoking	Yes	9	13	5	7.2
	No	60	87	64	92.8
Following a Healthy diet	Yes	8	11.4	32	45.7
	No	62	88.6	38	54.3
Following recommended	Yes	14	20	36	51.4
Physical activity	No	66	80	34	48.6
Waist Circumference	Abnormal	59	84.3	56	80
	Normal[#]	11	15.7	14	20
Body Mass Index (kg/m^2)	Normal (<25)	26	37.1	27	38.6
	Overweight and obese (25 and above)	44	62.9	43	61.4
Diabetic control	Yes	41	41.4	38	54.3
	No	29	58.6	32	45.7
Lipid control	Yes	12	17.1	67	95.3
	No	58	82.7	3	4.7
Hypertension control	Yes	28	40	51	27.1
	No	42	60	19	72.9

Diabetic control-Among patients with diabetes FBS 70-130 and HBAIC ≥7 and in non diabetics HBAIC ≥6.5 and FBS ≥126, Hypertension control- SBP ≤140 and DBP ≤90 among hypertensives and in non hypertensives SBP ≤130 and DBP ≤ 80 and Lipid control- LDL ≤100 and TC≤ 200 among patients with dyslipidaemia. A healthy diet was defined consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets, fried foods. Recommended physical activity was at least 30 minutes of moderate

physical activity like walking for at least 3 days a week. # normal <80 cm in women and <94 cm in men.

4.1.2 Results of Bivariate analysis

4.1.2.1 Demographic characteristics and stroke recurrence

Demographic characteristics of the participants and its association with stroke recurrence is given in table 4.8 (results of bivariate analysis). The risk of stroke recurrence was four times to those who belongs to the category of BPL while comparing to APL category. None of the other variables showed statistically significant difference.

Table 4.8: Demographic characteristics and stroke recurrence (70 matched pairs)

	Variables (dichotomised)		**Control**		**MHR**	**P@ value**	**95% CI**	
			n	**n**			**LL**	**UL**
	Sex	Male	35	22	1.83	0.121	0.91	3.7
		Female*	12	1				
	Place of residence	Rural	31	14	0.93	1.000	0.45	1.93
		Urban*	15	10				
	caste	Reservation	27	19	1.27	0.608	0.64	2.49
Case		group	15	9				
		General*						
	Education of patient	≤10	39	12	1.5	0.503	0.61	3.67
		>10*	8	11				
	Nature of occupation of the patient	Sedentary	11	15	0.88	0.860	0.44	1.77
		Non sedentary*	17	27				
	Monthly Income	<5000	33	20	1.54	0.296	0.77	3.09
		≥5000*	13	4				
	Civil supply card	**BPL**	**4**	**16**	**4.00**	**0.012**	**1.33**	**11.96**
		APL*	**4**	**46**				

MHR-Mantel Haenszel Ratio; CI-Confidence Interval: LL-Lower Limit; UL-Upper Limit: *Reference category; @ Mc Nemar p value.

4.1.2.2 Radiographic and imaging characteristics of index stroke and stroke recurrence

Radiographic and imaging characteristics of index stroke and stroke recurrence risk is given in table 4.9 (Results of bivariate analysis). The cardioembolic subtype of stroke had more risk of recurrence compared to other etiological subtypes. Intra cranial vessel disease and lacunar type of stroke was associated with less risk of recurrence but the difference was not statistically significant.

Table 4.9: **Radiographic and imaging characteristics of index stroke and stroke recurrence**

	Variables (dichotomised)		**Control**				**MHR**	**P@ value**	**95% CI**	
			n	**%**	**n**	**%**			**LL**	**UL**
Case	Ischemic lesion	Single	29	44.6	14	21.5	1.17	0.845	0.54	2.52
		Multiple*	12	18.5	10	15.4				
	Intracranial vessel disease	**Yes**	**8**	**14.6**	**9**	**16.4**	**0.5**	**0.08**	**0.23**	**1.11**
		No*	**18**	**32.7**	**30**	**5.5**				
	Extracranial vessel disease	Yes	4	6.2	13	20	1.44	0.4	0.61	3.38
		No*	9	13.8	39	60				
	Blood vessel stenosis	Yes	7	10.6	11	16.7	0.79	0.69	0.36	1.73
		No*	14	21.2	34	51.5				
	Blood vessel occlusion	Yes	5	7.6	10	15.2	0.77	0.678	0.34	1.75
		No*	13	19.7	38	57.6				
	Cardioembolic stroke	**Yes**	**3**	**4.3**	**12**	**17.1**	**6.00**	**0.013**	**1.34**	**26.8**
		No*	**2**	**2.9**	**53**	**75.7**				
	Small artery atherosclerosis	Yes	4	5.7	7	10	0.54	0.263	0.27	1.35
		No*	13	18.6	46	65.7				
	Large artery atherosclerosis	Yes	9	12.2	15	22.1	0.88	0.728	0.44	1.77
		No*	17	25	27	39.7				
	Undetermined	Yes	2	2.9	12	17.1	0.67	0.362	0.32	1.38
		No*	18	25.7	38	54.3				
	Other determined	Yes	0	0.0	4	6.06	2	0.45	0.37	10.92
		No*	2	3.03		93.9				

Variables (dichotomised)		Control				MHR	P@ value	95% CI	
		n	%	n	%			LL	UL
Lacunar stroke	**Yes**	**3**	**4.3**	**4**	**5.7**	**0.33**	**0.077**	**0.11**	**1.03**
	No*	**12**	**17.1**	**51**	**72.9**				
Partial anterior circulation	Yes	16	22.9	18	25.7	1.2	0.728	0.6	2.38
	No*	15	21.4	21	30.0				
Total anterior circulation	Yes	0	0.0	4	5.7	0.36	0.118	0.12	1.14
	No*	11	15.7	55	78.6				
Posterior circulation	Yes	4	5.7	17	24.3	1.89	0.169	0.84	4.24
	No*	9	12.9	40	57.1				

MHR-Mantel Haenszel Ratio; CI-Confidence Interval; LL-Lower Limit; UL-Upper Limit; *Reference category; @Mc Nemar p value.

4.1.2.3 Clinical presentation and treatment of index stroke and stroke recurrence

The controls had higher mean NIHSS (National Institute Health Stroke Scale) score [8.27(5.96), p=0.043] and a greater number of days of hospitalisation [7.47(6.42), p =0.006] during index stroke comparing to cases 6.54(3.76) and 5.04(4.25) respectively. The clinical presentation and treatment of index stroke related variables and its association to stroke recurrence is given in table 4.10 (Results of bivariate analysis)

Table 4.10: The clinical presentation and treatment of index stroke and stroke recurrence (70 matched pairs)

	Variables (dichotomised)		Control		MHR	P@ value	95% CI	
Case			**n**	**n**			**LL**	**UL**
	Treatment of index stroke	Medical	51	12	2.00	0.167	0.75	5.33
		Interventional*	6	1				
	mRS index	≤2	6	12	1.09	1.00	0.48	2.47
		>2*	11	41				
	NIHSS index	≤4	13	13	0.87	0.851	0.41	1.82
		>4*	15	29				
	Time to reach hospital	>4.5hours	22	16	1.23	0.711	0.59	2.56
		<4.5hours*	13	19				
	Treatment in stroke unit	No	6	22	1.57	0.19	0.8	3.07
		Yes*	14	28				
	Received discharge education	**No**	**3**	**28**	**7**	**<0.001**	**2.5**	**20**
		Yes*	**4**	**34**				
		Yes	**8**	**30**	**2.50**	**0.008**	**1.28**	**4.89**
	Shifted to another hospital	**No***	**12**	**20**				

mRS-modified Rankin Scale; NIHSS- National Institute Health Stroke Scale; MHR-Mantel Haenszel Ratio; CI-Confidence Interval; LL-Lower Limit; UL-Upper Limit; * Reference category; @ Mc Nemar p value.

4.1.2.4 Mental and emotional status and health behaviour of the of cases and controls prior to recurrence period and stroke recurrence

Mental and emotional status and health behaviour of the of the participants prior to recurrence period and its association with stroke recurrence is given in table 4.11 (results from bivariate analysis). Presence of depression, anxiety, memory issues and medication non adherence were associated with increased risk of stroke recurrence.

Table 4.11: Mental and emotional status and health behaviour of the of cases and controls prior to recurrence period and stroke recurrence (70 matched pairs)

	Variables (dichotomised)		**Control**		**MHR**	**P@ value**	**95% CI**	
Case			**n**	**n**			**LL**	**UL**
	Depression	**Yes**	**3**	**24**	**4**	**0.001**	**1.64**	**9.79**
		No*	**6**	**37**				
	Anxiety	**Yes**	**23**	**22**	**2**	**0.08**	**0.97**	**4.12**
		No*	**11**	**14**				
	Memory problem	**Yes**	**1**	**13**	**4.33**	**0.021**	**1.23**	**15.21**
		No*	**3**	**53**				
	Medication adherence	**No**	**7**	**30**	**4.29**	**<0.001**	**1.88**	**9.76**
		Yes*	**7**	**26**				
	Last visit to health care facility	>1month	39	11	0.69	0.442	0.32	1.48
		≤1month*	16	4				
	mRS	≤2	5	14	1.40	0.667	0.62	3.15
		>2*	10	41				

MHR-Mantel Haenszel Ratio; CI-Confidence Interval; LL-Lower Limit; UL-Upper Limit; *Reference category; mRS- modified Rankins Scale score; @ Mac Nemar p value.

4.1.2.5 Prevalence of cardiovascular risk factors among cases and controls and stroke recurrence

Prevalence of cardiovascular risk factors among the participants and its association with stroke recurrence is give in table 4.12 (Results from bivariate analysis). Presence of valvular heart disease was associated with stroke recurrence.

Presence of none of the other cardiovascular risk factors was not associated with increased risk of stroke recurrence.

Table 4.12: Prevalence of cardiovascular risk factors among cases and controls and stroke recurrence (70 matched pairs)

	Variables (dichotomised)		**Control**		**MHR**	**P@ value**	**95% CI**	
Case			**n**	**n**			**LL**	**UL**
	Diabetes Mellitus	Yes	27	15	0.728	0.83	0.42	1.65
		No*	18	10				
	Hypertension	Yes	46	9	0.664	0.75	0.32	1.78
		No*	12	3				
	Dyslipidaemia	Yes	47	9	0.804	1.29	0.48	3.45
		No*	7	7				
	Coronary Artery Disease	Yes	0	11	0.824	1.22	0.51	2.95
		No*	9	50				
	Valvular heart disease	**Yes**	**1**	**9**	**4.50**	**0.065**	**0.97**	**20.83**
		No*	**2**	**58**				
	Atrial fibrillation	Yes	2	5	1.25	0.739	0.34	4.65
		No*	4	59				
	Carotid disease	Yes	0	15	1.00	1.00	0.49	2.05
		No*	15	40				
	Thyroid dysfunction	Yes	0	6	0.75	0.607	0.26	2.161
		No*	8	56				
	smoking	Yes	11	25	1.56	0.164	0.83	2.9
		No*	16	18				

MHR-Mantel Haenszel Ratio; CI-Confidence Interval; LL-Lower Limit; UL-Upper Limit; * Reference category; @ Mc Nemar p value.

4.1.2.6 Status of control of risk factors prior to recurrence period and stroke recurrence

Status of risk factors prior to recurrence period and its association with stroke recurrence is given in table 4.13 (Results from bivariate analysis). Physical inactivity, unhealthy diet, glycosylated haemoglobin value of more than seven and uncontrolled lipid values were associated with increased risk of stroke recurrence.

Table 4.13: Status of risk factors prior to recurrence period and stroke recurrence (70 matched pairs)

	Variables(dichotomised)	Characteristics	Control		MHR	P@ value	95% CI	
			n	n			LL	UL
	Current smoking	Yes	2	7	2.33	0.344	0.60	9.02
		No*	3	56				
	Alcohol Use	Yes	1	8	1.33	0.791	0.46	3.84
		No*	6	55				
Case	Body Mass Index	Over weight	24	20	1.05	1.00	0.56	1.97
		Normal*	19	7				
	Waist circumference	Abnormal	47	12	1.33	0.664	0.56	3.16
		Normal*	9	2				
	Physical activity	**No**	**27**	**29**	**4.14**	**<0.001**	**1.81**	**9.46**
		Yes*	**7**	**7**				
	Healthy diet	**No**	**31**	**31**	**4.43**	**<0.001**	**1.95**	**10.06**
		Yes*	**7**	**1**				
	Diabetic control	No	13	16	0.64	0.211	0.34	1.2
		Yes*	25	16				
	Glycosylated	**≤7**	**13**	**22**	**2**	**0.080**	**0.97**	**4.12**
	haemoglobin	**>7***	**11**	**24**				
	Hypertension control	No	8	20	1.81	0.150	0.87	3.79
		Yes*	11	31				
	Lipid control	**No**	**1**	**11**	**5.5**	**0.022**	**1.22**	**24.8**
		Yes*	**2**	**56**				

MHR-Mantel Haenszel Ratio; CI-Confidence Interval; LL-Lower Limit; UL-Upper Limit; * Reference category; **@** -Mc Nemar P value.

4.1.3 Result of multivariate analysis

After the bivariate exploration of data some of the demographic, clinical and treatment of index stroke and condition of the participants and risk factors prior to recurrence period related variables got significant relation with stroke recurrence. Hierarchical conditional logistic regression analysis was done classifying the significant variables into different groups based on the existing knowledge of proximity of association to stroke recurrence. More distal variables were put into the model initially and new variables were added to significant variables in each step for further analysis.

Step 1: The variables categorized as demographic which included were age, sex and nature civil supply card.

Step2: The Variables categorized as risk factors, included medication adherence, glycosylated haemoglobin, lipid control, intracranial vessel disease and history of valvular heart disease and significant variable in the first step (nature of civil supply card)

Step 3: The variables included were significant variable in the second step- nature of civil supply card and medication adherence and the variables related life style- following recommended physical activity and a healthy diet

Step 4: The significant variables in the step 3 was medication adherence. Along with that significant variables related to clinical and treatment characteristics of index stroke were added to build the fourth model. The Final model is given in table 4.14.

Table 4.14: Factors associated with stroke recurrence

Variable	Category	OR	P value	95% CI for OR	
				LL	UL
Medication adherence	No Yes*	7.46	0.008	1.67	33.28
Discharge education	No Yes*	10.79	0.002	2.38	49.02
Greater number of days of hospitalization		0.82	0.039	0.67	0.99
Lacunar stroke	Yes No*	0.08	0.014	0.01	0.59

OR- Conditional Odds Ratio; CI- Confidence Interval; LL-Lower Limit; UL-Upper Limit *reference category

Conditional logistic regression analysis revealed patient who were not adherent to medication (OR=7.46) and did not receive discharge education (OR=10.79) were at increased risk of stroke recurrence whereas lacunar stroke (OR=0.08) and greater number of days of hospitalization during index stroke (OR=0.82) were associated with less chance of recurrence. The predictive accuracy of this model is 64.36%. Power of this study was calculated in online open epi statistical calculator, showed 97.87%.

4.1.4 Attributable risk of stroke recurrence

The attributable risk for stroke recurrence by the significant variables in multivariate analysis is shown in table 4.15. Nearly 86% of recurrent stroke risk can be attributed to medication non adherence.

Table 4.15: **The attributable risk of stroke recurrence**

Variable	Category	OR	95% CI for OR		Attributable risk (%)	Attributable risk for UL and LL of OR	
			LL	UL		LL	UL
Medication adherence	No Yes*	7.46	1.67	33.28	86.6	40.12	96.99
Discharge education	No Yes*	10.79	2.38	49.02	90.73	57.98	97.96
Greater number of days of hospitalization (>7)		0.82	0.67	0.99	21.95	1.00	49.25
Lacunar stroke	Yes No*	0.08	0.01	0.59	11.5	69	99

OR- Conditional Odds Ratio; CI- Confidence Interval; LL-Lower Limit; UL-Upper Limit; *reference category

4.2 Section II: Result of cross sectional survey

4.2.1 Characteristics of the study participants

4.2.1.1 The demographic characteristics of the participants

Stroke survivors within a post stroke period of three months to one year 240 numbers (n=240) participated. The mean age was 58.64 ±10.96 years. Females constituted 25.4% of the sample. Rural inhabitants were 76.7%. Among the participants 32.1% belonged to the category of poor households based on official government classification. Unskilled workers were 61.3%; 32.1% were skilled workers and the rest were professionals. The work or employment status of 44.6% were affected by stroke. Nearly 5.4% had to go on long leave and 6.3% lost their

jobs. The other demographic characteristics of the participants are given in table 4.16.

Table 4.16: Demographic characteristics of the study participants

Variables	Categories	n (%)
Age	≤45 years	31 (12.9)
	>45 years	209 (87.1)
Sex	Male	179 (74.6)
	Female	61 (25.4)
Place of residence	Rural	184 (76.7)
	Urban	56 (23.3)
Religion	Hindu	171(71.2)
	Christian	39(16.3)
	Islam	30(12.5)
Caste	SC	5(2.1)
	ST	2(0.8)
	OBC	141(58.8)
	Others	92(38.3)
Education of patient	Up to 10^{th} standard	175(72.9)
	Graduate	50(20.8)
	professional	15(6.3)
Occupation of patient	Manual laborer	147(61.3)
	Skilled worker	77(32.1)
	Professional	14(5.8)
House hold monthly income (Rupees)	< 1500	88 (36.7)
	1500-5000	83(34.6)
	≥5000	69(28.8)
Number of family members	≤4	97(40.4)
	>4	143(59.6)
Living with spouse	Yes	225(93.8)
	No	25(6.2)

Variables	Categories	n (%)
Education of care giver	Up to 10th	157(65.4)
	Higher secondary and above	83(34.6)
Nature of occupation of the care giver	Full time	33(13.8)
	Part time	25(10.4)
	Un employed	182(75.8)
Enrolment in health insurance	Yes	158(65.8)
	No	82(34.2)
Nature of insurance	Government	134(84.8)
	Private	24(15.2)
Ownership of vehicle	Two wheeler	82(34.2)
	Four wheeler	8(3.3)
	Both	105(43.8)
	none	45(18.8)
Receiving financial assistance or free outpatient medication	Yes	64(26.7)
	No	176(73.3)
Civil supply card	Yellow	2(0.8)
	Pink	75(31.3)
	Blue	82(34.2)
	white	81(33.8)

4.2.1.2 Access to health care and health care seeking behaviour

The mean distance to the nearby hospital is 3.4±2.55 km and a medical shop is available to the participants at a mean distance of 2.54±1.88 km. The mean cost of medication per week was ₹377.96 (minimum 100; maximum 2000). Majority (68.5%) had medical insurance which covered their inpatient treatment expenditure, in which 84.8% had insurance provided from government agencies. Only 26.7% (n=64) had any form of assistance to cover the expenditure of their prescribed

medications. In which 40.6% were getting reimbursement for their outpatient care and 59.4% were getting free medications from government hospitals. Nearly 90% of the patients received discharge education from the hospital at the time of discharge from hospital during index stroke. The discharge education was received from multiple sources by individual patients. The discharge education was received from treating physician by 77%, 43% received from nurses and 80% received discharge education from other sources like physiotherapist and research coordinators. The components of discharge education included diet (67.5%), physical activity (77.1), follow up care (60%) and regular intake of medication (79.2%). The other characteristics related to access to health and health care seeking behaviour is given in table 4.17.

Table 4.17: Access to health care and health care seeking behaviour

Variables	**Categories**	**n (%)**
System of medicines followed for treatment of stroke	Allopathy	238(99.2)
	Homeopathy	2(0.8)
	Ayurveda	15(6.3)
Usual checkup being done in	Private hospital	40(16.7)
	Private clinics	76(31.7)
	Government hospital	124(51.7
Ever visited by ASHA worker or PHN	Yes	26(10.8)
	no	214(89.2)
Last visit to doctor	<30days	61(25.4)
	31-90days	125(52.1)
	3-6 months	35(14.6)
	6 months -1 year	19(7.9)
Availability of medicine in the nearest medical shop	Yes	156(65)
	No	84(35)
Ever told medicine out of stock from pharmacy	Yes	63(26.3)
	No	177(73.7)

Variables	Categories	n (%)
Do you buy medicine for one month	Yes	106(44.2)
	No	174(55.8)
Reason for not buying for one month	Financial	122(50.8)
	others	10(4)
Any communication problem with doctor	Yes	15(6.3)
		225(93.7)
Received discharge education from hospital	Yes	210(87.5)
	No	30(12.5)

ASHA- Accredited Social Health Activist; PHN- Public health Nurse

4.2.1.3 Characteristics related to stroke

Ischemic stroke patients constituted 83.8% of the participants. The mean NIHSS score at ictus was 6.5(5.9) and the mean mRS score at ictus was 1.2(1.3). The mean NIHSS score at recruitment was 1.2(2.2). Characteristics of the study participants based on stroke related variables are given in table 4.18. Majority of the participants were with a post stroke period of three months to six months. At ictus more than 50% of the participants had neurological disability corresponding to an NIHSS score of >4 while at recruitment (3- 12 months post stroke) only 7% had that level neurological disability. Around 38% of the participants had memory problem and depression.

Table 4.18: Characteristics related to stroke

Characteristics	Categories	n (%)
Type of stroke	Ischemic	201(83.8)
	Hemorrhagic	30(12.5)
	TIA	9(3.8)
Post stroke period	3-6 months	141(58.8)
	6-9 months	31(12.9)
	9-12 months	68(28.3)
NIHSS score at ictus	≤4	114(47.5)
	>4	126(52.5)
NIHSS score at review	≤4	223(92.9)
	>4	17(7.1)
mRS ictus	≤2	156(65)
	>2	84(35)
Presence memory problem	Yes	92(38.3)
	No	148(61.7)
Presence of depression	Yes	92(38.3)
	No	148(61.7

NIHSS- National Institute Health Stroke Scale; mRS- modified Rankins Scale

4.2.1.4 Prevalence of risk factors and unhealthy life style among stoke survivors

Prevalence of cardiovascular risk factors and unhealthy life style among stoke survivors is shown in table 4.19. Even though more than 45% of the participants had the habit of smoking, only around 4% were smoking at the time of recruitment. Around 75% of the participants were obese or had overweight. Normal waist circumference was found only in 25% of the participants; when calculated with the given separate cut off values for men and women. Majority of the participants were not following a healthy diet or doing recommended physical activity. The prevalence of diabetes and hypertension was high among stroke survivors. Presence of dyslipidaemia was very high as 96%.

The blood pressure, lipid, sugar values and body mass index are summarised in table 4.20. The mean systolic blood pressure was 140 mm of Hg, the mean diastolic blood pressure was 84 mm of Hg. The mean fasting blood sugar was 120 mg/dl while the mean glycosylated haemoglobin was 7.2. The mean total cholesterol was 147 mg/dl, while the mean low density lipoprotein was 83 mg/dl. The mean BMI among stroke survivors of three months to one year was 31 kg/m^2.

Table 4.19: Prevalence of cardiovascular risk factors and unhealthy life style among stoke survivors

Risk factors	**Category**	**N (%)**
Ever smoked >100 cigarettes in life time	Yes	112(46.7)
	No	128(53.3)
Current smoking	Yes	10(4.2)
	No	230(95.8)
Waist circumference (cm)	Normal	52(21.7)
	Moderate central fat	94(39.2)
	High central fat	94(39.2)
Body Mass Index (kg/m^2)	Under weight	2(0.8)
	Normal	60(25)
	Over weight	147(61.3)
	Obese	31(12.9)
Physical inactivity	Yes	150(62.5)
	No	90(37.5)
Unhealthy diet	Yes	209(87.1)
	No	31(12.9)
Diabetes	Yes	154(61.2)
	No	86(38.8)
Hypertension	Yes	213(88.6)
	No	27(11.4)
Dyslipidemia	Yes	232(96.7)
	No	8(3.3)

Table 4.20: Mean and five number summaries of quantitative variables related to risk factors

Variables	N	Mean	SD	Minimum	Maximum	Median	Q1	Q3
Systolic Blood Pressure	240	139.94	20.64	90	230	140	130	150
Diastolic Blood Pressure	240	83.53	11.47	8	120	80	80	90
Fasting blood sugar	230	120.53	39.04	1	341	112	98	132.25
Glycosylated Hemoglobin	181	7.15	1.63	1	12.7	6.8	6.05	8.05
Total Cholesterol	228	146.87	34.03	5.9	330	142.5	126	168
Low density lipoprotein	207	83.13	30.50	14	236	80	63	103
Body mass index	240	30.67	59.60	16.5	949.0	26.7	24.9	28.8

SD- Standard Deviation; Q1- First quartile; Q3- Third quartile

4.2.1.5 Medication adherence

Adherence to five categories of medications and overall adherence is shown in figure 7. and self reported reasons for non adherence are in table 4.21. Adherence to anti diabetic medication, seperately for injectable and oral medication is given in table 4.22. Medication adherence was highest for antiplatelet medications; the anticoagulants ranked second. Adherence was least for antidiabetic medications. Overall medication adherence among stroke survivors was 43.8±6.27. The adherence to insulin therapy was very poor compared to oral hypoglycaemic agents. The most frequently reported reason (self-reported reasons among non-adherent participants) for medication non adherence was financial problems. Simple forgetfulness was also reported by stroke survivors as a reason for their non adherence to medications.

Figure 9: Adherence to five categories of medication and overall adherence

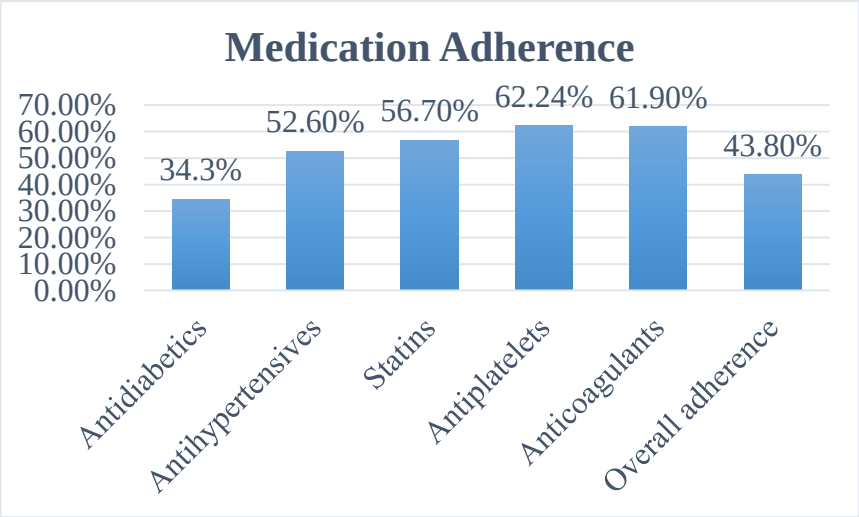


Table 4.21: Anti diabetic medication adherence for injectable and oral medication

Adherence	Injectable		OHA		Total	
	n	%	n	%	n	%
Yes	6	15.4	40	42.1	46	34.3
No	33	84.6	55	57.9	88	65.7
Total	39	100	95	100	134	100

Table 4.22: Self reported reasons for medication non adherence

Self reported reasons for medication non adherence	Frequency (n)	Percentage (%)
Side effects	39	16.3
No need for medications	11	4.6
Forgetfulness	56	23.3
Journeys	37	15.4
Financial problems	84	35

4.2.1.6 Risk factor control

The control of risk factor among stroke survivors is given in table. Even though around 47% of our participants had the history of smoking >100 cigarettes over life time, only 4.2 % are currently smoking. More than 50% had stopped smoking after first ever stroke and others stopped before the first stroke. The alcohol use was less prevalent among stroke survivors in our centre. The targeted level of diabetic control and hypertension control level was achieved by only a small proportion while around 72% attained the targeted lipid control status. More than 90% of the participants had a desirable level of total cholesterol value. Optimal level of low density lipoprotein was achieved by 63% of the participants.

Table 4.23: The control of risk factor among stroke survivors

Variables	Categories	n (%)
Current alcohol use	Yes	9(3.8)
	No	231(96.2)
Current smoking	Yes	10(4.2)
	No	230(95.8)
Diabetic control*	Yes	40(26.0)
	No	114(74)
Hypertension control#	Yes	77(36.2)
	No	136(63.8)
Lipid control@	Yes	151(72.9)
	No	56(27.1)
LDL	Optimal	152(63.3)
	Acceptable	46(19.2)
	Border line high	5(2.1)
	High	4(1.7)

Variables	Categories	n (%)
	Desirable	221(92.1)
Total cholesterol	Border line high	5(2.1)
	Above high	2(0.8)
HbA1C	<6.5	70(29.2)
	≥6.5	111(46.3)

*Diabetic control-Among patients with diabetes FBS 70-130 and HBAIC >7, #Hypertension control- SBP <140 and DBP<90 among hypertensives and @lipid control- LDL<100 and TC<200, Lipids:100-129- acceptable;130 -159- borderline high;169-189-high;<100- optimal, Total Cholesterol:<200- desirable;200-239- borderline high;240 and above high

4.2.1.7 Characteristics of the participants on the basis of factors related to patient's belief about stroke and treatment

The Characteristics of the participants on the basis of factors related to belief about stroke and treatment is given in table 2.24. Around 65% of the stroke survivors were anxious about their disease and around 70% had self-perceived state of average to very poor health. Almost half of the participants were following a routine in their activities of daily living. Around 72% of the participants expressed currently had a simple treatment regimen for their disease. Nearly 80% of the participants agree that they medicine prescribed for them were really needed and around 35% expressed fear of dependence to their medication. Almost equal number of participants; around 60% agree that stroke had a high chance of recurrence and medications will prevent recurrence. More than 90% of the participants were satisfied with their existing treatment. Even though only around 30 % of the participants were able to read and understand their prescription and medication; more than 70% were confident in taking their medication based on prescription by self. Around 75% of the stroke survivors had family help in taking their medication based on prescription while 85% of the participants were reminded by the family members regarding medication intake. History of treatment default was reported by around 30% of the participants.

Table 2.24: Factors related to patient's belief about stroke and treatment

Characteristics	Categories	N (%)
Presence of anxiety about stroke	Yes	156(65)
	No	84(35)
Having daily routine	Yes	118(49.2)
	No	122(50.8)
Perceived state of health	Very poor	13(5.4)
	Poor	65(27.1)
	Average	64(26.7)
	Good	88(36.7)
	Very good	10(4.2)
Feeling about treatment regimen	Simple	174(72.5)
	Complex	66(27.5)
Fear of dependence	Yes	83(34.6)
	No	157(65.4)
Believes that medicine really needed	Yes	190(79.2)
	No	21(8.8)
	Don't know	29(12.1)
Do you agree that stroke has a higher chance of recurrence	Agree	139(57.9)
	Not agree	11(4.6)
	Don't know	90(37.5)
Believes that medicine prevent recurrence	Believe	138(57.5)
	Not believe	9(3.8)
	Don't know	93(38.8)
Are you satisfied with the treatment	Yes	223(92.9)
	No	17(8.1)
Are you able to read and understand medicine label	Yes	66(27.5)
	No	174(72.5)
Are you confident in taking your medications as per recommendation	Highly confident	111(46.3)
	Somewhat confident	68(28.3)
	Not confident	61(25.4)

Characteristics	Categories	N (%)
Did you continue recommended physiotherapy	Yes	116(48.3)
	No	124(51.7)
Presence of family help in taking medication	Yes	182(75.8)
	No	58(24.2)
Family members remind you to take medication	Yes	203(84.6)
	No	37(15.4)
History of treatment default	Yes	71(29.6)
	No	169(70.4)

4.2.2 Results of bivariate analysis

4.2.2.1 The demographic characteristics and medication adherence

Medication adherence was high among those aged less than or equal to 45 years but the difference was not statistically significant. Higher medication adherence was observed among urban residents and people belong to the category of Above Poverty Line (APL) based on official classification of government of India. Medication adherence was not significantly different among stroke survivors for the other demographic variables assessed in this study. The demographic characteristics and medication adherence are given in table 4.25 (Results of bivariate analysis).

Table 4.25: The demographic characteristics (N=240) and medication adherence

Variables	Categories	Adherence* Yes (n=105)		χ^2 value	P value
		n	%		
Age	**≤45**	**18**	**58.1**	**1.94**	**0.085**
	>45	**87**	**41.6**		
Sex	Male	73	40.8	2.52	0.112
	Female	32	52.5		
Place of residence	**Urban**	**31**	**55.4**	**3.99**	**0.046**
	Rural	**74**	**40.2**		
Religion	Hindu	80	46.8	3.31	0.191
	Christian	12	30.8		
	Muslim	13	43.3		
Caste	Scheduled caste/Tribes	3	42.86	1.63	0.442
	OBC	57	40.43		
	General	45	48.91		
Education of patient	High school	74	42.30	0.56	0.453
	Higher secondary and above	31	47.70		
Occupation	Skilled worker	43	47.3	0.73	0.393
	Unskilled worker	62	41.60		
Monthly income	<1500	37	42.05	0.654	0.721
	1500-5000	35	42.17		
	≥5000	33	47.83		
Number of family members	<4	41	42.23	0.145	0.703
	≥4	64	44.76		
Living with spouse	Yes	96	44.44	0.423	0.665
	No	9	60.00		
Education of the care giver	High school	64	40.76	1.644	0.200
	Higher secondary and above	41	49.40		
Nature of occupation of the care giver	Full time	13	39.4	0.441	0.802
	Part time	12	48.00		
	Un employed	80	43.96		

Variables	Categories	Adherence* Yes (n=105)		χ^2 value	P value
		n	%		
Enrolled in health insurance	Yes	74	46.84	1.789	0.181
	No	31	37.80		
Getting financial assistance for medication	Yes	30	46.86	0.346	0.556
	No	75	42.61		
Ownership of vehicle	Yes	66	48.90	1.62	0.96
	No	39	37.10		
Nature of civil supply card (dichotomized)	**BPL**	**26**	**33.77**	**4.592**	**0.032**
	APL	**79**	**48.47**		

*Outcome variable; Abbreviations: OR- Odds Ratio, CI- Confidence Interval; APL-Above Poverty Line; BPL-Below Poverty Line

4.2.2.2 Factors related to access to health care and health care seeking behaviour and medication adherence

The participant characteristics related to access to health care and health care seeking behaviour in relation to medication adherence is given in table 4.26 (Result of bivariate analysis). Those who had prescribed medications available in the nearest medical shop and buy medication for one months were adherent to medications. Those expressed financial problem as a reason to not buying medication for one month were also not adherent to medication. The other variable characteristics assessed in this domain did not showed a significant difference in medication adherence.

Table 4.26: Factors related to access to health care and health care seeking behaviour and medication adherence

Variables	Categories	Adherence* Yes (n=105) n	%	χ^2 value	P value
Usual check up being done in	Private hospital	19	47.50	0.738	0.691
	Private clinic	35	46.05		
	Government hospital	51	41.12		
Ever visited by ASHA/ PHN	Yes	15	57.69	2.303	0.129
	No	90	42.06		
Last visit to doctor	<7days	5	45.45	5.446	0.245
	8-30days	16	32.00		
	31-90days	56	44.80		
	3-6 months	20	57.14		
	>6months	8	42.11		
Availability of medicines in the nearest medical shop	**Yes**	**80**	**51.28**	**10.275**	**0.001**
	No	**25**	**29.76**		
Ever told medicine out of stock in the pharmacy	Yes	24	38.10	1.110	0.292
	No	81	45.76		
Do you buy medicine for one month	**Yes**	**55**	**51.89**	**5.108**	**0.024**
	No	**50**	**37.31**		
Financial problem to buy medicine for one month	**Yes**	**48**	**39.34**	**0.033**	**0.856**
	No	**7**	**35.00**		
Communication problem with the doctor	Yes	8	53.33	0.597	0.440
	No	97	43.11		
Received discharge education from hospital	Yes	95	45.24	1.512	0.219
	No	10	33.33		

ASHA- Accredited Social Health Activist; PHN- Public Health Nurse

4.2.2.3 Stroke related characteristics and medication adherence

Stroke related characteristics of the participants and its relationship to medication adherence is given in table 4.27 (result of bivariate analysis). Those who had more severe stroke in terms of neurological and functional disability were more adherent to medication. Presence of moderate to severe neurological disability at

recruitment was also associated with medication adherence. The post stroke period was not significantly associated with medication adherence. Presence of memory problem reduced adherence to medication.

Table 4.27: Stroke related characteristics and medication adherence

Variables	**Categories**	**Adherence* Yes (n=105)**		**χ^2 value**	**P value**
		n	**%**		
Post stroke period	3-6 months	63	44.05	0.258	0.879
	6-9 months	14	45.16		
	9-12 months	28	41.17		
NIHSS at ictus	**0-4**	**43**	**47.70**	**8.859**	**0.031**
	5-15	**44**	**44.44**		
	16-20	**12**	**60.00**		
	21-42	**6**	**85.71**		
NIHSS at review	**0-4**	**93**	**41.70**	**5.355**	**0.021**
	5-15	**12**	**70.58**		
mRS	**≤2**	**61**	**39.10**	**3.912**	**0.033**
	>2	**44**	**52.38**		
Memory problem	**Yes**	**34**	**36.95**	**2.798**	**0.094**
	No	**71**	**47.97**		
Depression	Yes	38	41.3	0.363	0.547
	No	67	45.27		

NIHSS- National Institute Health Stroke Scale; mRS- modified Rankins Scale

4.2.2.4 Patient's belief about stroke and treatment and its relationship with medication adherence

The characteristics of the participants related to their belief about stoke and treatment and its relation to medication adherence is given in table 4.28 (Result of bivariate analysis). Perceived poor state of health and need of medication is associated with increased adherence to medication. Those who had a simple treatment regimen and believed that medicine prevent recurrence were adherent to medication while those who had fear of dependence to medication were not adherent to prescribed medication. Patients who had daily routine and followed the recommended physiotherapy at home were adherent to their medication also.

Table 4.28: Patient's belief about stroke and treatment and its relationship with medication adherence

Variables	**Categories**	**Adherence* Yes (n=105)**		**χ^2 value**	**P value**
		n	**%**		
Presence of anxiety about stroke	Yes	72	46.15	1.047	0.306
	No	33	39.28		
Having daily routine	**Yes**	**66**	**55.93**	**13.999**	**0.000**
	No	**39**	**29.50**		
Perceived state of health	**Very poor**	**9**	**69.23**	**12.793**	**0.012**
	Poor	**34**	**52.30**		
	Average	**20**	**31.25**		
	Good	**35**	**39.77**		
	Very good	**7**	**70.00**		

Variables	Categories	Adherence* Yes (n=105) n	%	χ^2 value	P value
Feeling about treatment regimen	**Simple**	**85**	**48.85**	**6.689**	**0.010**
	Complex	**20**	**30.30**		
Fear of dependence to treatment	**Yes**	**30**	**36.14**	**2.982**	**0.084**
	No	**75**	**47.77**		
Believes that medicine really needed	**Yes**	**93**	**48.94**		
	No	**6**	**28.57**	**10.318**	**0.006**
	Don't know	**6**	**20.68**		
Do you agree that stroke has a higher chance of recurrence risk	Agree	66	47.48	1.895	0.388
	Not agree	4	36.36		
	Don't know	35	38.88		
Believes that medicine prevent recurrence	**Believe**	**73**	**52.89**		
	Not believe	**3**	**33.33**	**11.059**	**0.004**
	Don't know	**29**	**31.18**		
Are you satisfied with the treatment	Yes	98	43.75	0.000	1.000
	No	7	43.75		
Are you able to read and understand medicine label	Yes	32	48.48	0.829	0.362
	No	73	41.95		

Variables	Categories	Adherence* Yes (n=105)		χ^2 value	P value
		n	%		
Are you confident in taking your medications as per recommendation	Highly confident	49	44.14	0.815	0.665
	Somewhat confident	27	39.70		
	Not confident	29	47.54		
Do you continued recommended physiotherapy	**Yes**	**58**	**50.00**	**3.564**	**0.059**
	No	**47**	**37.90**		
Presence of family help in taking medication	Yes	80	43.95	0.013	0.909
	No	25	43.10		
Family members remind you to take medication	Yes	89	43.84	0.005	0.946
	No	16	43.24		
History of treatment default	Yes	36	50.70	1.981	0.159
	No	69	40.82		

4.2.2.5 Effect of medication adherence and healthy life style on risk factor control

Effect of medication adherence and life style such as current smoking, alcohol use, physical activity and healthy diet on risk factor control (diabetic control, hypertension control and dyslipidaemia control) is given in tables 4.29, 4.30 and 4.31 respectively (Result of bivariate analysis).

Table 4.29: Medication adherence and healthy life style on hypertension control

Adherence to antidiabetic medication was associated with control blood sugar. Diabetic control was more among those who did recommended physical activities, but this difference was not statistically significant.

Variables	Categories	Diabetic control*		χ^2 value	P value
		n	%		
Medication adherence#	Yes	21	45.65	15.21	0.00
	No	13	14.77		
Following recommended physical activity	Yes	36	40.00	2.27	0.07
	No	43	28.66		
Following Healthy diet	Yes	13	41.93	1.31	0.25
	No	66	31.57		
Current smoking	Yes	1	10.00	2.48	0.12
	No	78	33.91		
Alcohol use	Yes	4	44.44	0.56	0.45
	No	75	32.46		

*Outcome variable; Diabetic control-Among patients with diabetes FBS 70-130 and HBAIC >7; #Adherence to corresponding categories of medication was taken.

Table 4.30: Medication adherence and healthy life style on hypertension control

Adherence to antihypertensive medication was associated with control blood pressure. Hypertension control was more among those who did recommended physical activities, but this difference was not statistically significant.

Variables	Categories	Hypertension control			
		n	%	χ^2 value	P value
Medication adherence	Yes	51	51.0	15.41	0.00
	No	21	23.3		
Following recommended physical activity	Yes	33	36.7	0.08	0.78
	No	51	34.0		
Following Healthy diet	Yes	10	32.3	0.12	0.73
	No	74	35.4		
Current smoking	Yes	3	30.0	0.12	0.74
	No	81	35.2		
Alcohol use	Yes	4	44.4	0.37	0.55
	No	80	34.6		

Hypertension control- SBP <140 and DBP<90 among hypertensives; #Adherence to corresponding categories of medication was taken.

Table 4.31: Medication adherence and healthy life style on dyslipidaemia control

Dyslipidaemia control was associated with adherence statins and following recommended physical activity. Those who follow a healthy life style also had their lipid values controlled compared to others, but this difference was not statistically significant.

Variables	Categories	Dyslipidemia control*			
		n	%	χ^2 value	P value
Medication adherence#	Yes	95	85.6	16.15	0.00
	No	52	60.5		
Following recommended physical activity	Yes	61	81.3	4.192	0.04
	No	90	68.2		
Following Healthy diet	Yes	26	86.7	3.35	0.06
	No	125	70.6		
Current smoking	Yes	4	57.1	0.92	0.34
	No	147	73.5		
Alcohol use	Yes	5	62.5	0.46	0.49
	No	146	73.4		

Outcome variable; dyslipidaemia control- LDL<100 and TC<200 among patients with dyslipidaemia; #Adherence to corresponding categories of medication was taken.

4.2.3 Result of Multivariate Analysis

4.2.3.1 Facilitator and barriers to medication adherence

Those variables have statistical significance <0.1 were considered for multivariate regression analysis. Sequential stepwise logistic regression analysis was done in the following steps.

Step1- The significant variables were categorized into five groups. Sociodemographic variables included age, sex, ownership of vehicle, belongs to poor households and place of residence. The second category of variables were

availability of medicine in the nearest medical shop and buy medicines for one month. The third group- stroke related variables included stroke severity at ictus, stroke severity at recruitment, mRs score at recruitment and presence of memory issues. Variables related to patient's belief about treatment and disease were perceived need of medication, experiencing side effects, fear of dependence to medications, belief that medicine prevents recurrence, simple treatment regimen and perceived poor state of health. Life style factors are following a healthy diet, continuing physiotherapy, doing regular physical activity and routine life style. Separate logistic regressions were built including age and sex in each model, corresponding to each group of predictors resulting in five models. Those variables having significance level <0.1 in each model were considered for the second step.

Step2- Those variables having significance level <0.1 from each category were selected for regression analysis at second step. The variables were availability of medicine in the nearest medical shop, buy medicines for one month, continuing physiotherapy at home, having a daily routine, NIHSS<4 at review, presence of memory problem, experiencing side effects, belief that medicine prevents recurrence and perceived poor state of health. A multiple logistic regression model was created including all the variables plus age and sex.

Step3- Final model was created by backward elimination from step 2, with alpha level set to 0.05.

In the final model, availability of medicine in the nearest medical shop, having a daily routine and perceived poor state of health were facilitators and memory issues, minimum neurological deficits at recruitment and experiencing side effects were barriers to medication adherence. The final model (result of multivariate analysis by multiple binary stepwise logistic regression analysis) with odds ratios is displayed in table 4.32.

Table 4.32: Final model of facilitators and barriers to medication adherence among stroke survivors (variables dichotomised)

The final model of facilitators and barriers to medication adherence showed availability of medication in the nearest medical shop, buying medication for one month, daily routines, perceived poor state of health and presence of neurological disability facilitated medication adherence while memory problems and experiencing side effects remained as barriers to medication adherence.

Variables	Reference category	Unadjusted OR	95% CI		Adjusted OR	95% CI	
			LL	UL		LL	UL
Age ≤45	>45Years	1.94	0.90	4.17	1.34	0.54	3.35
Sex- Male	Females	0.62	0.35	1.12	0.60	0.3	1.21
Availability of medicines in the nearest medical shop	No	2.48	1.41	4.36	2.36	1.23	4.52
Buy medicines for one month	No	1.81	1.08	3.04	1.84	0.99	3.45
Having a daily routine	No	2.70	1.60	4.57	2.81	1.5	5.26
Mild stroke (NIHSS≤4) at recruitment	Severe stroke (NIHSS> 4)	0.3	0.10	0.86	0.19	0.05	0.73
Memory issues	No	0.64	0.37	1.08	0.34	0.16	0.71
Experiencing side effects	No	0.21	0.11	0.40	0.22	0.10	0.46
Perceived poor state of health	No	1.98	1.15	3.43	2.65	1.3	5.4

OR- Odds Ratio; CI- Confidence Interval; LL- Lower Limit; UL- Upper Limit

This model is in good fit to the data. The Hosmer–Lemeshow test *P* value is > 0.05 (p=0.15) which indicates that the outcome is not significantly different from those predicted by the model and that the overall model fit is good. R^2 value is 0.325. Approximately 32.5% of variation in the outcome can be explained by this model. The predictive accuracy of this model is 73.8%.

4.2.3.2 Risk factor control and medication adherence

To find out the risk factor control, the proportion of patients who achieved the targeted level of diabetic control, hypertension control and dyslipidaemia control were analysed. Separate models were created to find out the effect of medication adherence (corresponding categories) on risk factor control (diabetes, hypertension and dyslipidaemia) adjusted for the following: physical activity, healthy diet, current smoking and alcohol use. Adjusted odds ratio and 95% confidence interval were reported.

Multiple logistic regression analysis revealed medication adherence was associated with risk factor control when adjusted for physical activity, healthy diet, current smoking and alcohol use (Table 4.33).

Table 4.33: Risk factor control and medication adherence

Risk Factors	On treatment		Adherence[#]		Risk Factor control[*]		OR[a]	95% CI	
	n	%	n	%	n	%		Lower limit	Upper limit
Diabetes(N=154)	134	87.07	46	34.3	40	26	4.85	2.12	11.08
Hypertension (N=213)	187	89.05	100	52.6	77	36.2	3.4	1.83	6.4
Dyslipidaemia (N=232)	218	93.97	127	56.7	95	40.9	3.88	1.96	4.04

Abbreviations: OR- Odds Ratio, CI- Confidence Interval *Outcome variables; Diabetic control-Among patients with diabetes FBS 70-130 and HBAIC >7, Hypertension control- SBP <140 and DBP<90 among hypertensives and LDL<100

and TC<200 among patients with dyslipidaemia. #Adherence to corresponding categories of medication was taken. OR[a] –adjusted OR (Adjusted for physical activity, healthy diet, current smoking and alcohol use); reference category- not achieving corresponding risk factor control

4.2.4 Population attributable risk for stroke recurrence

Population attributable risk of significant factor for stroke recurrence was calculated by taking the prevalence of risk factors in the population from cross sectional survey. Since the prevalence of medication non adherence (56.2%) and not receiving discharge education at the time of index stroke (12.5) is available from cross sectional survey, we could calculate the population attributable risk of medication nonadherence and not receiving discharge education at the time of index stroke risk for stroke recurrence (Table 4.34). The prevalence of lacunar stroke and the proportion of stroke patients who had hospitalisation of less than seven days were not available in the cross sectional survey. For estimating the population attributable risk, the distribution of these risk factors among stroke population was taken from literature. The prevalence of lacunar stroke was 8.05% (Somasundaram & Potty, 2020). The available data on hospitalisation days showed 75% of stroke patients had a hospitalisation day of less than 8 (Sheedy et al, 2020). In the absence of other data, it is considered as the prevalence of less than 7 days of hospitalisation. The 78.4% and 55.04% of risk of stroke recurrence in the population over a mean post stroke period of 5 years can be attributed to medication non adherence and not receiving discharge education respectively.

Table 4.34: Population attributable risk for stroke recurrence

Variable	Attributable risk (%)	Attributable risk for UL and LL of OR		Average attributable fraction	95% CI	
		LL	UL		LL	UL
Medication non adherence	78.4	27.38	97.78	21.24	13.16	34.26
Not receiving discharge education	55.04	14.75	85.71	20.93	12.75	30.5
Other than lacunar stroke	94*	40	99	19.6	1.76	60.02
Number of days of hospitalisation <7	99.91*	0.00	32	30.35	3.14	45.5

OR- Conditional Odds Ratio; CI- Confidence Interval; LL-Lower Limit; UL-Upper Limit; * reference category. *Prevalence of exposure was taken from another study.

Chapter 5
DISCUSSION

Discussion of the findings of this thesis is divided into two sections:

5.1 Section I: Discussion of the findings of case control study

5.1.1 Methodology

This study used a strong methodology- incident pair matched case control, which is higher in the evidence pyramid. We have selected incident stroke patients as cases which removed the survival bias. The stroke recurrence rate depends on the duration of post stroke period and factors related to early and late stroke recurrence are different. This was taken into consideration by selecting the recurrences beyond one month of index stroke as incident cases of recurrent strokes. The interview was conducted in the home setting for both the cases and controls which aided in the assessment of the sociodemographic and life style pattern more accurately. The participants were more relaxed in the home environment. We had assessed the medication adherence, risk factor control and life style factor for cases just before recurrence and for matched controls just before the corresponding recurrence period which made the data more comparable.

We used self-reported medication adherence, defined as consumption of at least more than 80% of their medications for last two weeks, based on their last prescription. Consumption of more than 80% medication is widely accepted as optimal and is used in most of the clinical trials too (Lam & Fresco, 2015). We selected two weeks period to collect the history of medication intake to reduce recall bias as well as the tendency of patients to be more adherent to the instructions around the days of follow up.

We had selected recurrent stroke cases who had index stroke admitted and treated in our centre and some other hospitals. Among those who were treated outside during index stroke, some patients came to our centre after discharge and were on follow up in our stroke clinics but few patients (7%) came to our centre only

with recurrent stroke. This was only small percentage (7%) and the likely hood of selection bias very minimal. The other hospitals were mainly government and private medical college hospital and other corporate hospitals which were following the same treatment guidelines and there were no deficiencies in the treatment of those patients.

5.1.2 Characteristics of the participants and stroke recurrence

5.1.2.1 Sociodemographic characteristics

This study was conducted among age matched cases and controls. The age matching was done in such a way that the age of controls was matched to cases ±3 years. Studies have shown that advanced age is associated with stroke recurrence and stroke recurrence rate increased as the age advances (de la Camera, 2014; Zao et al, 2017). In matched case control, matching is done just to ensure that there are enough pairs in each stratum, not for eliminating confounding. Patients belonging to low income category had increased risk of recurrence (OR 4, 95% CI 1.33-11.96), but on adjusted model effect was not significant. The other sociodemographic factors like education and occupation were not associated with stroke recurrence. None of the previous studies assessed these variables. One previous study conducted among stroke survivors found an increased risk for stroke recurrence among urban residents (Rafie et al, 2019) but we could not demonstrate such a difference.

5.1.2.2 Index stroke related characteristics

This study recruited post stroke period matched cases and controls (p=0.29). The median stroke recurrence period was 65.5 months. The recurrence risk is associated with post stroke period (Beunaflor, 2017; Stahmeyer et al, 2019). The early and late recurrences are implicated to different aetiologies and risk factors (Beunaflor, 2017; Wanquin et al, 2017).

Our study showed, that the index stroke severity and greater number of days of hospitalization were associated with less risk of recurrence. The patients with severe stroke tend to get admitted for more days and they may tend to adhere the life style modifications because of the fear of recurrence. The more hospitalisation days helps completing the etiologic evaluation and planning and implementation of

discharge education. In patients with more severe stroke and disability there is a tendency to miss the recurrences, but in our study 90% of the patients had an mRS score of less than 2 prior to recurrence period so there is less chance of missing recurrences.

The ischemic stroke subtype (Kauw et al, 2018) proved to be an independent predictor of stroke recurrence compared to haemorrhagic stroke, but we could not demonstrate that association because the proportion of patients' haemorrhagic stroke was very low in our study which made the comparison not possible. Though large artery atherosclerosis (Lovett et al 2004 & Kauw et al 2018) and cardioembolic stroke are associated with increased risk of stroke recurrence (Lovett et al 2004, Wolf et al 2013, Kauw et al 2018), we did not find that to be significant in our study. Unlike other studies (Kauw et al, 2018) the imaging predictors like number of lesions, location of lesions, and affected territory were not associated with stroke recurrence in our study, this may be due to smaller sample size we had in our study.

Presence of memory problems and depression (use of antidepressants) prior to recurrence period were associated with increased risk of stroke recurrence, but it was not significant on multivariate analysis. Study on post stroke depression showed it is independently associated with stroke recurrence (Morgenstern et al, 2011, Wu et al, 2019). They have assessed depression on the basis of self reported symptoms of depression and not assessed the use of antidepressants. In our study we had assessed depression on the basis of use of prescribed antidepressants.

5.1.2.3 Medication adherence

We could demonstrate a strong relationship between medication adherence and stroke recurrence. Medication nonadherence is associated with an increased risk around seven times of stroke recurrence compared to those who ae not adherent. Previous studies have shown that nonadherence to statins and antiplatelets were associated with increased risk of stroke recurrence (Rothwell, 2004; Ruksakulpiwat, 2020), But the exact medication adherence is integral to risk factor control which is the forerunner of preventing recurrent strokes. Medication adherence can be improved through interventions like simple reminders by family members friends or by short messages. Patients awareness can be improved through individualised educations. Periodic review with assessment of risk factor control status and

correlating with medication consumption will provide incentives to continue the adherence behaviour. Referring to health care centres in the periphery and centres which provide free medications can also help.

We assessed adherence to all categories of medications through a face to face interview which makes the data more reliable rather than telephonic interviews or from prescription as done in previous studies (Rothwell, 2004; Ruksakulpiwat, 2020). The medication adherence rate we found in our study was higher for controls (80%) whereas only around 47.1% of the cases were adherent to all the categories of medication prescribed for them.

5.1.2.4 Discharge education

Patients who did not receive discharge advice while getting discharged from the hospital during index stroke admission showed increased risk of stroke recurrence. Patients who received discharge advice were more likely to be aware of life style modifications and medication adherence which are essential for risk factor control and prevention of recurrence. The stroke care should be exclusive and comprehensive so that individualised education can be given to patients tailoring to their needs. Various studies have shown that the education interventions given by doctors, nurses or physiotherapists are equally effective in behaviour modification (Ellis et al, 2005; Hohmann et al, 2009). The discharge education should incorporate risk communication. Risk communication implies not the communicating the risk factors, it is the communication for future stroke risk. Risk communication and further risk awareness is proposed as a way to increase adherence to medications and other secondary stroke prevention strategies to reduce recurrent stroke. (Slark & Sarma, 2014). Studies have shown that only 42% of the stroke patients were aware of the recurrence risk (Samsa et al, 1997). The lack of awareness among the public regarding the serious and devastating complications of stroke and underappreciation of the risk may be the reason for their reduced compliance to secondary stroke prevention strategies (Montaner et al, 2001). The risk awareness communication should be given with caution and require specialist to convey the risk awareness message and alter the behaviour in response to the risk.

5.1.3 Risk factors and life style

Studies have shown that atrial fibrillation and ischemic heart disease (Lovett, 2004; Aziz S, 2019; Fu et al, 2005; Xu et al, 2007) are associated with increased risk of stroke recurrence. But for ischemic heart disease and atrial fibrillation we did not get a significant difference in risk even in bivariate analysis. This may be due to smaller proportion of participants with coronary artery disease (12.6%) and atrial fibrillation (9.28%) and smaller sample size in our study. In our study, cardio embolic stroke subtype and history of valvular heart disease had increased risk of stroke recurrence on bivariate analysis, but on multivariate analysis the difference was not significant. The stroke patients need evaluation and correction of the underlying cardiac conditions causing thromboembolism. Patients require continuous monitoring of blood parameters and problems associated with anticoagulant use. Studies have shown that presence of side effects were associated with poor medication adherence (Jamison et al, 2017). The use of newer anticoagulants can be encouraged which doesn't require monitoring of coagulation parameters. Even though these medicines are costlier, the absence of requirement for periodic blood investigations makes the cost almost equal to conventional treatment.

We were not able to demonstrate association between stroke recurrence and risk factors such as heart disease and diabetes. There was a significantly higher stroke recurrence risk among patients with glycosylated haemoglobin value of more than seven and uncontrolled lipid values but the difference was not significant on multivariate analysis. Rather than the prevalence of risk factors, the status of risk factor control affects the risk of recurrence. Previous studies consistently showed diabetes as a risk factor for stroke recurrence but they haven't assessed the diabetic control status prior to recurrence (Xu et al, 2007; Turan et al, 2017). Even though studies could not establish obesity as a risk factor for stroke, studies on stroke recurrence showed obesity as a risk factor for stroke recurrence (Ying et al, 2018). We could not detect such a risk in spite of a high proportion of obese patients (63%) in the sample.

Our study revealed the life style factors like unhealthy diet and physical inactivity were associated with increased risk of stroke recurrence, similar to previous studies (Kono et al, 2007; Turan et al, 2017). But the difference was not

statistically significant on multivariate analysis. We have measured the data on unhealthy diet and physical inactivity based on the latest definition given by the WHO and ASA which made the data up to date and comparable. We measured these variables at the time of home interview which helped in more realistic estimation of details. We are prompted to believe that the preponderance of one indicator of risk- the type of stroke- has masked the effect of other risk factors in this sample.

5.I.4 Attributable risk of stroke recurrence

This study revealed 86% of the risk of stroke recurrence can be attributed to medication non adherence. Based on odds ratio the range of attributable risk of stroke recurrence for medication non adherence was 40.12- 96.99. At least 40% of recurrent stroke happening over a mean post stroke period of 5 years in patients who are not taking medications properly can be attributed to medication non adherence. Even though studies have shown that medication non adherence can lead to stroke recurrence none of the studies assessed the attributable risk of stroke recurrence. Stroke survivors adhere to their medications so that they can reduce their excess risk which is attributed to medication non adherence. Since adherence is mostly dichotomous, the individual can modify his/her stroke recurrence risk by adopting the new behaviour of medication adherence which requires support from within the individual, family, community and the health care system.

Our study revealed around 11% of the excess risk among those who did not get discharge education at the time of index stroke hospitalisation can be attributed to not getting a proper discharge education. Our study points out the need of individualised education on the basis of their identified risk factors and control, medications, its properties and adherence, relevant life style modifications and appropriate referrals for support services can help improve risk recurrent stroke risk. As a part of this study a discharge education guideline for stroke survivors was developed which can be utilised in the clinical area to plan individualised patient education.

Our study revealed index stroke other than lacunar type is associated with increased risk of stroke recurrence. Lacunar stroke was compared with other large vessel strokes which were caused due to atherosclerotic disease of the large cerebral blood vessels, resultant of un healthy life style and cardiovascular risk factors like

diabetes, hypertension and dyslipidaemia (Mehndiratta et al 2012; Rafieian-Kopaei et al, 2014; Matos Casano et al, 2020). So, the etiological evaluation should be completed in the and initiate secondary stroke prevention as early as possible preferably in the index stroke hospital admission itself. The adherence to secondary stroke prevention strategies should be ensured by proper individualised discharge education. And frequent follow up. Thus, even though the index stroke had happened the individual can modify the risk profile by sticking on the secondary stroke prevention strategies.

Our study showed 17% of the excess risk of stroke recurrence can be attributed to less the seven days of hospitalisation during index stroke admission. In context of early discharge and appropriate referrals to peripheral centres to utilise critical care bed it is not practical to increase the number of days of hospitalisation. The Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PMJAY) insurance scheme offers a treatment cost of Rs 4600/day for a patient with acute stroke on ventilator in intensive care unit. The specified number of days of hospitalisation is five extending beyond this require pre authorisation. The criteria to extent hospitalisation days are not specified. Most of the time severity of the disease and unfitness for discharge may be the factors which determine the number of hospitalisation days or approving authorisation to continue hospitalisation. In this context etiologic evaluation and patient education may suffer. This scheme should provide provisions to complete patient evaluation and initiation of secondary prevention strategies during hospitalisation itself. Guidelines should suggest completion of complete the etiologic evaluation and initiation of secondary stroke prevention strategies before discharging the patient from hospital.

Reports attributable fraction of stroke recurrence was very limited in the literature. The only available report was from a prospective study of 1500 stroke survivors followed up for a period of five years and they have found out the factors associated with stroke recurrence. They have reported attributable risk of stroke for diabetes 36.93% (−3.10 to 62.63) and atrial fibrillation AF -19.68% (−34.40 to 52.00) during the first year after the index stroke (Hillen et al, 2003) using a nonsignificant hazard ratio.

5.1.5 Strengths and limitations of the study

One of the major strengths of this study is the methodology. We have selected incident stroke patients as cases which removed the survival bias. The interview was conducted in the home setting for both the cases and controls which helped to assess the sociodemographic and life style pattern more accurately. Since matched controls were selected as and when the incident case was recruited, we could collect the data on medication adherence, risk factor control and life style factors on the same post stroke period for both cases and controls which helped in good comparison.

One of the major limitations of this study is that we did not use validated scale to assess medication adherence. We had measured medication adherence based on self report of consumption of at least more than 80% of the medication for last two weeks based on last prescription. This is widely accepted and most of the clinical trials follow this definition. We selected two weeks period to collect the medication intake history to reduce recall bias as well as the tendency of patients to be more adherent to the instructions around the days of follow up. The data on memory problems and anxiety were also collected based on self-report only.

Section II- Discussion of the findings of cross-sectional survey

The first phase- case control, of the study showed medication nonadherence and not receiving discharge education at the time of index stroke admission were associated with increased risk of stroke recurrence. This cross sectional survey – second phase of this study explored further into the prevalence of medication adherence among stroke survivors. In addition to that the nature of discharge education, the person who provided education and the components included in it were also explored in detail. Many previous studies reported poor risk factor control among stroke survivors, so the prevalence and control status of cardiovascular risk factors were also included in this cross sectional survey. This cross sectional exploration was done to find out the population attributable fraction for the identified risk factors of stroke recurrence through the case control study.

5.2.1. Medication adherence

This study revealed that adherence to medications intended to control risk factors and prevent stroke recurrence was very low at 43.8% in our setting. The reported medication adherence varies widely in studies ranging from 40% to 85% (Sappok et al, 2001; Khan et al, 2010; Kronish et al, 2013; Al Shaikh et al, 2016; Albright et al, 2017). This present study in a low and middle income country supports the findings of studies done among low and underprivileged groups (Kronish et al, 2013; Chen et al, 2018). A study conducted using validated adherence measure in a low income setting found out an adherence level of 40% among stroke survivors (Kronish et al, 2013). We used consumption of more than 80% of all the category of prescribed medications during last two weeks as an indicator of adherence. Our study result is similar to the study done using validated measure. We could reduce the recall bias as we had assessed the medication intake status of last two weeks only.

In this study the overall adherence, that is adherence to all the categories of medication prescribed for a patient was 43.8%. We had assessed adherence to individual categories of medication, which showed a highest adherence rate to antiplatelets (62.24%) and least adherence to anti diabetic medication (33.3%). Adherence to anticoagulants was also higher compared to other categories (61.9%). Adherence to antidiabetic medication was assessed separately for injectable and oral hypoglycaemic agents. Adherence to insulin was at least 15.4%. Even with a valid prescription people tend to alter the dose and timings and even skip the doses or take medications based on the perceived need. They tend to alter the dose based on their diet, physical activity, 'gut feeling', availability of insulin and accessories for injection and availability of personnel to administer insulin. Stroke patients who experienced feeding problems tend to alter the dose for fear of inadequate diet and over medication. Those who are taking OHA were more adherent 42.1%. The lower adherence to injectable agents created a lower over all adherence to anti diabetic medication. This result is contradictory to the result of a study conducted among patients on insulin in Chennai which reported an adherence of 80% to insulin (Raut et al, 2014). But a community-based study conducted among rural inhabitants of Kerala showed and adherence of 26% to anti diabetic medication. They have also

reported significantly different levels of medications adherence among those who receive OHA and insulin (Sankar et al, 2015). In the present study the prevalence of diabetic medication adherence was 34.3% and overall adherence was 43.8%. Since this is a hospital based study and conducted in a tertiary care center, we cannot expect to get a very small prevalence as compared to a community based study. More over our patients are in continuous follow up also. Studies conducted in other countries showed an adherence level of 60% for insulin therapy (Alsayed & Ghoraba, 2019; Peyrot et al, 2010).

In the context of epidemiological and demographic transitions there is an increased trend in the incidence of stroke in both developing and developed countries. Nearly 25% of all strokes are recurrent. Adherence to secondary stroke prevention medication can lead to reduced cardiovascular events (Kernan et al 2014; Sokol, 2005), but medication non adherence is a major problem in all settings irrespective of income categories. Medication non adherence and recurrent strokes lead to poor outcome and increased health care costs (Mayor, 2013). Medication adherence leads to increased medication costs, but will reduce hospitalisations and use of emergency care (Roebuck et al, 2011). While considering the economic burden caused by recurrent strokes and other vascular events, it is worthwhile to focus on adherence promoting interventions

5.2.2 Facilitators and barriers to medication adherence

Availability of medication in the nearest medical shop and the practice of buying medicine for one month were facilitators to medication adherence. Those people who had financial concerns expressed not being able to buy medicine for one month, which led to missing of doses till they bought next time. Studies done among low income group had identified high cost of medication and difficulties to access health care as barriers to medication adherence (Kronish et al ,2013; Chen et al 2018).

Presence of neurological deficits and perceived poor state of health were associated with higher adherence. The initial step in the process of development of medication adherence behaviour is perceived need of medicine. The disability caused by stroke and subsequent perceived poor state of health thus remained a major facilitator for medication adherence. A systematic review of psychological

determinants of medication adherence also revealed perceived medication necessity is a major facilitator to medication adherence (Crayton et al, 2017). Following daily routine facilitated medication adherence, as previously reported (Jamison et al, 2017).

The most common self- reported reason for non-adherence was simple forgetfulness. Our study showed memory issues and experiencing side effects as major barriers to medication adherence. Studies done in both developing and developed countries showed similar results (Thorogood, 2004; Bauler et al, 2014). We could collect only self-reported data on memory issues and side effects, which remains one of our limitations.

The identified factors negatively affecting adherence among low income groups were mainly related to health care system such as inadequate continuity of care, high cost of medication, poor communication from care provider, difficulty in accessing care, perceived discrimination and low trust with treating doctor (Burkhart P V & Sabaté E, 2003; Banerjee et al, 2018). But studies done in developed countries identified fear of side effects, forgetfulness, higher education and increased quality of life as barriers to medication adherence (Bauler et al, 2014; Sjo¨lander et al, 2018; Cheiloudaki et al, 2019). Our study showed mixed results.

The effect of age, gender, income and education on medication adherence was inconsistent and varied in studies conducted in different settings. In our present study, on bivariate analysis there was a significant difference between medication adherence among people belonging to poor and non-poor households, but when adjusted for other factors the difference was not significant. A study done in a developed country among stroke survivors also found no effect of income on medication adherence (Sjo¨lander et al, 2018). We did not get any significant difference between medication adherence between those who had income to buy medications or access to free medications and those who did not have such facility. A systematic review of 21 studies showed almost similar level of poor medication adherence among patients with free medication and with different payment schemes (Aziz et al, 2016). Gender and medication adherence present contrasting evidence (Sjo¨lander et al, 2018; Cheiloudaki et al, 2019). We found statistically non significant higher adherence among females and those with higher education and

professionals. In contrast to some qualitative study findings, we could not get any significant difference in adherence between those have care giver support and those without (Perreault et al 2012; Bauler et al, 2014). Previous study on the pattern and predictors of complementary alternative medicine use among stroke patients in India showed that around one third of stroke patients used it. Presence of deficits correlates with use (Durai Pandian et al, 2012). But we could not demonstrate significant use of alternative medicine use by our stroke patients. Very few patients were following alternate medicine for stroke treatment and none were exclusively using it. This could perhaps be due to the nature of the institution, being a tertiary level reference centre for neurology, to which only doctors practising modern medicine refer patients. Thus, it could be a selection bias.

Continuous access and availability of medications is prerequisite for uninterrupted consumption. Relevant policy decisions can be made to ensure continuous access and availability of medication locally. Since forgetfulness is the common reason identified in almost all the settings, periodic reminders in the form of care giver reminding or text messages can help. Another major area of intervention is forming strong habit of medication intake. Incorporating medication intake into daily routines can enhance adherence. At every clinic visit people should be screened and asked for side effects. Misconceptions about side effects of medications should be corrected by awareness programs. Future studies to assess the effect of habit training and routinisation, motivational counselling and periodic reminders on medication adherence will be worthwhile.

5.2.3 Prevalence and control of risk factors

This study showed 80% of the stroke survivors had moderate to high central fat distribution and 75% were overweight and obese. The prevalence of overweight and obesity was 40% and high central fat distribution was 60% among our target population (Sarma et al, 2019). Previous studies also demonstrated that the prevalence of obesity is high (60%) among stroke survivors (Vemmos et al,2011) whereas the prevalence of obesity among their general public was 34% (Flegel et al, 2012). The physical disability caused by stroke limit activity. Fear of fall may compound the problem. Our study has shown that 62% and 87% of stroke survivors are not following recommended physical activity and healthy diet respectively. The

prevalence levels of diabetes, dyslipidaemia as well as hypertension were very high among stroke survivors in our setting. The prevalence proportions of diabetes, hypertension and dyslipidaemia were around 61%, 89% and 97% respectively. It reflects the prevalence of these risk factors among the general population of Kerala. Nearly 83% of general population in Kerala possess at least one of the five risk factors of NCD (Sarma et al, 2019). A Recent study in Kerala showed 54% of general population had total cholesterol >200mg/dl. Our study assessed dyslipidaemia by the use of cholesterol lowering medications and the prevalence was 97%. Previous studies also revealed high prevalence of dyslipidaemia in stroke patients (Olamoyegun et al, 2016).

The control of diabetic, hypertension and dyslipidaemia, was assessed separately. The target levels were fixed as per standard recommendations (NCEP, 2001; Kernan et al, 2014; ADA, 2019). Our study revealed poor control of risk factors among stroke survivors. The targeted values were achieved by 26% of diabetic patients and 36% of hypertensive stroke survivors. Previous studies also brought out similar results (Thorogood et al, 2004 & Brenner et al, 2010). One recent study conducted among general population in Kerala showed that only 12% and 15% of those afflicted achieved hypertension and diabetic control respectively (Sarma et al ,2019). Among stroke survivors the control status of diabetes and hypertension is better than general public because of their fear of recurrences and our participants were selected from hospital based stroke registry. Only 46% of the general population in Kerala had total cholesterol level <200 mg/dl (Thankappan et al, 2010), but in our study 73% of stroke survivors had both TC<200mg/dl and LDL<100mg/dl.

Similar to other studies, our study also demonstrated medication adherence is associated with control of hypertension, diabetes and dyslipidaemia. We could also prove that following recommended physical activity is associated with control of diabetes and dyslipidaemia. Following a healthy diet is associated with control of dyslipidaemia. Previous studies demonstrated that physical activity and healthy diet were essential for risk factor control. But for hypertension control we did not get similar results. We could prove that medication adherence is independently associated with risk factor control- diabetes, hypertension and dyslipidaemia

(adjusted for following a healthy diet, following recommended physical activity, smoking and alcohol use). There is no substitute for medication adherence. None of the studies assessed the effect of medication adherence and following other health recommendation on risk factor control which made our results unique.

5.2.4 Life style

Our study showed 62% and 87% of stroke survivors are not following recommended physical activity and healthy diet respectively. The physical disability caused by stroke and fear of falls may prevent patients from doing regular physical activity (Prior & Suskin, 2018). Post stroke swallowing difficulty impose greater restrictions on dietary intake, and might be responsible for not taking a healthy diet. Studies have shown that economic status also can affect intake of a healthy diet (Lo et al, 2009). The prevalence of smoking and alcohol use was very low among stroke survivors in our setting in contrast to the prevalence of both 9.63% (GAT 2-Kerala, 2016) and 12.8% (Aravindakshan et al, 2017) respectively among adult population in Kerala. We strongly insist limiting alcohol use and smoking cessation at the very first clinic visit and consistently enquire about the status during every clinic visit. This may the reason for getting low prevalence of smoking and alcohol use among stroke survivors in our study.

The future direction for strengthening stroke support in the community includes equipping primary care centres and health care workers in the primary care area under the non- communicable disease program so that each and every stroke survivor can be traced and registry can be maintained. Their follow up care, risk factor monitoring and assessment of other health care needs can be met through the primary health care centres. Since stroke is emerging as a growing public health issue an exclusive national program is warranted to combat with the stroke burden in the community (Sylaja & Pradeep Kumar, 2018) Stroke self help groups can be created so that those who require guidance for physiotherapy, dietary advice, financial support for rehabilitation and medication can be supported. Medication adherence and physical activity reminders and updated guidelines for life style modification can be sent through self- help groups.

5.2.5 Population attributable fraction of stroke recurrence

The population attributable fraction of stroke recurrence for medication non adherence was 21.24%. Nearly 20% of the recurrent strokes happening over a post stroke period of five years in the population can be attributed to medication non adherence. The prevalence of medication non adherence among the stroke population (those who have recovered from first episode of stroke) was 56.2%. Since the prevalence of medication non adherence was very high, there is scope for improvement in this area. We can improve the medication adherence to prevent recurrent strokes. Multicomponent community interventions targeting the whole population can be planned and implemented to improve medication adherence. Health information messages can be given through mass media, flex and banners can be raised to increase awareness. The primary health worker and ASHA workers can contact stroke survivors in their areas and encourage medication intake.

The attributable fraction of stroke recurrence for not getting discharge education was 22%. Around 90% of the stroke survivors are getting discharge education at the time of getting discharge from the hospital. All stroke patients should get a planned discharge education in presence of significant care giver regarding their risk factors medications and required life style modifications and medication adherence.

In terms of population attributable fraction, types of stroke other than lacunar type of index stroke ranked first- 30%. More than 90% of the index stroke are other than lacunar type. As a population strategy secondary stroke prevention strategy should incorporate primary and primordial prevention, so that the unhealthy life style such as tobacco use, alcohol intake, physical inactivity, unhealthy diet and obesity will not emerge in the population. This will reduce the cardiovascular risk factors like diabetes, hypertension and dyslipidaemia in the population. The stroke survivors should be contacted periodically by the peripheral health workers and evaluate for risk factor control.

Nearly 19% of the recurrent stroke risk in the population can be attributed lesser number of days of hospitalisation. Even though the recurrent stroke risk for this factor is 1.22, around 75% of the stroke patients were discharged within 8 days of hospitalisation (Prior & Suskin, 2018). In our setting the hospitalisation days

presently vary widely, based on the severity of stroke. In the era of high demand for critical care hospital bed and insurance package driven hospitalisation plans, there is a less likely hood of increasing the hospitalisation days to complete etiological evaluation and planned discharge education. Even though limited in performance, the currently available risk scoring systems for 90-day stroke recurrence and long-term stroke recurrence can be utilised to predict those who are at high risk. Those high-risk patients can be admitted for longer duration for evaluation of stroke risk factors and initiation of secondary stroke prevention strategies. The useful tools currently available for predicting 90 day stroke recurrence risk were ABCD score and Recurrence Risk Estimator at 90days (RRE-90), whereas for predicting long term recurrence risk, Essen Stroke Risk Score (ESRS) and Stroke Prognosis Instrument-II (SPI-II) can be used (Chaudhary et al ,2019). Nurse led clinics can be planned and organized in the hospitals where patients who are discharged earlier can be seen to complete the pending investigations, impart individualised discharge education and coordinate with respected peripheral centres for further care and managements.

As per our study results more than 40% of the stroke recurrence risk among stroke survivors can be attributed to medication non adherence and not getting discharge education. The stroke recurrence rate at one year is 17%. The prevalence of stroke in India is 420/100000 population. According to this data around 25000 stroke recurrences are happening in Kerala in one year. At least half of this can be prevented with medication adherence and patient education.

The reported population attributable fraction of stroke recurrence was for diabetes 9.1% (95% CI, -2.0 to 20.2) and AF 4.9% (95% CI, -7.3 to 17.2) by Hillen et al in 2003. They have reported PAF using a non significant risk ratio. None of the previous studies reported PAF for any of the factors we have studied which makes our results unique.

5.2.6 Strengths and limitations of the study

All the interviews were conducted one to one by the principal investigator herself which reduced the chance of interviewer bias. Since all patients were meticulously followed up in the stroke clinic, blood reports of all these patients were

available at the time of data collection. In this study we could assess the adherence to each category of medication (antidiabetic, antihypertensive and statins) separately and correlate with achieving corresponding risk factor control targets. One of the major limitations of this study is that we did not use validated scale to assess medication adherence. We used self-reported medication adherence, defined as consumption of at least more than 80% of their medications for last two weeks, based on their last prescription. Consumption of more than 80% medication is widely accepted as optimal and is used in most of the clinical trials too. We selected two weeks period to collect the medication intake history to reduce recall bias as well as the tendency of patients to be more adherent to the instructions around the days of follow up. The data on memory issues and side effects were also collected based on self report only.

The patients coming to a tertiary care center may be different mostly in their education and employment status or severity of illness. In this center we get nearly 50% of urban residents who may be well versed in risk factor control and follow up care. This may not be true for patients in other centres. This is the limitation of the study. But our study result showed the factors like education, employment or rural urban difference doesn't not have implications on the medication adherence or stroke recurrence.

Recruitment of samples and data collection were completed in the pre covid-19 era, so the health care seeking behaviour, medication adherence, access to health care and physical activity level were not affected by the Covid -19 related restrictions. Covid-19 related restrictions and shift of health care system focus might have adversely affected the secondary stroke prevention strategies.

5.3 Conclusion

Medication adherence and risk factor control among survivors of first episode of stroke at three months to one year was suboptimal. Lacunar type of index stroke and a greater number of days of hospitalisation during index stroke were associated with less risk of recurrence. Medication non adherence and not getting discharge education were the reasons for stroke recurrences among survivors of first ever stroke. Major causes of medication nonadherence were memory issues,

experiencing side effects and financial concerns. Local availability of medicines, having a daily routine and presence of neurological deficits facilitated medication adherence. Patient education, medication adherence, and greater number of days of hospitalisation can reduce the risk of stroke recurrence.

Most of our study findings are in concordance with other studies which had done in the similar settings. We were not able to compare some of the study results because of the nonavailability of research data. The clinical and sociodemographic factors of recurrent strokes are now well studied. But there is lack of enough data to conclude on the imaging predictors of recurrent stroke for which our study as well as the available studies are not giving a conclusive picture.

Chapter 6

SUMMARY AND RECOMMENDATIONS

6.1. Summary of major findings of this study

Medication adherence among stroke survivors between three months to one year was very low. The cardiovascular risk factors are more prevalent in them and majority had multiple risk factors. Majority of the stroke survivors were not attained the targeted levels for risk factor control as per recommendations. Majority of them were not following a healthy diet and not doing the recommended physical activity. The Medication adherence was independently associated with risk factor control when adjusted for physical inactivity, unhealthy diet, current smoking and alcohol use. Age, gender, economic status and family support were no associated with medication adherence. Forgetfulness was the most common self reported reason for medication non adherence among non adherent participants. Multivariate analysis showed that major causes of medication nonadherence were memory issues, experiencing side effects and financial constraints. Local availability of medicines, having a daily routine and presence of neurological deficits facilitated medication adherence.

Compared to index stroke, the recurrent strokes are more physical and neurologically disabling. Medication non adherence not receiving discharge education during index stroke hospitalisation were associated with increased risk of stroke recurrence. Whereas greater number of days of hospitalisation during index stroke and lacunar type of index stroke were associated with less risk of stroke recurrence. The attributable fraction of stroke recurrence was highest for other than lacunar type of index stroke. Medication nonadherence ranked second.

In terms of population attributable fraction, the other than lacunar type of index stroke ranked first. Medication non adherence ranked second. The prevalence of medication non adherence was very high among stroke population. The pictorial representation of the findings of this study is shown in figure 8.

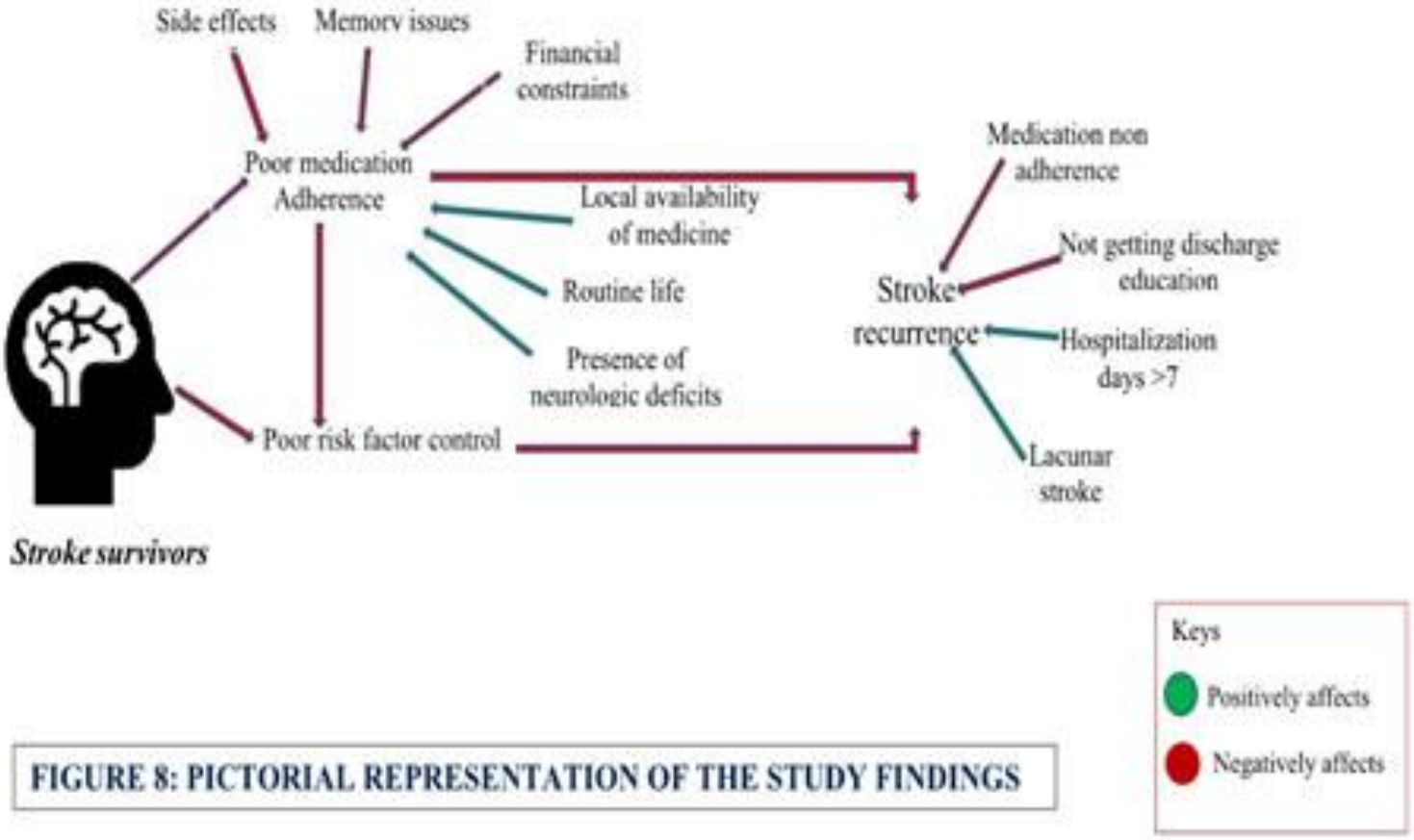


FIGURE 8: PICTORIAL REPRESENTATION OF THE STUDY FINDINGS

6.2. Future research recommendations

This study had identified certain areas which require further explorations are identified. A validated instrument to measure medication adherence is lacking in the public domain, future studies can be undertaken to create a tool which accurately measures the medication adherence level and can be validated among stroke population. This may be used in the clinic as well as for research. So that it can be utilised in the clinical as well as research areas. We have noticed adherence to insulin therapy was very low. Future qualitative studies can be undertaken to find out the perceptions and attitude of patients receiving insulin therapy. Interventional studies can be conducted to assess the effect of patient awareness building and behavioural therapy on adherence to insulin therapy. This study identified the facilitators and barriers to medication adherence among stroke survivors; based on that interventions can be designed and validated so that it can be widely utilised to improve medication adherence. The interventions can be any type of reminders, habit forming, peer support and education interventions.

Our case control study had enough power to identify the main factor of our interest; medication adherence. But we could not identify some of the clinical and imaging variables which are thought to be related to stroke recurrence based on our existing clinical knowledge. Future studies can be undertaken with larger samples size to identify these factors.

A discharge education guideline and module are developed based on the study findings of this study which can be utilized in the clinical area and its effectiveness can be assessed through further researches.

6.3 Policy Recommendations

Our study results showed medication adherence and receiving discharge education is associated with reduced risk of stroke recurrence. Availability of medication locally and buying medication for one month is associated with more adherence. A registry of stroke patients can be kept in the PHCs. Free medications can be provided to all those who require. Free bus passes can be given to them for

follow ups. Ambulance services can be provided to bedridden patients. ASHA workers can visit the at least one in a month to provide necessary education and remind them regarding medication adherence and risk factor control. So that the risk of stroke recurrence can be minimised. If these patients develop a recurrent stroke, they are to be treated in a tertiary care center, the cost of rehabilitation, morbidity and family burden all constitute a huge economic burden to family and government. American Stroke Association argues, 80% of recurrent strokes can be prevented with appropriate secondary stroke prevention strategies. At least half of the stroke recurrences can be prevented with medication adherence and patient education. It justifies government interventions through policies that aim to achieve uninterrupted medication supply and other supports to stroke survivors.

Nurses can be trained in stroke education with very little additional cost and the time invested in this would be worthwhile in preventing recurrent stroke. Nurse led NCD OP clinics can be conducted in tertiary care hospitals, where nurses can educate patients as 2-3 scheduled classes. A registry can be maintained and followed up during clinic visits. Sms reminders can be sent regarding medication adherence, life style modification and risk factor control. In private sector, some policy can be drafted as a part of NCD program to help private hospitals organize similar clinics. In addition to this it can be incorporated with accreditation mechanism. As a part of accreditation program like NABH, private hospital with stroke centres, along with quality standards for stoke care, quality indicators like ongoing discharge can be included to address the problem.

Upon discharge a referral letter can be given to nearest PHC, so that follow up care for risk factor screening can be done. A registry can be maintained in PHC for such patients. ASHA workers can utilize this registry and follow them up in home also. Existing system and staff can be utilised for that. Newer system like e health can also be utilised. This can be integrated with state NCD program. Deputy DMO can supervise and monitor the program. Stroke treatment standards and protocols for discharge need to be documented.

Guidelines for treating first instances of stroke should mandatorily include a counselling session for the whole family and the content and method of counselling should be discussed among experts and approved. Curriculum changes can be advocated to incorporate patient education in the training of doctors and nurses. I have a prepared discharge education module for patient and health care workers. The patient module is in use at our comprehensive stroke care unit. I propose to take on advocacy for extending this module to all major hospitals in the area.

6.4 Conclusions

Medication adherence and risk factor control among survivors of first episode of stroke at three months to one year was suboptimal. Majority of them were not following unhealthy life style. Medication non adherence and not getting discharge education were the reasons for stroke recurrences among survivors of first ever stroke.

Educating the patient regarding stroke, recurrence risk, medication adherence, healthy lifestyle and risk factor control can reduce stroke risk of recurrence. Positive behaviours should be incorporated and maintained as a new life style in order avoid recurrent strokes. These findings have implications for developing preventive strategies and improving stroke care in the community.

As a secondary stroke prevention strategy health education can be adopted for managing risk factor control through appropriate life style and pharmacological interventions. Incorporating the modifiable risk factors identified through this thesis a discharge planning and education guideline is developed, it can be used in the clinical area to plan and implement individualised discharge education for stroke survivors at the time of index stroke (appendix). A discharge planning and education check list also developed to avoid shortfalls (appendix). A patient self learning module is developed for reading and learning for patients and care givers in Malayalam language (appendix).

REFERENCES

1. Aigner A, Grittner U, Folfs A, Norrving B, Siegerink B, Busch MA (2017) Contribution of Established Stroke Risk Factors to the Burden of Stroke in Young Adults. Stroke 48:1744–51 https://doi.org/10.1161/STROKEAHA.117.016599
2. Albright KC, Zhao H, Blackburn J, Limdi NA, Beasley TM, Howard G, Bittner V, Howard VJ, Muntner P (2017) Racial differences in statin adherence following hospital discharge for ischemic stroke. Neurology 88:1839–48.
3. Alsayed KA, Ghoraba MK (Online) Assessment of diabetic patients' adherence to insulin injections on basal-bolus regimen in diabetic care center in Soubi Arabia 2018: cross sectional survey. J Family Med Prim Care 2(8):1964-70. Available: https://www.jfmpc.com/text.asp?2019/8/6/1964/261405 Accessed [25November 2020]
4. Al Shaikh S, Quinn T, Dunn W, Walters M, Dawson J (2016) Predictive factors of non-adherence to secondary preventative medication after stroke or transient ischaemic attack: A systematic review and meta-analyses. Eur Stroke J 1(2):65-75. doi: 10.1177/2396987316647187.
5. American Diabetes Association (ADA) Glycemic targets: Standards of Medical Care in Diabetes—2019 (2019) Diabetes Care. 42(Suppl. 1): S 61-S70.
6. Amuna P & Zotor FB (2018) Epidemiological and nutrition transition in developing countries: impact on human health and development. Proceedings of the Nutrition Society 67(1):82–90. doi: 10.1017/s0029665108006058.
7. Adams HP, Bendixen BH, Kappelle LJ, Biller J, Love BB, Gordon DL, Marsh EE (1993) Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. Stroke. 1993; 24:35–41
8. Adams HP & Biller J (2015) Classification of Subtypes of Ischemic Stroke

   History of the Trial of Org 10 172 in Acute Stroke Treatment Classification. Stroke 46(5): e114–7
9. Anderson D S (2015) Recurrent Stroke-The Value of the CHA2DS2VASc Score and the Essen Stroke Risk Score in a Nationwide Stroke Cohort. Stroke 46:2491-97.

10. Aravindhakshan R Rajeev, Abraham S, Reddy T, Skariah C M, E R., Indiradevi, Jacob A. (2017). A community study of alcohol consumption in a rural area in South India. International Journal Of Community Medicine And Public Health. 4(6) 2172. 10.18203/2394-6040.ijcmph20172197.
11. Arsava EM, Kim GM, Oliveira-Filho J, Gungor L, Noh HJ, Lordelo Mde J, Avery R, Maier IL, Ay H (2016) Prediction of Early Recurrence After Acute Ischemic Stroke. JAMA Neurol 73(4):396-401. doi: 10.1001/jamaneurol.2015.4949. PMID: 26926383.
12. Aziz H, Md Hatah E, Makmor Bakry M, Islahudin F (2016) How payment scheme affects patients' adherence to medications? A systematic review. Dove medical press10: 837—850.
13. Aziz S, Sheikh Ghadzi SM, Ezzati Abidin N, Tangiisuran B, Zainal H, Looi I, Ibrahim KA, Sidek N N, Wei LK, Yee L K, Abdul Aziz Z, Harun SN (2019) Gender Differences and Risk Factors of Recurrent Stroke in Type 2 Diabetic Malaysian Population with History of Stroke: The Observation from Malaysian National Neurology Registry. J Diabetic Res. https://doi.org/10.1155/2019/1794267
14. Bauler S, Jacquin-Courtois S, Haesebaert J, Luaute J, Coudeyre E, Feutrier C Allenet B, Decullier E, Rode G, Janoly-Dumenil A (2014) Barriers and facilitators for medication adherence in stroke patients: a qualitative study conducted in French neurological rehabilitation units. Eur Neurol 72(5-6):262-70.
15. Banerjee A, Khandelwal S, Nambiar L, Saxena M, Peck V, Moniruzzaman M, Faria Neto JR, Neto5, Curi Quinto K, Smyth A, Leong D, Werba J P (2016) Health system barriers and facilitators to medication adherence for the secondary prevention of cardiovascular disease: a systematic review. Open Heart 3 (2):e000438.
16. Banerjee C, Chimowitz MI (2017) Stroke Caused by Atherosclerosis of the Major Intracranial Arteries. Circulation ResearchVol 120(3):502-13. https://doi.org/10.1161/CIRCRESAHA.116.308441
17. Banerjee TK, Choudhury D, Das A, Sekhar A, Roy D, Sen S (2005) Analysis of hospital-based stroke registry in a neurological centre in Kolkata. Journal of the Indian Medical Association 103(12): 665–8.
18. Becerra V, Gracia A, Desai K, Abogunrin S, Brand S, Chapman R, García Alonso F, Fuster V, Sanz G (2015) Cost-effectiveness and public health benefit of

secondary cardiovascular disease prevention from improved adherence using a polypill in the UK. BMJ open 5(5): e007111.
https://doi.org/10.1136/bmjopen-2014-007111

19. Bissonnette JM (2008) Adherence: a concept analysis. Journal of Advanced Nursing 63(6):634–43.
20. Bosu W. K (2010) Epidemic of hypertension in Ghana: a systematic review. *BMC Public Health* 10 (418) doi: 10.1186/1471-2458-10-418
21. Brenner DA, Zweifler RM, Gomez CR, Kissela BM, Levine D, Howard G, Coull B, Howard VJ (2010) Awareness, treatment, and control of vascular risk factors among stroke survivors. J Stroke Cerebrovasc Dis. 19(4):311–20.
22. Brewer L, Mellon L, Hall P (2015) Secondary prevention after ischaemic stroke: the ASPIRE-S study. BMC Neurology 15:216
23. Buenaflor FG (2017) Recurrence rate of Ischemic stroke: A single center experience. Neurology 88 (16 Supplement):308.
24. Burkhart PV, Sabaté E (2003) Adherence to long-term therapies: evidence for action. Journal of nursing scholarship: an official publication of Sigma Theta Tau International Honor Society of Nursing 35(3): 207.
25. CAST (Chinese Acute Stroke Trial) Collaborative Group (1997) Randomized placebo controlled trial of early aspirin use in 20,000 patients with acute ischemic stroke. 349:1641-9.
26. Case control and cross sectional surveys. BMJ resources Available https://www.bmj.com/about-bmj/resources-readers/publications/epidemiology-uninitiated/8-case-control-and-cross-sectional [Accessed on 17 December 2020]
27. Chaudhary D, Abedi V, Li J, Schirmer CM, Griessenauer CJ, Zand R (2019) Clinical Risk Score for Predicting Recurrence Following a Cerebral Ischemic Event. Front Neurol 12(10):1106. doi: 10.3389/fneur.2019.01106. PMID: 31781015; PMCID: PMC6861423.
28. Cheiloudaki E, Alexopoulos EC (2019) Adherence to Treatment in Stroke Patients. International journal of environmental research and public health 16(2): 196. https://doi.org/10.3390/ijerph16020196

29. Chen MJ, Wu CC, Wan L, PhD, Zou G, PhD; Neidlinger SH (2018) Association Between Medication Adherence and Admission Blood Pressure Among Patients With Ischemic Stroke. J Cardiovasc Nurs 34(2): E1–E8.
30. Chia-Ling K, Yinghui D, James G (2018) Unconditional or Conditional Logistic Regression Model for Age-Matched Case–Control Data? Frontiers in Public Health 6:1-57. URL=https://www.frontiersin.org/article/10.3389/fpubh.2018.00057
31. Coreil J, Bruant C, Henderson JN, Forthofer MS, Quinn PG (2009). Social and Behavioural Foundations of Public Health.Sage, USA.
32. Coutts SB (2017) Diagnosis and Management of Transient Ischemic Attack. Continuum (Minneapolis, Minn.). Cerebrovascular Disease 23(1): 82–92. https://doi.org/10.1212/CON.0000000000000424
33. Crayton E, Fahey M, Ashworth M, Besser S J, Weinman J, Wright A J (2017) Psychological Determinants of Medication Adherence in Stroke Survivors: a Systematic Review of Observational Studies. Annals of behavioural medicine 51(6): 833–45. https://doi.org/10.1007/s12160-017-9906-0.
34. Cutler RL, Fernandez-Llimos F, Frommer M, Benrimoj C, Garcia-Cardenas V (2018) Economic impact of medication non-adherence by disease groups: a systematic review. BMJ Open 8:e016982. doi: 10.1136/bmjopen-2017-016982
35. Dalal PM, Bhattacharjee M, Vairale J, Bhat P, Deshmukh S, Khandelwal K, Mathur VD (2008) Mumbai Stroke Registry (2005-2006)-Surveillance Using WHO Steps Stroke Instrument-Challenges and Opportunities. JAPI 56: 675–80.
36. Das SK, Banerjee TK, Biswas A, Raut DK, Mukherjee CS, Chaudhuri A, Hazra A, Roy J (2007) A prospective community-based study of stroke in Kolkata, India. Stroke 38:906 –910.
37. de la Cámara AG, Varona Arche JF, Vivas F P, Guzmán JD, Fernández del Pozo SV, Cuadrado AR, Pareja FB (2013) Recurrence after a First- ever Ischemic Stroke Development of a Clinical Prediction Rule. Research in Neurology: An International Journal 2013: 264063, DOI: 10.5171/2013.264063
38. Di Carlo A (2009) "Human and Economic Burden of Stroke," Age Ageing. 38: 4-5
39. Dickmann E, Müller E (1985) Lacunar cerebral infarcts Z Gerontol.18(4):222-5.

40. Durai Pandian J, Toor G, Arora R, Kaur P, Dheeraj KV, Bhullar RS, Sylaja PN (2012) Complementary and Alternative Medicine Treatments Among Stroke Patients in India. Top Stroke Rehabil19(5):384-94
41. Efroymson MA (1960) Multiple regression analysis: Mathematical methods for digital computers. Wiley, New York.
42. Ellis G, Rodger J, McAlpine C, Langhorne P (2005) The impact of stroke nurse specialist input on risk factor modification: a randomised controlled trial. Age Ageing 34(4): 389–92.
43. Elnady HM, Mohammed GF, Elhewag HK, Khoderi M, Mohamed, Borai A (2020) Risk factors for early and late recurrent ischemic strokes. Egypt J Neurol Psychiatry Neurosurg 56:(2020). https://doi.org/10.1186/s41983-020-00190-3
44. Esenwa C, Gutierrez J (2015) Secondary stroke prevention: challenges and solutions. Vasc Health Risk Manag 11:437-50. doi: 10.2147/VHRM.S63791.
45. Evers SMAA (2004) International Comparison of Stroke Cost Studies. Stroke 35(5): 1209–15.
46. Flegal KM, Carroll MD, Kit BK, Ogden CL (2010) Prevalence of obesity and trends in the distribution of body mass index among US adults. JAMA 307:491–97.
47. Glader EL, Sjölander M, Eriksson M, Lundberg M (2010) Persistent use of secondary preventive drugs declines rapidly during the first 2 years after stroke. Stroke. 41: 397–401.
48. Global Adult Tobacco Survey Fact sheet Kerala 2016-2017. Available https://tiss.edu/uploads/files/30_KL.pdf Accessed: [Available from 16 December 2020]
49. Gordis, L (2009) Epidemiology. Elsevier/Saunders, Philadelphia.
50. Greenland S, Drescher K (1993) Maximum likelihood estimation of the attributable fraction from logistic models. Biometrics 49(3):865-72.
51. Groves RM (2004) Survey errors and survey costs. John Wiley & Sons, New Jersey; USA
52. Guang-Rong Fu, Wei-QiangYuan, Wan-LiangDu, Zhong-HuaYang, NaFu, Hua-GuangZheng, Zi-XiaoLi,Yu-MingHuang, Yu-MmeiZhang, Guang-ZhengDai, Hua-BingWang, Jian-MeiLi, Jing-DongYi, Qing-BiaoYang, Hong-JunTian, Li-NanHe, Geng-YuLi, Jia-LiZhang, Zi-WeiFu (2015) Risk Factors Associated with Recurrent

Strokes in Young and Elderly Patients: A Hospital-based Study. International Journal of Gerontology 9(2): 63-6. https://doi.org/10.1016/j.ijge.2015.02.004

53. Gutierrez J, Koch S, Dong C, Casanova T, Modir R, Katsnelson M, Ortiz GA, Sacco RL, Romano JG, Rundek T (2014) Racial and ethnic disparities in stroke subtypes: a multiethnic sample of patients with stroke. Neurol Sci 35(4): 877–82
54. Hankey GJ, Jamrozik K, Broadhurst RJ, Forbes S, Burvill PW, Anderson CS, Stewart-Wynne EG (2000) Five-year survival after first-ever stroke and related prognostic factors in the Perth Community Stroke Study. Stroke 31:2080–6.
55. Hillen T, Coshall C, Tilling K, Rudd AG, McGovern R, Wolfe CD (2003) Cause of Stroke Recurrence Is Multifactorial-Patterns, Risk Factors, and Outcomes of Stroke Recurrence in the South London Stroke Register. Stroke 34:1457-63.

https://doi.org/10.1161/01.STR.0000072985.24967.7Fstroke.2003

37. Hohmann C, Klotz JM, Radziwill R, Klotz JM, Jacobs AH (2009) Pharmaceutical care for patient with ischemic stroke: improving the patient quality of life. Pharm World Sci 31(5): 550–8.
56. Howard VJ, Tanner RM, Anderson A, Irvin MR, Calhoun DA, Lockland DT, Oparil S, Muntner P (20115) Apparent Treatment-resistant Hypertension Among Individuals with History of Stroke or Transient Ischemic Attack. The American Journal of Medicine 128 (7): 707-14.
57. Jamison J, Sutton S, Mant, J, Simoni AD (2017) Barriers and facilitators to adherence to secondary stroke prevention medications after stroke: analysis of survivors and care givers views from an online stroke forum. BMJ Open. 7(7): e016814.
58. Jerrgensen HS, Nakayama H, Reith J, Raaschou HO, Olsen TS (1997) Stroke recurrence: predictors, severity, and prognosis. The Copenhagen Stroke Study. Neurology 48 (4): 891-5.
59. Johnston SC, Fayad PB, Gorelick PB, Hanley DF, Shwayder P, van Husen D, Weiskopf T (2003) Prevalence and knowledge of transient ischemic attack among US adults. Neurology 60(9):1429-34. doi: 10.1212/01.wnl.0000063309.41867.0f.

60. Kauw F, Takx RAP, de Jong HWAM, Velthuis BK, Kappelle LJ, Dankbaar JW (2018) Clinical and Imaging Predictors of Recurrent Ischemic Stroke: A Systematic Review and Meta-Analysis. Cerebrovasc Dis 45:279–87.
61. Kernan WN, Ovbiagele B, Black HR, Bravata DM, Chimowitz MI, Ezekowitz MD, Fang MC, Fisher M, Furie KL, Heck DV, Johnston SC, Kasner SE, Kittner SJ, Mitchell PH, Rich MW, Richardson D, Schwamm LH, Wilson JA (2014) Guidelines for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke 45(7): 2160–2236.
62. Khan NA, Yun L, Humphries K, Kapral M (2010) Antihypertensive drug use and adherence after stroke: are there sex differences? Stroke 41:1445–9.
63. Kim YD, Jung YH, Saposnik G (2016) Traditional Risk Factors for Stroke in East Asia. Journal of stroke 18(3): 273–85. https://doi.org/10.5853/jos.2016.00885
64. Kobayashi A, Wardlaw JM, Lindley RI, Lewis SC, Sandercock PAG, Czlonkowska A (2009) IST-3 Collaborative Group: Oxfordshire community stroke project clinical stroke syndrome and appearances of tissue and vascular lesions on pretreatment CT in hyperacute ischemic stroke among the first 510 patients in the Third International Stroke Trial (IST-3). Stroke 40: 743-8
65. Kocaman G, Dürüyen H, Koçer A, Asil T (2015) Recurrent Ischemic Stroke Characteristics and Assessment of Sufficiency of Secondary Stroke Prevention. Arch Neuropsychiatr 52: 139-44
66. Kono Y, Yamada S, Kamisaka K, Araki A, Fujioka Y, Yasui K, Hasegawa Y, Koike Y (2011) Recurrence risk after non cardioembolic mild ischemic stroke in a Japanese population. Cerebrovasc Dis 31(4): 365-72. doi: 10.1159/000323233.
67. Kronish IM, Diefenbach MA, Edmondson DE, Phillips LA, Fei K, Horowitz CR (2013) Key barriers to medication adherence in survivors of strokes and transient ischemic attacks. Journal of general internal medicine, 28(5): 675–82. https://doi.org/10.1007/s11606-012-2308-x
68. Lam WY, Fresco P (2015) Medication Adherence Measures: An Overview. BioMed research international: 217047. https://doi.org/10.1155/2015/217047

69. Larrue V, von Kummer R, del Zoppo G, Bluhmki E (1997) Hemorrhagic Transformation in Acute Ischemic Stroke.
Stroke 28 (5):957-60. https://doi.org/10.1161/01.STR.28.5.957
70. Lee AH, Somerford PJ, Yau KK (2004) Risk factors for ischaemic stroke recurrence after hospitalisation. MJA 181: 244–6
71. Leoo T, Lindgren A, Petersson J, von Arbin M (2008) Risk factors and treatment at recurrent stroke onset: results from the Recurrent Stroke Quality and Epidemiology (RESQUE) Study. Cerebrovasc Dis 25(3):254-60.
72. Levin ML ((1953) The occurrence of lung cancer in man. Acta Unio IntContra Cancrum 9(3):531-541.
73. Lewallen S, Courtright P (1998) Epidemiology in practice: case-control studies. Community eye health 11(28): 57–8.
74. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data (2006) Lancet 367(9524):1747-57. doi: 10.1016/S0140-6736(06)68770-9
75. Lovett JK, Coull AJ, Rothwell PM (2004) Early risk of recurrence by subtype of ischemic stroke in population-based incidence studies. Neurology 62(4):569-73.
76. Lo YT, Chang YH, Lee MS, Wahlqvist ML (2009) Health and nutrition economics: diet costs are associated with diet quality. Asia Pac J Clin Nutr 18(4):598-604. PMID: 19965354.
77. Luger S, Hohmann C, Niemann D, Kraft P, Gunreben I, Neumann-Haefelin T, Kleinschnitz C, Steinmetz H, Foerch C, Pfeilschifter W (2015) Adherence to oral anticoagulant therapy in secondary stroke prevention – impact of the novel oral anticoagulants. Patient preference and adherence. 9:1695-1705. doi:10.2147/PPA.S88994
78. Lummis HL, Sketris IS, Gubitz GJ, Joffres MR, Flowerdew GJ (2008) Medication Persistence Rates and Factors Associated with Persistence in Patients Following Stroke: A Cohort Study. BMC Neurology 8:25. doi:10.1186/1471-2377-8-25
79. Matos Casano HA, Tadi P, Ciofoaia GA (2020) Anterior Cerebral Artery Stroke. In: StatPearls Treasure Island (FL): Stat Pearls Publishing. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537333/

80. Mayor S (2013) Non-adherence to medication increases stroke risk in patients with high blood pressure. BMJ 347: f4586.
81. Mehndiratta M, Pandey S, Nayak R, Alam A (2012) Posterior circulation ischemic stroke-clinical characteristics, risk factors, and subtypes in a north Indian population: a prospective study. The Neurohospitalist 2(2): 46–50. https://doi.org/10.1177/1941874412438902
82. Miller ET, Spiker J (2003) Readiness to change and brief educational interventions: successful strategies to reduce stroke risk. J Neuroscience Nursing 35(4):215-222
83. Mohan KM, Wolfe CD, Rudd AG, Heuschmann PU, Kolominsky Rabas PL, Grieve AP (2011) Risk and cumulative risk of stroke recurrence: a systematic review and meta-analysis. Stroke 42(5): 1489–94.
84. Moran A, Forouzanfar M, Sampson U, Chugh S, Feigin V, Mensah G (2013) The epidemiology of cardiovascular diseases in sub-Saharan Africa: the Global Burden of Diseases, Injuries and Risk Factors 2010 Study. Prog Cardiovasc Dis 56(3):234-9.
85. Morgenstern LB, Sanchez BN, Skolarus LE, Garcia N, Risser JMH, Wing JJ, Smith MA, Zahuranec DB, Lisabeth LD (2011) Fatalism, optimism, spirituality, depressive symptoms, and stroke outcome: a population based analysis. Stroke 42:3518–23.
86. Montaner J, Vidal C, Molina C (2001) Selecting the target and the message for a stroke public education campaign: a local survey conducted by Neurologists. Eur J Epidemiol 17: 581–6.
87. Moroney JT, Bagiella E, Paik MC, Sacco RL, Desmond DW (1998) Risk Factors for Early Recurrence After Ischemic Stroke-The Role of Stroke Syndrome and Subtype. Stroke 29:2118-24
88. National Institute of Mental Health and Neuro Sciences. Handbook for counsellors. Directorate general of health services and ministry of health and family welfare. Government of India.in collaboration with World Health Organization India (2017):1-65.
89. National Program for Prevention and Control of Cancer, Diabetes, Cardio Vascular Disease and Stroke [Online] Director General of Health Services: Available:

https://dghs.gov.in/content/13633 National Programme Prevention Control.aspx [Accessed 23 September 2020]

90. Navarro-Orozco D, Sánchez-Manso JC (2020) Neuroanatomy, Middle Cerebral Artery [Updated 2020 Aug 22]. In: StatPearls [Internet]. Treasure Island (FL) Available from: https://www.ncbi.nlm.nih.gov/books/NBK526002/ [Accessed 17 December 2020]
91. Non communicable disease control program, National rural health mission, Government of Kerala: Available from: http://arogyakeralam.gov.in/2020/03/23/ncd-non-communicable-diseases-control-programme/ [Accessed 17 August 2020]
92. Oberman A, Kuller Lh (1994) Carleton RA. Prevention of Cardiovascular Disease-Opportunities for Progress. Preventive Medicine 23: 727-32.
93. O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, Rangarajan S, Islam S, Pais P, McQueen MJ, Mondo C, Damasceno A, Lopez-Jaramillo P, Hankey GJ, Dans AL, Yusoff K, Truelsen T, Diener HC, Sacco RL, Ryglewicz D, Czlonkowska A, Weimar C, Wang X, Yusuf S, INTERSTROKE investigators (2010) Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. Lancet 376(9735):112-23. doi: 10.1016/S0140-6736(10)60834-3.
94. Olamoyegun MA, Akinlade AT, Fawale MB, Ogbera A O (2016) Dyslipidaemia as a risk factor in the occurrence of stroke in Nigeria: prevalence and patterns. The Pan African medical journal 25:72. https://doi.org/10.11604/pamj.2016.25.72.6496.
95. Owolabi MO, Akarolo-Anthony S, Akinyemi R, Tiwari H, Arulogun O, Akpalu A, Sarfo FS, Obiako R, Owolabi L, Sagoe K, Melikam S, Adeoye AM, Lackland D, Ovbiagele B (2015) The burden of stroke in Africa: A glance at the present and a glimpse into the future. *Cardiovascular Journal of Africa* 26(2):S27–S38. doi: 10.5830/CVJA-2015-038.
96. Pandian JD, Sudhan P (2013) Stroke epidemiology and stroke care services in India. J Stroke15(3):128-34. doi: 10.5853/jos.2013.15.3.128.
97. Park TH, Ko Y, Lee SJ, Lee KB, Lee J, Han MK, Park JM, Cho YJ, Hong KS, Kim DH, Cha JK, Oh MS, Yu KH, Lee BC, Yoon BW, Lee JS, Lee J, Bae HJ (2015) Identifying Target Risk Factors Using Population Attributable Risks of Ischemic

Stroke by Age and Sex. Journal of stroke 17(3),302–11. https://doi.org/10.5853/jos.2015.17.3.302.

98. Pearce Neil (2016) Analysis of matched case- control studies BMJ 352:i969
99. Perreault S, Yu A, Cote A, Dragomir A, White-Guay B, Dumas S (2012) Adherence to antihypertensive agents after ischemic stroke and risk of cardiovascular outcomes. Neurology. 79:2037–43.
100. Petty GW, Brown RD, Whisnant JP, Sicks JD, O'Fallon WM, Wiebers DO (1998) Survival end recurrence after first cerebral infarction: a population based study in Rochester, Minnesota, 1975 through 1989. Neurology 50:208–16.
101. Peyrot M, Rubin RR, Kruger DF, Travis LB (2010) Correlates of insulin injection omission. Diabetes care 33(2):240–5.
102. Philip LA, Leventhal H (2011) Using habit theory and common sense self-regulation theory to improve medication adherence assessment. Graduate School-New Brunswick Rutgers. The State University of New Jersey.
103. Prior PL, Suskin N (2018) Exercise for stroke prevention. Stroke and vascular neurology 3(2):59–68. https://doi.org/10.1136/svn-2018-000155
104. Rafieian-Kopaei M, Setorki M, Doudi M, Baradaran A, Nasri H (2014) Atherosclerosis: process, indicators, risk factors and new hopes. International journal of preventive medicine 5(8): 927–46.
105. Rafie S, Kaveyani H, Choghakabodi PM (2019) Risk factors associated with recurrent stroke: A retrospective hospital-based study. J Acute Dis 8(6): 245-49.
106. Raut MS, Balasubramanian J, Anjana RM, Unnikrishnan R, Mohan V (2014) Adherence to insulin therapy at a tertiary care diabetes center in South India. Journal of diabetology 5 (1): 5.
107. R Core Team (2015) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.
108. Rehm J, Baliunas D, Borges GL, Graham K, Irving H, Kehoe T, Parry CD, Patra J, Popova S, Poznyak V, Roerecke M, Room R, Samokhvalov AV, Taylor B (2010) The relation between different dimensions of alcohol consumption and burden of disease: an overview. Addiction.105(5):817–43

109. Roger VL, Go AS, Lloyd-Jones DM, Adams RJ, Berry JD, Brown TM, Carnethon MR, Dai S, de Simone G, Ford ES, Fox CS, Fullerton HJ, Gillespie C, Greenlund KJ, Hailpern SM, Heit JA, Ho PM, Howard VJ, Kissela BM, Kittner SJ, Lackland DT, Lichtman JH, Lisabeth LD, Makuc DM, Marcus GM, Marelli A, Matchar DB, McDermott MM, Meigs JB, Moy CS, Mozaffarian D, Mussolino ME, Nichol G, Paynter NP, Rosamond WD, Sorlie PD, Stafford RS, Turan TN, Turner MB, Wong ND, Wylie-Rosett J (2010) American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics--2011 update: a report from the American Heart Association. Circulation 123(4):e18-e209. doi: 10.1161/CIR.0b013e3182009701.
110. Roebuck MC, Liberman JN, Gemmill-Toyama M, Brennan TA (2011) Medication adherence leads to lower health care use and costs despite increased drug spending. Health Aff (Millwood) 30:91–9.
111. Rothman KJ, Greenland, S (1998) Modern epidemiology. Lippincott Williams & Wilkins, Philadelphia.
112. Rothman KJ, Greenland S, Lash TL (2008) Modern Epidemiology. Lippincott Williams & Wilkins, Philadelphia.
113. Rothwell P (2004) Preventative measures against stroke can reduce stroke incidence. Lancet 363:1925-33.
114. Rothwell PM, Giles MF, Chandratheva A, Marquardt L, Geraghty O, Redgrave JNE, Lovelock CE, Binney LE, Bull LM, Cuthbertson FC, Welch SJV, Bosch S, Alexander FC, Silver LE, Gutnikov SA, Mehta Z (2007) Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison. Lancet 370 (9596):1432-42.
115. Rückinger S, von Kries R, Toschke AM (2009) An illustration of and programs estimating attributable fractions in large scale surveys considering multiple risk factors. BMC Med Res Methodol 9(7). https://doi.org/10.1186/1471-2288-9-7.
116. Rudd AG, Lowe D, Hoffman A, Irwin P, Pearson M (2004) Secondary prevention for stroke in the United Kingdom: results from the National Sentinel Audit of Stroke. Age Ageing 33(3):280-6. doi: 10.1093/ageing/afh107

117. Ruksakulpiwat S, Liu Z, Yue S, Fan Y (2020) The Association Among Medication Beliefs, Perception of Illness and Medication Adherence in Ischemic Stroke Patients: A Cross-Sectional Study in China. Patient preference and adherence 14: 235–47. https://doi.org/10.2147/PPA.S235107
118. Rymer MM (2011) Hemorrhagic stroke: intracerebral hemorrhage. Missouri medicine 108(1): 50–54.
119. Sacco RL, Shi T, Zamanillo MC, Kargman DE (1994) Predictors of mortality and recurrence after hospitalized cerebral infarction in an urban community: the Northern Manhattan Stroke Study. Neurology 44:626–34.
120. Sappok T, Faulstich A, Stuckert E, Kruck H, Marx P, Koennecke HC (2001) Compliance with secondary prevention of ischemic stroke: a prospective evaluation. Stroke 32:1884–1889.
121. Samsa G, Cohen S, Goldstein L (1997) Knowledge of risk among patients at increased risk of stroke. Stroke 28: 916–21.
122. Samsa GP, Bian J, Lipscomb J, Matchar DB (1999) Epidemiology of recurrent cerebral infarction: a medicare claims-based comparison of first and recurrent strokes on 2-year survival and cost. Stroke 30: 338-49.
123. Sankar UV, Lipska K, Mini GK, Sarma PS, Thankappan KR (2015) The adherence to medications in diabetic patients in rural Kerala, India. Asia Pac J Public Health 27(2):NP513-23. doi: 10.1177/1010539513475651.
124. Sarma PS, Sadanandan R, Thulaseedharan JV, Soman B, Srinivasan K, Varma RP, Nair MR, Pradeepkumar AS, Jeemon P, Thankappan KR, Kutty RV (2019) Prevalence of risk factors of non-communicable diseases in Kerala, India: results of a cross-sectional study. BMJ open 9(11), e027880. https://doi.org/10.1136/bmjopen-2018-027880.
125. Sebateb E (2003) Adherence to long term therapies: Evidence to action. World Health Organisation 2003:3-45.
126. Semin GR, Fielder K (1996) Applied social Psychology. Thousand Oaks, CA, Sage.
127. Setia MS (2016) Methodology Series Module 2: Case-control Studies. Indian journal of dermatology 61(2):146–51. https://doi.org/10.4103/0019-5154.177773
128. Setia MS (2016) Methodology Series Module 3: Cross-sectional Studies. Indian journal of dermatology 61(3):261–4. https://doi.org/10.4103/0019-5154.182410

129. Shah RS, Cole JW (2010) Smoking and stroke: the more you smoke the more you stroke. Expert Rev Cardiovasc Ther 8(7):917-32.
130. Shamsaee MH, Tavangar A, Chitsaz A, Akbari M, Saadatnia M (2012) Epidemiologic evaluation and seasonal variations of stroke risk factors among patients with first and recurrent stroke. J Isfahan Med School 29(173)
131. Shani S D, V R Kutty, RP Varma, Jissa VT, Sylaja PN (2020) Facilitators and barriers to medication adherence among stroke survivors. Stroke. 51(suppl_1)
132. Sheedy R, Kramer SF, Johnson L, Shields N, Churilov L, Cadilhac DA, Bernhardt J (2020) Acute Hospital Admission for Stroke Is Characterised by Inactivity. Stroke Research and Treatment. https://doi.org/10.1155/2020/5879295
133. Shield KD, Rehm J. Difficulties with telephone-based surveys on alcohol consumption in high-income countries: the Canadian example (2012) Int J Methods Psychiatr Res 21(1):17–28.
134. Sjo¨lander M, Eriksson M, and Glader EL (2016) Inequalities in medication adherence to statin treatment after stroke: A nationwide observational study. European Stroke Journal 1(2):101–7.
135. Slark J, Sharma P (2014) Risk awareness in secondary stroke prevention: a review of the literature. JRSM Cardiovascular Disease. doi:10.1177/2048004013514737
136. Smith, G (2018) Step away from stepwise. J Big Data 5(32). https://doi.org/10.1186/s40537-018-0143-6
137. Sokol MC, McGuigan KA, Verbrugge RR, Epstein RS (2005) Impact of medication adherence on hospitalization risk and healthcare cost. Med Care. 43:521–30.
138. Somasundaran A, Potty SN (2020) Epidemiological Profile of Stroke in Central Kerala. Int J Sci Stud 8(4):61-65.
139. Souter C, Kinnear A, Kinnear M, Mead G (2014) Optimisation of secondary prevention of stroke: a qualitative study of stroke patients' beliefs, concerns and difficulties with their medicines. Int J Pharm Pract 22: 424–32.
140. Sridharan SE, Unnikrishnan JP, Sukumaran S, Sylaja PN, Nayak S D, Sarma PS, Radhakrishnan K (2009) Incidence, types, risk factors and outcome of stroke in a developing country: the Trivandrum Stroke Registry. Stroke 40: 1212-18.

141. Srivastava RK (2008) Role in prevention and control of non-communicable diseases, Reading material for ASHA book no 8. Ministry of health and family welfare and National rural health mission.
142. Stahmeyer JT, Stubenrauch S, Geyer S, Weissenborn K, Eberhard S (2019) The Frequency and Timing of Recurrent Stroke: An Analysis of Routine Health Insurance Data. Deutsches Arzteblatt international 116(42): 711–17. https://doi.org/10.3238/arztebl.2019.0711
143. State, Local, and Tribal Heart Disease and Stroke Programs. Available https://www.cdc.gov/dhdsp/programs/spha/index.htm [Accessed on 17 December 2020].
144. Strack F, Martin LL. Thinking, judging, and communicating: A process account of context effects in attitude surveys (1987) Springer-Verlag, New York, USA pp. 123–48.
145. Subramanian G, Silva J, Silver FL, Fang J, Kapral MK, Oczkowski W, Gould L, O'Donnell MJ (2009) Investigators of the Registry of the Canadian Stroke Network. Risk factors for posterior compared to anterior ischemic stroke: an observational study of the Registry of the Canadian Stroke Network. Neuroepidemiology.33(1):12-6
146. Sylaja PN, Pradeep Kumar VG (2018) Stroke is taking its toll. Business line Dove medical press. Available https://www.thehindubusinessline.com/opinion/stroke-is-taking-its-toll/article25363138.ece [Accessed on 1/12/2020]
147. Tayler C F, Kumar S, Stroke in India factsheet (2012) South Asian Center for Chronic Diseases. Available: https://www.researchgate.net/publication/264116605 [Accessed on 23 September 2020]
148. Thankappan KR, Shah B, Mathur P, Sarma PS, Srinivas G, Mini GK, Daivadanam M, Soman B, Vasan RS (2010) Risk factor profile for chronic non-communicable diseases: Results of a community-based study in Kerala, India. Indian J Med Res 131:53-63.
149. The Emerging Risk Factors Collaboration (2010) Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. The Lancet 375(9733):2215–22.

150. Heuschmann PU, Wiedmann S, Wellwood I, Rudd A, Di Carlo A, Bejot Y, Ryglewicz D, Rastenyte D, Wolfe CD (2009) Incidence of Stroke in Europe at the Beginning of the 21st Century- The European Registers of Stroke (EROS). Stroke 40:1557-63
151. Third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), NCEP, National Heart, Lung, and Blood Institute, National Institutes of Health (2001) NIH Publication No. 01-3670.
152. Thorogood M (2004) Southern Africa Stroke Prevention Initiative (SASPI) study Bulletin of the World Health Organization. 82:503-8.
153. Towfighi A, Saver JL (2011) Stroke declines from third to fourth leading cause of death in the United States: historical perspective and challenges ahead. Stroke 42(8):2351-5. doi: 10.1161/STROKEAHA.111.621904.
154. Thrift A, Dewey H, Macdonell R, McNeil J, Donnan G (2000) Stroke Incidence on the East Coast of Australia The North East Melbourne Stroke Incidence Study (NEMESIS). Stroke 31:2087-92
155. Truelsen T, Begg S and Mathers C [Online]) The global burden of cerebrovascular diseases. Available from: http://www.who.int/entity/healthinfo/statistics/bod_cerebrovasculardiseasestroke.pdf?ua=1 [accessed 8 March 2016].
156. Turan TN, Nizam A, Lynn MJ, Egan BM, Le NA, Lopes-Virella MF, Hermayer KL, Harrell J, Derdeyn CP, Fiorella D, Janis LS, Lane B, Montgomery J, Chimowitz MI (2017) Relationship between risk factor control and vascular events in the SAMMPRIS trial. Neurology 88(4):379–85.
157. Vemmos K, Ntaios G, Spengos K, Savvari P, Vemmou A, Pappa T, Manios E, Georgiopaulos G, Alevizaki M (2011) Association between obesity and mortality after acute first-ever stroke: the obesity-stroke paradox. Stroke. 42:30–36.
158. Victora CG, Huttly SR, Fuchs SC, Olinto MT, Olinto MTA, Huttly S, Fuchs S P (1997) The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Journal: Int J Epidemiol 26 (1):224-47.
159. Warlow CP (1998) Epidemiology of stroke. The Lancet 352(3):14.
160. Wang P, Wang Y, Zhao X, Du W, Wang A, Liu G, Liu L, Ji R, Wang C, Dong K, Wang Y (2016) In-hospital medical complications associated with stroke recurrence

after initial ischemic stroke: A prospective cohort study from the China National Stroke Registry. Medicine 95(37): e4929.

161. Wangqin R, Wang X, Wang Y, Xian Y, Zhao X, Liu L, Li H, Meng X, Wang Y (2017) Risk factors associated with 90-day recurrent stroke in patients on dual antiplatelet therapy for minor stroke or high-risk TIA: a subgroup analysis of the CHANCE trial. Stroke and Vascular Neurology 0:e000088
162. Waters MF, Hoh BL, Lynn M J, Kwon HM, Turan TN, Derdeyn CP, Fiorella D, Khanna A, Sheehan TO, Lane BF, Janis S, Montgomery J, Chimowitz MI (2016) Stenting and Aggressive Medical Management for Preventing Recurrent Stroke in Intracranial Stenosis (SAMMPRIS) Trial Investigators. Factors Associated with Recurrent Ischemic Stroke in the Medical Group of the SAMMPRIS Trial. JAMA neurology 73(3): 308–15.
163. Wolf M, Sauer T, Hennerici M, Chatzikonstantinou A (2013) Characterization of patients with recurrent ischaemic stroke using the ASCO classification. Eur J Neurol 20(5): 812-817.
164. World Health Organization, the top ten causes of death. [Online]. Available from https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death. [Accessed on 23 May 2018]
165. World Health Organization (2005) Fruit and vegetables for health: report of the Joint FAO/WHO Workshop on Fruit and Vegetables for Health, Kobe, japan Organization. https://apps.who.int/iris/handle/10665/43143
166. Wu QE, Zhou AM, Han YP, Liu YM, Yang Y, Wang XM, Shi X (2019). Poststroke depression and risk of recurrent stroke: A meta-analysis of prospective studies. Medicine 98(42):e17235. https://doi.org/10.1097/MD.0000000000017235
167. Xu G, Liu X, Wu W, Zhang R, Yin Q (2007) Recurrence after ischemic stroke in Chinese patients: impact of uncontrolled modifiable risk factors. Cerebrovasc Dis 23(2-3): 117-20.
168. Yi Ying, Harith C, Ahmad S, Mukhali A, Hassan (2018) Prevalence, risk factors and secondary prevention of stroke recurrence in eight countries from South, East and Southeast Asia: A scoping review. The Medical journal of Malaysia. 73 (2): 90-99.

169. Yi X, Luo H, Zhou J, Yu M, Chen X, Tan L, Wei W, Li J (2020) Prevalence of stroke and stroke related risk factors: a population based cross sectional survey in southwestern China. BMC Neurol 20 (5). https://doi.org/10.1186/s12883-019-1592-z
170. Ying CY, Harith S, Ahmad A, Mukhali H B (2018) Prevalence, risk factors and secondary prevention of stroke recurrence in eight countries from south, east and southeast Asia: a scoping review. Med J Malaysia Vol 73 (2): 90-99.
171. Zeng J, Zhu L, Liu J, Zhu T, Xie Z, Sun X, Zhang H (2014) Metformin-inclusive therapy reduces the risk of stroke in patients with diabetes: a 4- year follow-up study, Journal of Stroke and Cerebrovascular Diseases 23(2): e99–105.
172. Zhao W, Wu J, Liu J, Wu Y, Ni J, Gu H, Tu J, Wang J, An Z, Ning X (2019) Trends in the incidence of recurrent stroke at 5 years after the first-ever stroke in rural China: a population-based stroke surveillance from 1992 to 2017. Aging 11(6): 1686–94. https://doi.org/10.18632/aging.101862

Appendix - I

List of publications

Publications - abstract

1. SD Shani , Kutty VR, RP Varma, Jissa VT and PN Sylaja (2020). Facilitators and Barriers to Medication Adherence Among Stroke Survivors in India. Stroke; Vol 51 (Suppl.1): WP237. Available from (https://www.ahajournals.org/doi/10.1161/str.51.suppl_1.WP237)
2. SD Shani, RP Varma, VR Kutty, PN Sylaja (2020). Factors associated with stroke recurrence- Incident pair matched case control study. Int.J.Stroke; Vol 15 (Suppl.1):504. Available from (https://journals.sagepub.com/toc/wsoa/15/1_suppl)

Original article

1. S.D. Shani, R.P. Varma, P.S. Sarma, P.N. Sylaja, V. Raman Kutty. Life Style and Behavioural Factors are Associated with Stroke Recurrence Among Survivors of First Episode of Stroke: A Case Control Study, Journal of Stroke and Cerebrovascular Diseases, Volume 30, Issue 4,2021,105606,ISSN 1052-3057, https://doi.org/10.1016/j.jstrokecerebrovasdis.2021.105606.
2. S.D.Shani, P.Sankara Sarma and V.Raman Kutty. Facilitators and barriers to medication adherence among stroke survivors in India. Journal of Clinical Neuroscience Volume 88, June 2021, Pages 185-190 https://doi.org/10.1016/j.jocn.2021.03.019
3. Poor risk factor control among stroke survivors- a cross sectional survey SD Shani PhD, PN Sylaja DM, PS Sarma PhD& V Raman Kutty MD, MPH, M Phil, Accepted for publication in the International Journal of Non Communicable Diseases on 12/09/21
4. Shani S D, Sylaja PN, Sarma PS, Kutty VR. Medication adherence among stroke survivors within a post stroke period of three months to one year. The Nursing Journal of India. Volume CXII (3) PP 110-115.

Life Style and Behavioural Factors are Associated with Stroke Recurrence Among Survivors of First Episode of Stroke: A Case Control Study

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Background: Secondary stroke prevention treatment is associated with an 80% reduction in risk of recurrent stroke. But one out of every four strokes are recurrent. Adherence to pharmacological therapy and strict control of risk factors are essential for prevention of recurrent strokes. *Methods:* Pair matched incident case control study was done to find out the factors associated with stroke recurrence after first ever stroke. Incident cases of recurrent strokes and age and post stroke period matched controls were recruited prospectively. The estimated sample size for the study was 70 matched pairs. Data collected from medical records and by visiting their homes. Analysis was done using R statistical software. *Results:* Bivariate analysis showed cardio embolic stroke subtype, poor lipid control, unhealthy diet, physical inactivity, medication nonadherence, presence of depression, memory problems no discharge advice at index admission and low income were associated increased risk of recurrence. Higher mean NIHSS score and a greater number of days of hospitalisation during index stroke had less risk of recurrence. Conditional logistic regression analysis revealed non adherence to medication (OR 7.46, 1.67−33.28) and not receiving discharge advice at index admission (OR 10.79, 2.38−49.02) were associated with increased risk of recurrence whereas lacunar stroke (OR 0.08, 0.01−0.59) and a greater number of days of hospitalization during index stroke (OR 0.82, 0.67−0.99) were associated with less risk of recurrence. *Conclusion:* Individualised patient education regarding stroke, recurrence risk, medication adherence, healthy lifestyle and risk factor control can reduce stroke recurrence risk.

Key Words: Stroke recurrence—Medication adherence—Life style—Behavioural factors—Risk factors

Introduction

Early initiation of treatment for secondary stroke prevention is associated with an 80% reduction in risk of early recurrent stroke.[1] One out of every four strokes are recurrent.[2] The risk of stroke recurrence varies from 7.4% at three months,[3] 5.1% at six months [4] and 11.1% at 1 year.[5]

The etiologic subtype of index stroke is an important factor which predicts stroke recurrence with large artery atherosclerosis having increased risk of recurrence whereas small vessel stroke has a lower risk of recurrence.[6,7]

The secondary stroke prevention guidelines include medications to reduce thrombosis risk and control risk factors like diabetes, hypertension, dyslipidaemia. It strongly insists behavioural modification in the form of medication adherence and adopting new life style such as healthy diet, physical activity, smoking cessation and

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limiting alcohol consumption. Post stroke depression and lack of recommended physical activity is associated with increased risk of stroke recurrence.[8,9] Patients treated in a hospital maintaining a stroke unit at index stroke had a reduced the risk of recurrence (HR, 0.84; 95% CI, 0.72−0.99)[4] highlighting the importance of proper discharge planning and education.

Studies have shown that nonadherence to medication and poor risk factor control were associated with poor patient out come and stroke recurrence.[10−14] But this studies on stroke recurrence are mostly retrospective and have looked at the prevalence of risk factors and stroke subtype in relation to stroke recurrence. There is lack of prospective study with a comprehensive assessment of life style, behavioural factors, risk factor control and medication adherence in relation to stroke recurrence. Identifying these factors has important implications in planning secondary prevention strategies to reduce the stroke burden.

Objective of the study

To identify the life style and behavioural factors associated with recurrence of stroke after the first episode

Study Design

Ours was a pair matched incident case control study. Cases were incident cases of recurrent stroke among survivors of first episode of stroke and controls matched for age and period after first ever stroke. Participants are recruited based on the presence or absence of outcome which is the stroke recurrence. This is a nested case control study embedded in a retrospective cohort of patients with first ever stroke.

A recurrent stroke is defined as a stroke with clinical evidence of sudden onset of a new focal neurological deficit with no apparent cause other than that of vascular origin.[15] Case was defined as the incident case of recurrent stroke beyond one month after first episode among survivors of first episode of ischemic stroke, haemorrhagic stroke or transient ischemic attack with evidence of acute infarct within one month of stroke recurrence. Recurrence beyond one month was selected because early recurrences may be often confused with progression of index stroke and we intend to look into life style and health behaviour factors associated with stroke recurrence. Clinical data regarding index stroke were collected from medical records. An appointment for visiting home after one week was obtained for further data collection on the day of discharge. During home visit interview was conducted.

Control was defined as age and post stroke period matched survivors of first episode of stroke and transient ischemic attack with evidence of acute infarct without a recurrent stroke. The age matching of controls pair was done within an age ±3 years of that of the cases. The post stroke period of controls pair was matched within a post stroke period of ±2 weeks of that of cases.

As an incident case of recurrent stroke was recruited, the stroke registry data was examined to get a closest pair (age ±3 years, post stroke period of ±2 weeks) of stroke survivor without stroke recurrence, as control for each recurrent case. The control had an index stroke at the time when the case had index stroke (±2 weeks), but not yet developed stroke recurrence. The researcher contacted them through telephone and an appointment for home visit was obtained. None of them refused to participate. At home visit, data was collected using pretested structured interview schedule. Clinical details of index stroke and investigation reports were obtained from medical records.

Setting

The eligible incident cases of recurrent strokes were recruited from stroke clinic and stroke unit of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala. The age and post stroke period matched controls were recruited from stroke registry. Data was collected from medical records and by visiting the home of the patient.

Sample size

Sample size was calculated with fixing α error = 0.05, power = 0.80, anticipated proportion of discordant pairs-0.5, anticipated odd ratio = 3 (medication nonadherence) and for a two-sided test. The number of matched pairs was estimated to be 61. Considering probability of nonresponse, 70 matched pairs were recruited for this study.

Inclusion criteria

Incident cases of recurrent stroke one month after index stroke, aged 18 and above were taken as cases. Index stroke should be ischemic stroke, haemorrhagic stroke or transient ischemic stroke with evidence of acute infarct. Controls were stroke survivors without stroke recurrence, pair matched to age and post stroke period.

Exclusion criteria

Early recurrence within one month were excluded from the study. Stroke survivors who were comatose, severely disabled (modified Rankins Scale score 5 and above), having multiple coexisting diseases having life expectancy less than six months were excluded from the study.

Data collection tools and techniques

70 cases were recruited over a period of 11 months in 2019. Controls were taken concurrently. Pretested structured interview schedule was used to collect sociodemographic and clinical details. Clinical information sheet was used collect information on clinical and imaging details of index stroke from medical records. Standard

instruments were used to measure height, weight and blood pressure. Medication adherence and compliance with other recommended health advice like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption just prior to recurrence period were also assessed. A healthy diet was defined consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets and fried foods. Recommended physical activity was at least 30 minutes of moderate physical activity like walking for at least 3 days a week. Self-reported medication adherence was defined as consumption of at least more than 80% of their medications, based on their last prescription.

The data on blood sugars, lipid levels prior to recurrence period was also collected from available blood reports from the patient. The risk factor control is defined as achieving the desired levels of blood pressure, blood sugars and cholesterol prior to recurrence period. The targets for risk factor control were taken from National Cholesterol Education Program (NCEP) ATP III guidelines[16] for Cholesterol (LDL < 100 and TC < 200), American diabetes Association guidelines[17] (FBS 70-130 and HBAIC < 7) for Diabetes control and ASA secondary stroke prevention guidelines[1] for blood pressure (SBP < 140 and DBP < 90).

Ethical considerations

The study was undertaken after ethical clearance from Institutional Ethics Committee of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala. Written informed consent was obtained from all the participants before data collection.

Analysis

Analysis for pair matched case control study was done using R statistical software.[18] Mc Nemar Ch^2 tests were done for dichotomous variables and paired t tests were done for continuous variables to find out the relationship between variables and stroke recurrence. Odds Ratio (OR) with 95% Confidence Interval (CI) is reported. Those variables had statistical significance < 0.1 were considered for multivariate analysis. Hierarchical conditional logistic regression models were build using R statistical software.[18]

Results

Over a period of 11 months we recruited 70 incident cases of recurrent stroke beyond one month after index stroke. Among the 70 age and post stroke period matched pairs (mean age- case 60.79 ± 11.54 years; control 60.29 ± .38), 18.6% of cases and 32.9% of controls constituted females. The characteristics of study participants are given in Table 1. The mean stroke recurrence period for cases was 49.53 ± 53.35 and that of control was 50.09 ± 53.03. The median stroke recurrence period was 65.5 months. The difference in age and post stroke period between cases and controls were not statistically significant ($p = 0.48$ and $p = 0.29$ respectively). Recurrent stroke was more physically [(mRS > 2) 75% vs 88.6%] and neurologically [(NIHSS > 4) 61.4%Vs 67.1] disabling than index stroke.

Factors associated with stroke recurrence

Poor risk factor control such as glycosylated haemoglobin >7 (OR 2, 95% CI 0.97−4.12) and poor lipid control (OR 5.5, 95% CI 1.22−24.8) prior to recurrence period were associated with increased risk of recurrence. Life style factors like unhealthy diet (OR 4.43, 95% CI 1.95−10.06) and lack of physical activity (OR 4.14, 95% CI 1.81−9.46) were also associated with increased risk of recurrence. Medication nonadherence (OR 4.29, 95% CI 1.88−9.76), depression (OR 4, 95% CI 1.64−9.79) and memory problems (OR 4.33, 95% CI 1.23−15.21) prior to recurrence period were associated increased risk of recurrence. Among the stroke etiologic subtypes, cardio embolic stroke (OR 6, 95% CI 1.34−26.8) had highest risk of recurrence. Patients who did not receive discharge advice had more risk of recurrence (OR 7, 95% CI 2.5−20).

The controls had higher mean NIHSS (National Institute Health Stroke Scale) score [8.27(5.96), p=0.043] and a greater number of days of hospitalisation [6.54(3.76), $p = 0.006$] during index stroke. Patients in low income category based on government categorization had increased risk of recurrence (OR 4, 95% CI 1.33−11.96) (Table 2).

None of the other sociodemographic variables such as gender, education of patient, occupation, area of residence, risk factors and imaging variables such as vessel affected, infarct location and number of lesions were statistically significant (Table 3).

Conditional logistic regression analysis revealed patients who were not adherent to medication (OR 7.46, 95% CI 1.67−33.28) and who did not receive discharge advice (OR 10.79, 95% CI 2.38−49.02) were at increased risk of stroke recurrence whereas lacunar stroke (OR 0.08, 95% CI 0.01−0.59) and a greater number of days of hospitalization during index stroke (OR 0.82, 95% CI 0.67−0.99) were associated with less risk of recurrence. The final model is given in Table 4.

Discussion

This study used a strong methodology- incident pair matched case control, which is higher in the evidence pyramid. We have selected incident stroke patients as cases which removed the survival bias. The stroke recurrence rate depends on the duration of post stroke period and factors related to early and late stroke recurrence are different. This was taken into consideration in selecting the cases and controls. The interview was conducted in the home setting for both the cases and controls which gave

Table 1. *Characteristics of the study participants*

Characteristics		Case (n = 70)	Control (n = 70)
Age (years)		60.79(11.54)	60.29(11.38)
Post stroke period (months)		49.53(53.35)	50.09(53.03)
Sex	Male	57(81.4)	47(67.1)
	Female	13(18.6)	23(32.9)
Education	Below 10^{th}	27(38.6)	22(31.4)
	Pre degree	35(50)	41(58.6)
	Graduate and above	8(11.4)	7(10)
Area of residence	Rural	45(64.3)	46(65.7)
	Urban	25(35.7)	24(34.3)
Nature of occupation of the patients	Sedentary	26(37.1)	28(40)
	Non sedentary	44(62.9)	42(60)
Income category	Low	20(28.6)	8(11.4)
	High	50(71.4)	62(88.6)
Current smoker	Yes	9(12.9)	5(7.1)
	No	61(87.1)	65(92.9)
Alcohol use	Yes	9(12.9)	7(10)
	No	61(87.1)	63(90)
Diabetes	Yes	41(58.6)	32(45.7)
	No	29(41.6)	38(54.3)
Hypertension	Yes	42(60)	51(72.9)
	No	28(40)	19(27.1)
Dyslipidaemia	Yes	56(80)	54(77.1)
	No	14(20)	16(22.9)
Valvular heart disease	Yes	10(14.3)	3(4.3)
	No	60(85.7)	67(95.7)
Atrial fibrillation	Yes	7(10)	6(8.6)
	No	63(90)	64(91.4)
Total Cholesterol (Mean± SD)		159.34(41.74)	149.13(27.2)
LDL (Mean± SD)		91.76(36.03)	79.79(19.65)
*BMI	Normal	26(37.1)	27(38.6)
	Overweight and obese	44(62.9)	43(61.4)
#Waist circumference	Normal	11(15.7)	14(20)
	Abnormal	59(84.3)	56(80)
@Following Healthy Diet	Yes	8(11.4)	32(45.7)
	No	62(88.6)	38(54.3)
$Doing recommended physical activity	Yes	14(20)	36(51.4)
	No	56(80)	34(48.6)
Ischemic lesion of index stroke	Single	43(65.1)	44(62.9)
	Multiple	23(34.9)	26(37.1)
Blood vessel affected	Extracranial ICA	12(18.2)	9(12.9)
	Intracranial ICA	4(6.1)	8(11.4)
	MCA	14(21.2)	19(27.1)
	PCA	1(1.5)	1(1.4)
	ACA	0(0.0)	1(1.4)
	Vertebral	5(7.6)	5(7.1)
	Basilar	3(4.5)	2(2.9)
	Stenosis	18(27.3)	21(30)
	Occlusion	15(22.7)	20(28.6)

*normal < 80 in women and < 94 in men.
#normal <25 and overweight and obese>25.
@A healthy diet was defined consumption of approximately 350−400 g of vegetables a day, one medium sized fruit or two small sized fruit per day and [a]voiding extra salts, sweets, fried foods.
$recommended physical activity was at least 30 minutes of moderate physical activity like walking for at least 3 days a week.
LDL-Low Density Lipoprotein; BMI-Body Mass Index.

better assessment of the sociodemographic and life style pattern more accurately. The participants were more relaxed in the home environment. Since the matched controls were selected as and when the incident case was recruited, we could collect the data on medication adherence, risk factor control and life style factors on the same

Table 2. *Characteristics of index and recurrent strokes*

Characteristics		Index stroken (%)	Recurrent stroken (%)
Stroke type	Ischemic	131(93.6)	56(80)
	Haemorrhagic	4(2.9)	10(14.3)
	TIA	5(3.6)	4(5.7)
OCSP	Lacunar	22(15.7)	0.0 (0)
	Partial anterior circulation	65(25)	39(65.0)
	Total anterior circulation	15(10.7)	1(1.6)
	Posterior circulation	34(24.3)	20(33.4)
mRS	<2	35(25)	8(11.4)
	>2	105(75)	62(88.6)
NIHSS	<4	54(38.6)	23(32.9)
	>4	86(61.4)	47(67.1)

OCSP- The Oxfordshire Community Stroke Project Classification; TOAST- Trial of ORG 10172 in acute stroke treatment classification; TIA- Transient Ischemic attack; mRS-modified Rankins Scale; NIHSS- National Institute Health Stroke Scale.

post stroke period for both cases and controls which helped in good comparison.

We used self-reported medication adherence, defined as consumption of at least more than 80% of their medications for last two weeks, based on their last prescription. Consumption of more than 80% medication is widely accepted as optimal and is used in most of the clinical trials too. We selected two weeks period to collect the history of medication intake to reduce recall bias as well as the tendency of patients to be more adherent to the instructions around the days of follow up.

This study was conducted among age matched cases and controls. The age matching was done in such a way that the age of controls was matched to cases ±3 years. Studies have also shown that advanced age is associated with stroke recurrence.[19] Since age matching was done, we did not assess that variable. Patients belonging to low income category had increased risk of recurrence (OR 4, 95% CI 1.33−11.96), but on adjusted model effect was not significant. The other sociodemographic factors like education and occupation were not associated with stroke recurrence. None of the previous studies assessed these variables. One study found an increased risk for stroke recurrence among urban residents[20] but we could not demonstrate such a difference.

Our study showed, that the index stroke severity and greater number of days of hospitalization were associated with less risk of recurrence. The patients with severe stroke tend to get admitted for more days and they may tend to adhere the life style modifications because of the fear of recurrence. More number of days of hospitalisation helps in completing etiologic evaluation and initiation of secondary stroke prevention strategies. The patients with more severe stroke and disability there is a tendency to miss the recurrences, but in our study 90% of the patients had an mRS score of less than 2 prior to recurrence period.

We could demonstrate a strong relationship between medication adherence and stroke recurrence. Medication nonadherence is associated with an increased risk of stroke recurrence. Previous studies have shown that nonadherence to statins and antiplatelets were associated with increased risk of stroke recurrence.[21,22] We assessed adherence to all the categories of medications through a face to face interview which makes the data more reliable rather than telephonic interviews or from prescription as done in previous studies.[21,22]

Patients who did not receive discharge advice while getting discharged from the hospital during index stroke admission showed increased risk of stroke recurrence. Patients who received discharge advice were more likely to be aware of life style modifications and medication adherence which are essential for risk factor control and prevention of recurrence. The stroke care should be exclusive and comprehensive so that individualised education can be given to patients tailored to their needs. Various studies have shown that the education interventions given by doctors, nurses or physiotherapists are equally effective in behaviour modification.[23,24]

Our study revealed the life style factors like unhealthy diet and physical inactivity were associated with increased risk of stroke recurrence, similar to previous studies.[8,25-27] but the difference was not statistically significant on multivariate analysis. Similarly, we were not able to demonstrate association between stroke recurrence and risk factors. This may due to the small sample size in our study. But there was a significantly higher stroke recurrence risk among patients with glycosylated haemoglobin >7 and uncontrolled lipid values but the difference was not significant on multivariate analysis. Rather than the prevalence of risk factors, the status of risk factor control affects the risk of recurrence. Previous studies consistently showed diabetes as a risk factor for stroke recurrence but they haven't assessed the diabetic control status prior to recurrence.[8,28]

Though large artery atherosclerosis[7,29] and cardioembolic stroke[6,30] were associated with increased risk of stroke recurrence, we did not find that to be significant in our study.

Table 3. *Factors associated with stroke recurrence (Number of matched pairs=70)*

	Variable		Control		MHR	Mc Nemar test P	95% CI of MHR	
			n	n			L	U
case	Sex	Male*	35	22	1.83	0.121	0.91	3.7
		Female	12	1				
	Place of residence	Rural	31	14	0.93	1.000	0.45	1.93
		Urban*	15	10				
	Education of patient	≤10*	39	12	1.5	0.503	0.61	3.67
		>10	8	11				
	Income category	Low*	4	16	4.00	0.012	1.33	11.96
		High	4	46				
	Current smoker	Yes*	2	7	2.33	0.344	0.60	9.02
		No	3	56				
	Alcohol Use	Yes*	1	8	1.33	0.791	0.46	3.84
		No	6	55				
	Physical activity[@]	No*	27	29	4.14	<0.001	1.81	9.46
		Yes	7	7				
	Healthy diet[#]	No*	31	31	4.43	<0.001	1.95	10.06
		Yes	7	1				
	Diabetic control[+]	No*	13	16	0.64	0.211	0.34	1.2
		Yes	25	16				
	Glycosylated haemoglobin	>7*	13	22	2.00	0.080	0.97	4.12
		<7	11	24				
	Hypertension control[^]	No*	8	20	1.81	0.150	0.87	3.79
		Yes	11	31				
	Lipid control[$]	No*	1	11	5.50	0.022	1.22	24.8
		Yes	2	56				
	Medication adherence	No*	7	30	4.29	<0.001	1.88	9.76
		Yes	7	26				
	Discharge advice	No*	3	28	7.00	<0.001	2.5	20
		Yes	4	34				
	Depression	Yes*	3	24	4.00	0.001	1.64	9.79
		No	6	37				
	Anxiety	Yes*	23	22	2.00	0.08	0.97	4.12
		No	11	14				
	Memory problem	Yes*	1	13	4.33	0.021	1.23	15.21
		No	3	53				
	Cardioembolic stroke	Yes*	3	12	6.00	0.013	1.34	26.8
		No	2	53				
	Lacunar stroke	Yes	3	4	0.33	0.077	0.11	1.03
		No*	12	51				
	Valvular heart disease	Yes*	1	9	4.45	0.07	0.97	20.83
		No	2	58				
NIHSS index stroke	6.54(3.76)*	8.27(5.96)	-2.06	$p = 0.043$				
Number of days of hospitalisation	5.04(4.25)*	7.47(6.42)	-2.85	$p = 0.006$				

MHR-Mantel Haenszel Ratio; CI- Confidence Interval.
*risk category.
[+]Diabetic control-Among patients with diabetes FBS 70-130 and HBAIC >7 and in non diabetics HBAIC > 6.5 and FBS > 126,
[^]Hypertension control- SBP < 140 and DBP < 90 among hypertensives and in non hypertensives SBP < 130 and DBP < 80.
[$]Lipid control- LDL < 100 and TC < 200 among patients with dyslipidaemia.
[#]A healthy diet was defined consumption of approximately 350−400 g of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets, fried foods.
[@]Recommended physical activity was at least 30 min of moderate physical activity like walking for at least 3 days a week.

Presence of memory problems and depression (use of antidepressants) prior to recurrence period were associated with increased risk of stroke recurrence, but it was not significant on multivariate analysis. Study on post stroke depression showed it is independently associated with stroke recurrence.[8] They have assessed depression on the basis of self reported symptoms of depression and not assessed the use of antidepressants.

Table 4. *Hierarchical conditional logistic regression model of factors associated with stroke recurrence*

Variable	Category	OR	*p* value	95% CI for OR	
				LL	UL
Medication adherence	No*	7.46	0.008	1.67	33.28
	Yes				
Discharge advice	No*	10.79	0.002	2.38	49.02
	Yes				
Greater number of days of hospitalization	<7 days	0.82	0.039	0.67	0.99
Lacunar stroke	Yes	0.08	0.014	0.01	0.59
	No*				

OR- Conditional Odds Ratio; CI- Confidence Interval.
*risk category

Even though the sample size is small, the post hoc power analysis showed that it had a power of 97.87. The probability that this study accurately picked the difference if it was really present is 0.98. We have got wider confidence intervals for the significant variables. This is due to matched analysis which yield less precise estimation compared to unmatched analysis.

Strength and limitations of the study

One of the major strengths of this study is the methodology. We have selected incident stroke patients as cases which removed the survival bias. The interview was conducted in the home setting both the cases and controls which helped to assess the sociodemographic and life style pattern more accurately. Since the matched controls were selected as and when the incident case was recruited, we could collect the data on medication adherence, risk factor control and life style factors on the same post stroke period for both cases and controls which helped in good comparison.

One of the major limitations of this study is that we did not use validated scale to assess medication adherence. We selected two weeks period to collect the medication intake history to reduce recall bias as well as the tendency of patients to be more adherent to the instructions around the days of follow up. The data on memory problems and anxiety were collected based on self-report only. Other limitations of this study were small sample size and single centre study

Conclusion

Educating the patient regarding stroke, recurrence risk, medication adherence, healthy lifestyle and risk factor control can reduce stroke risk of recurrence. Positive behaviours should be incorporated and maintained as a new life style inorder avoid recurrent strokes. Our study highlights the importance of life style and behavioural factors in preventing stroke recurrence which has long term implications.

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Declaration of Competing Interest

None

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References

1. Kernan WN, Ovbiagele B, Black HR, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2014;45(7):2160-2236.
2. Di Carlo A. Human and economic burden of stroke. Age Ageing 2009;38:4-5.
3. Moroney JT, Bagiella E, Paik MC, Sacco RL, Desmond DW. Risk factors for early recurrence after ischemic stroke-the role of stroke syndrome and subtype. Stroke. 1998;29:2118-2124.
4. Lee AH, Somerford PJ, Yau KK. Risk factors for ischaemic stroke recurrence after hospitalisation MJA 2004;181:244-246.
5. Mohan KM, Wolfe CDA, Rudd AG, et al. Risk and cumulative risk of stroke recurrence: a systematic review and meta-analysis. Stroke 2011;42(5):1489-1494.
6. Lovett JK, Coull AJ, Rothwell PM. Early risk of recurrence by subtype of ischemic stroke in population-based incidence studies. Neurology 2004;62(4):569-573.
7. Kauw F, Takx RAP, de Jong HWAM, Velthuis BK, Kappelle LJ, Dankbaar JW. Clinical and imaging predictors of recurrent ischemic stroke: a systematic review and meta-analysis. Cerebrovasc Dis 2018;45:279-287.
8. Turan TN, Nizam A, Lynn MJ, et al. Relationship between risk factor control and vascular events in the SAMMPRIS trial. Neurology 2017;88(4):379-385.

9. Wu QE, Zhou AM, Han YP, et al. Poststroke depression and risk of recurrent stroke: a meta-analysis of prospective studies. Medicine (Baltimore) 2019;98(42):e17235.
10. Anderson D S. Recurrent Stroke-The Value of the CHA2DS2VASc Score and the Essen Stroke Risk Score in a. Nationwide Stroke Cohort. Stroke. 2015;46:2491-2497.
11. Leoo T, Lindgren A, Petersson J, von Arbin M. Risk factors and treatment at recurrent stroke onset: results from the Recurrent Stroke Quality and Epidemiology (RESQUE) Study. Cerebrovasc Dis 2008;25:254-260.
12. Waters MF, Hoh BL, Lynn M J, et al. Stenting and Aggressive Medical Management for Preventing Recurrent Stroke in Intracranial Stenosis (SAMMPRIS) Trial Investigators. Factors Associated with Recurrent Ischemic Stroke in the Medical Group of the SAMMPRIS Trial. JAMA neurology 2016;73(3):308-315.
13. Kronish IM, Ye S. Adherence to cardiovascular medications: lessons learned and future directions. Progress in cardiovascular diseases 2013;55(6):590-600.
14. Al Shaikh S, Quinn T, Dunn W, Walters M, Dawson J. Predictive factors of non-adherence to secondary preventative medication after stroke or transient ischaemic attack: a systematic review and meta-analyses. SAGE Journals May 5, 2016.
15. Jamison J, Sutton S, Mant J, Simoni AD. Barriers and facilitators to adherence to secondary stroke prevention medications after stroke: analysis of survivors and caregivers views from an online stroke forum. BMJ Open 2017;7(7): e016814.
16. Lummis HL, Sketris IS, Gubitz GJ, Joffres MR, Flowerdew GJ. Medication persistence rates and factors associated with persistence in patients following stroke: a cohort study. BMC Neurology 2008;8:25. https://doi.org/10.1186/1471-2377-8-25.
17. Brenner, et al. Awareness, treatment, and control of vascular risk factors among stroke survivors. J Stroke Cerebrovasc Dis 2010;19(4):311-320.
18. Howard VJ, Tanner RM, Anderson A, Irvin MR, Calhoun DA, et al. Apparent treatment-resistant hypertension among individuals with history of stroke or transient ischemic attack. Am J Med 2015:(7):128.
19. Shani S D, Kutty V R, Varma RP, Jissa VT, Sylaja PN. Facilitators and barriers to medication adherence among stroke survivors. Stroke 2020;51(suppl_1).
20. Rafie S, Kaveyani H, Choghakabodi P M. Risk factors associated with recurrent stroke: a retrospective hospital based study. J Acute Dis 2019;8(6):245-249.
21. Kocaman G, Dürüyen H, Koçer A, Asil T. Recurrent ischemic stroke characteristics and assessment of sufficiency of secondary stroke prevention. Arch Neuropsychiatr 2015;52:139-144.
22. Brewer L, Mellon L, Hall P. Secondary prevention after ischaemic stroke: the ASPIRE-S study. BMC Neurology 2015;15:216.
23. Third report of the National Cholesterol Education Program (NCEP). Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). NCEP, National Heart, Lung, and Blood Institute, National Institutes of Health; May 2001 NIH Publication No. 01-3670.
24. Glycemic targets: standards of Medical Care in Diabetes—2019. Diabetes Care 2019 Jan;42(Suppl. 1):S61-S70.
25. Kuwashiro T, Sugimori H, Kamouchi M, Ago T, Kitazono T, Iida M. Lower levels of high-density lipoprotein cholesterol on admission and a recurrence of ischemic stroke: a 12-month follow-up of the Fukuoka Stroke Registry. J Stroke Cerebrovasc Dis 2012;21(7):561-568.
26. Kono Y, Yamada S, Kamisaka K, Araki A, Fujioka Y, Yasui K, et al. Recurrence risk after non cardioembolic mild ischemic stroke in a Japanese population. Cerebrovasc Dis 2011;31(4):365-372.
27. Xu G, Liu X, Wu W, Zhang R, Yin Q. Recurrence after ischemic stroke in Chinese patients: impact of uncontrolled modifiable risk factors. Cerebrovasc Dis 2007;23 (2-3):117-120.
28. Ellis G, Rodger J, McAlpine C, et al. The impact of stroke nurse specialist input on risk factor modification: a randomised controlled trial. Age Ageing 2005;34(4):389-392.
29. Wangqin R, Wang X, Wang Y, et al. Risk factors associated with 90-day recurrent stroke in patients on dual antiplatelet therapy for minor stroke or high-risk TIA: a subgroup analysis of the CHANCE trial. Stroke Vasc Neurol 2017:e000088.
30. Hohmann C, Klotz JM, Radziwill R, et al. Pharmaceutical care for patient with ischemic stroke: improving the patient quality of life. Pharm World Sci 2009;31(5): 550-558.

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Clinical study

Facilitators and barriers to medication adherence among stroke survivors in India

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ABSTRACT

Strict compliance with medication and life style modification are integral to secondary stroke prevention. This study was undertaken to find out medication adherence among stroke survivors and factors associated with it. Cross sectional survey among stroke survivors was conducted. Interview based self-reported medication adherence was defined as consumption at least >80% of their medications for last two weeks, based on last prescription. Structured interview using pretested interview schedule was done to collect other data. Sequential step wise logistic regression analysis was done to find out the facilitators and barriers to medication adherence. Two hundred and forty stroke survivors (mean age 58.64 ± 10.96 years; 25.4% females) with a mean post-stroke period of 6.65 ± 3.36 months were participated. Overall medication adherence was 43.8% (n = 105). Medication adherence was 34.3% (n = 134), 52.6% (n = 190) and 56.7% (n = 224) for antidiabetics, antihypertensives and statins respectively and was associated with risk factor control (Diabetes: Odds Ratio (OR) = 4.85; 95% Confidence Interval (CI) 2.12–11.08, Hypertension: OR = 3.42; 95% CI 1.83–6.4, Dyslipidaemia: OR = 3.88; 95% CI 1.96–4.04). Having daily routine (OR = 2.82; 95% CI 1.52–5.25), perceived need of medication (OR = 2.33; 95% CI 1.04–5.2) and perceived poor state of health (OR = 2.65; 95% CI 1.30–5.40) were facilitators. Memory issues (OR = 0.34; 95% CI 0.16–0.71), side effects (OR = 0.24; 95% CI 0.11–0.42) and financial constraints (OR = 0.46; 95% CI 0.24–0.91) were barriers to medication adherence. Establishing daily routines, periodic reminders, financial supports to buy medicines and patient education can enhance medication adherence to prevent future strokes.

1. Introduction

Survivors of first ever stroke have an increased chance of stroke recurrence: 11.1% at 1 year; 26.4% at 5 years; and 39.2% at 10 years [1]. Studies have shown that effective secondary stroke prevention is associated with an 80% reduction in risk of early recurrent strokes [2]. But one out of every four strokes are recurrent [3], suggesting inadequate secondary stroke prevention strategies or lack of adherence to it.

Adherence to medication is important in the management of chronic diseases and is a mediator between the treatment and patient outcome. Over 30–50% of medicines prescribed for long term illnesses are not taken as directed [4]. It is a major problem in both developing and developed countries and medication adherence varies from 40 to 85% among stroke survivors [5–9]. The lowest ranges are from studies conducted in China and United States among low income under- privileged groups [7–10]. Medication nonadherence is associated with poor control of risk factors, worse outcome [11] and risk of death (OR: 7.99; 6.28–10.18) when compared to adherent group [12]. Adherence to antihypertensives after stroke have been shown to reduce the incidence of cardiovascular events [13], hospitalisations and health care costs [14].

Studies on factors associated with medication adherence among stroke survivors are mainly from developed countries and they have identified factors like difficulties in taking medications, fear of over medication, lack of knowledge on stroke and medication benefits and perceived discrimination from health care setting as the barriers [15–17]. Support from caregivers and healthcare professionals, fear of recurrence, advanced age, following daily routines, fixed dose combination and counselling were facilitators for treatment adherence [8,15,17–19]. The use of alternate medicine

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is also a reason for stopping modern medicine among stroke survivors especially in Asian countries [20].

Causes of non-adherence to treatment are multifactorial and studies exploring multidimensional indicators of adherence to medications intended to prevent recurrent strokes are lacking especially in low and middle income settings [19]. Identifying the modifiable factors which affect adherence to medications to prevent stroke recurrence can help in planning intervention to improve medication adherence. The results can also inform relevant policy decision makers to improve stroke care in the community.

2. Objectives of the study

The aim of our study was to assess the level of medication adherence among survivors of first episode of stroke, to analyse the control of risk factors among them and to identify the facilitators and barriers to medication adherence among survivors of first episode of stroke.

3. Methodology

A cross sectional survey among hospital based stroke survivors of first episode of stroke within a post stroke period of three months to one year was conducted to find out the medication adherence, risk factor control and facilitators and barriers to medication adherence among them. This study received Institutional Ethics committee approval (SCT/IEC/1327). Written informed consent was obtained from all the participants.

3.1. Setting

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram is a tertiary level referral hospital which admit patients of neurology and cardiology specialities. The comprehensive stroke care unit admits 450–500 patients per year. The patients are followed up in the stroke clinic on an outpatient basis.

3.2. Population and sample

Survivors of first episode of stroke refers to the survivors of diagnosed cases of ischemic stroke, haemorrhagic and transient ischemic attack with evidence of acute infarct. The study population for this cross sectional survey were the survivors of first episode of stroke within a post stroke period of three months to one year.

The risk factor control is defined as achieving the desired levels of blood pressure, blood sugars and cholesterol. The targets for risk factor control were taken from National Cholesterol Education Program (NCEP) ATP III guidelines [21] for Cholesterol (LDL < 100 and TC (200), American diabetes Association guidelines [22] (FBS 70–130 and HBAIC < 7) for Diabetes control and ASA secondary stroke prevention guidelines [23] for blood pressure (SBP < 140 and DBP < 90).

3.3. Sample size

Sample size for this study was determined based on the following formula:

$n = z\alpha^2\ p\ (1\text{-}p)/d^2$, where $z\alpha = 1.96$ (at 95% confidence interval), p = 40% (prevalence of medication adherence among stroke survivors [7], d = absolute precision of 7%. A sample size of 185 was calculated using Open Epi. Considering a non-response rate of 20%, the total sample size came out to be 222 participants. To round up, the total sample size estimated for this study was 240 participants.

3.4. Sample selection procedure

Survivors of first episode of stroke, aged 18 and above within a period of three months to one year were recruited from the stroke clinic for this survey. The data collection period was February 2019 to August 2019. Comatose, severely disabled [modified Rankin Scale (mRS) score = 5] or having multiple coexisting diseases with life expectancy less than six months were excluded from the study. Data were collected during their follow up visit to stroke clinic.

3.5. Data collection tools and techniques

Pretested structured interview schedule was used to collect data. The interview schedule included sections to collect sociodemographic data, family support, financial support for medications, health care seeking behaviour, access to health care and relationship with health care provider. Details regarding stroke survivor's belief about treatment and disease and presence of anxiety and depressive mood were also assessed.

Compliance with other recommended health advice like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption were also assessed. A healthy diet was defined consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets and fried foods. Recommended physical activity was at least 30 min of moderate physical activity like walking for at least 3 days a week.

Standard instruments were used to measure blood pressure, weight, height and waist circumference (WC). Clinical information sheet was used to collect data from medical records which included stroke related data, history of diabetes, hypertension, dyslipidaemia, their treatment and blood investigation results of fasting blood sugar, glycosylated haemoglobin, low density lipoprotein and total cholesterol. Modified Rankin scale was used to measure physical disability at the time of follow up.

Medication intake history of previous 14 days prior to recruitment was collected through face to face interview with patients and their primary care giver. The last given prescription from our hospital was used to identify the medications prescribed for the patients. The patients and the care givers were asked to fill the check list of medication intake prior to 14 days of recruitment. The check list included the name of medication and frequency. Medication intake history was taken for antiplatelets, antihypertensives, antidiabetics, statin and anticoagulants. This medication intake history was compared with the prescription and medication adherence was calculated for each category of medication. Self-reported medication adherence was defined as consumption of at least >80% of their medications for last two weeks, based on their last prescription. Medication adherence was calculated for five categories of medication; antiplatelets, antihypertensives, antidiabetics, statin and anticoagulants. Overall adherence was defined adherence to all the categories of medication prescribed. The self-reported reasons for non-adherence were also collected from non-adherers.

3.6. Analysis

For meeting the first objective, the proportion of patients who had consumed at least >80% of their medications for last two weeks, based on their last prescription was reported.

To find out the risk factor control, the proportion of patients who achieved the targeted level of diabetic control, hypertension control and dyslipidaemia control were analysed. Separate models

were created to find out the effect of medication adherence on risk factor control, adjusted for the following: physical activity, healthy diet, current smoking and alcohol use. Adjusted odds ratio and 95% confidence interval were reported.

Bivariate analysis with medication adherence as outcome variable and patient's characteristics was done to find out facilitators and barriers to medication adherence. Odds Ratio (OR) with 95% Confidence Interval (CI) was reported. Those variables have statistical significance < 0.1 were considered for regression analysis. Sequential stepwise logistic regression analysis was done in the following steps.

Step1- The variables were categorized into five groups. Sociodemographic variables included age, sex, ownership of vehicle, belongs to poor households and place of residence. The second category of variables are treatment access, availability of medicine in the nearest medical shop and buying medicines for one month. Stroke related variables included stroke severity at ictus, stroke severity at recruitment and presence of memory issues. Variables related to patients belief about treatment and disease were perceived need of medication, experiencing side effects, fear of dependence to medications, belief that medicine prevents recurrence, simple treatment regimen and perceived poor state of health. Separate logistic regressions were built including age and sex in each model, corresponding to each group of predictors resulting in five models. Those variables having significance level < 0.1 in each model were considered for the second step.

Step2- Those variables having significance level < 0.1 from each category were selected for regression analysis at second step. The variables were availability of medicine in the nearest medical shop, buying medicines for one month, continuing physiotherapy at home, having a daily routine, NIHSS < 4 at review, presence of memory problem, experiencing side effects, belief that medicine prevents recurrence and perceived poor state of health. A multiple logistic regression model was created including all the variables plus age and sex.

Step3- Final model was created by backward elimination from step 2, with alpha level set to 0.05.

4. Results

4.1. Participant's characteristics

Stroke survivors (n = 240; mean age 58.64 ± 10.96 years; 25.4% females) with mean years of education 9.78 ± 3.77 constituted the sample. Ischemic stroke patients constitute 83.8% and mean post stroke period was 6.65 ± 3.36 months. Rural inhabitants were 76.7%. Among the participants 32.1% belonged to the category of poor households based on official government classification. Manual laborers were 58.8%; 32.1% were skilled workers, 5.3% were professionals and rest were unemployed. The work or employment status of 44.6% were affected by stroke. Nearly 5.4% had to go on long leave and 6.3% lost their jobs. The other characteristics of the study population is given in Table 1.

The mean cost of medication per week was □377.96 (minimum 100; maximum 2000). Majority (68.5%) had medical insurance which covered only their inpatient treatment expenditure, in which 84.8% had insurance provided from government agencies. Only 26.7% (n = 64) had any form of assistance to cover the expenditure of their prescribed medications after discharge. Of them 40.6% were getting reimbursement for their outpatient care and 59.4% were getting free medications from government hospitals. Modern medicine was followed for the treatment of stroke by 99.17% while 6.25% followed Ayurveda treatment also. The mean distance to nearby hospital was 3.4 ± 2.6 km and that of a medical shop was 2.5 ± 1.9 km. >50% of the patients had a last medical check-up within 1–3 months. Usual check-up was done in nearby government hospital by 51.7% while around 32% had gone to physicians' private clinics. >90% of the participants had good relationship with treating physician and had not experienced any communication problem in terms of language or understanding.

Table1
Characteristics of the study participants.

Variables	Categories	n (%)
Age	≤45 years > 45 years	31 (12.9) 209 (87.1)
Sex	Male Female	179 (74.6) 61 (25.4)
Place of residence	Rural Urban	184 (76.7) 56 (23.3)
House hold monthly income (Rupees)	<1500 1500–5000 ≥5000	88 (36.7) 83(34.6) 69(28.8)
Education of patient	Up to 10th standard Graduate professional	175(72.9) 50 (20.8) 15(6.3)
Occupation of patient	Manual labourer Skilled worker Professional Unemployed	141(58.8) 77 (32.1) 14(5.3) 8 (3.3)
Number of family members	≤4 > 4	97(40.4) 143 (59.6)
System of treatments followed for stroke	Modern medicine Ayurveda Homeopathy	238(99.2) 15(6.3) 2(0.8)
BMI	Under weight Normal Over weight Obese	2(0.8) 60(25) 147 (61.3) 31(12.9)
Diabetes	Yes No	154(61.2) 86 (38.8)
Hypertension	Yes No	213(88.6) 27 (11.4)
Dyslipidemia	Yes No	232(96.7) 8(3.3)
Type of stroke	Ischemic Hemorrhagic TIA	201(83.8) 30 (12.5) 9(3.8)
Post stroke period	3–6 months 6–9 months 9–12 months	141(58.8) 31 (12.9) 68(28.3)
NIHSS	At ictus At recruitment	Mean (SD) 6.5(5.9) 1.2(2.2)
mRS at recruitment	1.2(1.3)	
Waist circumference (cm)	97.34(9.5)	

NIHSS – National Institute Health Stroke Scale, mRS –Modified Rankin Scale.

4.2. Medication adherence

Overall medication adherence was 43.8% (N = 240). Lowest adherence was seen for antidiabetic medication 34.3% (n = 134). Adherence to antiplatelets and anticoagulants were nearly same [62.4% (n = 196) and 61.9% (n = 21)]. Adherence to antihypertensives and statins were 52.6% (n = 190) and 56.7% (n = 224) respectively. The self-reported reasons for nonadherence (n = 135) were forgetfulness (41.5%), experiencing side effects (28.9%), perceived lack of need (8.1%), journeys (27.4%) and not being able to buy medicine for one month (62.2%).

4.3. Risk factor control and medication adherence

Patients with Diabetes, hypertension and dyslipidaemia constituted 64.2%, 88.8% and 96.7%. The prevalence of smoking and alcohol use were very low among stroke survivors. Only 4.2% were current smokers and 3.8% were using alcohol. More than half of the patients were following the recommended physical activity (57.6%), but a healthy diet was followed by only 12.9%. Optimal level of low density lipoprotein was present in 63.3% (n = 207). Among the 228 patients in which value of total serum cholesterol was available, desirable level of total serum cholesterol was achieved in 92.1%. Diabetic control was achieved in 26% (n = 154), desired level of blood pressure was achieved in 36.2% (n = 213), lipid control was achieved in 72.9% (n = 207). Multiple

logistic regression analysis revealed medication adherence was associated with risk factor control when adjusted for physical activity, healthy diet, current smoking and alcohol use (Table 2).

4.4. Facilitators and barriers to medication adherence

Strokes survivor aged ≤45 years (58.1%), females (52.5%) and those had an education of higher secondary and above (47.7%) had higher medication adherence compared to others. Professionals had highest medication adherence (64.3%) but it was least among manual labourers (41.6%). People belonging to poor household had low adherence compared to others (33.8% Vs 48.5%). Medication adherence was lesser in patients with a post stroke duration of 9–12 months (41.2%) compared to patients with post stroke duration of 3–6 months (44.7%). Family support or treating physician did not had any significant influence on medication adherence. The participants characteristics and its relationship with medication adherence (p value <0.1 and their odds ratios) are summarised in Table 3.

In the final model, availability of medicine in the nearest medical shop, having a daily routine and perceived poor state of health were facilitators and memory issues, minimum neurological deficits at recruitment and experiencing side effects were barriers to medication adherence. The final model with odds ratios is displayed in Table 4.

5. Discussion

This study revealed that adherence to medications intended to control risk factors and prevent stroke recurrence was very low as 43.8% in our setting. The reported medication adherence varies widely in studies ranging from 40% to 85% [5–10]. This present study being done in a low and middle income country supports the findings of studies done among low and underprivileged groups [7,10]. In a study conducted using validated adherence measure in a low income setting found out an adherence level of 40% among stroke survivors [7]. This study used consumption of at least >80% of their prescribed medication during last two weeks. Our study result is similar to the study done using validated measure. We could reduce the recall bias as we had assessed the medication intake status of last two weeks only.

Availability of medication in the nearest medical shop and buying medicine for one month were facilitators to medication adherence. Those people had financial constraints expressed not being able to buy medicine for one month, which led to missing of doses till they bought next time. Studies done among low income group had identified high cost of medication and difficulties to access health care as barriers to medication adherence [7,10].

Presence of neurological deficits and perceived poor state of health were associated with higher adherence. The presence of neurological impairment can be a confounder for factors like memory issues, perceived poor state of health and having a daily routine. However, the confounding caused by neurological impairment on medication adherence has been accounted for in logistic regression analysis. The initial step in the process of development of medication adherence behaviour is perceived need of medicine. The disability caused by stroke and subsequent perceived poor state of health thus remained a major facilitator for medication adherence. A systematic review of psychological determinants of medication adherence also revealed perceived medication necessity is a major facilitator to medication adherence [24]. Following daily routine facilitated medication adherence, as previously reported [18].

The most common self- reported reason for non-adherence was simple forgetfulness and when they remember it would have been the time for next dose. Our study showed memory issues and experiencing side effects as major barriers to medication adherence. Studies done in both developing and developed countries showed similar results [11,15]. We collected self-reported data on memory issues and side effects, which remains one of our limitations.

The identified factors negatively affected adherence among low income groups were mainly related to health care system such as inadequate continuity of care, high cost of medication, poor communication from care provider, difficulty in accessing care, perceived discrimination and low trust with treating doctor [7,11]. But studies done in developed countries identified fear of side effects, forgetfulness, higher education and increased quality of life as barriers to medication adherence [15,25,26]. Our study yielded mixed results.

The effect of age, gender, income and education on medication adherence was inconsistent and varied in studies conducted in different settings. In our present study, on bivariate analysis there was a significant difference between medication adherence among people belonging to poor households, but when adjusted for other factors the difference was not significant. A study done in a developed country among stroke survivors also found out no effect of income on medication adherence [26]. We did not get any significant difference between medication adherence among those who had financial support to buy medications or free medications available and who did not have such facility. A systematic review of 21 studies showed almost similar level of poor medication adherence among patients with free medication and with different payment schemes [27]. Gender and medication adherence is still controversial with contrasting evidence [25,26]. We found higher adherence among females and those with higher education and professionals but for these variables the difference was not significant. In contrast to some qualitative study findings, we could not get any significant difference in adherence among those have care giver support or not [11,15].

Our study revealed poor control of risk factors among stroke survivors. Previous studies brought out the similar results [11,28]. None of the studies assessed the effect of medication adherence and following other health recommendation on risk factor control. We could prove that medication adherence is independently associated with risk factor control. There is no substitute for medication adherence.

Table 2
Adjusted models for medication adherence and risk factor control.

Risk Factors	On treatment		Adherence#		Risk Factor control*		OR[a]	95% CI	
	n	%	n	%	n	%		Lower limit	Upper limit
Diabetes (N = 154)	134	87.07	46	34.3	40	26	4.85	2.12	11.08
Hypertension (N = 213)	190	89.05	100	52.6	77	36.2	3.4	1.83	6.4
Dyslipidaemia (N = 232)	224	93.97	127	56.7	95	64.6	3.88	1.96	4.04

Abbreviations: OR- Odds Ratio, CI- Confidence Interval *Outcome variables; Diabetic control-Among patients with diabetes FBS 70–130 and HBAIC > 7, Hypertension control-SBP < 140 and DBP < 90 among hypertensives and LDL < 100 and TC < 200 among patients with dyslipidaemia. #Adherence to corresponding categories of medication was taken. OR[a] –adjusted OR (Adjusted for physical activity, healthy diet, current smoking and alcohol use).

Table 3
Bivariate association between characteristics of stroke survivors and medication adherence.

Variables	Categories	Total participants N = 240		Adherence* Yes (n = 105)		OR	95% CI for OR	
		N	%	n	%		Lower limit	Upper limit
Age	≤45	31	12.9	18	58.1	1.94	0.90	4.17
	>45(R)	209	87.1	87	41.6			
Sex	Male	179	74.6	73	40.8	0.62	0.35	1.12
	Female(R)	61	25.4	32	52.5			
Place of residence	Urban Rural (R)	56	23.3	31	55.4	1.84	1.01	3.37
		184	76.7	74	40.2			
Ownership of vehicle	Yes	135	56.3	66	48.9	1.62	0.96	2.72
	No (R)	105	43.8	39	37.1			
Belongs to poor households	No	77	33.1	26	33.8	0.54	0.31	0.95
	Yes (R)	163	67.9	79	48.5			
Availability of medicines	Yes	156	65	80	51.3	2.48	1.41	4.36
in the nearest medical shop	No (R)	84	35	25	29.8			
Buy medicine for one month	Yes	106	44.2	55	51.9	1.81	1.08	3.04
	No (R)	134	55.8	50	37.3			
NIHSS at ictus	Mild stroke(≤4) Moderate	114	47.5	43	37.7	0.63	0.37	1.05
	to severe(>4)(R)	126	52.5	72	57.1			
MRS	≤2	156	65	61	39.1	0.58	0.34	1.00
	>2 (R)	84	35	44	52.4			
Memory issues	Yes	92	38.3	34	37.0	0.64	0.37	1.08
	No (R)	148	61.7	71	48.0			
NIHSS at recruitment	Mild stroke	223	92.9	93	41.7	0.30	0.10	0.88
	(≤4)	17	7.1	12	70.6			
	Moderate to severe (>4) (R)							
Perceived poor state of health	Yes	78	32.5	43	55.1	1.98	1.15	3.43
	No (R)	162	67.5	62	38.3			
Treatment regimen	Simple	174	72.5	85	48.9	2.20	1.20	4.02
	Complex (R)	66	27.5	20	30.3			
Fear of dependence to treatment	Yes	83	34.6	30	36.1	0.62	0.36	1.07
	No (R)	157	65.4	75	47.8			
Perceived need of medicine	Yes	190	79.2	93	48.9	3.04	1.50	6.17
	No (R)	50	20.8	12	24			
Believes that medicine prevent recurrence	Yes	138	57.5	73	52.9	2.46	1.44	4.2
	No (R)	102	42.5	32	31.4			
Experiencing side effects	Yes No (R)	68	28.3	13	19.1	0.21	0.11	0.40
		172	71.7	92	53.5			
Having a daily routine	Yes No (R)	118	49.2	66	55.9	2.70	1.60	4.57
		122	50.8	39	32			
Healthy diet	Yes No (R)	31	12.9	18	58.1	1.94	0.90	4.17
		209	87.1	87	41.6			
Continuing physiotherapy	Yes No (R)	116	48.4	58	50	1.64	0.98	2.74
		124	51.6	47	37.9			

*Outcome variable; Abbreviations: OR- Odds Ratio, CI- Confidence Interval; (R) –Reference category.

Table 4
Final model of facilitators and barriers to medication adherence among stroke survivors.

Variables	UnadjustedOR	95% CI		AdjustedOR	95% CI	
		Lower limit	Upper limit		Lower limit	Upper limit
Age ≤ 45	1.94	0.90	4.17	1.340	0.54	3.35
Sex- Male	0.62	0.35	1.12	0.60	0.3	1.21
Availability of medicines in the nearest medical shop	2.48	1.41	4.36	2.36	1.23	4.52
Buy medicines for one month	1.81	1.08	3.04	1.84	0.99	3.45
Having a daily routine	2.70	1.60	4.57	2.81	1.5	5.26
Mild stroke (≤4) at recruitment	0.3	0.10	0.86	0.19	0.05	0.73
Memory issues	0.64	0.37	1.08	0.34	0.16	0.71
Experiencing side effects	0.21	0.11	0.40	0.2	0.1	0.42
Perceived poor state of health	1.98	1.15	3.43	2.65	1.3	5.4

Abbreviations: OR- Odds Ratio, CI- Confidence Interval; Outcome variable- medication adherence.

Continuous access and availability of medications is prerequisite for uninterrupted consumption. Relevant policy decisions can be made to ensure continuous access and availability of medication locally. Since forgetfulness is the common reason identified in almost all the settings, periodic reminders in the form of care giver reminding or through text messages can help. Another major area of intervention is forming strong habit of medication intake. Incorporating medication intake into daily routines can enhance adherence. At every clinic visit people should be screened and asked for side effects of medication. Misconceptions about side effects of medications should be corrected by awareness programs. Future studies to assess the effect of habit training and routinisation, motivational counselling and periodic reminders on medication adherence will be worthwhile.

6. Strengths and limitations of the study

All the interviews were conducted one to one by the principal investigator only which reduced the chance of interviewer bias. Since all patients were meticulously followed up in the stroke clinic, blood reports of all these patients were available at the time of data collection. In this study we could assess the adherence to each category of medication (antidiabetic, antihypertensive and statins) separately and correlate with achieving corresponding risk factor control targets. One of the major limitations of this study is that we did not use validated scale to assess medication adherence. We used self-reported medication adherence, defined as consumption of at least >80% of their medications for last two weeks, based on their last prescription. Consumption of >80% medication is widely accepted as optimal and is used in most of the clinical trials too. We selected two weeks period to collect the medication intake history to reduce the recall bias and the tendency of patients to be more adherent to the instructions around the days of follow up. But there is still a chance of recall bias while eliciting medication intake history for 14 days prior to the date of interview. The data on memory issues and side effects were also collected based on self report only.

7. Conclusion

Medication adherence among survivors of first episode of stroke at three months to one year was suboptimal. Medication adherence was independently associated with risk factor control. The major causes of nonadherence were memory issues, experiencing side effects and financial constraints. Local availability of medicines, having a daily routine and presence of neurological deficits facilitated medication adherence. These findings have implications for developing preventive strategies and improving stroke care in the community.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

[1] Mohan KM, Wolfe CDA, Rudd AG, Heuschmann PU, Kolominsky-Rabas PL, Grieve AP. Risk and cumulative risk of stroke recurrence: a systematic review and meta-analysis. Stroke 2011;42(5):1489–94.
[2] Rothwell PM, Giles MF, Chandratheva A, Marquardt L, Geraghty O, Redgrave JNE, et al. Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison. Lancet 2007;370(9596):1432–42.
[3] Di Carlo A. Human and Economic Burden of Stroke. Age Ageing 2009;38 (1):4–5.
[4] Burkhart PV, Sabaté E (2003) Adherence to long-term therapies: evidence for action. J Nurs Scholarsh. 35(3):207.
[5] Khan NA, Yun L, Humphries K, Kapral M. Antihypertensive drug use and adherence after stroke: are there sex differences?. Stroke 2010;41(7):1445–9.
[6] Albright KC, Zhao H, Blackburn J, Limdi NA, Beasley TM, Howard G, et al. Racial differences in statin adherence following hospital discharge for ischemic stroke. Neurology 2017;88:1839–48.
[7] Kronish IM, Diefenbach MA, Edmondson DE, Phillips LA, Fei K, Horowitz CR. Key barriers to medication adherence in survivors of strokes and transient ischemic attacks. J Gen Intern Med 2013;28(5):675–82.
[8] Sappok T, Faulstich A, Stuckert E, Kruck H, Marx P, Koennecke H-C. Compliance with secondary prevention of ischemic stroke: a prospective evaluation. Stroke 2001;32(8):1884–9.
[9] Al Shaikh S, Quinn T, Dunn W, Walters M, Dawson J. Redictive factors of non-adherence to secondary preventative medication after stroke or transient ischaemic attack: A systematic review and meta-analyses. Eur Stroke J 2016;1 (2):65–75.
[10] Chen MJ, Wu CC, Wan L, PhD, Zou G, PhD; Neidlinger SH (2018) Association between medication adherence and admission blood pressure among patients with ischemic stroke. J Cardiovasc Nurs 34(2): E1–E8.
[11] Thorogood M. Southern Africa Stroke Prevention Initiative (SASPI) study. Bull World Health Organ 2004;82:503–8.
[12] Mayor S. Non-adherence to medication increases stroke risk in patients with high blood pressure. BMJ 2013;347:f4586.
[13] Perreault S, Yu A, Cote A, Dragomir A, White-Guay B, Dumas S. Adherence to antihypertensive agents after ischemic stroke and risk of cardiovascular outcomes. Neurology 2012;79:2037–43.
[14] Sokol MC, McGuigan KA, Verbrugge RR, Epstein RS. Impact of medication adherence on hospitalization risk and healthcare cost. Med Care 2005;43:521–30.
[15] Bauler S, Jacquin-Courtois S, Haesebaert J, Luaute J, Coudeyre E, Feutrier C, et al. Barriers and facilitators for medication adherence in stroke patients: a qualitative study conducted in French neurological rehabilitation units. Eur Neurol 2014;72(5-6):262–70.
[16] Souter C, Kinnear A, Kinnear M, Mead G. Optimisation of secondary prevention of stroke: a qualitative study of stroke patients' beliefs, concerns and difficulties with their medicines. Int J Pharm Pract 2014;22:424–32.
[17] Glader EL, Sjölander M, Eriksson M, Lundberg M. Persistent use of secondary preventive drugs declines rapidly during the first 2 years after stroke. Stroke 2010;41:397–401.
[18] Jamison J, Sutton S, Mant J, Simoni AD. Barriers and facilitators to adherence to secondary stroke prevention medications after stroke: analysis of survivors and caregivers views from an online stroke forum. BMJ Open 2017;7(7): e016814. https://doi.org/10.1136/bmjopen-2017-016814.
[19] Banerjee A, Khandelwal S, Nambiar L, Saxena M, Peck V, Moniruzzaman M, et al. Health system barriers and facilitators to medication adherence for the secondary prevention of cardiovascular disease: a systematic review. Open Heart 2016;3(2):e000438.
[20] Durai Pandian J, Toor G, Arora R, Kaur P, Dheeraj KV, Bhullar RS, Sylaja PN. Complementary and alternative medicine treatments among stroke patients in India. Top Stroke Rehabil 2013;19(5):384–94.
[21] Third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (2001) JAMA. 16;285(19):2486–97.
[22] Glycemic targets: Standards of Medical Care in Diabetes—2019. Diabetes Care 42(Suppl. 1):S61–S70.
[23] Kernan WN, Ovbiagele B, Black HR, Bravata DM, Chimowitz MI, Ezekowitz MD, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2014;45 (7):2160–236.
[24] Crayton E, Fahey M, Ashworth M, Besser SJ, Weinmann J, Wright AJ. Psychological determinants of medication adherence in stroke survivors: a systematic review of observational studies. Ann BehavMed 2017;51:833–45.
[25] Cheiloudaki E, Alexopoulos EC. Adherence to treatment in stroke patients. Int J Environ Res Public Health 2019;16(2):196.
[26] Sjölander M, Eriksson M, Glader E-L. Inequalities in medication adherence to statin treatment after stroke: A nationwide observational study. Eur Stroke J 2016;1(2):101–7.
[27] Aziz H, Md Hatah E, Makmor Bakry M, Islahudin F. How payment scheme affects patients' adherence to medications? A systematic review. Dove Med Press 2016;10:837–50.
[28] Brenner DA, Zweifler RM, Gomez CR, Kissela BM, Levine D, Howard G, et al. Awareness, treatment, and control of vascular risk factors among stroke survivors. J Stroke Cerebrovasc Dis 2010;19(4):311–20.

Poor risk factor control among stroke survivors- a cross sectional survey

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Abstract

Objectives: A cross sectional survey was done to find out the prevalence and control status of cardiovascular risk factors among stroke survivors within a post stroke period of three months to one year. **Methods:** The data on prevalence of risk factors was taken from past medical history and medical records. The risk factor control is defined as achieving the targeted levels of blood pressure, blood sugars and cholesterol. Data on diet, physical activity, tobacco use and alcohol consumption were also collected. Standard instruments were used to measure blood pressure, weight, height and waist circumference. The blood sugar and lipid values were taken from lab reports. **Results:** Stroke survivors (N=240) participated. Around 75% of the participants were obese or overweight. Normal waist circumference was found only in 25% of the participants. Majority of the participants were not following a healthy diet (62.5%) or doing

recommended physical activity (87.1%). The prevalence of diabetes (61.2%), hypertension (88.6%) and dyslipidaemia (96%) were high among stroke survivors. The targeted level of diabetic control and hypertension control level was achieved by 26% and 36.2 respectively, while around 72% attained lipid control. **Conclusion:** Prevalence of cardiovascular risk factors are very high among stroke survivors and it is poorly controlled.

Key words: Risk factor; Stroke survivors; Prevalence and control

Introduction

Strict control of risk factors is integral to prevention of stroke recurrence. The target levels of blood pressure, blood sugars and lipid values for secondary stroke prevention are given by the American Stroke Association (ASA),[1] American Diabetes Association (ADA)[2] and National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III[3] guidelines. The stroke survivors have unrecognized hypertension (18.7% vs 13.5%), unrecognized Stage 2 hypertension (4.4% vs 2.2%), and unrecognized diabetes (4.2% vs 3.2%) (Brenner et al, 2010) [4]. The risk factor control is poor among stroke survivors. [5,6,7] The disability caused by stroke may affect the initiation of secondary stroke prevention strategies by the patients. Stroke patients with more severe disability (Barthel score ≤ 14) were less likely to receive appropriate secondary prevention than those with mild or no disability (Barthel score 15 to 20).[8,9] Poor risk factor control is associated with increased risk of stroke recurrence. [5,7] This study aims to have a prospective assessment of prevalence and present status of risk factors among stroke survivors. The knowledge gained can improve the stroke care to prevent stroke recurrence in the community.

Methodology

Sree Chitra Tirunal Institute for Medical Science and Technology (SCTIMST), Thiruvananthapuram is a quaternary level referral hospital which admit patients of neurology and cardiology specialities. The comprehensive stroke care unit admits 450-500 patients per year. It has an acute stroke care unit, is maintaining a stroke registry and the patients are followed up in stroke clinic. The stroke registry maintained in SCTIMST is based on the WHO STEPS Stroke Manual.

Cross sectional survey among hospital-based stroke survivors of first episode of stroke within a post stroke period of three months to one year was conducted to identify the prevalence and control of risk factors. Survivors of first episode of stroke refers to the survivors of diagnosed cases of ischemic stroke, haemorrhagic and transient ischemic attack with evidence of acute infarct. The study population for this cross sectional survey were the survivors of first episode of stroke within a post stroke period of three months to one year. The data was collected during their follow up visit to stroke clinic on an outpatient basis. Survivors of first episode of stroke, aged 18 and above within a period of three months to one year were recruited for the cross sectional survey. Comatose, severely disabled [modified Rankin's Score (mRS)≥5], having multiple coexisting diseases were excluded from the study. The estimated sample size for this study was 240 participants.

Locally translated pretested structured interview schedule was used to collect data. The risk factor control is defined as achieving the desired levels of blood pressure, blood sugars and cholesterol. The targets for risk factor control were taken from National Cholesterol Education Program (NCEP) ATP III guidelines (NCEP,

2004) for Cholesterol (LDL<100 and TC<200)[3], American diabetes Association guidelines (FBS 70-130 and HbA_1C <7) for Diabetes control (ADA, 2019)[2] and ASA secondary stroke prevention guidelines (Kerman et al, 2014) for blood pressure (SBP <140 and DBP<90).[1]

Compliance to recommended health advices like following a healthy diet, physical activity, tobacco abstinence and limiting alcohol consumption were also assessed. A healthy diet was defined consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets and fried foods.[10] Recommended physical activity was at least 30 minutes of moderate physical activity like walking for at least 3 days a week.[1]

Standard instruments were used to measure blood pressure, weight, height and waist circumference (WC). The reference value for Body Mass Index (BMI) was taken from Canters for Disease Control and Prevention (CDC)[11] guideline and for waist circumference was taken from World Health Organisation report.[12]

The data on prevalence of risk factors was taken from past medical history and medical records. The blood sugar and lipid values were taken from lab reports. The prevalence of dyslipidaemia was identified by the presence of either lipid lowering medication or by abnormal lipid values at the time of presentation. Clinical information sheet was used to collect data from medical records which included history of diabetes, hypertension, dyslipidaemia, blood investigation results of fasting blood sugar, glycosylated haemoglobin, low density lipoprotein and total cholesterol.

To identify the prevalence of risk factors, the proportion of patients with history of corresponding risk factor was reported. To find out the risk factor control,

the proportion of patients who achieved the targeted level of diabetic control, hypertension control and dyslipidaemia control were analysed and reported. The

The study was undertaken after obtaining clearance from Institutional Ethics Committee of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala (SCT/IEC-1327/November-2018).

Results

Stroke survivors within a post stroke period of three months to one year 240 numbers (n=240) participated. The mean age was 58.64 ±10.96 years. Females constituted 25.4% of the sample. Rural inhabitants were 76.7%. Among the participants 32.1% belonged to the category of poor households based on official government classification. More than 70% of the participants were educated up to 10^{th} standard, rest were graduates or professionals. Unskilled workers were 61.3%; 32.1% were skilled workers and the rest were professionals. Ischemic stroke patients constituted 83.8% of the participants, 12.5% had haemorrhagic stroke and 3.8% had Transient Ischemic Attack (TIA).

Prevalence of risk factors

Prevalence of cardiovascular risk factors and unhealthy life style among stoke survivors is shown in table 1. Even though more than 45% of the participants had the habit of smoking, only around 4% were smoking at the time of recruitment. Around 75% of the participants were obese or had overweight. Normal waist circumference was found only in 25% of the participants; when calculated with the given separate cut off values for men and women. Majority of the participants were not following a

healthy diet (62.5%) or doing recommended physical activity (87.1%). The prevalence of diabetes (61.2%) and hypertension (88.6%) was high among stroke survivors. Presence of dyslipidaemia was very high as 96%.

The blood pressure, lipid, sugar values and body mass index are summarised in table 2. The mean systolic blood pressure was 140 mm of Hg, the mean diastolic blood pressure was 84 mm of Hg. The mean fasting blood sugar was 120 mg/dl while the mean glycosylated haemoglobin was 7.2. The mean total cholesterol was 147 mg/dl, while the mean low density lipoprotein was 83 mg/dl. The mean BMI among stroke survivors of three months to one year was 31 kg/m^2.

Table 1: Prevalence of cardiovascular risk factors among survivors of first episode of stroke

Risk factors	**Category**	**N (%)**
Ever smoked >100 cigarettes in	Yes	112(46.7)
life time	No	128(53.3)
Current smoking	Yes	10(4.2)
	No	230(95.8)
Waist circumference (cm)[#]	Normal	52(21.7)
	Moderate central fat	94(39.2)
	High central fat	94(39.2)

Body Mass Index (kg/m^2)*	Under weight	2(0.8)
	Normal	60(25)
	Over weight	147(61.3)
	Obese	31(12.9)
Physical inactivity&	Yes	150(62.5)
	No	90(37.5)
Unhealthy diet@	Yes	209(87.1)
	No	31(12.9)
Diabetes	Yes	154(61.2)
	No	86(38.8)
Hypertension	Yes	213(88.6)
	No	27(11.4)
Dyslipidemia	Yes	232(96.7)
	No	8(3.3)

*Underweight=BMI <18.5, Normal=BMI <25, overweight=BMI<30, Obese=BMI 30 and above; # In men: normal <94 cm, moderate= 94-101.9 cm, high >=102 cm, in women: normal <80cm, moderate 80 -87.9cm, High 88 and above; @ Consumption of approximately 350-400gms of vegetables a day, one medium sized fruit or two small sized fruit per day and avoiding extra salts, sweets and fried foods; & least 30 minutes of moderate physical activity like walking for at least 3 days a week.

Table 2: Mean and five number summaries of quantitative variables related to risk factors

Variables	N	Mean	SD	Minimum	Maximum	Median	Q1	Q3
Systolic Blood Pressure*	240	139.94	20.64	90	230	140	130	150
Diastolic Blood Pressure*	240	83.53	11.47	8	120	80	80	90
Fasting blood sugar@	230	120.53	39.04	1	341	112	98	132.25
Glycosylated Hemoglobin	181	7.15	1.63	1	12.7	6.8	6.05	8.05
Total Cholesterol@	228	146.87	34.03	5.9	330	142.5	126	168
Low density lipoprotein@	207	83.13	30.50	14	236	80	63	103
Body mass index#	240	30.67	59.60	16.5	949.0	26.7	24.9	28.8

*****Mm of Hg, Mg/dL, Weight/Height in meter^2

Risk factor control

The control of risk factor among stroke survivors is given in table 3. Even though around 47% of our participants had the history of smoking >100 cigarettes over life time, only 4.2 % are currently smoking. More than 50% had stopped smoking after first ever stroke and others stopped before the first stroke. The alcohol use was less prevalent among stroke survivors in our centre. The targeted level of diabetic control and hypertension control level was achieved by only a small proportion 26% and 36.2 respectively, while around 72% attained the targeted lipid control status.

More than 90% of the participants had a desirable level of total cholesterol value. Optimal level of low density lipoprotein was achieved by 63% of the participants.

Table 3: The control of risk factor among stroke survivors

Variables	Categories	n (%)
Current alcohol use	Yes	9(3.8)
	No	231(96.2)
Current smoking	Yes	10(4.2)
	No	230(95.8)
Diabetic control*	Yes	40(26.0)
	No	114(74)
Hypertension control#	Yes	77(36.2)
	No	136(63.8)
Lipid control@	Yes	151(72.9)
	No	56(27.1)
LDL	Optimal	152(63.3)
	Acceptable	46(19.2)
	Border line high	5(2.1)
	High	4(1.7)
	Desirable	221(92.1)
Total cholesterol	Border line high	5(2.1)
	Above high	2(0.8)
HbA1C	<6.5	70(29.2)
	≥6.5	111(46.3)

*Diabetic control-Among patients with diabetes FBS 70-130 and HBAIC <7, #Hypertension control-SBP <140 and DBP<90 among hypertensives and @lipid control- LDL<100 and TC<200, Lipids:100-129- acceptable;130 -159- borderline high;169-189-high;<100- optimal, Total Cholesterol:<200-desirable;200-239- borderline high;240 and above high

Discussion

Our study demonstrated that the risk factor control among stroke survivors is suboptimal. This study showed 80% of the stroke survivors had moderate to high central fat distribution and 75% were overweight and obese. The prevalence of overweight and obesity was 40% and high central fat distribution was 60% among our target population.[13] Previous studies also demonstrated that the prevalence of obesity is high (60%) among stroke survivors[14] whereas the prevalence of obesity among their general public was 34%.[15] The physical disability caused by stroke limit activity. Fear of fall may compound the problem. Our study has shown that 62% and 87% of stroke survivors are not following recommended physical activity and healthy diet respectively. The prevalence levels of diabetes, dyslipidaemia as well as hypertension were very high among stroke survivors in our setting. The prevalence proportions of diabetes, hypertension and dyslipidaemia were around 61%, 89% and 97% respectively. It reflects the prevalence of these risk factors among the general population of Kerala. Nearly 83% of general population in Kerala possess at least one of the five risk factors of NCD.[13] A Recent study in Kerala showed 54% of general population had total cholesterol >200mg/dl. Our study assessed dyslipidaemia by the use of cholesterol lowering medications and the prevalence was 97%. Previous studies also revealed high prevalence of dyslipidaemia in stroke patients.[16]

The control of diabetic, hypertension and dyslipidaemia, was assessed separately. The target levels were fixed as per standard recommendations. [1,2,3] Our study revealed poor control of risk factors among stroke survivors. The targeted values were achieved by 26% of diabetic patients and 36% of hypertensive stroke survivors. Previous studies also brought out similar results.[4,17] One recent study conducted among general population in Kerala showed that only 12% and 15% of those afflicted achieved hypertension and diabetic control respectively.[13] Among stroke survivors the control status of diabetes and hypertension is better than general public because of their fear of recurrences and our participants were selected from hospital based stroke registry. Only 46% of the general population in Kerala [18] had total cholesterol level <200 mg/dl, but in our study 73% of stroke survivors had both TC<200mg/dl and LDL<100mg/dl.

Strict adherence to medication and risk factor control are integral to secondary stroke prevention. A comprehensive evidence-based guideline is issued by the ASA for recurrent stroke prevention. Compliance to this guideline can lead to an 80% reduction in recurrent stroke risk. A brief overview of secondary stroke prevention strategies includes the following; antiplatelet medications such as aspirin and clopidogrel to be initiated within 24 hours of a minor ischemic stroke or TIA and continued for 90 days. Antihypertensives medications to be initiated to achieve a systolic pressure <140 mm Hg and a diastolic pressure <90 mm Hg. Statin therapy with intensive lipid-lowering effects is recommended to maintain LDL-C level less than 100 mg/dL. After an ischemic stroke, all patients should be screened for diabetes and glycaemic control. Counselling should be given for lifestyle modification, diet,

exercise and weight loss. Advise patients to engage in aerobic physical activity, average 40 minutes per session, 3-4 days a week. Strong advice to be given to quit smoking. Patient should eliminate or reduce alcohol consumption. Sodium intake should be reduced to less than ≈2.4 g/day. Further reduction to <1.5 g/day should be advised for BP reduction. Mediterranean type of diet instead of a low-fat diet can be followed. The Mediterranean type diet emphasizes vegetables, fruits, and whole grains and includes low-fat dairy products, poultry, fish, legumes, olive oil, and nuts. It limits intake of sweets and red meats. [1]

The secondary stroke prevention guidelines include medications to reduce thrombosis risk and control vascular risk factors like diabetes, hypertension, dyslipidaemia. It strongly insists behavioural modification in the form of medication adherence and adopting new life style such as healthy diet, physical activity, smoking cessation and limiting alcohol consumption. The stroke units are predominantly located in the urban and private hospitals. Facilities for monitoring risk factor control and drug levels at the community level are not uniform throughout India. The stroke and other chronic noncommunicable prevention and con control program need multidisciplinary approach, support from voluntary organizations, self help groups and other influential people in the society for its successful implementation and outcome. In areas of limited access to health care specialised nurses can be utilised to attain health related goals.

This study was conducted in a single centre and data collected by a single investigator who is well trained which make the data more reliable. The stroke survivors were regularly followed up in stroke clinic which make and risk factors are

screened which helped to get accurate report of all the risk factors. This study was comprehensive and we could collect data on all the risk factors. The major disadvantage of this study was that we could include only 240 participants in this study. Data on risk factor control status among stroke survivors in India was lacking and we could do this study as a pilot project. Community based future studies can be planned with large sample size find out the burden of this problem in the community.

Conclusion

Risk factor control among survivors of first episode of stroke at three months to one year was suboptimal. Majority of them were not following healthy life style. Risk factor control requires strict medication adherence and adopting new life style such as healthy diet, physical activity, smoking cessation and limiting alcohol consumption. Screening for risk factor control can be done from nurse led clinics or local health centres. In areas of limited access to health care specialised nurses can be utilised to attain health related goals.

References

1. Kernan WN, Ovbiagele B, Black HR, Bravata DM, Chimowitz MI, Ezekowitz MD, Fang MC, Fisher M, Furie KL, Heck DV, Johnston SC, Kasner SE, Kittner SJ, Mitchell PH, Rich MW, Richardson D, Schwamm LH, Wilson JA. Guidelines for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke 2014;45(7): 2160–2236.
2. American Diabetes Association (ADA) Glycemic targets: Standards of Medical Care in Diabetes—2019. Diabetes Care2019; 42(Suppl. 1): S 61-S70.

3. Third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), NCEP, National Heart, Lung, and Blood Institute, National Institutes of Health. NIH Publication.2001; No. 01-3670.
4. Brenner DA, Zweifler RM, Gomez CR, Kissela BM, Levine D, Howard G, Coull B, Howard VJ. Awareness, treatment, and control of vascular risk factors among stroke survivors. J Stroke Cerebrovasc Dis2010; 19(4):311–320.
5. Brewer L, Mellon L, Hall P. Secondary prevention after ischaemic stroke: the ASPIRE-S study. BMC Neurology 2015;15:216
6. Kocaman G, Dürüyen H, Koçer A, Asil T. Recurrent Ischemic Stroke Characteristics and Assessment of Sufficiency of Secondary Stroke Prevention. Arch Neuropsychiatr 2015; 52: 139-144
7. Wangqin R, Wang X, Wang Y, Xian Y, Zhao X, Liu L, Li H, Meng X, Wang Y. Risk factors associated with 90-day recurrent stroke in patients on dual antiplatelet therapy for minor stroke or high-risk TIA: a subgroup analysis of the CHANCE trial. Stroke and Vascular Neurology 2017; 0:e000088
8. Rudd AG, Lowe D, Hoffman A, Irwin P, Pearson M. Secondary prevention for stroke in the United Kingdom: results from the National Sentinel Audit of Stroke. Age Ageing 2004;33(3):280-286. doi: 10.1093/ageing/afh107
9. Esenwa C, Gutierrez J. Secondary stroke prevention: challenges and solutions. Vasc Health Risk Manag 2015;11:437-50. doi: 10.2147/VHRM.S63791.

10. World Health Organization. Fruit and vegetables for health: report of the Joint FAO/WHO Workshop on Fruit and Vegetables for Health, 2005. https://apps.who.int/iris/handle/10665/43143. Accessed January 15,2021.
11. Healthy weight, Nutrition and physical activity, CDC. https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html. Accessed January 15,2021.
12. Waist circumference and waist-hip ratio: report of a WHO expert consultation, Geneva, 8-11 D, 2008, Available https://www.who.int/publications/i/item/9789241501491. Accessed January 15,2021
13. Sarma PS, Sadanandan R, Thulaseedharan JV, Soman B, Srinivasan K, Varma RP, Nair MR, Pradeepkumar AS, Jeemon P, Thankappan KR, Kutty RV. Prevalence of risk factors of non-communicable diseases in Kerala, India: results of a cross-sectional study. BMJ open2019; 9(11), e027880. https://doi.org/10.1136/bmjopen-2018-027880.
14. Vemmos K, Ntaios G, Spengos K, Savvari P, Vemmou A, Pappa T, Manios E, Georgiopaulos G, Alevizaki M. Association between obesity and mortality after acute first-ever stroke: the obesity-stroke paradox. Stroke 2011; 42:30–36.
15. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults. JAMA 2012;307:491–97.
16. Olamoyegun MA, Akinlade AT, Fawale MB, Ogbera A O.Dyslipidaemia as a risk factor in the occurrence of stroke in Nigeria: prevalence and patterns. The Pan African medical journal 2016;25:72. https://doi.org/10.11604/pamj.2016.25.72.6496.
17. Thorogood M. Southern Africa Stroke Prevention Initiative (SASPI) study Bulletin of the World Health Organization. 2006; 82:503-508

18. Thankappan KR, Shah B, Mathur P, Sarma PS, Srinivas G, Mini GK, Daivadanam M, Soman B, Vasan RS (2010) Risk factor profile for chronic non-communicable diseases: Results of a community-based study in Kerala, India. Indian J Med Res 131:53-63.

Medication Adherence among Stroke Survivors within a Post-stroke Period of Three Months to One Year

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Abstract

Strict compliance with medication is integral to secondary stroke prevention. This study was undertaken to find out medication adherence among stroke survivors and factors associated with it. Cross sectional survey among stroke survivors was conducted. Interview based self-reported medication adherence was defined as consumption at least more than 80 percent of their medications for last two weeks, based on last prescription. Structured interview using pre-tested interview schedule was done to collect other data; stroke survivors (mean age 58.64 ±10.96 years; 25.4% females) with a mean post-stroke period of 6.65±3.36 months participated. Overall medication adherence was 43.8 percent (n=105). Medication adherence was 34.4 percent (n=134), 52.6 percent (n=190) and 56.7 percent (n=224) for antidiabetics, antihypertensives and statins respectively. People less than 45 years of age, urban residents and those with physical and neurological deficits were more adherent to medications. Periodic reminders, financial support to buy medicines and patient education can enhance medication adherence to prevent future strokes.

Adherence to medication is important in the management of chronic diseases and is also a mediator between the treatment and patient outcome. Over 30-50 percent of medicines prescribed for long term illnesses are not taken as directed (Burkhart & Sabate, 2013).

Medication non-adherence is associated with poor control of risk factors (Thorogood, 2004) and risk of death (OR=7.99; 95% CI 6.28 - 10.18) when compared to adherent group (Perreault et al, 2012). Adherence to antihypertensives after stroke have been shown to reduce the incidence of cardiovascular events (Mayor, 2013), hospitalisations and health care costs (Sokol et al, 2013; Cutler et al, 2018). Medication adherence among stroke survivors was suboptimal and it reduces as the post stroke period increases.

The knowledge on medication adherence among stroke survivors can improve the stroke care to prevent stroke recurrence in the community.

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Objectives

This study was set out to find out the adherence to prescribed medications among stroke survivors within a post-stroke period of three months to one year.

Review of Literature

The World Health Organization (WHO) defined adherence as "The extent to which a person's behaviour of taking medication, following a diet, or making healthy lifestyle changes corresponds with agreed-upon recommendations from a health-care provider" (Sebatab, 2003). Attributes of medication adherence are: knowing and agreeing to the medication, communicating and negotiating the regimen and active, continuous involvement and appraisal of the treatment effect. The identified antecedents of medication adherence include a valid prescribed medication regimen, cognitive and action abilities in her/his role as a patient and a level of preparation for medication treatment. The consequences of medication adherence are improving symptom control, decreasing re-hospitalisations and mortality, reducing medical care costs and restoring self-esteem (Bissonnette, 2003).

Medication adherence is a cluster of behaviours simultaneously affected by multiple fac-

tors. According to WHO there are five interacting dimensions of medication adherence. Each dimension will have many factors and many of the factors are not exclusive to one dimension rather they may overlap each other. One or more dimensions can contribute to patients' non-adherence. The five dimensions are: health-care system or team, patient, therapy, condition, or social and economic factors. Improved adherence requires the successful interplay between the patient and those involved in managing his care.

Theories of Medication Adherence

Different theoretical perspectives can be used to explain the behaviour of adherence: biomedical, behavioural, communication, cognitive and self-regulatory etc. Several general theoretical frameworks from the literature in social psychology are useful in understanding adherence (Philip & Leventhal, 2011), The intrapersonal models use mental construct about a health-related domain. Emphasis of these models is on cognitive and behavioural factors such as knowledge, attitude, perception, intention, and expectancies. Examples of intrapersonal models are health belief model, theory of planned behaviour, trans-theoretical model and self-regulatory model. They emphasise the active role of the person. Inter personal models argue that social context of people influences their health. Common sense self-regulation model (CS-SRM) takes the most comprehensive approach to representing the concepts that are proposed to influence adherence behaviour (Philip & Leventhal, 2011). CS-SRM also has the potential to be the most successful at predicting adherence behaviour over a longer period. This theory incorporates the basic concepts of other theories such as severity, susceptibility specific to that illness, ability to perform the treatment and treatment efficacy specific to the illness, experienced symptoms of that illness of a particular patient. Illness identity, causes, timeline, consequences and control belief affect the initial phase of adherence behaviour development. It also incorporates two constructs which are relevant for behaviour maintenance beyond its initiation. As the patient becomes aware of the health threat, forms belief about treatment and his abilities which is influenced by the conflicting information he receives from his environment and his own personal experiences. Based on the belief formed they intent to adhere or non-adhere.

The specific health belief formed into cognitive representation integrates feedback from time to time. If the performance of the behaviour results in evidence that it works, it confirms the patient's belief and it became coherent. Feedback from behavioural performance motivate behavioural repetition, repetition leads to routinisation and the person acquires a strong behavioural habit. This may motivate multiple behaviour repetition also. The potential barriers to this phase are tempting behavioural alternatives, cost, time, physical limitations, low motivation, too varied daily routine etc.

Measurement of Medication Adherence: There is no gold standard for measuring adherence. Self-reported nonadherence has a high negative predictive value. The widely accepted definition of medication adherence is at least consumption of more than 80 percent of their medications prescribed. This is the cut off accepted by the clinical trials to calculate drug efficiency. The subjective and objective measurements of adherence indicate different aspect of adherence behaviour. The subjective measures determine the belief and barriers to adherence while the objective measures describe how the patient performs the medication regimen. The methods of pill count and electronic devices do not ensure the ingestion of medication by the patient. The questionnaires such as Hill-Bone Compliance Scale, Medication Adherence Rating Scale (MARS) and Brief Medication Questionnaire are validated for specific health conditions. Morisky Medication Adherence scale (MMAS-8) and Medication Adherence Questionnaire (MAQ) have good sensitivity and specificity and are recommended to use in validated conditions with outcome data. The MMAS-8 questionnaire is not in the public domain and not validated for stroke. But the permission to use and validate in stroke was denied.

Prevalence of medication non-adherence among stroke survivors: Medication non-adherence is a major problem in both developing and developed countries. WHO report on non-adherence, estimated that over 30 -50 percent medicines prescribed for long term illnesses are not taken as directed (Sebateb, 2003). A study of over 3,000 patients in Germany reported that 84 percent were still taking aspirin at one year post-stroke, 77 percent oral anticoagulants, but only 61 percent who were prescribed clopidogrel at discharge were still taking it one year later. The reported medication adherence varies widely from 40- 85 percent among stroke survivors (Hamann et al, 2003; Kronish et al 201; Al Shaikh, 2016). The lowest ranges are from studies conducted in China and United States among low income under-privileged groups. No published study is available on medication adherence among stroke survivors is available.

Methodology

It was a cross sectional survey among hospital-based stroke survivors of first episode of stroke within a post-stroke period of three months to one year. The study was conducted the stroke clinic of

e Chitra Tirunal Institute for Medical Sciences l Technology (SCTIMST), Thiruvananthapu-ı, which is a tertiary level referral hospital. The ıprehensive stroke care unit admits 450-500 ients per year. The patients are followed up in stroke clinic on an outpatient basis.

Stroke is defined as "Rapidly developing clin-l signs of focal (or global) disturbance of cer-·al function, with symptoms lasting 24 hours longer or leading to death, with no apparent ıse other than of vascular origin". Survivors of st episode of stroke refers to the survivors of di-ıosed cases of ischaemic stroke, haemorrhagic d transient ischemic attack with evidence of ute infarct. The study population for this cross-ctional survey were the survivors of first epi-de of stroke within a post-stroke period of three ınths to one year.

The sample size for this study was determined sed on the formula: $n=z\alpha^2\ p\ (1-p)/d^2$, where zα 1.96 at 95% confidence interval, p = prevalence medication adherence among stroke survivors; ken as 40 percent and d = absolute precision 7 percent. A sample size of 185 was calculated sing Open Epi Software. Considering a non-re-ıonse rate of 20 percent, the total sample size ıme out to be 222 participants. To round up, the total sample size estimated for this study was 240 participants.

Table 1: Demographic characteristics of the study participants

Variables	Categories	n (%)
Age	≤ 45 years > 45 years	31 (12.9) 209 (87.1)
Sex	Male Female	179 (74.6) 61 (25.4)
Place of residence	Rural Urban	184 (76.7) 56 (23.3)
Education of patient	Up to 10th standard Graduate professional	175 (72.9) 50 (20.8) 15 (6.3)
Occupation of patient	Manual laborer Skilled worker Professional Unemployed	141 (58.8) 77 (32.1) 14 (5.8) 8 (3.8)
House hold monthly income (Rupees)	< 1500 1500-5000 ≥5000	88 (36.7) 83 (34.6) 69 (28.8)
Enrolment in health insurance	Yes No	158 (65.8) 82 (34.2)
Nature of insurance	Government Private	134 (84.8) 24 (15.2)
Receiving financial assistance or free outpatient medication	Yes No	64 (26.7) 176 (73.3)
Civil supply card	Yellow Pink Blue White	2 (0.8) 75 (31.3) 82 (34.2) 81 (33.8)

Sampling criteria: Survivors of first episode of stroke aged 18 and above within a period of three months to one year were recruited for the cross sectional survey during the period, February 2019 to August 2019. Comatose, severely disabled [modified Rankin's Score (mRS) ≥ 5], having multiple coexisting diseases with life expectancy less than six months were excluded from the study.

Data collection tools and techniques: Structured interview schedule was used to collect basic sociodemographic data and medication adherence. Self-reported medication adherence was defined as consumption of at least more than 80 percent of their medications for last two weeks, based on their last prescription. The data on medication adherence was collected by interviewing the patient and primary care giver regarding the medication intake history of two weeks. Medication adherence was calculated for five categories of medication; antiplatelets, antihypertensives, antidiabetics, statin and anticoagulants. Overall adherence was defined adherence to all the categories of medication prescribed. The self-reported reasons for non-adherence were also collected from non-adherers.

Analysis: For meeting the objective, the proportion of patients who had consumed at least >80% of their medications for last two weeks, based on their last prescription was reported. Bivariate analysis with medication adherence as outcome variable and patients' characteristics was done to find out the factors associated with medication adherence.

Ethical considerations: The study was undertaken after obtaining clearance from Institutional Ethics Committee of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala (SCT/IEC).

Results

Characteristics of the Study Participants: A group of 240 stroke survivors within a post-stroke period of three months to one year 240 numbers (n=240) participated. The mean age was 58.64±10.96 years. Females constituted 25.4 percent of the sample. Rural inhabitants were 76.7 percent. Among the participants 32.1 percent belonged to the category of poor households based on government classification. The work or employment status of 44.6 percent was affected by stroke. Nearly 5.4 percent had to go on long leave and 6.3 percent lost their jobs. The other demographic characteristics of the participants are given in Table 1.

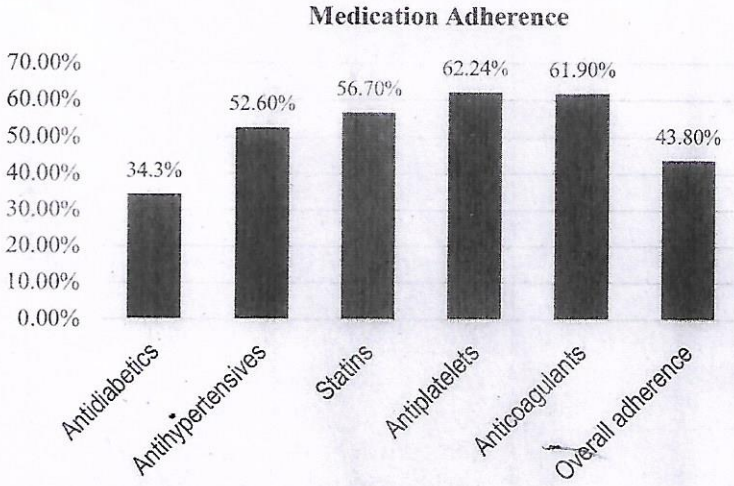

Fig 1: Adherence to five categories of medication and overall adherence

Ischaemic stroke patients constituted 83.8 percent of the participants. The mean NIHSS score at ictus was 6.5 (5.9) and the mean mRS score at ictus was 1.2 (1.3). The mean NIHSS score at recruitment was 1.2 (2.2). Majority of the participants were with a post stroke period of three months to six months. The mean cost of medication per week was Rs. 377.96 (minimum 100; maximum 2000). Majority (68.5%) had medical insurance which covered their inpatient treatment expenditure, in which 84.8 percent had insurance provided from government agencies. Only 26.7 percent (n=64) had any form of assistance to cover the expenditure of their prescribed medications. In which 40.6 percent were getting reimbursement for their outpatient care and 59.4 percent were getting free medications from government hospitals. Nearly 90 percent of the patients received discharge education from the hospital at the time of discharge from hospital during index stroke. The discharge education was received from multiple sources by individual patients. The discharge education was received from treating physician by 77 percent, 43 percent received from nurses and 80 percent received it from other sources like physiotherapist and research coordinators. The components of discharge education included diet (67.5%), physical activity (77.1%), follow up care (60%) and regular intake of medication (79.2%).

Table 2: Self-reported reasons for medication non-adherence

Self-reported reasons for medication non-adherence	Frequency (n)	Percentage (%)
Side effects	39	16.3
No need for medications	11	4.6
Forgetfulness	56	23.3
Journeys	37	15.4
Financial problems	84	35

Table 3: Anti-diabetic medication adherence for injectable and oral medication

Adherence	Injectable		OHA		Total	
	n	%	n	%	n	%
Yes	6	15.4	40	42.1	46	34.3
No	33	84.6	55	57.9	88	65.7
Total	39	100	95	100	134	100

Medication Adherence

Adherence to five categories of medications and overall adherence is shown in Figure 1 and self reported reasons for non adherence in Table 2. Adherence to anti-diabetic medication, separately for injectable and oral medication is given in Table 3. Medication adherence was highest for antiplatelet medications; the anticoagulants ranked second. Adherence was least for anti-diabetic medications. Overall medication adherence among stroke survivors was 43.8±6.27. The adherence to insulin therapy was very poor compared to oral hypoglycaemic agents. The most frequently reported reason (self-reported reasons among non-adherent participants) for medication non adherence was financial issue. Simple forgetfulness was reported by stroke survivors as a reason for their non-adherence to medications.

Medication adherence was high among those aged 45 years or below but the difference was not statistically significant. Higher medication adherence was observed among urban residents and people belonging to the category Above Poverty Line (APL) based on classification of government. Those who had more severe stroke in terms of neurological and functional disability were more adherent to medication. Presence of moderate to severe neurological disability at recruitment was also associated with medication adherence. The post-stroke period was not significantly associated with medication adherence. Medication adherence was not significantly different among stroke survivors for the other characteristics of the patients assessed in this study. The patients' characteristics and medication adherence are given in Table 4.

Discussion

This cross sectional survey revealed that adherence to medications intended to control risk factors and prevent stroke recurrence was very low (43.8%). The reported medication adherence varies widely in studies ranging from 40 percent to 85 percent (Hamann et al, 2003; Kronish et al, 2013; At Shaikh et al, 2016). The findings of this

Table 4: Patients' characteristics and medication adherence (N=240)

Variables	Categories	Adherence* Yes (n=105)		χ^2 value	p value
		n	%		
Age	≤ 45	18	58.1	1.94	0.085
	> 45	87	41.6		
Sex	Male	73	40.8	2.52	0.112
	Female	32	52.5		
Place of residence	Urban	31	55.4	3.99	0.046
	Rural	74	40.2		
Education of patient	High school	74	42.30	0.56	0.453
	Higher secondary and above	31	47.70		
Occupation	Skilled worker	43	47.3	0.73	0.393
	Unskilled worker	62	41.60		
Monthly income	<1500	37	42.05	0.654	0.721
	1500-5000	35	42.17		
	≥5000	33	47.83		
Enrolled in health insurance	Yes	74	46.84	1.789	0.181
	No	31	37.80		
Getting financial assistance for medication	Yes	30	46.86	0.346	0.556
	No	75	42.61		
Nature of civil supply card (dichotomized)	BPL	26	33.77	4.592	0.032
	APL	79	48.47		
Post stroke period	3-6 months	63	44.05	0.258	0.879
	6-9 months	14	45.16		
	9-12 months	28	41.17		
NIHSS at ictus	0-4	43	47.70	8.859	0.031
	5-15	44	44.44		
	16-20	12	60.00		
	21-42	6	85.71		
NIHSS at review	0-4	93	41.70	5.355	0.021
	5-15	12	70.58		
mRS	≤ 2	61	39.10	3.912	0.033
	> 2	44	52.38		
Received discharge education from hospital	Yes	95	45.24	1.512	0.219
	No	10	33.33		

**Outcome variable; Abbreviations: OR- Odds Ratio; CI- Confidence Interval; APL-Above Poverty Line; BPL-Below Poverty Line; NIHSS- National Institute Health Stroke Scale; mRS- modified Rankins Scale.*

study in a low and middle income country are in agreement with those done among other low and underprivileged groups. A study conducted using validated adherence measure in a low income setting found out an adherence level of 40 percent among stroke survivors (Kronish et al, 2013). We used consumption of more than 80 percent of all the category of prescribed medications during last two weeks as an indicator of adherence. Our study result is similar to the one done using validated measure. We could reduce the recall bias as we had assessed the medication intake status of last two weeks only.

In this study the overall adherence, that is adherence to all the categories of medication prescribed for a patient was 43.8 percent. We had assessed adherence to individual categories of medication, which showed a highest adherence rate to antiplatelets (62.24%) and least adherence to anti-diabetic medication (33.3%). Adherence to anticoagulants was also higher compared to other categories (61.9%).

Adherence to antidiabetic medication was assessed separately for injectable and oral hypoglycaemic agents. Adherence to insulin was at least 16.4 percent. Even with a valid prescription people tend to alter the dose and timings and even skip the doses or take medications based on the perceived need. They tend to alter the dose based on their diet, physical activity, 'gut feeling', availability of insulin and accessories for injection and availability of personnel to administer insulin. Stroke patients who experienced feeding problems tend to alter the dose for fear of inadequate diet and over medication. Those who are taking OHA were more adherent 42.1 percent. The lower adherence to injectable agents created a lower overall adherence to anti diabetic medication. This result is contradictory to the result of a study conducted among patients on insulin in Chennai which reported an adherence of 80 percent to insulin (Sankar et al, 2015). But a community-based study conducted among rural inhabitants of Kerala showed and adherence of 26 percent to anti diabetic medication. They have also reported significantly different levels of medications adherence among those who receive OHA and insulin. Studies conducted in other countries showed an adherence level of 60 percent for insulin therapy (Alsayed & Ghoraba, 2018).

The effect of age, gender, income and education on medication adherence was inconsistent and varied in studies conducted in different settings. We found statistically non-significant higher adherence among females and those with higher education and professionals. In our present study, there was a significant difference between medication adherence among people belonging to poor and non-poor households. A study done in a developed country among stroke survivors also found no effect of income on medication adherence (Aziz et al, 2018). A systematic review of 21 studies showed almost similar level of poor medication adherence among patients with free medication and with different payment schemes (Al Shaikh et al, 2016). In contrast to

some qualitative study findings, we could not get any significant difference in adherence between those have care giver support and those without (Perreault et al, 2013; Al Shaikh et al, 2016). The most common self-reported reason for non-adherence was simple forgetfulness. Studies done in both developing and developed countries showed similar results Kronish et al, 2013; Al Shaikh et al, 2016). Presence of neurological deficits was associated with higher adherence. The initial step in the process of development of medication adherence behaviour is perceived need of medicine. The disability caused by stroke and subsequent perceived poor state of health thus remained a major facilitator for medication adherence.

Recommendations

This study had identified certain areas which require further explorations. A validated instrument to measure medication adherence is lacking in the public domain. Future studies can be undertaken to create a tool which accurately measures the medication adherence level and can be validated among stroke population. We have noticed adherence to insulin therapy was very low. Future qualitative studies can be undertaken to find out the perceptions and attitude of patients receiving insulin therapy. This study identified factors associated with medication adherence among stroke survivors; based on that, interventions can be designed and validated so that it can be widely utilised to improve medication adherence.

Nursing Implications

Nurses working in the clinical area can contribute to increase patient's adherence to their prescribed medication. Since forgetfulness is the common reason identified in almost all the settings, periodic reminders to care giver reminding or through text messages can help. An immediate care giver can be entrusted with this rile while discharging the patient. At every clinic visit people should be screened and asked for side effects of medication. Misconceptions about side effects of medications should be corrected through awareness programmes. Planned discharge education can be given to all patients regarding importance of adherence to medication and risk control.

Conclusion

In our study medication adherence among stroke survivors between three months to one year was very low. Since forgetfulness is the common reason identified in almost all the settings, periodic reminders in the form of care giver reminder or text messages to the care giver can help. At every clinical visit people should be screened and asked for side effects. Misconceptions about side effects of medications should be corrected by awareness programmes.

References

1. Burkhart PV, Sabaté E. Adherence to long-term therapies: Evidence for action. *Journal of Nursing Scholarship*: (Official publication of Sigma Theta Tau International Honor Society of Nursing) 2003; 35(3): 207
2. Thorogood M. Southern Africa stroke prevention initiative (SASPI) study. Bulletin of the World Health Organization 2004; 82: 503-508
3. Perreault S, Yu A, Cote A, et al. Adherence to antihypertensive agents after ischemic stroke and risk of cardiovascular outcomes. *Neurology* 2012; 79: 2037-43
4. Mayor S. Non-adherence to medication increases stroke risk in patients with high blood pressure. *BMJ* 2013; 347: f4586
5. Sokol MC, McGuigan KA, Verbrugge RR, Epstein RS. Impact of medication adherence on hospitalization risk and healthcare cost. *Med Care* 2013; 43: 521-30
6. Cutler RL, Fernandez-Llimos F, Frommer M, et al. Economic impact of medication non-adherence by disease groups: a systematic review. *BMJ Open* 2018; 8: e016982. doi: 10.1136/bmjopen-2017-016982
7. Sebateb E. Adherence to long term therapies: Evidence to action. World Health Organisation. Geneva; 2003, p 3-45
8. Bissonnette JM. Adherence: A concept analysis. *Journal of Advanced Nursing* 2008; 63(6): 634-43
9. Philip LA, Leventhal H. Using Habit Theory and Commonsense Self-regulation Theory to Improve Medication Adherence Assessment. Graduate School-New Brunswick Rutgers. The State University of New Jersey; 2011
10. Hamann GF, Weimar C, Glahn J, et al. Adherence to secondary stroke prevention strategies - results from the German Stroke Data Bank. *Cerebrovascular Disease* 2003;15: 282-88
11. Kronish IM, Diefenbach MA, Edmondson DE. Key barriers to Medication Adherence in survivors of strokes and transient ischemic attacks. *Journal of General Internal Medicine* 2013; 28 (5): 675-82
12. Al Shaikh S, Quinn T, Dunn W, et al. Predictive factors of non-adherence to secondary preventative medication after stroke or transient ischaemic attack: A systematic review and meta-analyses. *Eur Stroke J* 2016; 1(2): 65-75. doi: 10.1177/2396987316647187
13. Sankar UV, Lipska K, Mini GK, et al. The adherence to medications in diabetic patients in rural Kerala, India. *Asia Pac J Public Health* 2015; 27(2): NP513-23. doi: 10.1177/1010539513475651
14. Alsayed KA, Ghoraba MK. Assessment of diabetic patients' adherence to insulin injections on basal-bolus regimen in diabetic care center in Saudi Arabia 2018: Cross sectional survey. *J Family Med Prim Care* 2018; 2(8): 1964-70
15. Aziz H, Md Hatah E, Makmor Bakry M, Islahudin F. How payment scheme affects patients' adherence to medications? A systematic review. Dove Medical Press 2018; 10: 837-50

Appendix -II

Unique ID | | | | | |

Date | | | | | | | |

Case/ control **Unique ID** | | | | |

"**Factors associated with stroke recurrence and the facilitators and barriers to medication adherence and risk factor control among stroke survivors**".

Interview schedule

Instructions: Put 'X' mark in the box on the right side to your answer. In case of questions where more than one answers can be marked, put 'X' mark in the boxes on the right side of the selected answers.

Section A: General information

Section A: General information		
A1	Case control status	Case ☐ control ☐
A2	Age in completed years	☐☐
A3	Recurrent stroke- date	Years ☐☐ Months ☐☐ Days ☐☐
	Index stroke –date	
A4	Sex	
A5	Residential area	1.Rural ☐ 2.Urban ☐
A6	Phone number of Patient	
A7	Phone number of care giver	
A8	Address	
Section B: Socio demographic characteristics		
B1	Religion	1. Hindu ☐ 2. Christian ☐ 3. Islam ☐ 4. Others ☐

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B2	Whether belongs to SC/ST/OBC	1. SC ☐ 2. ST ☐ 3. OBC ☐ **4.** Others ☐
B3	Total completed years of education of patient	
B4	Total completed years of education of primary care giver	
B5	Occupation of patient	1. Clerical. ☐ 2. Manual laborer/ unskilled worker. ☐ 3. Professionals ☐ 4. Home maker ☐ 5. Unemployed ☐ 6. Self employed ☐ 7. Retired / Pensioner ☐
B6	Nature of occupation of patient	1. sedentary (mostly sitting during work) ☐ 2. non sedentary (mostly moving around during work, e.g. nurses, postman, bus conductor) ☐ 3. manual labour ☐ 4. homemaking
B8	Nature of occupation of primary care giver of patient.	1.Full time ☐ 2. Part time ☐ 3.unemployed ☐

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B9	Marital status of patient	1. Married ☐ 2. Single ☐ 3. Separated ☐ 4.Widowed ☐
B12	House hold income	
B13	Income category as in SCTIMST records	1. A ☐ 2. B ☐ 3. B1 ☐ 4. C ☐ 5. D
B18	What is the type of Civil supply card you have?	1.Yellow ☐ 2. pink ☐ 3.Blue ☐ 4.White ☐
Section 3: Access to health care		
C1	Where do you go for usual health related follow up?	1. Private hospital ☐ 2. Private clinic ☐ 3. Government hospital ☐
C3	Have ever been visited by a health care worker / Asha after your stroke	1. Yes ☐ 2.No ☐
C4	When was your last visit to doctor/ clinic	1. within 0-7 days ☐ 2. 8-30 days ☐ 3. 31 days- 90 days ☐ 4. 3 months-6 months ☐ 5. 6 months- 12 months ☐ 6. >12months ☐

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Section D: Cardiovascular risk factors. Status of these risk factors at the time of stroke recurrence will be collected		
D1	Have you ever been smoked more than 100 cigarettes in your life time	1. Yes ☐ 2. No ☐
D2	Are you currently smoking	1. Yes ☐ 2. No ☐ If No, when did you quit smoking? 1. Before first episode of stroke ☐ 2. After first episode of stroke ☐
D3	Do you currently drink alcohol?	1. Yes ☐ 2. No ☐
D4	Do you exercise regularly?	1. Yes ☐ 2. No ☐
D5	If yes, what type of exercise you are doing?	
D6	How long you are doing exercise in a day?	
D7	How many days in a week you are doing exercise?	
D8	Do you consume approximately 350-400gms of vegetables a day	1.Yes ☐ 2. No ☐
D9	Do you consume at least one medium size fruit in a day?	1. Yes ☐ 2. No ☐
D10	Do you consume the following food items?	1. Pappad ☐ 2. Pickle ☐ 3. Extra salt ☐ 4. Fried foods ☐ 5. Sweets ☐
D11	Do you continued physiotherapy after discharged from hospital?	1. Yes ☐ 2. No ☐
D12	Have you given any advice on follow up care at the time of discharge?	1. Yes ☐ 2. No ☐
Section E: Post stroke status (condition of subjects one week prior to stroke recurrence)		

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E1	Physical deficits Eg. Arm weakness, dysarthria etc	
E2	Physical disability as measured by modified Rankin's Scale	
E3	Have you been anxious about your disease condition?	1. Yes ☐ 2. No ☐
E4	Have you got depressed about your disease condition or current status of health	1. Yes ☐ 2. No ☐
E5	Have you had any memory disturbances just prior to recurrence of stroke?	1. Yes ☐ 2. No ☐

Class of medication	Name of medication	Medication intake status	Adherence
		1.Stopped by self 2.Continuing	
		1.Stopped by self 2.Continuing	
		1.Stopped by self 2.Continuing	
		1.Stopped by self 2.Continuing	
		1.Stopped by self 2.Continuing	
		1.Stopped by self 2.Continuing	
		1.Stopped by self 2.Continuing	

Appendix – III Clinical Information sheet

Case control status –Case/control **Unique ID** | | | | |

Factors of stroke recurrence among stroke survivors in tertiary care hospital, Thiruvananthapuram, Kerala.

Clinical information sheet

Blood pressure, Blood sugar, Glycosylated hemoblobin, Cholesterol values on admission with stroke recurrence (Will be collected from medical records)	
Parameter	**Values**
Blood pressure	
RBS/FBS	
Glycosylated haemoglobin	
Total cholesterol	
Low Density Lipoprotein	
Body weight	
Height	
Waist circumference	
History of medical illness	
Diabetes	1. Yes ☐ 2. No ☐
Hypertension	1. Yes ☐ **2.** No ☐
Dyslipidaemia	1. Yes ☐ **2.** No ☐
Coronary artery disease	1. Yes ☐ **2.** No ☐
Carotid artery disease	1. Yes ☐ 2. No ☐

Valvular heart disease	1. Yes ☐ 2. No ☐
Atrial Fibrillation	1. Yes ☐ 2. No ☐

Section F: Clinical and imaging variables of index stroke			
F1	Type of index stroke	1. Ischemic stroke ☐ 2. Transient ischemic attack ☐ 3. haemorrhagic	
F2	Ischemic lesion location Single lesion Yes / No	If yes right / left / both	location of single lesion Cerebral hemisphere cerebellum Brain stem
	Multiple lesion Yes / No	If yes right / left / both	location of multiple lesion Cerebral hemisphere cerebellum Brain stem
F3	Blood vessel affected (mark if either is present stenosis/occlusion)	Extra cranial ICA Yes / No	If Yes right / left / both
		Intracranial ICA Yes / No	If Yes right / left / both
		MCA Yes / No	If Yes right / left / both
		ACA Yes / No	If yes right / left / both
		PCA Yes / No	If Yes right / left / both
		Vertebral Yes / No	If Yes right / left / both
		Basilar Yes / No	If yes right / left / both

F4	Presence of stenosis	Yes	No					
F5	Presence of occlusion	Yes	No					
F6	If stenosis present	Extra cranial						
		Mild	Moderate	Severe				
		Intracranial						
		Mild	Moderate	Severe				
F7	Presence of micro bleeds	Yes	No	Unknown				
F8	OCSP classification	1. Lacunar stroke ☐						
		2. Partial anterior circulation ☐						
		3. Total anterior circulation ☐						
		4. Posterior circulation ☐						
F9	TOAST classification	1. Large artery atherosclerosis ☐						
		2. Cardioembolism ☐						
		3. Small artery atherosclerosis ☐						
		4. Undetermined ☐						
		5. Other determined etiology ☐						
		Specify :						
F10	Haemorrhagic stroke	Cortical	Yes	No	Unknown	If yes	right	left	both
		Basal ganglia	Yes	No	Unknown	If yes	right	left	both
		Cerebellum	Yes	No	Unknown	If yes	right	left	both
		Brain stem	Yes	No	Unknown	If yes	right	left	both
		Thalamus	Yes	No	Unknown	If yes	right	left	both
		Intra ventrucular bleed	Yes	No	Unknown				

F11	Modified Rankin scale	
F12	National institute health stroke scale score	
F13	Time to reach hospital	
F14	Treatment in hospital with stroke unit	1. Yes ☐ 2. No ☐
F15	Treatment done	1. Thrombolysis ☐ 2. Mechanical thrombectomy ☐ 3. Surgery ☐ 4. Medical management ☐
F16	Number of days hospitalised	
Section G: Recurrent stroke		
G1	Type	1. Ischemic stroke 2. Transient ischemic attack 3. Haemorrhagic
G2	NIHSS	
G3	mRS score	
G4	OCSP	1. Lacunar stroke ☐ 2. Partial anterior circulation ☐ 3. Total anterior circulation ☐ 4. Posterior circulation ☐

Appendix - IV

Unique ID

Date

"**Factors associated with stroke recurrence and the facilitators and barriers to medication adherence and risk factor control among stroke survivors**"

Interview schedule-Phase II

Instructions: Put 'X' mark in the box on the right side to your answer. In case of questions where more than one answers can be marked, put 'X' mark in the boxes on the right side of the selected answers.

Section A: General information

Section A: General information		
A1	Age in completed years	
A2	Post stroke period after first episode of stroke	Years Months Days
A3	Sex	
A4	Residential area	1.Rural 2.Urban
A5	Phone number of Patient	
A6	Phone number of care giver	
A7	Address	
Section B: Socio demographic characteristics		
B1	Religion	1. Hindu 2. Christian 3. Islam **4.** Others
B2	Whether belongs to SC/ST/OBC	1. SC 2. ST 3. OBC 4. Others

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B3	Total completed years of education of patient	
B4	Total completed years of education of primary care giver	
B5	Occupation of patient	1. Clerical. ☐ 2. Manual laborer/ unskilled worker. ☐ 3. Professionals ☐ 4. Home maker ☐ 5. Unemployed ☐ 6. Self employed ☐ 7. Retired / Pensioned ☐
B6	Nature of occupation of patient	1. sedentary (mostly sitting during work) ☐ 2. non sedentary (mostly moving around during work, e.g: nurses, postman, bus conductor) ☐ 3. manual labour ☐ 4. homemaking ☐
B7	Employment status prior to stroke recurrence	1. Employed ☐ 2. Lost Job ☐ 3. On long leave ☐
B8	Nature of occupation of primary care giver of patient.	1.Full time ☐ 2. Part time ☐

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Date

B9	Marital status of patient	1. Married ☐ 2. Unmarried ☐ 3. Widowed ☐ 4. Separated ☐
B10	Are you living with your spouse	1.Yes ☐ 2.No ☐
B11	Number of family members	
B12	House hold income	
B13	Income category as in SCTIMST records	1. A ☐ 2. B ☐ 3. C ☐ 4. D ☐
B14	Have you enrolment to any health insurance	1.Yes ☐ 2.No ☐
B15	If Yes what is the nature of the health insurance	1. Government ☐ 2.Private ☐
B16	Have you got any other financial assistance for your medications	1.Yes ☐ 2.No ☐ If Yes Specify ----------
B17	Ownership of Vehicle	1. Two wheeler ☐ 2. Four wheeler ☐ 3. None ☐
B18	What is the type of Civil supply card you have?	1.Yellow ☐ 2. pink ☐ 3.Blue ☐ 4.White ☐

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Section 3: Access to health care		
C1	Where do you go for usual health related follow up?	1. Private hospital ☐ 2. Private clinic ☐ 3. Government hospital ☐
C2	Distance to nearby hospital or clinic from your home, where you go for follow up in kilometres	
C3	Have ever been visited by a health care worker / Asha after your stroke	1. Yes ☐ 2.No ☐
C4	Which system of medicines, you are currently following	1. Modern medicine ☐ 2. Ayurveda ☐ 3. Homeopathic ☐ 4. Any other ☐ Specify----------
C5	When was your last visit to doctor/ clinic	1. within 0-7 days ☐ 2. 8-30 days ☐ 3. 31 days- 90 days ☐ 4. 3 months-6 months ☐ 5. 6 months- 12 months ☐ 6. >12months ☐
C6	Distance to nearest medical shop from your home in kilo meters	

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C7	All the medicines prescribed for you are available in the nearest medical shop	1. Yes ☐ 2. No ☐
C8	Cost of medication for one week	
C9	Have you ever been told from medical shop that medicines are out of stock	1.Yes ☐ 2.No ☐
C10	Do you buy medicines for one month at a time?	1. Yes 2. No If No state the reasons 1. Under dispensing from phanmacy 2. Financial issues **3.** Any other. Specify----------
C11	Do you take following types of medicines for treatment of stroke	1. Modern medicine ☐ 2. Ayurveda ☐ 3. Homeopathy ☐ 4. Others ☐ If others, specify----------
Section D: Cardiovascular risk factors. Status of these risk factors at the time of current follow up will be collected		
D1	Have you ever been smoked more than 100 cigarettes in your life time	1. Yes ☐ 2. No ☐

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D2	Are you currently smoking	1. Yes ☐ 2. No ☐ If No, when did you quit smoking? 1. Before first episode of stroke ☐ 2. After first episode of stroke ☐
D3	Do you currently drink alcohol?	1. Yes ☐ 2. No ☐
D4	Do you exercise regularly	1. Yes ☐ 2. No ☐
D5	If yes, what type of exercise you are doing?	
D6	How long you exercise in a day?	
D7	How many days in a week you exercise?	
D8	Do you consume approximately 350-400gms of vegetables a day?	1.Yes ☐ 2. No ☐
D9	Do you consume at least one medium size fruit in a day?	1. Yes ☐ 2. No ☐
D10	Do you consume the following food items	1. Pappad ☐ 2. Pickle ☐ 3. Extra salt ☐ 4. Fried foods ☐ 5. Sweets ☐
D11	Did you continue physiotherapy after discharge from hospital	1. Yes ☐ 2. No ☐

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Date

D12	Have you given any advice at the time of discharge from hospital?	1. Yes ☐ 2. No ☐
D13	If Yes, given by whom	1. Doctor ☐ 2. Nurse ☐ 3. Physiotherapist ☐ 4. Any others ☐ Specify----------
D14	The advice includes which of the following	1. Regular intake of medication 2. Diet modification 3. Physical activity 4. Follow up visit 5. Any other
D15	How would you explain your relationship with your care provider	1. Good 2. Not good 3. Cannot say
D16	Do you experience any problems in communicating with your physician? Eg. Language or medical terms	1. Yes ☐ 2. No ☐
Section E: Post stroke status. Condition of subjects at the time of follow up		
E1	Have you been anxious about your disease condition?	1. Yes ☐ 2. No ☐
E2	Have you got depressed about your disease condition or current status of health?	1. Yes ☐ 2. No ☐
E3	Have you had any memory disturbances?	1. Yes ☐ 2. No ☐

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E4	How would your assess your present state of health?	1. Very Poor ☐ 2. Poor ☐ 3. Average ☐ 4. Good ☐ 5. Very Good ☐ 6. Excellent ☐
E5	How do you like to explain your current treatment regimen	1. Simple ☐ 2. complex ☐
E6	What do you feel about your prolonged treatment regimen?	1. Fear of dependence ☐ 2. No fear of dependence ☐ 3. Cannot say ☐
E7	Do you think that the medications prescribed for you are really needed for your health?	1. Strongly believe ☐ 2. Not belive ☐ 3. Cannot say ☐
E8	Do you believe that the medications prescribed for you will prevent further episodes in the future?	1. Strongly believe ☐ 2. Not believe ☐ 3. Cannot say ☐
E9	Do you agree the a person who suffered a stroke has a higher chance of recurrence	1. Strongly agree ☐ 2. Not agree ☐ 3. Cannot say ☐
E10	Are you satisfied with your current treatment	1. Yes ☐ 2. No ☐
E11	What do you think about the benefit of your current medications	1. Not beneficial ☐ 2. Beneficial ☐ 3. Cannot say ☐

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E12	Whether anyone in your family help you in taking your medication	1.Yes ☐ 2.No ☐
E13	Do any one in your family remind you to take your medications?	1. Yes ☐ 2. No ☐
E14	How confident are you in taking your medications from your medicine box according to prescription?	1. Highly confident ☐ 2. Somewhat confident ☐ 3. Not confident ☐ 4. Cannot say ☐
E15	Are you able to read and understand labels on the medicine strip	1. Yes ☐ 2. No ☐
E16	Have you got a daily routine for activities of daily living	1. Yes ☐ 2. No ☐

Do you experience any side effects of the prescribed medications?

Name of medications	**Class**	**Dose**	**Duration**	**Side effects**

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Section H: Types of medications to be continued as per last prescription and adherence status

Class of medication	Name of medication	Medication intake status	Reasons for stopping the medication	Adherence
		1.Stopped by self ☐ 2.Continuing ☐		
		1.Stopped by self ☐ 2.Continuing ☐		
		1.Stopped by self ☐ 2.Continuing ☐		
		1.Stopped by self ☐ 2.Continuing ☐		
		1.Stopped by self ☐ 2.Continuing ☐		
		1.Stopped by self ☐ 2.Continuing ☐		
		1.Stopped by self ☐ 2.Continuing ☐		

Appendix -V

Unique ID				Date							

Clinical Information Sheet - Phase II

Facilitators and barriers to medication adherence among stroke survivors in tertiary care hospital, Thiruvananthapuram, Kerala.

Blood pressure, Blood sugar, Glycosylated hemoblobin, Cholesterol values on admission with stroke recurrence (Will be collected from medical records)			
Parameter	**Three months**	**Six months**	**One year**
Blood pressure			
RBS/FBS			
Glycosylated haemoglobin			
Total cholesterol			
Low Density Lipoprotein			
Body weight			
Height			
Waist circumference			
History of medical illnesses and treatment status			

Clinical information sheet

Diabetes	1. Yes 2. No	☐ Treatment initiated ☐ 1. Yes 2. No
Hypertension	1. Yes **2.** No	☐ 1. Yes ☐ 2. No
Dyslipidaemia	1. Yes **2.** No	☐ 1. Yes ☐ 2. No
Coronary artery disease	1. Yes **2.** No	☐ 1. Yes ☐ 2. No
Carotid artery disease	1. Yes 2. No	☐ 1. Yes ☐ 2. No

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Valvular heart disease	1. Yes 2. No	1.Yes 2.No
Atrial Flutter	1. Yes 2. No	1. Yes 2. No
Peripheral vascular disease	1. Yes 2. No	1.Yes 2. No
Post stroke status: Condition of subjects at the time of follow up		
Physical deficits Eg. Arm weakness, dysarthria etc	1. Yes 2. No	
Physical disability as measured by modified Rankin's Scale		
Functional status as measured by Barthel Index		
Neurological deficits as measured by NIHSS		
Presence of cognitive dysfunction	1. Yes 2. No	
Presence of memory dysfunction	1. Yes 2. No	

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പഠന ശീർഷകം: കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിന്റെ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം

ചോദ്യാവലി

നിർദ്ദേശങ്ങൾ

നിങ്ങളുടെ ഉത്തരത്തിനു വലതുവശത്തുള്ള കളത്തിൽ ഗുണനചിഹ്നം ഇടുക.

ഒന്നിൽ കൂടുതൽ ഉത്തരങ്ങളുണ്ടെങ്കിൽ വലതുവശത്തുള്ള കളത്തിലെല്ലാം ഗുണനചിഹ്നം ഇടുക

വിഭാഗം എ. പൊതു വിവരങ്ങൾ		
A1	**വയസ്സ് - പൂർത്തിയായ വർഷത്തിൽ**	☐
A2	പക്ഷാഘാതം *ആദ്യമായി* **വന്നതിനുശേഷമുള്ള കാലയളവ്**	1. **വർഷം** ☐ 2. **മാസം** ☐ 3. **ദിവസം** ☐
A3	ലിംഗം	
A4	താമസിക്കുന്ന പ്രദേശം	1. **ഗ്രാമം** ☐ 2. **നഗരം** ☐
A5	**രോഗിയുടെ ഫോൺ നമ്പർ**	
A6	പരിചരിക്കുന്നയാളുടെ ഫോൺ നമ്പർ	
A7	**മേൽവിലാസം**	
വിഭാഗം ബി. സാമൂഹ്യ-ജനസംഖ്യാപരമായ ഘടകങ്ങൾ		
B1	**മതം**	1. **ഹിന്ദു** ☐ 2. **ക്രൈസ്തവൻ** ☐ 3. **ഇസ്ലാം** ☐ 4. **മറ്റുള്ളവ** ☐

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B2	താഴെപ്പറയുന്നതിൽ ഏത് വിഭാഗത്തിൽപ്പെടുന്നു	5. ഷെഡ്യൂൾഡ് കാസ്റ്റ് ☐ 6. ഷെഡ്യൂൾഡ് ട്രൈബ് ☐ 7. പിന്നോക്കവിഭാഗം ☐ 8. വേറെ ഏതെങ്കിലും ☐
B3	രോഗിയുടെ വിദ്യാഭ്യസം - പൂർത്തിയാക്കിയ വർഷങ്ങൾ	
B4	പരിചരിക്കുന്നയാളുടെ വിദ്യാഭ്യസം - പൂർത്തിയാക്കിയ വർഷങ്ങൾ	
B5	തൊഴിൽ	1. ഗുമസ്ഥപ്പണി ☐ 2. കൂലിത്തൊഴിലാളി/ അവിദഗ്ദ്ധ തൊഴിലാളി. ☐ 3. പ്രൊഫഷണൽ ☐ 4. ഗൃഹഭരണം ☐ 5. തൊഴിൽരഹിതം . ☐ 6. സ്വയംതൊഴിൽ ☐ 7. റിട്ടയേർഡ് / പെൻഷൻ വാങ്ങുന്നയാൾ ☐
B6	രോഗിയുടെ തൊഴിലിന്റെ രീതി	1. കായികാദ്ധ്വാനമില്ലാത്ത (മിക്കസമയവും ഇരുന്നുകൊണ്ടുള്ള തൊഴിൽ) ☐ 2. കായികാദ്ധ്വാനം ആവശ്യമുള്ള (കൂടുതൽ സമയവും ചലിച്ചുകൊണ്ടുള്ള ജോലി ഉദ. നഴ്സുകൾ, പോസ്റ്റ്മാൻ, ബസ് കണ്ടക്ടർ) ☐ 3. കൂലിപ്പണി ☐ 4. ഗൃഹഭരണം ☐

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B7	മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിനു മുൻപ് തൊഴിൽ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐ 3. നീണ്ട അവധിയിൽ ☐
B8	പരിചരിക്കുന്നയാളുടെ തൊഴിലിന്റെ രീതി	1. മുഴുവൻസമയം ☐ 2. ഭാഗികം ☐
B9	വൈവാഹികാവസ്ഥ	1.വിവാഹിതൻ/വിവാഹിത ☐ 2. അവിവാഹിതൻ/അവിവാഹിത ☐ 3. ബന്ധം വേർപെടുത്തിയത് ☐ 4 പങ്കാളി മരണപ്പെട്ടു ☐
B10	ജീവിതപങ്കാളിയോടൊപ്പമാണോ ജീവിക്കുന്നത്	1. **അതെ** ☐ 2. **അല്ല** ☐
B11	കുടുംബാംഗങ്ങളുടെ എണ്ണം	
B12	കുടുംബ വരുമാനം	
B13	ശ്രീചിത്രയിൽ ഏത് വരമാനവിഭാഗത്തിൽ ഉൾപ്പെടുന്നു	1. A ☐ 2. B ☐ 3. C ☐ 4. D ☐
B14	ഏതെങ്കിലും ആരോഗ്യ സുരക്ഷാ പദ്ധതിയിൽ ചേർന്നിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
B15	ആരോഗ്യ സുരക്ഷാ പദ്ധതിയുടെ സ്വഭാവം	1. സർക്കാർ ☐ 2. സ്വകാര്യം ☐
B16	മരുന്നുകൾക്ക് ഏന്തെങ്കിലും സാമ്പത്തീക സഹായം ലഭിക്കുന്നുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐

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B17	വാഹന ഉടമസ്ഥത	1. ഇരുചക്ര വാഹനം ☐ 2. നാലുചക്രവാഹനം ☐ 3. ഇല്ല ☐
B18	റേഷൻകാർഡിന്റെ നിറം	1. **മഞ്ഞ** ☐ 2. **പിങ്ക്** ☐ 3. **നീല** ☐ 4. **വെള്ള** ☐
	വിഭാഗം സി. ആരോഗ്യ പരിരക്ഷയുടെ ലഭ്യത	
C1	സാധാരണ താങ്കൾ എവിടെയാണ് ആരോഗ്യ പരിശോധനയ്ക്ക് വേണ്ടി പോകുന്നത്	1. സ്വകാര്യ ആശുപത്രി ☐ 2. സ്വകാര്യ ക്ലിനിക് ☐ 3. സർക്കാർ ആശുപത്രി ☐
C2	താങ്കൾ വൈദ്യപരിശോധനയ്ക്കായി പോകുന്ന, സമീപത്തെ ആശുപത്രിയിലേക്കോ വൈദ്യശാലയിലേക്കോ താങ്കളുടെ വീട്ടിൽ നിന്നുള്ള ദൂരം (കിലോമീറ്ററിൽ)	
C3	പക്ഷാഘാതം വന്നതിനുശേഷം ആരോഗ്യ പ്രവർത്തകരോ ആശ പ്രവർത്തകരോ നിങ്ങളെ സന്ദർശിച്ചിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2.ഇല്ല ☐
C4	താങ്കൾ ഇപ്പോൾ പിൻതുടരുന്നത് ചികിത്സാ സമ്പ്രദായം ഏത്	1. അലോപ്പതി ☐ 2. ആയുർവ്വേദം ☐ 3. ഹോമിയോപ്പതി ☐ 4. മറ്റെന്തെങ്കിലും വിശദമാക്കുക ----------

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C5	അവസാനം നടത്തിയ മെഡിക്കൽ പരിശോധന എത്ര നാളുകൾക്ക് മുമ്പാണ്	1. 0-7 ദിവസം ☐ 2. 8-30 ദിവസം ☐ 3. 31 - 90 ദിവസം ☐ 4. മൂന്നു മുതൽ ആറു മാസം ☐ 5. ആറു മുതൽ 12 മാസം ☐ 6. 12 മസങ്ങൾക്ക് മുമ്പ് ☐
C6	നിങ്ങളുടെ താമസസ്ഥലത്തുനിന്നും അടുത്തുള്ള ഔഷധ ശാലയിലേക്ക് എത്ര കിലോമീറ്റർ ദൂരം ഉണ്ട്	
C7	താങ്കൾക്ക് നിർദ്ദേശിച്ച മരുന്നുകൾ അടുത്തുള്ള ഔഷധ ശാലയിൽ ലഭ്യമാണോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
C8	നിങ്ങളുടെ ഒരാഴ്ചത്തേക്കുള്ള മരുന്നിന്റെ വില	
C9	പക്ഷാഘാതത്തിന്റെ ചികിത്സയ്ക്കായി താങ്കൾ കഴിക്കുന്ന മരുന്നുകളുടെ തരം	1. **അലോപ്പതി** ☐ 2. **ആയുർവ്വേദം** ☐ 3. **ഹോമിയോപ്പതി** ☐ 4. **മറ്റുള്ളവ** ☐
വിഭാഗം. ഡി. ഹൃദയസംബന്ധമായ അപായ ഘടകങ്ങൾ		
D1	താങ്കളുടെ ജീവിതകാലത്ത് എപ്പോഴെങ്കിലും 100 സിഗറ്റിലേറെ ഉപയോഗിച്ചിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
D2	നിങ്ങൾ ഇപ്പോൾ പുകവലിക്കുന്നുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐ ഇല്ല എങ്കിൽ പുകവലി എന്നാണ് നിർത്തിയത്

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D3	നിങ്ങൾ ഇപ്പോൾ മദ്യം ഉപയോഗിക്കുന്നുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D4	നിങ്ങൾ പതിവായി വ്യായാമം ചെയ്യാറുണ്ടോ	**3.** ഉണ്ട് ☐ **4.** ഇല്ല ☐
D5	ഉണ്ട് എങ്കിൽ ഏതുതരത്തിലുള്ള വ്യായാമമാണ് ചെയ്യുന്നത്	
D6	ഒരു ദിവസം എത്ര സമയം വ്യായാമം ചെയ്യും	
D7	ഒരാഴ്ചയ്ൽ എത്ര ദിവസം വ്യായാമം ചെയ്യും	
D8	നിങ്ങൾ ഒരു ദിവസം ഏകദേഷം 350-400ഗ്രാം വരെ പച്ചക്കറികൾ കഴിക്കാറുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D9	നിങ്ങൾ ഒരു ദിവസം ഒരു ഇടത്തരം പഴമെങ്കിലും കഴിക്കാറുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D10	നിങ്ങൾ താഴെപ്പറയുന്ന ആഹാരപദാർത്ഥങ്ങൽ ക കഴിക്കാറുണ്ടോ	1. **പപ്പടം** ☐ 2. **അച്ചാർ** ☐ 3. **വറുത്ത ഭക്ഷണങ്ങൾ** ☐ 4. **മധുരപദാർത്ഥങ്ങൾ** ☐ 5. **കൂടുതൽ ഉപ്പ്** ☐
D11	ആശുപത്രിയിൽ നിന്നും വിട്ട ശേഷം ഫിസിയോ തൊറാപ്പി ചെയ്യുന്നുണ്ടായിരുന്നോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D12	ആശുപത്രിയിൽ നിന്നും വിട്ട സമയത്ത് തുടർ ചികിത്സയുടെ ആവശ്യത്തെപ്പറ്റി പറഞ്ഞുതന്നിട്ടുണ്ടായിരുന്നോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
വിഭാഗം സി: പക്ഷാഘാതത്തിനുശേഷമുള്ള (പക്ഷാഘാതം ആവർത്തിക്കുന്നതിന് ഒരാഴ്ച മുമ്പത്തെ) അവസ്ഥ		

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E1	ശാരീരിക പരിമിതികൾ ഉദ്. കൈയുടെ ബലക്കുറവ്, മുട്ടുവേദന മുതലായവ	
E2	പരിഷ്ക്കരിച്ച റാൻകിൻ സ്കെയിൽപ്രകാരമുള്ള ശാരീരിക ശേഷിക്കുറവിന്റെ അളവ്	
E3	ബാർത്തൽ സ്കെയിൽ പ്രകാരമുള്ള പ്രവർത്തന നിലവാരത്തിന്റെ അളവ്	
E4	താങ്കളുടെ രോഗാവസ്ഥയിൽ ഉത്കണ്ഠയുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
E5	താങ്കളുടെ രോഗാവസ്ഥയിലും ഇപ്പോഴത്തെ ആരോഗ്യസ്ഥിതിയിലും താങ്കൾക്ക് വിഷാദം തോന്നുന്നുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
E6	പക്ഷാഘാതം വീണ്ടും വരുന്നതിന് മുൻപ് ഓർമ്മ പ്രശ്നങ്ങളുണ്ടായോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐

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വിഭാഗം എച്ച്: **അവസാനത്തെ നിർദ്ദേശപ്രകാരം കഴിക്കേണ്ട മരുന്നുകളും അവയുടെ കൃത്യതാനിലവാരവും**

മരുന്നിന്റെ വിഭാഗം	മരുന്നുകളുടെ പേര്	മരുന്നുകൾ തുടങ്ങിയത് പ്രഥമ മസ്തിഷ്ക്കാഘാതത്തിനുമുൻപ്/ശേഷം	മരുന്നു കഴിക്കുന്ന നിലവാരം	മരുന്നു നിർത്താനുള്ള കാരണങ്ങൾ	മരുന്ന് കഴിക്കുന്നതിന്റെ സ്ഥിരതയുടെ നിലവാരം
		1. മുൻപ് ☐ 2. ശേഷംr ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് 2. ശേഷം	1. സ്വയം നിർത്തി 2.Continuing		

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പഠന ശീർഷകം: കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മരുന്ന് കൃത്യമായി കഴിക്കുന്നതിനു പ്രചോദനവും തടസ്സങ്ങളുമായ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം

ചോദ്യാവലി

നിർദ്ദേശങ്ങൾ

നിങ്ങളുടെ ഉത്തരത്തിനു വലതുവശത്തുള്ള കളത്തിൽ ഗുണനചിഹ്നം ഇടുക.

ഒന്നിൽ കൂടുതൽ ഉത്തരങ്ങളുണ്ടെങ്കിൽ വലതുവശത്തുള്ള കളത്തിലെല്ലാം ഗുണനചിഹ്നം ഇടുക

വിഭാഗം എ. പൊതു വിവരങ്ങൾ		
A1	**വയസ്സ് - പൂർത്തിയായ വർഷത്തിൽ**	☐
A2	**പക്ഷാഘാതം *ആദ്യമായി* വന്നതിനുശേഷമുള്ള കാലയളവ്**	1. **വർഷം** ☐ 2. **മാസം** ☐ 3. **ദിവസം** ☐
A3	ലിംഗം	
A4	താമസിക്കുന്ന പ്രദേശം	1. ഗ്രാമം ☐ 2. നഗരം ☐
A5	**രോഗിയുടെ ഫോൺ നമ്പർ**	
A6	പരിചരിക്കുന്നയാളുടെ ഫോൺ നമ്പർ	
A7	**മേൽവിലാസം**	
വിഭാഗം ബി. സാമൂഹ്യ-ജനസംഖ്യാപരമായ ഘടകങ്ങൾ		
B1	**മതം**	
B2	**താഴെപ്പറയുന്നതിൽ ഏത് വിഭാഗത്തിൽപ്പെടുന്നു**	1. **ഷെഡ്യൂൾഡ് കാസ്റ്റ്** ☐ 2. **ഷെഡ്യൂൾഡ് ട്രൈബ്** ☐ 3. **പിന്നോക്കവിഭാഗം** ☐ 4. **വേറെ ഏതെങ്കിലും** ☐
B3	**രോഗിയുടെ വിദ്യാഭ്യസം - പൂർത്തിയാക്കിയ വർഷങ്ങൾ**	

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B4	**പരിചരിക്കുന്നയാളുടെ വിദ്യാഭ്യസം - പൂർത്തിയാക്കിയ വർഷങ്ങൾ**	
B5	**തൊഴിൽ**	1. **ഗൃമസ്ഥപ്പണി** ☐ 2. **കൂലിത്തൊഴിലാളി/ അവിദഗ്ദ്ധ തൊഴിലാളി.** ☐ 3. പ്രൊഫഷണൽ ☐ 4. **ഗൃഹഭരണം** ☐ 5. **തൊഴിൽരഹിതം .** ☐ 6. **സ്വയംതൊഴിൽ** ☐ 7. റിട്ടയേർഡ് / **പെൻഷൻ വാങ്ങുന്നയാൾ** ☐
B6	രോഗിയുടെ തൊഴിലിന്റെ രീതി	1. കായികാദ്ധ്വാനമില്ലാത്ത (മിക്കസമയവും ഇരുന്നുകൊണ്ടുള്ള തൊഴിൽ) ☐ 2. കായികാദ്ധ്വാനം ആവശ്യ മുള്ള (കൂടുതൽ സമയവും ചലിച്ചുകൊണ്ടുള്ള ജോലി ഉദ. നഴ്സുകൾ, പോസ്റ്റ്മാൻ, ബസ് കണ്ടക്ടർ) ☐ 3. കൂലിപ്പണി ☐ 4. ഗൃഹഭരണം ☐
B6	മസ്തിഷ്ക്കാഘാതം അവർത്തിക്കുന്നതിുമുൻപ് തൊഴിൽ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐ 3. നീണ്ട അവധിയിൽ ☐
B6	പരിചരിക്കുന്നയാളുടെ തൊഴിലിന്റെ രീതി	1. മുഴുവൻസമയം ☐ 2. ഭാഗികം ☐

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B7	വൈവാഹികാവസ്ഥ	1.വിവാഹിതൻ/വിവാഹിത ☐ 2. അവിവാഹിതൻ/അവിവാഹിത ☐ 3. ബന്ധം വേർപെടുത്തിയത് ☐ 4 പങ്കാളി മരണപ്പെട്ടു ☐
B8	ജീവിതപങ്കാളിയോടൊപ്പമാണോ ജീവിക്കുന്നത്	1. **അതെ** ☐ 2. **അല്ല** ☐
B9	കുടുംബാംഗങ്ങളുടെ എണ്ണം	
B10	കുടുംബ വരുമാനം	
B11	ശ്രീചിത്രയിൽ ഏത് വരമാനവിഭാഗത്തിൽ ഉൾപ്പെടുന്നു	1. A ☐ 2. B ☐ 3. C ☐ 4. D ☐
B12	ഏതെങ്കിലും ആരോഗ്യ സുരക്ഷാ പദ്ധതിയിൽ ചേർന്നിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
B13	ആരോഗ്യ സുരക്ഷാ പദ്ധതിയുടെ സ്വഭാവം	1. സർക്കാർ ☐ 2. സ്വകാര്യം ☐
B14	മരുന്നുകൾക്ക് ഏന്തെങ്കിലും സാമ്പത്തീക സഹായം ലഭിക്കുന്നുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
B15	വാഹന ഉടമസ്ഥത	1. ഇരുചക്ര വാഹനം ☐ 2. നാലുചക്രവാഹനം ☐ 3. ഇല്ല ☐
B16	റേഷൻകാർഡിന്റെ നിറം	1. **മഞ്ഞ** ☐ 2. **പിങ്ക്** ☐ 3. **നീല** ☐ 4. **വെള്ള** ☐

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വിഭാഗം സി. ആരോഗ്യ പരിരക്ഷയുടെ ലഭ്യത		
C1	സാധാരണ താങ്കൾ എവിടെയാണ് ആരോഗ്യ പരിശോധനയ്ക്ക് വേണ്ടി പോകുന്നത്	1. സ്വകാര്യ ആശുപത്രി ☐ 2. സ്വകാര്യ ക്ലിനിക് ☐ 3. സർക്കാർ ആശുപത്രി ☐
C2	താങ്കൾ വൈദ്യപരിശോധനയ്ക്കായി പോകുന്ന, സമീപത്തെ ആശുപത്രിയിലേക്കോ വൈദ്യശാലയിലേക്കോ താങ്കളുടെ വീട്ടിൽ നിന്നുള്ള ദൂരം (കിലോമീറ്ററിൽ)	
C3	പക്ഷാഘാതം വന്നതിനുശേഷം ആരോഗ്യ പ്രവർത്തകരോ ആശ പ്രവർത്തകരോ നിങ്ങളെ സന്ദർശിച്ചിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2.ഇല്ല ☐
C4	താങ്കൾ ഇപ്പോൾ പിൻതുടരുന്നത് ചികിത്സാ സമ്പ്രദായം ഏത്	1. അലോപ്പതി ☐ 2. ആയുർവ്വേദം ☐ 3. ഹോമിയോപ്പതി ☐ 4. മറ്റെന്തെങ്കിലും വിശദമാക്കുക ----------
C5	അവസാനം നടത്തിയ മെഡിക്കൽ പരിശോധന എത്ര നാളുകൾക്ക് മുമ്പാണ്	1. 0-7 ദിവസം ☐ 2. 8-30 ദിവസം ☐ 3. 31 - 90 ദിവസം ☐ 4. മൂന്നു മുതൽ ആറു മാസം ☐ 5. ആറു മുതൽ 12 മാസം ☐ 6. 12 മസങ്ങൾക്ക് മുമ്പ് ☐

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C6	നിങ്ങളുടെ താമസസ്ഥലത്തുനിന്നും അടുത്തുള്ള ഔഷധ ശാലയിലേക്ക് എത്ര കിലോമീറ്റർ ദൂരം	
C7	താങ്കൾക്ക് നിർദ്ദേശിച്ച മരുന്നുകൾ അടുത്തുള്ള ഔഷധ ശാലയിൽ ലഭ്യമാണോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
C8	നിങ്ങളുടെ ഒരാഴ്ചത്തേക്കുള്ള മരുന്നിന്റെ വില	
C9	നിങ്ങൾ മരുന്ന് വാങ്ങുന്ന കടയിൽനിന്ന് എപ്പോഴെങ്കിലും മരുന്ന് സ്റ്റോക്ക് ഇല്ല എന്നുപറഞ്ഞിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
C10	നിങ്ങൾ ഒരു മാസത്തേക്കുള്ള മരുന്നുകൾ ഒന്നിച്ച് വാങ്ങാറാണോ പതിവ്	1. ഉണ്ട് ☐ 2. ഇല്ല ☐ ഇല്ല എങ്കിൽ കാരണം വിശദമാക്കുക 1. മരുന്ന് കടയിൽനിന്നും കുറച്ചേ ലഭ്യമാകു 2. സാമ്പത്തികപ്രശ്നങ്ങൾ 3. മറ്റെന്തെങ്കിലും വിശദമാക്കുക.....
C11	പക്ഷാഘാതത്തിന്റെ ചികിത്സയ്ക്കായി താങ്കൾ കഴിക്കുന്ന മരുന്നുകളുടെ തരം	1. **അലോപ്പതി** ☐ 2. **ആയുർവ്വേദം** ☐ 3. **ഹോമിയോപ്പതി** ☐ 4. **മറ്റുള്ളവ** ☐
വിഭാഗം. ഡി. ഹൃദയസംബന്ധമായ അപായ ഘടകങ്ങൾ		
D1	താങ്കളുടെ ജീവിതകാലത്ത് എപ്പോഴെങ്കിലും 100 സിഗറ്റിലേറെ ഉപയോഗിച്ചിട്ടുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐

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D2	നിങ്ങൾ ഇപ്പോൾ പുകവലിക്കുന്നുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐ ഇല്ല എങ്കിൽ പുകവലി എന്നാണ് നിർത്തിയത്
D3	നിങ്ങൾ ഇപ്പോൾ മദ്യം ഉപയോഗിക്കുന്നുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D4	നിങ്ങൾ പതിവായി വ്യായാമം ചെയ്യാറുണ്ടോ	**3.** ഉണ്ട് ☐ **4.** ഇല്ല ☐
D5	ഉണ്ട് എങ്കിൽ ഏതുതരത്തിലുള്ള വ്യായാമമാണ് ചെയ്യുന്നത്	
D6	ഒരു ദിവസം എത്ര സമയം വ്യായാമം ചെയ്യും	
D7	ഒരാഴ്ചയ്ൽ എത്ര ദിവസം വ്യായാമം ചെയ്യും	
D8	നിങ്ങൾ ഒരു ദിവസം ഏകദേഷം 350-400ഗ്രാം വരെ പച്ചക്കറികൾ കഴിക്കാറുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D9	നിങ്ങൾ ഒരു ദിവസം ഒരു ഇടത്തരം പഴമെങ്കിലും കഴിക്കാറുണ്ടോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D10	നിങ്ങൾ താഴെപ്പറയുന്ന ആഹാരപദാർത്ഥങ്ങൾ കഴിക്കാറുണ്ടോ	1. **പപ്പടം** ☐ 2. **അച്ചാർ** ☐ 3. **വറുത്ത ഭക്ഷണങ്ങൾ** ☐ 4. **മധുരപദാർത്ഥങ്ങൾ** ☐ 5. **കൂടുതൽ ഉപ്പ്** ☐
D11	ആശുപത്രിയിൽ നിന്നും വിട്ട ശേഷം ഫിസിയോ തൊറാപ്പി ചെയ്യുന്നുണ്ടായിരുന്നോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐
D12	ആശുപത്രിയിൽ നിന്നും വിട്ട സമയത്ത് തുടർ ചികിത്സയുടെ ആവശ്യത്തെപ്പറ്റി പറഞ്ഞുതന്നിട്ടുണ്ടായിരുന്നോ	**1.** ഉണ്ട് ☐ **2.** ഇല്ല ☐

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D13	ഉണ്ടെങ്കിൽ ആരാണ് തന്നത്	1. ഡോക്ടർ ☐ 2. നഴ്സ് ☐ 3. ഫിസിയോതെറാപ്പിസ്റ്റ് ☐ മറ്റാരെങ്കിലും... വ്യക്തമാക്കുക
D14	എന്തൊക്കെ നിർദ്ദേശങ്ങളാണ് തന്നത്	1. മരുന്ന് കൃത്യമായി കഴിക്കണം ☐ 2. ആഹാര നിയന്ത്രണം ☐ 3. വ്യായാമം ചെയ്യണം ☐ 4. തുടർ ചികിത്സ ☐ 5. വേറെ എന്തെങ്കിലും ☐
D15	നിങ്ങളെ ചികിത്സിക്കുന്ന ഡോക്ടറുമായുള്ള ബന്ധത്തെ എങ്ങനെ വിശേഷിപ്പിക്കുന്നു	1. **നല്ലത്** ☐ 2. **നല്ലതല്ല** ☐ 3. **പറയാൻ പറ്റില്ല** ☐
D16	ഡോക്ടറുമായി സംവദിക്കുന്നതിൽ ഭാഷയുടെയോ ബുദ്ധിമുട്ട്	1. ഉണ്ട് ☐ **2.** ഇല്ല ☐
വിഭാഗം ഇ: പക്ഷാഘാതത്തിനുശേഷമുള്ള അവസ്ഥ ഇപ്രാവശ്യത്തെ ആശുപത്രി സന്ദർശന സമയത്തെ അവസ്ഥ		
E1	താങ്കളുടെ രോഗാവസ്ഥയിൽ താങ്കൾക്ക് ഉത്കണ്ഠയുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
E2	താങ്കളുടെ രോഗാവസ്ഥയിലോ ഇപ്പോഴത്തെ ആരോഗ്യനിലയിലോ താങ്കൾക്ക് വിഷാദം തോന്നുന്നുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
E3	താങ്കൾക്ക എന്തെങ്കിലും ഓർമ്മപ്രശ്നങ്ങളുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐

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E4	ഇപ്പോഴത്തെ ആരോഗ്യാവസ്ഥയെ എങ്ങിനെ വിശദീകരിക്കുന്നു	1. വളരെ മോശം ☐ 2. മോശം ☐ 3. ഇടത്തരം ☐ 4. നല്ലത് ☐ 5. വളരെ നല്ലത് ☐ 6. ഏറ്റവും നല്ലത് ☐
E5	നിങ്ങളുടെ ഇപ്പോഴത്തെ ചികിത്സാവിധിയെ എങ്ങിനെ നോക്കിക്കാണുന്നു	1. ലളിതം ☐ 2. കഠിനം ☐
E6	നിങ്ങളുടെ നീണ്ടകാലയളവിലേയ്ക്ക് ആവശ്യമുള്ള ചികിത്സാവിധിയെപ്പറ്റി ആലോചിക്കുമ്പോൾ എന്തു തോന്നുന്നു	1. മരുന്ന് നിർത്താൻ കഴിയാതെ വരും ☐ 2. മരുന്ന് നിർത്തുവാൻ കഴിയും ☐ 3. ഒന്നും പറയുന്നില്ല ☐
E7	നിങ്ങൾക്ക് നിർദ്ദേശിക്കപ്പെട്ട മരുന്നുകളെല്ലാം നിങ്ങൾക്ക് ആരോഗ്യത്തിന് വേണ്ടതാണെന്ന് വിശ്വസിക്കുന്നുണ്ടോ	1. ഉറച്ച് വിശ്വസിക്കുന്നു ☐ 2. ഇത്രയും മരുന്ന് വേണ്ടതില്ല ☐ 3. പറയാൻ കഴിയുന്നില്ല ☐
E8	നിങ്ങൾക്ക് നിർദ്ദേശിക്കപ്പെട്ടമരുന്നുകൾ പക്ഷാഘാതത്തെ തുടർന്നുവരുന്നത് പ്രതിരോധിക്കും എന്ന് വിശ്വസിക്കുന്നുണ്ടോ	1. ഉറച്ച് വിശ്വസിക്കുന്നു ☐ 2. വിശ്വസിക്കുന്നില്ല ☐ 3. പറയാൻ കഴിയുന്നില്ല ☐
E9	ഒരു പ്രാവശ്യം പക്ഷാഘാതം വന്നവർക്ക് വീണ്ടും വരാനുള്ള സാദ്ധ്യത ഉണ്ടെന്നതിനോട് എത്രമാത്രം യോജിക്കുന്നു	1. പൂർണ്ണമായും യോജിക്കുന്നു ☐ 2. യോജിക്കുന്നില്ല ☐ 3. പറയാൻ കഴിയില്ല ☐
E10	നിങ്ങളുടെ ഇപ്പോഴത്തെ ചികിത്സയിൽ തൃപ്തി തോന്നുന്നുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐

Unique ID

Date

E11	ഇപ്പോഴുള്ള ചികിത്സാവിധി നിങ്ങൾക്ക് പ്രയോജനപ്രദമാണെന്ന് തോന്നുന്നുണ്ടോ	1. പ്രയോജനപ്രദമല്ല ☐ 2. പ്രയോജനപ്രദമാണ് ☐ 3. പറയാൻ കഴിയില്ല ☐
E12	വീട്ടിലുള്ള ആരെങ്കിലും മരുന്ന് എടുത്തുകഴിക്കാൻ സഹായിക്കാറുണ്ടോ	1. ഉണ്ട് ☐ 2. ഇല്ല ☐
E13	നിങ്ഹളുടെ ചികിത്സാവിധിപ്രകാരം മരുന്ന് കൃത്യമായി എടുക്കാൻ കഴിയും എന്ന് എത്രമാത്രം ആത്മവിശ്വാസമുണ്ട്	1. നല്ല ആത്മവിശ്വാസം ☐ 2. ഒരുവിധം ☐ 3. ആത്മവിശ്വാസമില്ല ☐ 4. പറയാൻ കഴിയില്ല
E14	വീട്ടിലുള്ള ആരെങ്കിലും മരുന്ന് എടുത്തുകഴിക്കാൻ ഓർമ്മപ്പെടുത്താറുണ്ടോ	5.
E15	മരുന്നിന്റെ പുറത്തുള്ള എഴുത്ത് വായിച്ച് മനസ്സിലാക്കാൻ കഴിയുമോ	1. കഴിയും ☐ 2. ഇല്ല ☐
E16	നിങ്ങൾ കൃത്യമായ ദിനചര്യ പാലിക്കുന്ന ആളാണോ	1. അതെ ☐ 2. അല്ല ☐
നിങ്ങൾ ഇപ്പോൾ കഴിക്കുന്ന മരുന്നുകളുടെ എന്തെങ്കിലും ദൂഷ്യഫലങ്ങൾ അനുഭവപ്പെടാറുണ്ടോ		

Unique ID

Date

മരുന്നിന്റെ പേര്	അരുന്നിന്റെ വിഭാഗം	അളവ്	കഴിക്കുന്ന കാലയളവ്	ദൂഷ്യഫലം

Unique ID

Date

വിഭാഗം എഫ്: **അവസാനത്തെ നിർദ്ദേശപ്രകാരം കഴിക്കേണ്ട മരുന്നുകളും അവയുടെ കൃത്യതാനിലവാരവും**

മരുന്നിന്റെ വിഭാഗം	മരുന്നുകളുടെ പേര്	മരുന്നുകൾ തുടങ്ങിയത് പ്രഥമ മസ്തിഷ്ക്കാഘാതത്തിനുമുൻപ്/ശേഷം	മരുന്നു കഴിക്കുന്ന നിലവാരം	മരുന്നു നിർത്താനുള്ള കാരണങ്ങൾ	മരുന്ന് കഴിക്കുന്നതിന്റെ സ്ഥിരതയുടെ നിലവാരം
		1. മുൻപ് ☐ 2. ശേഷംr ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് ☐ 2. ശേഷം ☐	1. സ്വയം നിർത്തി ☐ 2. തുടരുന്നു ☐		
		1. മുൻപ് 2. ശേഷം	1. സ്വയം നിർത്തി 2.Continuing		

Appendix - VI

Modified Rankin's scale to assess the physical disabilities

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	dead

TOTAL (0–6): _____

Appendix -VII

National Institute Health Stroke Scale (NIHSS)

Category	Description/ Score UN= Untestable	Scoring Key	SCORE ▼▼▼
1a. Level of Consciousness (Alert, drowsy, etc.)	Alert Drowsy Stuporous Coma	0 1 2 3	
1b. Level of Consciousness Questions (Month, age)	Answers both correctly Answers one correctly Incorrect	0 1 2	
1c. Level of Consciousness Commands (Open/close eyes, squeeze and let go)	Obeys both correctly Obeys one correctly Incorrect	0 1 2	
2. Best Gaze (Eyes open - patient follow examiners finger / face)	Normal Partial gaze palsy Forced Deviation	0 1 2	
3. Visual (Introduce visual stimulus, or threat to patient's visual field quadrants)	No visual loss Partial hemianopia Complete hemianopia Bilateral hemianopia	0 1 2 3	
4. Facial Palsy (Show teeth, raise eyebrows and squeeze eyes shut)	Normal Minor Partial Complete	0 1 2 3	
5. Motor, Arm: Left / Right	 No drift Drift Can't resist gravity No effort against gravity No movement Amputation, joint fusion (explain)	Left / Right 0 0 1 1 2 2 3 3 4 4 UN UN	
6. Motor, Leg: Left / Right	 No drift Drift Can't resist gravity No effort against gravity No movement Amputation, joint fusion (explain)	Left / Right 0 0 1 1 2 2 3 3 4 4 UN UN	
7. Limb Ataxia (Finger-nose, heel down shin)	Absent Present in one limb Several limbs Amputation, joint fusion (explain)	0 1 2 UN	
8. Sensory (Pin prick to face, arm [trunk] and leg–compare side to side)	Normal Partial Loss Severe Loss	0 1 2	
9. Best Language	No aphasia Mild to moderate aphasia Severe aphasia Mute	0 1 2 3	
10. Dysarthria (Evaluate speech clarity by patient repeating listed words)	Normal articulation Mild to mod. dysarthria Near to unintelligible or worse Intubated or other physical barrier	0 1 2 UN	
11. Extinction or inattention (Use information from prior testing to identify neglect or double simultaneous stimuli)	No neglect Partial neglect Complete neglect	0 1 2	
		Total Score ➔	

Appendix VIII

"**Factors of stroke recurrence and the facilitators and barriers to medication adherence and risk factor control among survivors of first episode of stroke** "

Participant information sheet-Cases

Achutha Menon Centre for Health Science Studies,

Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum,

Kerala-695011

I am Shani S D, doing my Doctor of Philosophy (PhD) at Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum requesting your participation in a research study involving factors related to stroke recurrence. My doctoral research looks into the various factors that may increase or decrease the risk of recurrent stroke.

You have been approached for this study because you had a stroke recurrence. I am interested in knowing what are the factors which increased your risk for having a stroke recurrence. This information will guide me and others in the development of future interventions which are intended to prevent stroke recurrence in stroke survivors after first episode of stroke.

Participation in this interview will take about 20-30 minutes of your time. You are free to refuse to participate in the interview or you can stop participating in interview at any time during the course of the interview and you are also free to refuse to answer any question at any time. You may not directly benefit from participating in this interview, but the dissemination of the results of the research study may help developing future interventions which are intended to prevent stroke recurrence in

stroke survivors. **If you have any medical problem which need consultation by a neurologist I can refer you to stroke clinic at SCTIMST with your permission.**

The information provided by you will be kept strictly confidential. Details of this interview will be transcribed and used exclusively for research. Your name, other personal details and details of your community will not be identified in the transcripts used for analysis. Records and transcripts of the interviews will be kept in safe custody by me (Principal Investigator) and will be destroyed at the end of the study

If you agree to participate in the study, please indicate your agreement in the consent statement after reading it carefully. If you need any more information pertaining to any aspect of the study, please feel free to contact the following people.

You can contact me, the Principal Investigator, Shani S D at 9446176372 or mail at shanisd82@gmail.com.

If you have any questions or concerns regarding this study later and would like to talk to someone other than me (the principal investigator), you may contact the Member secretary of the Institutional Ethics Committee of the Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum : Dr Mala Ramanathan, Phone: 0471-2524234 or email to mala@sctimst.ac.in

Thank you

Interviewer's Name:

Interviewer's signature:

Consent Statement

I have read out the information in the information sheet. The nature of the study and my involvement has been explained and all my questions have been answered. By signing this consent form, I indicate that I understand what will be expected from me and that I am willing to participate in this study. I know that I can withdraw at any time. I have been informed who should be contacted if the need arises. **I am willing to be referred to stroke clinic of SCTIMST if I need a consultation from there for a medical problem identified during data collection.**

❑ Yes, I am agreeing to the interview

Signature: _____

OR

If you are not willing to participate, then thank you for your time.

Age-

Sex-

Reason for not participation-

Name of the respondent: _____

Address:_____

_____

Interviewer's Name:

Interviewer's signature:

Respondent's Unique Identification Code:

Date:

Place:

Appendix -IX

"**Factors of stroke recurrence and the facilitators and barriers to medication adherence and risk factor control among survivors of first episode of stroke**".

Participant information sheet- Controls

Achutha Menon Centre for Health Science Studies,

Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum,

Kerala-695011

I am Shani S D, doing my Doctor of Philosophy (PhD) at Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum requesting your participation in a research study involving factors related to stroke recurrence. My doctoral research looks into the various factors that may increase or decrease the risk of stroke recurrence.

You are recruited for this study from stroke registry of SCTIMT. Thank you for accepting the invitation sent from the stroke office to participate in the study and giving an appointment over telephone for me to visit home for interview. You have been approached for this study because you had a stroke. I am interested in knowing what are the factors which increase or decrease the risk for having a stroke recurrence after the first episode of stroke. This information will guide me and others in the development of future interventions which are intended to prevent stroke recurrence in stroke survivors.

Participation in this interview will take about 20-30 minutes of your time. You are free to refuse to participate in the interview or you can stop participating in interview at any time during the course of the interview and you are also free to refuse to

answer any question at any time. You may not directly benefit from participating in this interview, but the dissemination of the results of the research study may help developing future interventions which are intended to prevent stroke recurrence in stroke survivors. **If you have any medical problem which need consultation by a neurologist I can refer you to stroke clinic at SCTIMST with your permission.**

The information provided by you will be kept strictly confidential. Details of this interview will be transcribed and used exclusively for research. Your name, other personal details and details of your community will not be identified in the transcripts used for analysis. Records and transcripts of the interviews will be kept in safe custody by me (Principal Investigator) and will be destroyed at the end of the study

If you agree to participate in the study, please indicate your agreement in the consent statement after reading it carefully. If you need any more information pertaining to any aspect of the study, please feel free to contact the following people.

You can contact me, the Principal Investigator, Shani S D at 9446176372 or mail at shanisd82@gmail.com.

If you have any questions or concerns regarding this study later and would like to talk to someone other than me (the principal investigator), you may contact the Member secretary of the Institutional Ethics Committee of the Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum : Dr Mala Ramanathan, Phone: 0471-2524234 or email to mala@sctimst.ac.in

Thank you

Interviewer's Name:

Interviewer's signature:

Consent Statement

I have read out the information in the information sheet. The nature of the study and my involvement has been explained and all my questions have been answered. By signing this consent form, I indicate that I understand what will be expected from me and that I am willing to participate in this study. I know that I can withdraw at any time. I have been informed who should be contacted if the need arises. **I am willing to be referred to stroke clinic of SCTIMST if I need a consultation from there for a medical problem identified during data collection.**

❑ Yes, I am agreeing to the interview

Signature: _____

OR

If you are not willing to participate, then thank you for your time.

Age-

Sex-

Reason for not participation-

Name of the respondent: _____

Address:_____

_____

Interviewer's Name:

Interviewer's signature:

Respondent's Unique Identification Code: Date: Place:

Appendix - X

"Facilitators and barriers to medication adherence and risk factor control among survivors of first episode of stroke"

Participant information sheet- Phase II

Achutha Menon Centre for Health Science Studies,

Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum,

Kerala-695011

I am Shani S D, doing my Doctor of Philosophy (PhD) at Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum requesting your participation in a research study involving facilitators and barriers to medication adherence. My doctoral research looks into the various factors that may help or prevent you from taking your medications regularly as prescribed.

You have been approached for this study because you had a stroke and you have been prescribed with medications to control the risk factors so as to prevent a recurrent stroke. I am interested in knowing how well you are adhering to the prescription and what are the factors which help you to adhere to the prescribed regimen and what are the factors which prevent you from taking your medication regularly. This information will guide me and others in the development of future interventions which are intended increase medication adherence to prevent stroke recurrence in stroke survivors.

Participation in this interview will take about 25-35 minutes of your time. You are free to refuse to participate in the interview or you can stop participating in

interview at any time during the course of the interview and you are also free to refuse to answer any question at any time. You may not directly benefit from participating in this interview, but the dissemination of the results of the research study may help developing future interventions which help people adhere to their prescribed therapy.

The information provided by you will be kept strictly confidential. Details of this interview will be transcribed and used exclusively for research. Your name, other personal details and details of your community will not be identified in the transcripts used for analysis. Records and transcripts of the interviews will be kept in safe custody by me (Principal Investigator) and will be destroyed at the end of the study

If you agree to participate in the study, please indicate your agreement in the consent statement after reading it carefully. If you need any more information pertaining to any aspect of the study, please feel free to contact the following people.

You can contact me, the Principal Investigator, Shani S D at 9446176372 or mail at shanisd82@gmail.com.

If you have any questions or concerns regarding this study later and would like to talk to someone other than me (the principal investigator), you may contact the Member secretary of the Institutional Ethics Committee of the Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum : Dr Mala Ramanathan, Phone: 0471-2524234 or email to mala@sctimst.ac.in

Thank you

Interviewer's Name:

Interviewer's signature:

Consent Statement

I have read out the information in the information sheet. The nature of the study and my involvement has been explained and all my questions have been answered. By signing this consent form, I indicate that I understand what will be expected from me and that I am willing to participate in this study. I know that I can withdraw at any time. I have been informed who should be contacted if the need arises.

❑ Yes, I am agreeing to the interview

Signature: _____

OR

If you are not willing to participate, then thank you for your time.

Age-

Sex-

Reason for not participation-

Name of the respondent: _____

Address:_____

_____

Interviewer's Name:

Interviewer's signature:

Respondent's Unique Identification Code:

Date:

Place:

അച്ചുതമേനോൻ സെന്റർ ഫോർ ഹെൽത്ത് സയൻസ് സ്റ്റഡീസ്,
ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജി,
തിരുവനന്തപുരം, കേരളം 695011

പഠന ശീർഷകം: കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിന്റെ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം

പങ്കെടുക്കുന്നവർക്കുള്ള കാര്യവിവരണപത്രം - ഒന്നാം ഘട്ടം
മസ്തിഷ്ക്കാഘാത ആവർത്തനമുണ്ടായ രോഗികൾ

ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജി, തിരുവനന്തപുരത്തെ, അച്ചുതമേനോൻ സെന്റർ ഫോർ ഹോൽത്ത് സയൻസ് സ്റ്റഡീസിൽ ഡോക്ടർ ഓഫ് ഫിലോസഫിക്ക് (പിഎച്ച്ഡി) വേണ്ടിയുള്ള ഗവേഷണം നടത്തുന്ന ഷാനി എസ് ഡി എന്ന ഞാൻ *കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിന്റെ ഘടകങ്ങളും മരുന്ന് കൃത്യമായി കഴിക്കുന്നതിനു പ്രചോദനവും തടസ്സങ്ങളുമായ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം എന്ന വിഷയത്തിൽ നടത്തുന്ന ഗവേഷണ പഠനത്തിൽ മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതുമായി ബന്ധപ്പെട്ട ഘടകങ്ങളെപ്പറ്റി അറിയാൻ താങ്കളുടെ പങ്കാളിത്തം അഭ്യർത്ഥിക്കുന്നു. മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നത് വർദ്ധിപ്പിക്കുകയോ കുറയ്ക്കുകയോ ചെയ്യുന്ന വ്യത്യസ്ത ഘടകങ്ങളെപ്പറ്റിയാണ്* എന്റെ ഗവേഷണം.

മസ്തിഷ്ക്കാഘാതം ആവർത്തിച്ചുവന്നു എന്നതിനാലാണ് താങ്കളെ ഈ പഠനത്തിനായി സമീപിക്കുന്നത്. താങ്കൾക്ക് മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കാൻ കാരണമായ ഘടകങ്ങളെന്തെല്ലാമെന്ന് അറിയാൻ എനിക്ക് താത്പര്യമുണ്ട്. മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിൽ ആവർത്തനമുണ്ടാകുന്നതിനെ പ്രതിരോധിക്കാൻ ഭാവിയിലെ ഇടപെടലുകളിൽ വികസനം ഉണ്ടാക്കുന്നതിൽ എനിക്കും മറ്റുള്ളവർക്കും മാർഗ്ഗദർശകമാകാൻ ഈ വിവരങ്ങൾക്കാകും.

ഈ അഭിമുഖത്തിൽ പങ്കെടുക്കാൻ താങ്കളുടെ 20-30 മിനിട്ട് സമയം വേണ്ടിവരും. താങ്കൾക്ക് അഭിമുഖത്തിൽ പങ്കെടുക്കുന്നതിന് വിസമ്മതിക്കുകയോ അഭിമുഖം നടത്തുന്നതിനിടയിൽ ഏതു സമയത്തും അഭിമുഖം നിർത്താനാവശ്യപ്പെടാനോ ഏതെങ്കിലും ചോദ്യങ്ങൾക്ക് ഉത്തരം നൽകാതിരിക്കാനോ സ്വാതന്ത്ര്യമുണ്ട്. ഈ അഭിമുഖത്തിൽ പങ്കെടുക്കുന്നതു കൊണ്ട് താങ്കൾക്ക് നേരിട്ട് നേട്ടങ്ങളൊന്നും ഉണ്ടാകില്ല, പക്ഷേ ഗവേഷണപഠനത്തിന്റെ ഫലങ്ങളുടെ പ്രചാരം മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിൽ അതിന്റെ ആവർത്തനം പ്രതിരോധിക്കാനുള്ള ഇടപെടലുകൾ വികസിപ്പിക്കുന്നതിന് ഭാവിയിൽ സഹായകമാകും.

താങ്കൾ നൽകുന്ന വിവരങ്ങൾ കർശനമായും രഹസ്യമായി സൂക്ഷിക്കും ഈ അഭിമുഖത്തിന്റെ വിശദാംശങ്ങൾ രേഖപ്പെടുത്തുകയും ഗവേഷണത്തിനുമാത്രമായി ഉപയോഗിക്കുകയും ചെയ്യും. താങ്കളുടെ പേര്, മറ്റ് വ്യക്തിവിവരങ്ങൾ, സമുദായം എന്നിവ കാണിക്കാതെയുള്ള രേഖയേ വിശകലനത്തിനുപയോഗിക്കു. താങ്കളുമായുള്ള അഭിമുഖത്തിന്റെ ശബ്ദലേഖനവും രേഖകളും ഞാൻ (മുഖ്യ ഗവേഷക) സുരക്ഷിതമായി സൂക്ഷിക്കുകയും പടനത്തിനവസാനം നശിപ്പിക്കുകയും ചെയ്യും.

ഈ പഠനത്തിൽ പങ്കെടുക്കാൻ താങ്കൾ സമ്മതിക്കുന്നു എങ്കിൽ ദയവായി ശ്രദ്ധയോടെ വായിച്ചശേഷം സമ്മതപത്രത്തിൽ ഒപ്പിടുക. പഠനത്തിന്റെ ഏതെങ്കിലും വശത്തെപ്പറ്റി താങ്കൾക്ക് എന്തെങ്കിലും സംശയമുണ്ടെങ്കിൽ ദയവായി താഴെ നൽകുന്ന മേൽവിലാസത്തിലുള്ളവരെ ബന്ധപ്പെടുക.

എന്നെ ബന്ധപ്പെടാൻ
ഷാനി എസ് ഡി (പിഎച്ച് ഡി വിദ്യാർത്ഥിനി)
ഫോൺ. 9446176372, ഇമെയിൽ. shanisd82@gmail.com

പിന്നീട് ഈ പഠനസംബന്ധമായി എന്തെങ്കിലും ചോദ്യങ്ങളോ ഉത്കണ്ഠകളോ ഉണ്ടാവുകയും എന്നോടല്ലാതെ മറ്റാരെങ്കിലുമായി സംസാരിക്കാൻ താത്പര്യപ്പെടുകയുമാണെങ്കിൽ സ്ഥാപനത്തിലെ നൈതീക കമ്മിറ്റി മെമ്പർ സെക്രട്ടറി ഡോ. മാല രാമനാഥനുമായി ബന്ധപ്പെടാം ഫോൺ 0471 -2524234 ഇമെയിൽ mala@sctimst.ac.in

അഭിമുഖം നടത്തുന്നയാളുടെ പേര്

അഭിമുഖം നടത്തുന്നയാളുടെ ഒപ്പ്

സമ്മത പത്രം

കാര്യവിവരണപത്രത്തിൽ നൽകിയിട്ടുള്ള വിവരങ്ങൾ ഞാൻ വായിച്ചു. പഠനത്തിന്റെ സ്വഭാവത്തെപ്പറ്റിയും എന്റെ പങ്കാളിത്തത്തെപ്പറ്റിയും വിശദീകരിക്കുകയും എന്റെ എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം നൽകുകയും ചെയ്തു. ഈ സമ്മതപത്രം ഒപ്പിടുന്നതിലൂടെ ,എന്നിൽനിന്നും എന്താണ് പ്രതീക്ഷിക്കുന്നതെന്നു ഞാൻ മനസ്സിലാക്കിയെന്നും ഈ പഠനത്തിൽ പങ്കെടുക്കാൻ എനിക്ക് സമ്മതമാണെന്നും സൂചിപ്പിക്കുകയാണ്. എനിക്ക് ഏതുസമയത്തും പിൻമാറാമെന്ന് എനിക്കറിയാം. ആവശ്യമുണ്ടാകുകയാണെങ്കിൽ ആരെ ബന്ധപ്പെടണമെന്നും എന്നെ അറിയിച്ചിട്ടുണ്ട്.

അഭിമുഖത്തിന് ഞാൻ സമ്മതിക്കുന്നു. അതെ ❑

ഒപ്പ് ……..

അല്ലെങ്കിൽ

താങ്കക്ക് പങ്കെടുക്കാൻ സമ്മതമില്ലെങ്കിൽ, താങ്കൾ തന്ന സമയത്തിന് നന്ദി

പ്രതികരിച്ചയാളുടെ പേര്……

മേൽവിലാസം…….

അഭിമുഖം നടത്തുന്നയാളുടെ പേര്

അഭിമുഖം നടത്തുന്നയാളുടെ ഒപ്പ്

പ്രതികരിച്ചയാളുടെ ഏകകമായ തിരിച്ചറിയൽ കോഡ്

തിയതി

സ്ഥലം

അച്ചുതമേനോൻ സെന്റർ ഫോർ ഹെൽത്ത് സയൻസ് സ്റ്റഡീസ്,
ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജി,
തിരുവനന്തപുരം, കേരളം 695011

പഠന ശീർഷകം: കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിന്റെ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം

പങ്കെടുക്കുന്നവർക്കുള്ള കാര്യവിവരണപത്രം – സന്നദ്ധ മസ്തിഷ്ക്കാഘാത രോഗികൾ

ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജി, തിരുവനന്തപുരത്തെ, അച്ചുതമേനോൻ സെന്റർ ഫോർ ഹോൽത്ത് സയൻസ് സ്റ്റഡീസിൽ ഡോക്ടർ ഓഫ് ഫിലോസഫിക്ക് (പിഎച്ച്ഡി) വേണ്ടിയുള്ള ഗവേഷണം നടത്തുന്ന ഷാനി എസ് ഡി എന്ന ഞാൻ *കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിന്റെ ഘടകങ്ങളും മരുന്ന് കൃത്യമായി കഴിക്കുന്നതിനു പ്രചോദനവും തടസ്സങ്ങളുമായ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം എന്ന വിഷയത്തിൽ നടത്തുന്ന ഗവേഷണ പഠനത്തിൽ താങ്കളുടെ പങ്കാളിത്തം അഭ്യർത്ഥിക്കുന്നു. മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കുന്നതിനുള്ള സാദ്ധ്യത വർദ്ധിപ്പിക്കുകയോ കുറയ്ക്കുകയോ ചെയ്യുന്ന വ്യത്യസ്ത ഘടകങ്ങളെപ്പറ്റിയാണ്* എന്റെ ഗവേഷണം.
മസ്തിഷ്ക്കാഘാതം വന്നു എന്നതിനാലാണ് താങ്കളെ ഈ പഠനത്തിനായി സമീപിക്കുന്നത്. താങ്കൾക്ക് മസ്തിഷ്ക്കാഘാതം ആവർത്തിക്കാതിരിക്കാൻ കാരണമായ ഘടകങ്ങളെന്തെല്ലാമെന്ന് അറിയാൻ എനിക്ക് താത്പര്യമുണ്ട്. മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിൽ ആവർത്തനമുണ്ടാകുന്നതിനെ പ്രതിരോധിക്കാൻ ഭാവിയിലെ ഇടപെടലുകളിൽ വികസനം ഉണ്ടാക്കുന്നതിൽ എനിക്കും മറ്റുള്ളവർക്കും മാർഗ്ഗദർശകമാകാൻ ഈ വിവരങ്ങൾക്കാകും.
ഈ അഭിമുഖത്തിൽ പങ്കെടുക്കാൻ താങ്കളുടെ 20-30 മിനിട്ട് സമയം വേണ്ടിവരും. താങ്കൾക്ക് അഭിമുഖത്തത്തിൽ പങ്കെടുക്കുന്നതിന് വിസമ്മതിക്കുകയോ അഭിമുഖം നടത്തുന്നതിനിടയിൽ ഏതു സമയത്തും അഭിമുഖം നിർത്താനാവശ്യപ്പെടാനോ ഏതെങ്കിലും ചോദ്യങ്ങൾക്ക് ഉത്തരം നൽകാതിരിക്കാനോ സ്വാതന്ത്ര്യമുണ്ട്. ഈ അഭിമുഖത്തിൽ പങ്കെടുക്കുന്നതുകൊണ്ട് താങ്കൾക്ക് നേരിട്ട് നേട്ടങ്ങളൊന്നും ഉണ്ടാകില്ല, പക്ഷേ ഗവേഷണപഠനത്തിന്റെ ഫലങ്ങളുടെ പ്രചാരണം മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിൽ അതിന്റെ ആവർത്തനം പ്രതിരോധിക്കാനുള്ള ഇടപെടലുകൾ വികസിപ്പിക്കുന്നതിന് ഭാവിയിൽ സഹായകമാകും.

താങ്കൾ നൽകുന്ന വിവരങ്ങൾ കർശനമായും രഹസ്യമായി സൂക്ഷിക്കും ഈ അഭിമുഖത്തിന്റെ വിശദാംശങ്ങൾ രേഖപ്പെടുത്തുകയും ഗവേഷണത്തിനുമാത്രമായി ഉപയോഗിക്കു

കയും ചെയ്യും. താങ്കളുടെ പേര്, മറ്റ് വ്യക്തിവിവരങ്ങൾ, സമുദായം എന്നിവ കാണിക്കാതെയുള്ള രേഖയേ വിശകലനത്തിനുപയോഗിക്കൂ. താങ്കളുമായുള്ള അഭിമുഖത്തിന്റെ ശബ്ദലേഖനവും രേഖകളും ഞാൻ (മുഖ്യ ഗവേഷക) സുരക്ഷിതമായി സൂക്ഷിക്കുകയും പടനത്തിനവസാനം നശിപ്പിക്കുകയും ചെയ്യും.

ഈപഠനത്തിൽ പങ്കെടുക്കാൻ താങ്കൾ സമ്മതിക്കുന്നു എങ്കിൽ ദയവായി ശ്രദ്ധയോടെ വായിച്ചശേഷം സമ്മതപത്രത്തിൽ ഒപ്പിടുക. പഠനത്തിന്റെ ഏതെങ്കിലും വശത്തെപ്പറ്റി താങ്കൾക്ക് എന്തെങ്കിലും സംശയമുണ്ടെങ്കിൽ ദയവായി താഴെ നൽകുന്ന മേൽവിലാസത്തിലുള്ളവരെ ബന്ധപ്പെടുക.

എന്നെ ബന്ധപ്പെടാൻ
ഷാനി എസ് ഡി (പിഎച്ച് ഡി വിദ്യാർത്ഥിനി)
ഫോൺ. 9446176372, ഇമെയിൽ. shanisd82@gmail.com

പിന്നീട് ഈ പഠനസംബന്ധമായി എന്തെങ്കിലും ചോദ്യങ്ങളോ ഉത്കണ്ഠകളോ ഉണ്ടാവുകയും എന്നോടല്ലാതെ മറ്റാരെങ്കിലുമായി സംസാരിക്കാൻ താത്പര്യപ്പെടുകയുമാണെങ്കിൽ സ്ഥാപനത്തിലെ നൈതീക കമ്മിറ്റി മെമ്പർ സെക്രട്ടറി ഡോ. മാല രാമനാഥനുമായി ബന്ധപ്പെടാം ഫോൺ 0471 -2524234 ഇമെയിൽ mala@sctimst.ac.in

അഭിമുഖം നടത്തുന്നയാളുടെ പേര്

അഭിമുഖം നടത്തുന്നയാളുടെ ഒപ്പ്

സമ്മത പത്രം

കാര്യവിവരണപത്രത്തിൽ നൽകിയിട്ടുള്ള വിവരങ്ങൾ ഞാൻ വായിച്ചു. പഠനത്തിന്റെ സ്വഭാവത്തെപ്പറ്റിയും എന്റെ പങ്കാളിത്തത്തെപ്പറ്റിയും വിശദീകരിക്കുകയും എന്റെ എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം നൽകുകയും ചെയ്തു. ഈ സമ്മതപത്രം ഒപ്പിടുന്നതിലൂടെ ,എന്നിൽനിന്നും എന്താണ് പ്രതീക്ഷിക്കുന്നതെന്നു ഞാൻ മനസ്സിലാക്കിയെന്നും ഈ പഠനത്തിൽ പങ്കെടുക്കാൻ എനിക്ക് സമ്മതമാണെന്നും സൂചിപ്പിക്കുകയാണ്. എനിക്ക് ഏതുസമയത്തും പിൻമാറാമെന്ന് എനിക്കറിയാം. ആവശ്യമുണ്ടാകുകയാണെങ്കിൽ ആരെ ബന്ധപ്പെടണമെന്നും എന്നെ അറിയിച്ചിട്ടുണ്ട്.

അഭിമുഖത്തിന് ഞാൻ സമ്മതിക്കുന്നു. അതെ ❑

ഒപ്പ് ……..

അല്ലെങ്കിൽ

താങ്കക്ക് പങ്കെടുക്കാൻ സമ്മതമില്ലെങ്കിൽ, താങ്കൾ തന്ന സമയത്തിന് നന്ദി

പ്രതികരിച്ചയാളുടെ പേര്……

മേൽവിലാസം…….

അഭിമുഖം നടത്തുന്നയാളുടെ പേര്

അഭിമുഖം നടത്തുന്നയാളുടെ ഒപ്പ്

പ്രതികരിച്ചയാളുടെ ഏകകമായ തിരിച്ചറിയൽ കോഡ്

തിയതി

സ്ഥലം

അച്ചുതമേനോൻ സെന്റർ ഫോർ ഹെൽത്ത് സയൻസ് സ്റ്റഡീസ്,
ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജി,
തിരുവനന്തപുരം, കേരളം 695011

പഠന ശീർഷകം: കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രിയിലെ മ സ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മരുന്ന് കൃത്യമായി കഴിക്കുന്നതിനു പ്രചോദനവും തട സ്സങ്ങളുമായ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം

പങ്കെടുക്കുന്നവർക്കുള്ള കാര്യവിവരണപത്രം –
രണ്ടാംഘട്ടത്തിലെ മസ്തിഷ്ക്കാഘാത രോഗികൾ

ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജി, തിരുവനന്തപുരത്തെ, അച്ചുതമേനോൻ സെന്റർ ഫോർ ഹോൽത്ത് സയൻസ് സ്റ്റഡീസിൽ ഡോക്ടർ ഓഫ് ഫിലോസഫിക്ക് (പിഎച്ച്ഡി) വേണ്ടിയുള്ള ഗവേഷണം നടത്തുന്ന ഷാനി എസ് ഡി എന്ന ഞാൻ *കേരളത്തിൽ, തിരുവനന്തപുരത്തെ മൂന്നാം ഘട്ടത്തിലുള്ള ആശുപത്രി യിലെ മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിലെ മരുന്ന് കൃത്യമായി കഴിക്കുന്നതിനു പ്രചോദ നവും തടസ്സങ്ങളുമായ ഘടകങ്ങളെ പറ്റിയുള്ള പഠനം എന്ന വിഷയത്തിൽ നടത്തുന്ന ഗവേഷ ണ പഠനത്തിൽ താങ്കളുടെ പങ്കാളിത്തം അഭ്യർത്ഥിക്കുന്നു.* .

താങ്കൾക്ക് മസ്തിഷ്ക്കാഘാതം ഉണ്ടാവുകയും ആവർത്തിക്കുന്ന അപായം പ്രതിരോധിക്കാ നായി അപായ ഘടകങ്ങൾ നിയന്ത്രിക്കാൻ മരുന്നുകൾ നിർദ്ദേശിക്കപ്പെടുകയും ചെയ്തി ട്ടുണ്ട് എന്നതിനാലാണ് താങ്കളെ ഈ പഠനത്തിനായി സമീപിക്കുന്നത്. താങ്കൾ എത്ര കൃത്യ മായി മരുന്നുകൾ കഴിക്കുന്നുണ്ടെന്നും നിർദ്ദേശിതമായ മരുന്ന് കൃത്യമായി കഴിക്കാൻ സഹായകമായ ഘടകങ്ങളും മരുന്നുകൾ പതിവായി കഴിക്കുന്നതിന് തടസ്സമാകുന്ന ഘടക ങ്ങളെപ്പറ്റിയും അറിയാൻ എനിക്ക് താത്പര്യമുണ്ട്. മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവ രിൽ ആവർത്തനമുണ്ടാകുന്നതിനെ പ്രതിരോധിക്കാൻ ഭാവിയിലെ ഇടപെടലുകളിൽ എന്ത് വികസനം ഉണ്ടാക്കുന്നതിൽ എനിക്കും മറ്റുള്ളവർക്കും മാർഗ്ഗദർശകമാകാൻ ഈ വിവര ങ്ങൾക്കാകും.

ഈ അഭിമുഖത്തിൽ പങ്കെടുക്കാൻ താങ്കളുടെ 25-35 മിനിട്ട് സമയം വേണ്ടിവരും. താങ്കൾക്ക് അഭിമുഖത്തിൽ പങ്കെടുക്കുന്നതിൽ വിസമ്മതിക്കുകയോ അഭിമുഖം നടത്തുന്നതിനിടയിൽ ഏതു സമയത്തും അഭിമുഖം നിർത്താനാവശ്യപ്പെടാനോ ഏതെങ്കിലും ചോദ്യങ്ങൾക്ക് ഉത്തരം നൽകാതിരിക്കാനോ സ്വാതന്ത്ര്യമുണ്ട്. ഈ അഭിമുഖത്തിൽ പങ്കെടുക്കുന്നതു കൊണ്ട് താങ്കൾക്ക് നേരിട്ട് നേട്ടങ്ങളൊന്നും ഉണ്ടാകില്ല, പക്ഷേ ഗവേഷണപഠനത്തിന്റെ ഫല ങ്ങളും പ്രചാരണവും മസ്തിഷ്ക്കാഘാതം അതിജീവിച്ചവരിൽ അതിന്റെ ആവർത്തനം പ്രതിരോധിക്കാനുള്ള ഇടപെടലുകൾ വികസിപ്പിക്കുന്നതിന് ഭാവിയിൽ സഹായകമാകും.

താങ്കൾ നൽകുന്ന വിവരങ്ങൾ കർശനമായും രഹസ്യമായി സൂക്ഷിക്കും ഈ അഭിമുഖ ത്തിന്റെ വിശദാംശങ്ങൾ രേഖപ്പെടുത്തുകയും ഗവേഷണത്തിനുമാത്രമായി ഉപയോഗിക്കു

കയും ചെയ്യും. താങ്കളുടെ പേര്, മറ്റ് വ്യക്തിവിവരങ്ങൾ, സമുദായം എന്നിവ കാണിക്കാതെയുള്ള രേഖയേ വിശകലനത്തിനുപയോഗിക്കൂ. താങ്കളുമായുള്ള അഭിമുഖത്തിന്റെ ശബ്ദലേഖനവും രേഖകളും ഞാൻ (മുഖ്യ ഗവേഷക) സുരക്ഷിതമായി സൂക്ഷിക്കുകയും പഠനത്തിനവസാനം നശിപ്പിക്കുകയും ചെയ്യും.

ഈ പഠനത്തിൽ പങ്കെടുക്കാൻ താങ്കൾ സമ്മതിക്കുന്നു എങ്കിൽ ദയവായി ശ്രദ്ധയോടെ വായിച്ചശേഷം സമ്മതപത്രത്തിൽ ഒപ്പിടുക. പഠനത്തിന്റെ ഏതെങ്കിലും വശത്തെപ്പറ്റി താങ്കൾക്ക് എന്തെങ്കിലും സംശയമുണ്ടെങ്കിൽ ദയവായി താഴെ നൽകുന്ന മേൽവിലാസത്തിലുള്ളവരെ ബന്ധപ്പെടുക.

എന്നെ ബന്ധപ്പെടാൻ
ഷാനി എസ് ഡി (പിഎച്ച് ഡി വിദ്യാർത്ഥിനി)
ഫോൺ. 9446176372, ഇമെയിൽ. shanisd82@gmail.com

പിന്നീട് ഈ പഠനസംബന്ധമായി എന്തെങ്കിലും ചോദ്യങ്ങളോ ഉത്കണ്ഠകളോ ഉണ്ടാവുകയും എന്നോടല്ലാതെ മറ്റാരെങ്കിലുമായി സംസാരിക്കാൻ താത്പര്യപ്പെടുകയുമാണെങ്കിൽ സ്ഥാപനത്തിലെ നൈതീക കമ്മിറ്റി മെമ്പർ സെക്രട്ടറി ഡോ. മാല രാമനാഥനുമായി ബന്ധപ്പെടാം ഫോൺ 0471 -2524234 ഇമെയിൽ mala@sctimst.ac.in

അഭിമുഖം നടത്തുന്നയാളുടെ പേര്

അഭിമുഖം നടത്തുന്നയാളുടെ ഒപ്പ്

സമ്മത പത്രം

കാര്യവിവരണപത്രത്തിൽ നൽകിയിട്ടുള്ള വിവരങ്ങൾ ഞാൻ വായിച്ചു. പഠനത്തിന്റെ സ്വഭാവത്തെപ്പറ്റിയും എന്റെ പങ്കാളിത്തത്തെപ്പറ്റിയും വിശദീകരിക്കുകയും എന്റെ എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം നൽകുകയും ചെയ്തു. ഈ സമ്മതപത്രം ഒപ്പിടുന്നതിലൂടെ ,എന്നിൽനിന്നും എന്താണ് പ്രതീക്ഷിക്കുന്നതെന്നു ഞാൻ മനസ്സിലാക്കിയെന്നും ഈ പഠനത്തിൽ പങ്കെടുക്കാൻ എനിക്ക് സമ്മതമാണെന്നും സൂചിപ്പിക്കുകയാണ്. എനിക്ക് ഏതുസമയത്തും പിൻമാറാമെന്ന് എനിക്കറിയാം. ആവശ്യമുണ്ടാകുകയാണെങ്കിൽ ആരെ ബന്ധപ്പെടണമെന്നും എന്നെ അറിയിച്ചിട്ടുണ്ട്.

അഭിമുഖത്തിന് ഞാൻ സമ്മതിക്കുന്നു. അതെ ❑

ഒപ്പ് ……..

അല്ലെങ്കിൽ

താങ്കക്ക് പങ്കെടുക്കാൻ സമ്മതമില്ലെങ്കിൽ, താങ്കൾ തന്ന സമയത്തിന് നന്ദി

പ്രതികരിച്ചയാളുടെ പേര്……

മേൽവിലാസം…….

അഭിമുഖം നടത്തുന്നയാളുടെ പേര്

അഭിമുഖം നടത്തുന്നയാളുടെ ഒപ്പ്

പ്രതികരിച്ചയാളുടെ ഏകകമായ തിരിച്ചറിയൽ കോഡ്

തിയതി

സ്ഥലം

श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान, त्रिवेन्द्रम
तिरुवनन्तपुरम - ६९५०११, केरल, इंडिया
SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY, TRIVANDRUM
Thiruvananthapuram - 695 011, Kerala, India
(An Institute of National Importance under Govt. of India)
Grams : Chitramet, Phone : +91-471-2443152, Fax : +91-471-2550728 / 2446433, E-mail : sct@sctimst.ac.in, Website : www.sctimst.ac.in

Institutional Ethics Committee

(IEC Regn No. ECR/189/Inst/KL/2013/RR-16)

SCT/IEC/ 1327/NOVEMBER-2019 24.01.2019

Ms. Shani SD
PhD Student, AMCHSS
SCTIMST, Thiruvananthapuram

Dear Ms. Shani,

The Institutional Ethics Committee reviewed your application to conduct the study entitled "FACTORS ASSOCIATED WITH STROKE RECURRENCE AND FACILITATORS AND BARRIERS TO MEDICATION ADHERENCE AMONG STROKE SURVIVORS IN TERTIARY CARE HOSPITAL, THIRUVANANTHAPURAM, KERALA (IEC/1327)" on 24th January, 2019.

The following documents were reviewed:

Original submission

1. Covering letter addressed to the Chairperson, IEC, SCTIMST dated 26.11.2018 with check list
2. TAC Approval Letter 3. IEC Application Form 4. Project Proposal 5. CV of Principal Investigator and Co-PI
6. Cross Sectional Survey- Participant Information Sheet and Informed Consent Form in English and Malayalam
7. Case control study- Participant Information Sheet and Informed Consent Form in English and Malayalam
8. Clinical information sheet Phase I 9. Modified Morisky medication adherence scale in English and Malayalam
10. Barthel index and mRS scale 11. Interview schedule for Phase I and II in English and Malayalam

Revised submission

1. Covering letter addressed to the Chairperson, IEC, SCTIMST dated 21.01.2019 with check list
2. List of IEC comments and modifications done 3. TAC Approval Letter 4. IEC Application Form 5. Project Proposal
6. Cross Sectional Survey- Participant Information Sheet and Informed Consent Form in English and Malayalam
7. Case control study- Participant Information Sheet and Informed Consent Form in English and Malayalam
8. Clinical information sheet Phase I 9. Modified Morisky medication adherence scale in English and Malayalam
10. Barthel index and mRS scale 11. Interview schedule for Phase I and II in English and Malayalam
12. CV of Principal Investigator and Co-PI

The IEC Review Criteria

The study fulfils the expedited criteria from ethics review criteria vide section 9.1 of the Standard Operating Procedures (April 2017) of the SCTIMST-IEC.

IEC Decision

The IEC approved the conduct of the study in the present form.

Remarks:

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent and asks to be provided a copy of the final report.

There was no member of the study team who participated in voting / decision making process. The ethics committee is organized and operated according to the requirements of Good Clinical Practice and the requirements of the Indian Council of Medical Research (ICMR).

Sincerely,

Mala Ramanathan
Member Secretary, IEC

Appendix - XII

Guideline for planning discharge of stroke survivors for risk factor control

Recurrent brain ischemia is associated increased morbidity and health care cost in stroke survivors. This discharge planning guideline is prepared to plan comprehensively while a stroke patient is being discharged from hospital so that all the risk factors are identified and corrective actions taken as appropriately based on evidence-based recommendations for the prevention of future strokes. This guideline is prepared based on the American Stroke Association Guideline for the Prevention of Stroke in Patients with Stroke and Transient Ischemic Attack. The discharge education module is prepared based on the secondary stroke prevention guideline by the American Stroke Association, 'Reading Material for ASHA workers'; prepared and published jointly by the Ministry of Health and Family Welfare and National Rural health Mission and 'Reducing Risk of Non Communicable Diseases: Handbook for Counsellors' prepared by the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke under the Directorate General of Health Services, Ministry of Health and Family welfare, Government of India.

Recommendations

All stroke and TIA patients must undergo a risk assessment for recurrent stroke and categorized accordingly by a physician trained in stroke care to initiate appropriate investigations and management strategies. Every patient should be evaluated promptly for modifiable risk factors within one week of onset.

Basic investigations

- Basic investigations include: CT brain preferably with CTA or brain MRI with MRA, carotid ultrasound, ECG, Echo cardiography, complete blood count, serum electrolytes, creatinine, fasting lipid profile, fasting glucose level, HbA1C, coagulation profile, liver function test.

- In selected patients, when basic investigations are inconclusive, Holter monitoring for 24-48 hours should be done, especially in suspected arrhythmia cases
- In patients below 45 years of age without apparent cause, additional tests like serum VDRL, HIV and anti-phospholipid antibodies, protein C, S and anti-thrombin III, antinuclear antibodies, anti-cardio lipid antibodies should be done.

Risk Factors:

Hypertension:

- Initiate of blood pressure (BP) therapy is indicated for previously untreated patients with ischemic stroke or TIA who, after the first several days, have an established BP ≥140 mm Hg systolic or ≥90 mm Hg diastolic.
- Resume of BP therapy is indicated for previously treated patients with known hypertension.
- It is reasonable to achieve a systolic pressure <140 mm Hg and a diastolic pressure <90 mm Hg.
- Advice on life style modifications like salt restriction (2.4g/day and 15g/day for greater BP reduction) weight reduction, consumption of a diet rich in fruits, vegetables, and low-fat dairy products, regular aerobic physical activity and limited alcohol consumption.

Dyslipidaemia:

- Initiate statin therapy to reduce LDL<100mg/dl
- Advice life style modifications and dietary recommendations

Disorders of Glucose Metabolism and DM:

- After a TIA or ischemic stroke, all patients should probably be screened for DM with testing of fasting plasma glucose, HbA1c, or an oral glucose tolerance test.
- Perform the A1C test at least two times a year in patients who are meeting treatment goals and who have stable glycaemic control.

- Perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycaemic goals
- An A1C goal for adults of <7% (53 mmol/mol) is appropriate. On the basis of provider judgment and patient preference, achievement of lower A1C levels (such as <6.5%) may be acceptable if this can be achieved safely without significant hypoglycaemia or other adverse effects of treatment
- See Pharmacologic Approaches to Glycaemic Treatment: Standards of Medical Care in Diabetes—2020 for more detailed information on pharmacologic approaches to type 1 diabetes management.
- Advice life style modifications and dietary recommendations

Obesity and metabolic syndrome:

- All patients with TIA or stroke should be screened for obesity with measurement of body mass index
- For patients who are screened and classified as having the metabolic syndrome, management should focus on counselling for lifestyle modification (diet, exercise, and weight loss)

Physical inactivity:

- For patients with ischemic stroke or TIA who are capable of engaging in physical activity, at least 3 to 4 sessions per week of moderate- to vigorous-intensity aerobic physical exercise are reasonable to reduce stroke risk factors. Sessions should last an average of 40 minutes.
- Moderate-intensity exercise is typically defined as sufficient to break a sweat or noticeably raise heart rate (Eg. walking briskly, using an exercise bicycle). Vigorous-intensity exercise includes activities such as jogging
- Refer patients who are willing to increase physical activity to a comprehensive behavioural oriented program
- For individuals with disability after ischemic stroke, supervision by a healthcare professional such as a physical therapist or cardiac rehabilitation professional, at least on initiation of an exercise regimen, may be considered

Unhealthy diet:

- Conduct a nutritional assessment for patients with a history of ischemic stroke or TIA, looking for signs of overnutrition or undernutrition
- Patients with a history of ischemic stroke or TIA and signs of undernutrition should be referred for individualized nutritional counselling
- Recommend patients with a history of stroke or TIA reduce their sodium intake to less than ≈2.4 g/d. Further reduction to <1.5 g/d is also reasonable and is associated with even greater BP reduction
- Counsel patients with a history of stroke or TIA to follow a Mediterranean-type

  diet instead of a low-fat diet. The Mediterranean-type diet emphasizes vegetables, fruits, and whole grains and includes low-fat dairy products, poultry, fish, legumes, olive oil, and nuts. It limits intake of sweets and red meats

Sleep apnoea:

- A sleep study might be considered for patients with an ischemic stroke or TIA Treatment with continuous positive airway pressure might be considered for patients with sleep apnoea.

Carotid disease, intracranial atherosclerotic disease, atrial Fibrillation, valvular heart disease, Coronary heart disease, structural heart diseases, hypercoagulable states, Homocysteinemia, sickle cell disease, pregnancy and breast feeding should be identified and appropriate secondary stroke prevention strategies are to be initiated as per standard guidelines.

Haemorrhagic stroke

- Mainstay of secondary prevention of intra cerebral haemorrhage (ICH) is control of hypertension. Those who had ICH, whether hypertensive or amyloid angiopathy or subarachnoid haemorrhage, the blood pressure should be controlled to the target level of 130-135/80-85 mmHg

Appendix -XIII

Check list for discharge planning and education for stroke survivors

Name:

Age:

Sex:

Type of stroke:

Height:

Weight:

Investigations: CT/ CTA / brain MRI with MRA/ carotid ultrasound/ ECG/ Echo cardiography/ complete blood count/ serum electrolytes/ creatinine/ fasting lipid profile/ fasting glucose level/ HbA1C/ coagulation profile/ liver function test.

Risk factors

Risk Factor	**Yes/No**	**Interventions planned**	**Interventions done**	**Remarks**
Hypertension				
Diabetes				
Dyslipidaemia				
Obesity and metabolic syndrome				
Physical inactivity				
Unhealthy diet				
Smoking				
Alcohol use				
Carotid disease				
Intracranial atherosclerotic disease				
Atrial Fibrillation				
Valvular heart disease				
Coronary heart disease				
Structural heart diseases				
Hypercoagulable states				

Homocysteinemia				
Sickle cell disease				
Pregnancy				
Breast feeding				
Need of physiotherapy				
Feeding problems				
Need of speech therapy				
Need of occupational therapy				
Financial problems				

Patient/ care giver educated in		**Yes**	**No**	**NA**
	Cardiovascular risk factors			
	Personal risk factors			
	Stroke warning sign and symptoms			
	Emergency stroke number			
	Prescribed medication and adherence			
	Physiotherapy			
	Ryle's tube feeding			
	Diet			
	Physical activity			
	Follow up care			
	Monitoring of risk factor control			

Appendix – XIV

Discharge education module for stroke survivors to prevent recurrent strokes- For use by health care providers

Cardiovascular risk factors: Inform patients about their risk factors for stroke and stroke recurrence.

Hypertension

- Get B.P. checked at regular intervals
- If suffering from high B.P. or any symptoms such as headache, chest discomfort or pain, take advise of doctors for regular treatment.
- Don't stop or change medicines on your own or advice of friends.
- Avoid use of tobacco, alcohol, fried foods.
- Reduce intake of salt (1.5g/day) and oily food.
- Exercise regularly.
- Increase intake of seasonal fruits and vegetables.
- Avoid stress, practice meditation, yoga, spend quality time with children.
- Control weight.

Diabetes

- Get Blood Sugar checked regularly and if high consult doctor and follow advise. Perform A1C test quarterly. Maintain $HbA_1C<7$ and fasting sugar between 80-130 and post prandial sugar <180
- Patients using insulin should have an examination of insulin injection sites on a routine basis
- Self monitoring of blood sugar can be done to avoid hypoglycemia.
- If you experience hypoglycaemia with blood glucose <70 mg/dL, glucose (15–20 g) is to be administered orally for a conscious individual or any form

of carbohydrate that contains glucose may be used. Fifteen minutes after treatment, if blood sugar shows continued hypoglycaemia, the treatment should be repeated. Once blood sugar returns to normal, the individual should consume a meal or snack to prevent recurrence of hypoglycaemia.

- Don’t stop or change medication on your own or advice of friends.
- Take advice of doctor for regular tests e.g. kidney function, eye check up etc.
- Exercise regularly and control weight.
- Avoid excess sugar, sweets, ice cream, chocolate, candies, fried foods e.g. poori, paratha, potatoes, sweet potatoes, fruits with high sugar e.g. grapes, mangoes, banana etc.
- Avoid tobacco use, alcohol, junk food e.g. aerated drinks, pizzas, burgers, and other kinds of fast foods.
- Cook food in minimum oil.
- Increase intake of seasonal green leafy vegetables.

Dyslipidaemia:

- Maintain Total cholesterol<200mg/dl and low density lipoprotein<100mg/dl
- Continue medicine as recommended
- Initiate lifestyle modifications and dietary recommendations
    - ✓ Eat plenty of fruits and vegetables, whole grains and protein mostly from plants. *Apples, grapes, strawberries, citrus fruits, oats, soya protein-contain soluble fibre. Include* daily 20 to 35 grams of fibre in diet
    - ✓ **Reduce saturated fats.** Saturated fats, found primarily in red meat and full-fat dairy products
    - ✓ **Eliminate trans fats.** Trans fats, sometimes listed on food labels as "partially hydrogenated vegetable oil," are often used in margarines and store-bought cookies, crackers and cakes.
    - ✓ Eat foods rich in omega-3 fatty acids. Omega-3 fatty acids don't affect LDL cholesterol. But they have other heart-healthy benefits, including reducing blood pressure. Foods with omega-3

fatty acids include salmon, mackerel, herring, walnuts and flaxseeds.

- ✓ **Add whey protein.** Whey protein, which is found in dairy products,
- ✓ Increase physical activity
- ✓ Avoid smoking, limit alcohol use

Risk of recurrence:

One out of every four stroke, one is recurrent. Around 12 out of 100 stroke patients are getting recurrent stroke within one year. Medication adherence among stroke survivors is found to be decreasing from three months onwards and more than 50% of stroke survivors are not adherent to medications. Medication non adherence is found to be associated with stroke recurrence. There is poor risk factor control among stroke survivors due to poor medication adherence and unhealthy life style. The discharge time of the index stroke is the ideal time to impart these information and patients will be more receptive. Medication adherence, life style modification and risk factor control are essential to prevent recurrent strokes.

Stroke warning signs and symptoms:

- ✓ Stroke is a brain attack.
- ✓ It is an emergency.
- ✓ It is due to disruption of blood supply to an area of brain. Blood supply may be stopped due to a blood clot/break in blood vessel.

Emergency stroke number: 0471 2524333

Contact stroke emergency number of SCTIMST if you experience any warning symptoms of stroke: 0471 2524 333 and contact stroke office for clearing any other doubts 0471 2524363

Prescribed medications:

Explain the prescribed medications of the patient, action and common side effects

Medication adherence:

- ✓ Do not stop medication without doctor's advice
- ✓ Never skip medications
- ✓ Ask family members to remind if you experience forgetfulness
- ✓ Keep a routine for medication intake
- ✓ Couple it with other activity which you regularly do without fail
- ✓ Buy medicine for one month
- ✓ Use a pill box to keep medicine separately for each time of day for a whole week if you experience difficulty in taking medication as per prescription
- ✓ Communicate with the doctor if you experience any side effects of medication
- ✓ Regularly monitor for risk factor control

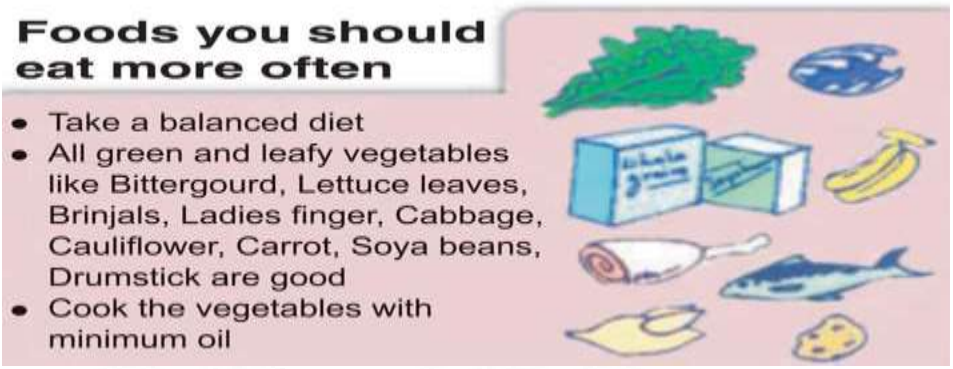
- ✓ Contact nearby PHC for available free medications

Physical activity:

- ✓ Make daily exercise a routine.
- ✓ Exercise for a minimum period of 30 min. daily, which can be split into intervals.
- ✓ Form a habit of using stairs.
- ✓ Include exercise in your routine work, develop a habit of walking e.g. to school,
  market, friend's house, workplace etc.
- ✓ Examples of simple and comfortable exercises are walking, cycling, jogging, swimming, dancing, playing games/sports, yoga, gardening and household chores-washing, mopping etc.

Healthy diet

- ✓ Wash vegetables & fruits properly before cooking.
- ✓ Develop the habit of taking meals at regular intervals.
- ✓ Avoid overeating.
- ✓ Use boiling, steaming, grilling etc. as methods of cooking.
- ✓ Increase of locally available seasonal fruits and green leafy vegetables in the diet. Add around 300-400gms of vegetable and one medium sized fruit per day in your diet.
- ✓ Avoid fried foods, restrict intake of ghee, oils.
- ✓ Reduce salt and sugar intake.
- ✓ Avoid intake of aerated drinks (cola), fast/processed food (Chips, burger, samosa)
- ✓ Increase intake of milk, butter milk, Lassi, coconut water etc.



Smoking:

Tobacco kills 8-9 lakh people every year in India. Tobacco smoke contains over 4000 harmful and poisonous chemicals. Use of tobacco products leads to diseases of the heart, lungs, cancer, blindness, etc. Use of gutka, khaini and other chewing forms of tobacco leads to cancer of mouth, food pipe and stomach. Use of tobacco by pregnant women leads to low birth weight of babies and still birth. Persons exposed to Second Hand Smoke (SHS Smoke from other person's cigarette/bidis) suffer from cancer and diseases of lungs. Young children in the family of smokers are prone to develop respiratory diseases and diseases of ear. Quitting is possible. Consult the doctor or nearest Health facility

TIPS TO QUIT TOBACCO

- ✓ Decide a DATE to QUIT
- ✓ Be confident and strong
- ✓ REMOVE all Tobacco products around you (home, office etc.)
- ✓ Drink lot of water

- ✓ Take HELP from a doctor or a Tobacco Cessation Clinic

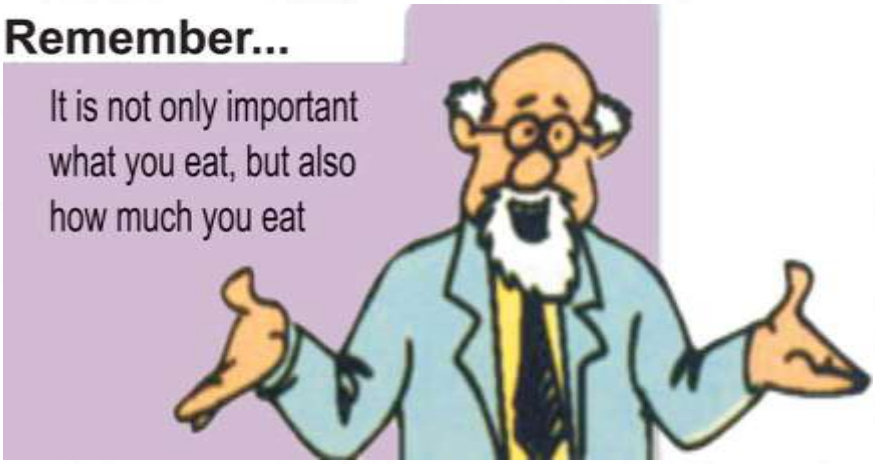
Alcohol use:

Alcohol use is associated with diseases of heart, liver, kidney, brain, cancers etc. Alcohol has socio economic effects also, leading to problems in the family, compromising of essential goods/items. Alcohol is not accepted in general by family members whose needs are compromised, e.g. children, wife, parents. Predisposes to fights, accidents, depression.

Obesity:

Communicate the risk of obesity. A sudden return to normal body weight may be difficult. A 10% weight loss can be an initial realistic goal. Changing eating habits is challenging.

- ✓ Change the meal composition ((with more vegetables, fruits and fibres).
- ✓ Daily intake should be roughly divided into: One quarter of fruits; One quarter of vegetables; One quarter of carbohydrates; and One quarter consisting of: milk and dairy, meat, fish and alternatives, fats and sugary food (smallest portion).
- ✓ Three meals and three snacks, with an emphasis on healthy snack choices.
- ✓ Start with two or three specific changes e.g.: Fruit instead of sweets; mustard oil or sunflower oil instead of butter, palm oil.
- ✓ Limit fatty meat, dairy fat and cooking oil (less than two tablespoons per day).
- ✓ Replace other meat with chicken (without skin).
- ✓ Reduce the serving or portion size.
- ✓ Encourage different eating patterns (e.g. slowing the rate of eating and limiting the time and place of eating).



Follow up care

Review in stroke clinic as per the instructions by the doctor and appointments. Do blood investigations as per instruction. Visit nearby physician every month to check the blood pressure, blood sugar, cholesterol level and weight as appropriately.

Monitoring of risk factor control

Blood sugar, blood pressure and cholesterol values are to be checked and to see whether it is in normal limits or not. If it is not controlled consult physician and get advice.

Ryles tube feeding:

- ✓ Demonstrate tube feeding
- ✓ Teach preparation of feeds
- ✓ Give a sample menu
- ✓ Review as per instructed for swallow screening

Physiotherapy:

Continue home physiotherapy. Include specific instructions for home exercise program, instructions about safety measures, possible complications and their prevention strategies, patients' special needs (artificial airway care, pressure sores, and altered sensorium), home modification and use of orthotics and adaptive devices if any.

Specific instructions for patients on Vit K antagonists

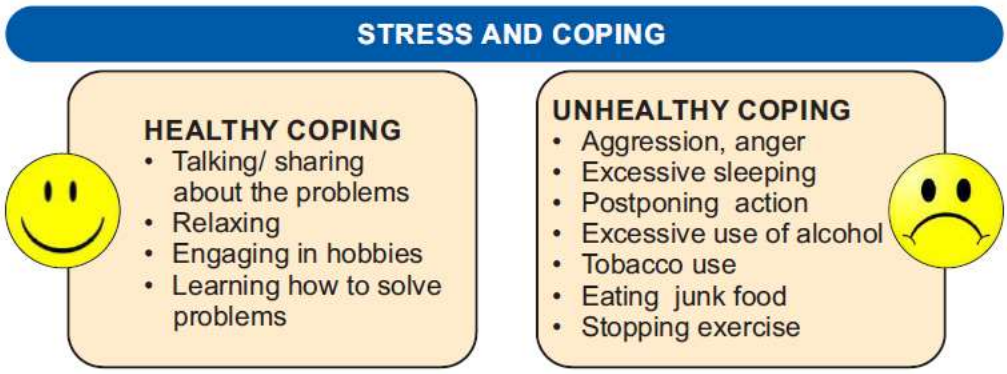
- If the patient is receiving Warfarin or similar drugs check your INR every month.
- For patients with mechanical aortic/mitral valve with history of ischemic stroke/TIA prior to its insertion, target INR of 2.5 and 3.0 respectively. If it is for DVT treatment or nonvalvular atrial fibrillation, achieve a target INR of 2.0-3.0.
- If the patient is receiving Vitamin K antagonists like warfarin, keep vitamin K intake in the diet steady. Vitamin K is required to help the blood to clot. If the level of Vit K vary in the diet too much, it will require repeated dose adjustment of blood thinner.
- People who take blood thinner can eat a normal diet. But it is important to make sure you get approximately the same amount of vitamin K each day.
- The best way to ensure a proper dosage of the nutrient is through a balanced, healthy diet that includes foods with almost equal amount of vitamin K at each meal. Sudden increase or decrease in foods rich in vitamin K should be avoided. The common food sources of Vitamin K are given in the below table.
- Restrict green leafy vegetables such as spinach, mustard leaves, coriander leaves, pudina, cauliflower, cabbage, tomato and egg yolk. Avoid Mustard oil and soyabean oil.
- Stop smoking and avoid alcohol and maintain ideal body weight.

Vitamin K Contents of food(µg/100 gm)

Food	Vit K	Food	Vit K
Mung	33	Apples	4
Snap	28	Banana	0.5
Asparagus	39	Oranges	1.3
Tomato	48	Peaches	3
Spinach	266	Straw berries	14
Kale	275	Eggs	50
Lettuce	113	Egg yolk	149
Soybean oil	200	Beef liver	104
Canola(rapeseed)	830	Chicken	80
Olive oil	58	Pork Liver	88
Oats	63	Rice	0.05
Wheat	20	Wheat Bran	83
Wheat germ	39	Peas	28

Avoid Stress

Encourage healthy ways of coping



പക്ഷാഘാത രോഗികളിൽ രോഗാവർത്തനം ഉണ്ടാകാതിരിക്കുന്നതിനും ജീവിതശൈലി ക്രമീകരിക്കുന്നതിനുമുള്ള മാർഗ്ഗനിർദ്ദേശങ്ങൾ

കൃത്യമായ മരുന്നുകളുടെ ഉപയോഗം ജീവിതശൈലി ക്രമീകരണം എന്നിവയിലൂടെ പക്ഷാഘാത ആവർത്തനം ഒരു പരിധിവരെ തടയാൻ കഴിയും. അതിനായി താഴെപരയുന്ന കാര്യങ്ങൾ കൃത്യമായി **പാലിക്കേണ്ടതാണ്**

ജീവിതശൈലീരോഗങ്ങളുടെ നിയന്ത്രണം

രക്താതിസമ്മർദ്ദം

- കൃത്യമായ ഇടവേളകളിൽ രക്തസമ്മർദ്ദം പരിശോധിക്കുക, രക്തസമ്മർദ്ദം 140/90-നു താഴെ നിർത്തുക
- തലവേദനയോ നെഞ്ചുവേദനയോ അനുഭവപ്പെട്ടാൽ ഡോക്ടറുടെ ഉപദേശം തേടി കൃത്യമായി മരുന്നുകൾ കഴിക്കുക
- മരുന്നുകൾ മുടക്കുകയോ സ്വന്ത താത്പര്യ പ്രകാരം നിർത്തുകയോ ചെയ്യാതിരിക്കുക
- മദ്യപാനം, പുകയിലയുടെ ഉപയോഗം എന്നിവ നിർത്തുക
- ഒരു ദിവസം ഏകദേശം 1.5 ഗ്രാമിൽ കൂടുതൽ ഉപ്പിന്റെ ഉപയോഗം പാടില്ല
- കൃത്യമായി വ്യയാമം ചെയ്യുക
- പച്ചക്കറിയും ഫലവർഗ്ഗങ്ങളും ധാരാളം ഉപയോഗിക്കുക, എണ്ണയുടെ ഉപയോഗം കുറയ്ക്കുക
- ഭാരം കുറയ്ക്കുക
- അനാവശ്യമായ പിരിമുറുക്കം ഒഴിവാക്കുക

പ്രമേഹം

- കൃത്യമായ ഇടവേളകളിൽ പഞ്ചസാരയുടെ അളവ് പരിശോധിക്കുക, ആഹാരത്തിനു മുമ്പുള്ള പഞ്ചസാരയുടെ അളവ് 80-130 മില്ലിഗ്രാം/dl, ആഹാരത്തിനു ശേഷമുള്ളത് 180നു താഴെയും ഗ്ലൈക്കോസിലേറ്റഡ് ഹീമോഗ്ലോബിൻ 7നു താഴെയും നിലനിർത്തുക
- മരുന്ന് കൃത്യമായി കഴിക്കുക
- കൃത്യമായി വ്യയാമം ചെയ്യുക
- അനുയോജ്യമായ ഭാരം നിലനിർത്തുക
- എണ്ണപ്പലഹാരങ്ങൾ, മധുരപദാർത്ഥങ്ങൾ, കിഴങ്ങുവർഗ്ഗങ്ങൾ, മധുരമുള്ള പഴവർഗ്ഗങ്ങൾ എന്നിവ ഒഴിവാക്കുക
- മദ്യപാനം, പുകയിലയുടെ ഉപയോഗം മധുര പാനീയങ്ങൾ എന്നിവ ഒഴിവാക്കുക
- പ്രാദേശീകമായി ലഭ്യമായിട്ടുള്ള പച്ചക്കറികളും ഇലക്കറികളും ധാരാളമായി ഉപയോഗിക്കുക

ഡിസ്ലിപിഡിമിയ

- രക്തത്തിലെ കൊഴുപ്പിന്റെ അളവ് 200നു താഴെയും, LDLന്റെ അളവ് 100നു താഴെയും നിലനിർത്തുക
- നിർദ്ദേശിക്കപ്പെട്ട പ്രകാരം മരുന്ന് കൃത്യമായി കഴിക്കുക
- ജീവിതശൈലീമാറ്റങ്ങൾ വേണ്ടതുപോലെ പാലിക്കുക
- പച്ചക്കറികളും പഴവർഗ്ഗങ്ങളും ധാന്യങ്ങളും ധാരാളമായി കഴിക്കുക
- നാരുകൾ അടങ്ങിയ ആഹാരം കഴിക്കുക. ഉദാ: ഓറഞ്ച്, സോയാബീൻ, ഓട്സ്
- കൊഴുപ്പടങ്ങിയ ഇറച്ചി എണ്ണ എന്നിവയുടെ ഉപയോഗം കുറയ്ക്കുക
- പാടനീക്കിയ പാൽ, തൊലികളഞ്ഞ കോഴി ഇറച്ചി, മീൻ എന്നിവ ആഹാരത്തിൽ ഉൾപ്പെടുത്തുക
- വ്യായാമം ചെയ്യുക, മദ്യപാനവും പുകയിലയുടെ ഉപയോഗവും നിർത്തുക

പക്ഷാഘാത ലക്ഷണങ്ങൾ

- പക്ഷാഘാത ആവർത്തനത്തിന്റെ ലക്ഷണങ്ങൾ
- ചുണ്ട് കോടൽ, കൈ തളർച്ച, നാക്കു കുഴച്ചിൽ എന്നിവ അനുഭവപ്പെട്ടാൽ ഉടനടി ചികിത്സ തേടുക.

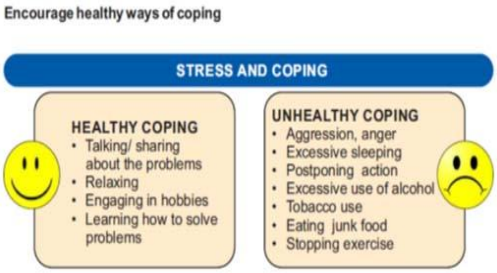
ശ്രീ ചിത്രയിലെ സ്ട്രോക്ക് എമർജൻസി നമ്പർ: 0471 – 2524333

മരുന്നുകളുടെ കൃത്യമായ ഉപയോഗം

- ഡോക്ടറുടെ നിർദ്ദേശപ്രകാരമുള്ള എല്ലാ മരുന്നുകളും മുടങ്ങാതെ കഴിക്കുക
- ദിവസവും കൃത്യമായ സമയങ്ങളിൽ മരുന്ന് കഴിക്കുക, സ്ഥിരമായി ചെയ്യുന്ന കാര്യങ്ങളുമായി ബന്ധപ്പെടുത്തുന്നതുവഴി മറവി ഒഴിവാക്കാം
- കൃത്യമായ ഇടവേളകളിൽ വൈദ്യപരിശോധന നടത്തി, പാർശ്വഫലങ്ങൾ, രോഗ നിയന്ത്രണം, മരുന്നിന്റെ ആവശ്യകത എന്നിവ പരിശോധിക്കുക

സമീകൃതാഹാരം

- കൃത്യമായ ഇടവേളകളിൽ ഭക്ഷണം കഴിക്കുക
- എണ്ണ ഉപയോഗിക്കാത്ത പാചകരീതികൾ അവലംബിക്കുക
- ഒരു ദിവസം 300-400ഗ്രാം പച്ചക്കറി ആഹാരത്തിൽ ഉൾപ്പെടുത്തുക
- ഇടത്തരം വലുപ്പമുള്ള ഒന്നോ രണ്ടോ പഴവർഗ്ഗങ്ങൽ ദിവസവും ഉപയോഗിക്കുക
- വറുത്തവ, എണ്ണ, നെയ്യ്, പഞ്ചസാര, മറ്റു പാനീയങ്ങൾ, ജങ്ക് ഫുഡ് എന്നിവ ഉപയോഗിക്കാതിരിക്കുക
- പാടനീക്കിയ പാൽ, തൊലികളഞ്ഞ കോഴി ഇറച്ചി, പയർ, പരിപ്പ് എന്നിവ ആഹാരത്തിൽ ഉൾപ്പെടുത്തുക
- പുകവലി, മദ്യപാനം ഒഴിവാക്കുക

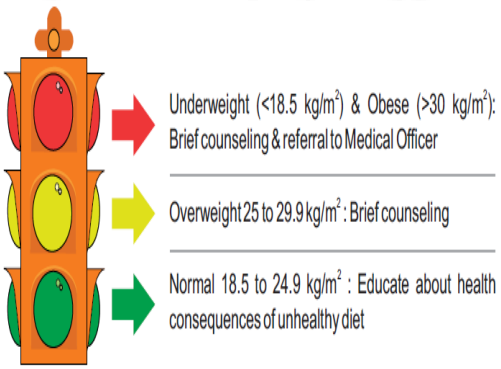


വ്യായാമം

- ദിവസവും കൃത്യ സമയങ്ങളിൽ വ്യായാമം ചെയ്യാനായി മാറ്റി വയ്ക്കുക
- ദിവസവും 30 മിനിറ്റ് ഇതിനായി മാറ്റി വയ്ക്കുക
- യാത്രകൾ - നടന്നു പോകാൻ പറ്റുന്ന സാഹചര്യങ്ങൾ പരമാവധി പ്രയോജനപ്പെടുത്തുക
- നടത്തം, സൈക്ലിംഗ്, നീന്തൽ, നൃത്തം, യോഗ, വീട്ടുജോലികൾ കളികൾ എന്നിവ വ്യായാമമായി ചെയ്യാവുന്നതാണ്

പൊണ്ണത്തടി

- ആഹാരത്തിൽ നാലിൽ ഒരുഭാഗം പച്ചക്കറികളും, നാലിൽ ഒന്ന് മാംസ്യം അടങ്ങിയവയും ഉൾപ്പെടുത്തുക
- ആഹാരത്തിന്റെ അളവ് കുറയ്ക്കുക
- ഒന്നോ രണ്ടോ മാറ്റങ്ങൾ ഒരു തവണ പരീക്ഷിക്കുക. ഉദാ: വെണ്ണയ്ക്കു പകരം സസ്യഎണ്ണ.
- സാവകാശം ചവച്ചരച്ച് കഴിക്കുക
- മൂന്നു നേരം ആഹാരം, രണ്ടുനേരം ആരോഗ്യകരമായ ലഘു ഭക്ഷണം എന്ന ക്രമം തുടങ്ങുക.



തുടർചികിത്സ

- കൃത്യമായ ഇടവേളകളിൽ വൈദ്യപരിശോധന നടത്തി രോഗാവസ്ഥയുടെ നിയന്ത്രണം മനസ്സിലാക്കുക

രക്തം കട്ടപിടിക്കാതിരിക്കാനുള്ള മരുന്ന് കഴിക്കുന്നവരുടെ പ്രത്യേക ശ്രദ്ധയ്ക്ക്

- വാർഫാരിൻ ഗുളിക കഴിക്കുമ്പോൾ INR മാസത്തിൽ ഒരു തവണ പരിശോധിക്കുക
- ഡോക്ടർ നിർദ്ദേശിച്ച അളവിൽ നിലനിർത്തുക. വേണ്ടിവന്നാൽ ഡോക്ടറുടെ നിർദ്ദേശാനുസരണം മരുന്ന് ക്രമീകരിക്കുക
- വിറ്റാമിൻ K അടങ്ങിയ ആഹാരത്തിന്റെ ആളവ് ദിവസവും ഏകദേശം കൃത്യമായിരിക്കാൻ ശ്രദ്ധിക്കണം
- മദ്യപാനം, പുകവലി, അമിത വണ്ണം ഇവ ഒഴിവാക്കുക

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