A Study of Stroke in Southern Ghana:

Epidemiology, Quality of Life and Community Perceptions

Eric Sampane-Donkor

Thesis Submitted for the degree of Philosophiae Doctor

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Rannsókn á heilablóðfalli í suður Gana:

Faraldsfræði, lífsgæði og samfélagsviðhorf

Eric Sampane-Donkor

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ÁGRIP

Bakgrunnur: Heilablóðfall er sjúkdómur sem er mjög mikilvægur lýðheilsu og getur haft í för með sér gríðarlegar efnahags- og félagslegar afleiðingar. Í Gana mælist heilablóðfall meðal efstu þriggja algengustu dánarorsaka og er ein helsta ástæða sjúkrahússinnlagna hjá fullorðnu fólki. Þrátt fyrir hátt og aukið álag á lýðheilsu sökum heilablóðfalls eru fáar nýlegar rannsóknir tengdar málefninu að finna í landinu. Þar af leiðandi er lítil þekking til staðar um ýmsa þætti heilablóðfalls í Gana sem setur virku eftirliti miklar takmarkanir þar í landi.

Markmið: Markmið doktorsverkefnisins var að (a) lýsa faraldsfræðilegum einkennum þeirra sem lifðu af heilablóðfall í Suður Gana (b) meta heilsutengd lífsgæði (HRQoL) þeirra sem lifa af heilablóðfall og bera kennsl á tilheyrandi áhrifaþætti (c) meta áhættu samfélagsáunninar bakteríumigu meðal þeirra sem lifa af heilablóðfall (d) meta þekkingu, viðhorf og hegðun með tilliti til heilablóðfalls í suðurhluta Gana.

Aðferðir: Verkefnið var unnið í Suður Gana og var skipt upp í þrjá rannsóknir. Í fyrstu rannsókninni var úrtakið 156 heilablóðfallsjúklingar sem stunduðu sjúkraþjálfun við Korle-Bu Teaching Hospital (KBTH) og Tema General Hospital (TGH). Til samanburðar var notast við úrtak 156 áætlaðra heilbrigðra einstaklinga með sambærilegri dreifingu aldurs og kyns. Margreyndur HRQoL spurningalisti, skipt upp í sjö lén, var notaður til að safna upplýsingum frá öllum þátttakenda rannsóknarinnar. Klínískum faraldsfræðigögnum var einnig safnað frá eftirlifendum heilablóðfalls um þætti eins og alvarleika heilablóðfallsins og áhættuþætti. Í annarri rannsókninni var þvagsýnum safnað frá 70 heilablóðfallssjúklingum í sjúkraþjálfun hjá KBTH og 83 áætlaðra heilbrigðra einstaklinga með sambærilegri dreifingu aldurs og kyns. Þvagsýnin voru greind með stöðluðum örverufræðilegum aðferðum til að finna bakteríumigu og greina orsakavaldinn. Í þriðju rannsókninni, var stigskipt úrtökutækni notuð til að velja 63 heimili í öllum 11 hverfum stórborgarsvæðisins í Accra (höfuðborg Gana). Staðlaður spurningalisti var notaður til að safna gögnum um almenna þekkingu á heilablóðföllum frá svarendum sem valdir voru af handahófi frá völdu heimilunum. Víðtækar tölfræðilegar greiningar voru gerðar á öllum söfnuðum gögnum, þar með talið aðhvarfsgreining til að skilgreina áhrifaþætti HRQoL, þvagfærasýkingar og almennrar þekkingar á heilablóðföllum.

Niðurstöður:

Rannsókn I: Meðalaldur þeirra sem lifðu af heilablóðfall og heilbrigðra var 58.0 (SD = 11.4) og 57.6 (SD = 12.0) ár í fyrrnefndri röð. Fimmtíu og þrjú prósent (86) af eftirlifendum heilablóðfalls hlutu vægt heilablóðfall, 35.3% (55) hlutu meðalsterkt, á meðan 12.2% (19) urðu fyrir alvarlegu heilablóðfalli. Heilablóðþurrð var ríkjandi undirflokkur heilablóðfalls (78.1%). Háþrýstingur var algengasti áhættuþátturinn (89%) meðal þeirra sem lifðu af heilablóðfall og sykursýki (29%) næstalgengust. HRQoL skor var frá 57.7% (vitræn geta) til 80.0% (andleg geta) hjá þeim sem lifðu af heilablóðfall. Skor samanburðarhópsins var 65.6% (vitræn geta) til 85.2% (andleg geta).

Marktækt hærri skor var fyrir hvert HRQoL lén hjá viðmiðunarhópnum samanborið við eftirlifendur heilablóðfalls eða $p<0.05$. Niðurstöður fjölliðugreiningar sýndu að forspárbreytur HRQoL hjá þeim sem lifa af heilablóðfall voru aldur, alvarleiki heilablóðfalls, tímalengd eftir heilablóðfall, endurtekning heilablóðfalla, tíðni hláturs og neikvæðar tilfinningar.

Rannsókn II: Bakteríumiga var marktækt hærri hjá heilablóðfallssjúklingum (24.3%, n = 17) miðað við samanburðarhóp (7.2%, n = 6) með hlutfallslega áhættu uppá 3.36 (CI = 1.40-8.01, p = 0.006). Allir sem höfðu bakteríumigu í samanburðarhópnum (n = 6) voru einkennalausir, en af 17 heilablóðfallssjúklingum með bakteríumigu voru 15 einkennalausir en 2 með þvagfæraeinkenni. Fjölliðugreining bar kennsl á kvenkyn (OR = 3.40, CI = 1.12-10.30, p = 0.03) og heilablóðfall (OR = 0.24, CI = 0.08-0.70, p = 0.009) sem forspárbreytur fyrir bakteríumigu. Orsök bakteríumigu var svipuð í báðum hópum. Kóagúlasa-neikvæðir stafýlókokkar voru mest ríkjandi sýklar hjá heilablóðfallssjúklingum (12.9%) og í samanburðarhópnum (2.4%).

Rannsókn III: Aðeins 40% (277) af 693 svarendum gátu bent rétt á heilann sem það líffæri sem skaddaðist í heilablóðfallinu. Eins voru <50% (347) svarenda sem gátu bent á þekkta áhættuþætti eða einhverja þekkta fyrirboða. Yfir 70% (n> 485) svarenda töldu að heilablóðfall væri fyrirbyggjanlegur sjúkdómur, eða að lífsstílsbreyting gæti dregið úr áhættu heilablóðfalls, eða að þörf væri á neyðaraðstoð við heilablóðfall. Í fjölliðugreiningu voru forspárbreytur um almenna þekkingu heilablóðfalls: aldur <50 ára (OR = 0.56, CI = 0.35-0.92, p = 0.021), áhættuþáttur heilablóðfalls til staðar (OR = 2.37, CI = 1.52-3.71, p<0.001) og kristin trú (OR = 14.86, CI = 1.37-161.01, p = 0.03).

Ályktanir: Þau lén HRQoL sem urðu mest fyrir áhrifum hjá þeim sem lifað höfðu af heilablóðfall voru; það líkamlega, sálræna og vitræna. Endurhæfing heilablóðfallssjúklinga í Suður Gana ættu að fela í sér inngrip sem sérstaklega tekur mið af þessari niðurstöðu og reyna að hafa áhrif á forspárgildi HRQoL. Heilablóðfallssjúklingar á rannsóknasvæðinu eru í verulega aukinni áhættu á að fá samfélagslega áunna bakteríumigu sem í flestum tilfellum er einkennalaus. Samfélagslega áunnin bakteríumiga í heilablóðfallssjúklingum virðist hafa lítil eða engin tengsl við klínískar breytur svo sem háþrýsting og undirgerðir heilablóðfalls. Þótt heilablóðfall sé álitið alvarlegt og fyrirbyggjanlegur sjúkdómur í Accra þá er samfélagslegur skilningur á áhættuþáttum og fyrirboðum lágur. Þetta gefur til kynna að samfélagsleg uppfræðsla til að auka vitund almennings um heilablóðföll gæti stuðlað að fækkun heilablóðfalla og flýtt tengingu við sjúkrahús við upphaf einkenna.

Lykilorðin: Lífsgæði, heilablóðfall, lén, Gana, bakteríumiga, áhættuþættir, viðvörunarmerki.

ABSTRACT

Background

Stroke is a disease of immense public health importance with serious economic and social consequences. In Ghana, stroke ranks among the top three causes of mortality and is a leading cause of adult medical admission. Despite the high and increasing public health burden of stroke in Ghana, there are hardly any recent epidemiological studies on the disease in the country. Consequently, several aspects of stroke in Ghana are poorly understood and this is a major constraint to effective control of the disease in country.

Objectives

The objectives of the doctoral research project were to (a) describe the epidemiological profile of stroke survivors in southern Ghana (b) assess health related quality of life (HRQoL) of the stroke survivors and identify the associated determinants (c) evaluate the risk of community-acquired bacteriuria among the stroke survivors (d) evaluate knowledge, attitudes and practices with respect to stroke in southern Ghana.

Methods

The research project was carried out in southern Ghana and was organized into three investigative studies. In the first study, 156 consecutive stroke survivors attending physiotherapy clinics of the Korle-Bu Teaching Hospital (KBTH) and Tema General Hospital (TGH) were sampled. A control group of 156 age and sex matched apparently healthy people were also sampled. A robust HRQoL questionnaire involving seven domains was used to collect data from all the study participants. Clinical epidemiology data was also collected from stroke survivors on parameters such as stroke severity and risk factors. In the second study, urine specimens were collected from 70 consecutive stroke patients attending the physiotherapy clinic of KBTH and 83 age and sex matched apparently healthy controls. The urine specimens were analysed by standard microbiological methods to detect bacteriuria and identify the causative organisms. In the third study, a multi-stage sampling technique was used to select 63 households in each of the 11 sub metropolitan areas of Accra (capital city of Ghana). A structured questionnaire was used to collect stroke awareness data from respondents randomly sampled in the selected households. Extensive statistical analyses were performed on all the data collected, including multiple regression analyses to identify determinants of HRQoL, bacteruria and stroke awareness.

Results

Study I

The mean age of the stroke survivors and healthy controls were 58.0 (SD=11.4) and 57.6 (SD=12.0) years respectively. Fifty three percent (86) of the stroke survivors had mild stroke, 35.3% (55) had moderate stroke, while 12.2% (19) had severe stroke. Ischemic stroke was the prevalent stroke subtype (78.1%). Hypertension was the most common risk factor (89%) among

the stroke survivors, followed by diabetes (29%). HRQoL scores ranged from 57.7% (cognitive domain) to 80.0% (Spirit domain) for stroke survivors, while HRQoL scores of the control group ranged from 65.6% (cognitive domain) to 85.2% (soul domain). For each HRQoL domain, significantly higher scores were observed for the control group compared to the stroke survivors at $p<0.05$. Statistical predictors of HRQoL of stroke survivors in multivariable analysis included age, stroke severity, post stroke duration, stroke recurrence, frequency of laughter, and negative emotions.

Study II

Bacteriuria was significantly higher among stroke patients (24.3%, n=17) than among the control group (7.2%, n=6) with a relative risk of 3.36 (CI= 1.40-8.01, p=0.006). Among the control group, all the 6 bacteriuria cases were asymptomatic, whereas the 17 stroke bacteriuria cases comprised 15 cases of asymptomatic bacteriuria and 2 cases of symptomatic bacteriuria. In the multivariable analysis, female gender (OR= 3.40, CI= 1.12-10.30, p= 0.03) and presence of stroke (OR= 0.24, CI= 0.08-0.70, p= 0.009) were identified as predictors of bacteriuria. The aetiology of bacteriuria was similar in both study groups and coagulase-negative staphylococci were the most predominant organisms isolated from stroke patients (12.9%) and the control group (2.4%).

Study III

Only 40% (277) of the 693 respondents correctly identified the brain as the organ affected in stroke. Similarly, <50% (347) of the respondents could recognize any of the established stroke risk factors as well as any of the established stroke warning signs. Over 70% (n>485) of the respondents either believed that stroke is a preventable disease, or lifestyle alterations can be made to reduce the risk of stroke, or stroke requires emergency treatment. In multivariable analysis, predictors of stroke awareness were: age <50 years (OR= 0.56, CI= 0.35-0.92, p= 0.021), presence of a stroke risk factor (OR= 2.37, CI=1.52-3.71, p<0.001) and Christian Religion (OR= 14.86, CI=1.37-161.01, p=0.03).

Conclusions

The most affected HRQoL domains of the stroke survivors are of the physical, psycho-emotional and cognitive domains. Rehabilitation of stroke survivors in southern Ghana should include interventions targeted at these domains and modifying the statistical predictors of HRQoL where possible. Stroke patients in the study region have a significantly higher risk of community-acquired bacteriuria which in most cases is asymptomatic. Community-acquired bacteriuria in stroke patients appears to have little or no relationship with clinical parameters such as hypertension and stroke subtype. Though stroke is perceived as a serious and preventable disease in Accra, community awareness of the risk factors and warning signs is sub-optimal. This indicates that a community-based education program to increase public awareness of stroke could contribute to decreasing the risk of stroke and to increasing the speed of hospital presentation after stroke onset.

Key words: Quality of life, stroke, domain, Ghana, bacteriuria, risk factors, warning signs.

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CONTENT

LIST OF ABBREVIATIONS

ASB	Asymptomatic Bacteriuria
ADL	Activities of Daily Living
CI	Confidence Interval
CT	Computerized Tomography
DALYs	Disability Adjusted Life Years
GHC	Ghana Cedi
HIV	Human Immunodeficiency Virus
HRQoL	Health Related Quality of Life
HRQOLISP	Health Related Quality of Life in Stroke Patients
ICIDH	International Classification of Impairments, Disabilities and Handicaps
KBTH	Korle-Bu Teaching Hospital
MRI	Magnetic Resonance Imaging
OR	Odds Ratio
SD	Standard Deviation
TOAST	Trial of ORG 10172 in Acute Stroke Treatment (TOAST)
TGH	Tema General Hospital
USD	United States Dollar
UTI	Urinary Tract Infection
UK	United Kingdom
WHO	World Health Organization
YRS	Years

LIST OF FIGURES

LIST OF TABLES

LIST OF PAPERS

This thesis is based on the following original publications or manuscripts, which are referred to in the text by their Roman numerals (I-III):

I. Donkor ES, Owolabi MO, Bampoh Patrick, Amoo PK, Aspelund T, Gudnason V. Profile and health related quality of life of Ghanaian stroke survivors. *Clinical Interventions in Aging* 2014:9 1701–1708

II. Donkor ES, Owolabi MO, Akumwena A, Aspelund T, Gudnason V. Stroke related bacteriuria: a case-control study of stroke patients attending a physiotherapy clinic in Ghana. *Scandinavian Journal of Public Health* (submitted manuscript).

III. Donkor ES, Owolabi MO, Bampoh Patrick, Aspelund T, Gudnason V. Community awareness of stroke in Accra, Ghana. *Biomed Central Public Health* 2014; 14:195.

DECLARATION

I, Eric Sampane-Donkor, confirm that the work presented in this thesis is my own. I conceived and designed the research project in collaboration with my PhD supervisory committee. I coordinated and supervised all aspects of data collection of the research project. I undertook statistical analysis of the data with support from a statistician. I drafted all the three manuscripts included in the thesis. I wrote the thesis in consultation with my PhD supervisory committee.

CHAPTER ONE

1.0 INTRODUCTION

1.0 DEFINITION OF STROKE

According to the definition proposed by the World Health Organization in 1970, "stroke is rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 h or longer, or leading to death, with no apparent cause other than of vascular origin" [1]. Recently, a new definition of stroke has been proposed by the American Stroke Association which is tissue-based and states that "stroke is an episode of acute neurological dysfunction presumed to be caused by ischemia or hemorrhage, persisting ≥24 hours or until death" [2]. The clinical manifestations of stroke include a wide range of signs and symptoms such as paralysis, weakness, numbness, severe headache, slurred speech, mental status change, vision problems, falling and dizziness [1-3]. A stroke may be described as a silent stroke if it occurs without clinical features [3]. In a silent stroke either a silent area of the brain is involved or symptoms are not noticed.

1.1 BRIEF HISTORICAL ACCOUNT OF STROKE

Stroke was first noted from 460 to 370 before the Common Era by Hippocrates who recorded that occlusion of the 'stout' carotid arteries caused loss of consciousness [4, 5]. At this time, stroke symptoms such as convulsions and paralysis were referred to as apoplexy. In 1658, Johann Jacob Wepfer reported that apoplexy resulted from obstruction of the carotid or vertebral artery or bleeding into the brain [4-6]. Around the same time period, Thomas Willis reported on the anastomotic vessels at the base of the brain in his *Cerebri Anatome* [4]. Between 1682 and 1836 it was possible to relate clinical presentations of stroke to morbid anatomical findings of brain through the work of Giovanni Battista Morgagni, John Cheyne and other scientists [4]. In 1828 John Abercombie clinically classified apoplexy into three groups including primary apoplexy (large intracerebral hemorrhages or infarcts with focal deficits and stupor), probable subarachnoid hemorrhage (with stupor and headache but no focal deficit) and small infarcts or hemorrhages (with focal deficit but no stupor or headache) [4-6]. In the last half of the 20th century, technological revolution produced major advances in antemortem visualization of

vascular lesions and discovery of new medical therapeutic strategies for stroke. Angiography invented by Moniz and Seldinger provided valuable information about vascular anatomy. Similarly, Computerized Tomographic (CT) scan and Magnetic Resonance Imaging invented in the 1970s by Hounsfield and Damadian respectively, have allowed definition of the site of brain infarction and haemorrhage [4]. Newer and more powerful techniques such as Positron and Single-Photon Emission Computerized Tomography are functional imaging procedures that allow the evaluation of cerebral perfusion and metabolism, and have provided insights into stroke pathophysiology and discovery of misery perfusion syndrome, diaschisis and luxury perfusion [4]. These advances in the area of stroke have facilitated the establishment of stroke units which offer effective care for stroke patients and survivors.

1.2 EPIDEMIOLOGY OF STROKE

1.2.1 Types of stroke

Generally, strokes can be classified into two major categories namely, ischemic stroke and hemorrhagic stroke. Ischemic stroke is caused by interruption of the blood supply to a part of the brain resulting in sudden loss of function, while haemorrhagic stroke is attributed to rupture of a blood vessel or an abnormal vascular structure [7]. Generally, ischemic strokes account for about 80% of stroke cases while haemorrhagic stroke accounts for 20% [7]. Recent epidemiological data indicates that the proportions of ischemic and haemorrhagic stroke in Africa are 66% and 34% respectively, compared to 91% of ischemic stroke and 9% of haemorrhagic stroke in high income countries [8]. In Ghana there appears to be an evolution of stroke subtypes showing a sharp decline in haemorrhagic stroke and an increasing trend of ischemic stroke [9, 10].

There are several subclassification schemes for ischemic stroke and the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) criteria is the most widely used. Based on the TOAST criteria, ischemic stroke can be grouped into five main pathological or etiological types (Table 1). There are two types of haemorrhagic stroke including intracerebral haemorrhage and subarachnoid haemorrhage. Intracerebral haemorrhage is the most common type of nontraumatic intracranial hemorrhage; it accounts for 80% of haemorrhagic stroke and 10-15% of all strokes [4].

Table 1: Types of ischemic stroke based on the TOAST classification

Stroke type	Causes	Percentage
Large artery thrombotic strokes	Atherosclerotic plaques in the large blood vessels of the brain lead to ischemia and infarction	20%
Small penetrating artery thromobotic stroke (Lacunar stroke)	One or more vessels in the brain are affected (microatheromatosis)	25%
Cardiogenic embolic stroke	Associated with cardiac dysrhythmias, valvular heart disease and thrombi in the left ventricles	15%
Cryptogenic strokes	Cause is unknown	5-10%
Strokes associated with other causes	Such as illicit drug use	20-25%

(Source: adapted from Adams *et al*. [11])

Intracerebral haemorrhage is mostly caused by uncontrolled hypertension leading to rupture of small vessels. The rupture leads to an avalanche type effect with breakage of nearby vessels resulting in hematoma expansion in up to 40% of cases [3, 4]. Subarachnoid haemorrhage is mainly due to saccular aneurysms though it is also associated with arteriovenous malformation, intracranial neoplasm and some medications such as anticoagulants [3, 4]. About 65% of subarachnoid haemorrhage patients survive, but half remain disabled primarily due to severe cognitive deficit [4].

Stroke subtypes are reliably determined using CT imaging or Magnetic Resonance Imaging (MRI). Though CT imaging is more commonly used in stroke diagnosis, MRI gives more accurate information, and can earlier than CT imaging distinguish between haemorrhage and thrombus [13]. In most developing countries, CT imaging or MRI facilities are not readily available and affordable. In Ghana, there are only four health institutions that offer CT imaging or MRI services and a session costs at least GHC 500 (USD 167) which is not covered by the National Health Insurance Scheme [9].

1.2.2 Risk factors of stroke

Through epidemiological studies a wide range of stroke risk factors have been identified and are important for primary and secondary prevention of stroke. Risk factors of stroke can be classified into two, which include risk factors that are modifiable and those that are non-modifiable. The modifiable risk factors of stroke include factors such as hypertension, diabetes mellitus, high blood cholesterol, obesity, cardiovascular diseases, sedentary lifestyle, atrial fibrillation, smoking and alcohol consumption [8, 14]. The non-modifiable risk factors are relatively few and include factors such as age, gender and genetics [8, 14].

Age is the strongest determinant of stroke and the risk of stroke doubles every decade above age 55 [4, 14]. Age can be considered a marker for duration of exposure to other risk factors of stroke [4, 14]. While in sub-Saharan Africa most stroke cases occur in people less than 60 years, in developed countries stroke usually affects much older people of 70-75 years [15, 16]. Hypertension is the strongest risk factor after age and people with hypertension are about 3 or 4 times more likely to have a stroke [17]. The strong association between hypertension and stroke has been attributed to the powerful effects of hypertension on the cerebral circulation [18]. In cerebral blood vessels, hypertension is known to produce hypertrophy and causes reduction in the external diameter of the vessels. In addition, hypertension alters the ability of endothelial cells to release vasoactive factors and increases the constrictor tone of systemic and cerebral arteries [18]. Sickle cell disease (which is highly prevalent in sub-Saharan Africa) is known to increase the risk of stroke by as high as 200-400 fold [19, 20]. Increased haemolylsis and changes in rheological properties of Red Blood Cells may be the main factors responsible for the increased risk of stroke among sickle cell patients [19, 20]. A previous stroke significantly elevates the risk of subsequent stroke with a recurrence rate of 5-25% in 1 year and 20-40% in 5 years [4].

Data from the recent INTERSTROKE study indicates that five stroke risk factors including hypertension, current smoking, obesity, lack of physical activity and diet were responsible for more than 80% of all strokes [8]. All these risk factors are modifiable which makes stroke highly preventable. Studies have shown that there are variations in the stroke risk factors among different races and populations [15, 21, 22]. In a comparative study of stroke risk factors among

stroke survivors in Nigeria and Germany, it was observed that smoking, hyperlipidemia, atrial fibrillation, congestive cardiac failure, ischemic heart disease, and atherosclerosis of the carotids and vertebral arteries were significantly more common among the German stroke survivors [15]. On the other hand, hypertension was significantly more common among the Nigerian stroke survivors [15]. A biracial study in the UK also showed that cardioembolic and large vessel atherosclerotic stroke were more common in white populations than black populations [22]. The racial differences in stroke risk factors has been attributed to interacting genetic, environmental, dietary, and socio-economic variables, and has implications for the distribution of stroke subtypes [21-23]. While haemorrhagic stroke appears to be more associated with hypertension, ischemic stroke is more related to factors such as smoking, hyperlipidemia, cardiac disease and atherosclerosis [24-27]. The relatively common occurrence of the latter group of risk factors in white populations accounts for the predominance of ischemic stroke in the western world [15, 21, 22]. Western lifestyle is now commonly adopted in many African countries, and thus it is expected that the distribution of stroke risk factors and subtypes in Africa would become similar to what is observed in the western world.

Conventional risk factors such as hypertension fail to explain all stroke risk, and there is increasing evidence for the potential pathophysiological role of genes in stroke [28, 29]. Genome wide association studies have identified a wide range of genes associated with stroke [30]. Some of these genes include Apolioprotein E (APOE), Methylenetetrahydrofolate reductase (MTHFR), Endothelial Nitric Oxide Synthase (ENOS), Factor V Leiden (F5), Cytochrome P450 4F2 (CYP4F2), beta-fibrinogen and Phosphodiesterase 4D (PDE4D). Interestingly some of the stroke related genes identified are also associated with the conventional risk factors of stroke. For example a genome wide association study on an Icelandic population found that risk variants for atrial fibrillation of ch4q25 were also risk factors for ischemic stroke [31]. The responsible gene is thought to be the *PITX2* gene, which encodes a β-catenin-regulated transcription factor [26]. In the Icelandic study, genotyping was done on 1,661 cases of ischemic stroke and 10,815 control subjects and the most important signals were replicated in two distinct European populations with 2224 cases and 2583 controls [31, 32]. The strongest association occurred with SNP (single nucleotide polymorphism) rs2200733, which showed a strong association with cardioembolic

stroke [31]. Additionally, a ch9 variant related to myocardial infarction and coronary artery disease was associated with ischemic stroke in the different populations [32].

Several other risk factors of stroke have been proposed but are less documented. Some of these risk factors include oral contraceptive use, vasculitides, inflammatory processes, migraine, sleep apnea syndrome, prothrombin activator inhibitor complex deficiency, hypotension, high C-reactive protein, neurocysticercosis, *Chlamydia pneumoniae*, *Helicobacter pylori*, *Legionella pneumophilia*, chronic bronchitis, periodontal disease, and hyperuricemia [4, 14, 33-35].

1.2.3 Public health burden of stroke

Stroke is ranked as the second leading cause of death worldwide with an annual mortality rate of 5.5 million [14]. The burden of stroke does not only lie in the high mortality but the high morbidity also results in up to 50% of survivors being chronically disabled [14, 36]. Thus stroke is a disease of immense public health importance with economic and social consequences. Geographically, the burden of stroke varies widely, with the highest burden occurring in eastern Europe, north Asia, central Africa, and the south Pacific (Figure 1) [37]. Until recently stroke was a disease of the developed world. However, through the application of evidence based control measures the burden of stroke has reduced drastically in many developed countries. In most Western European countries death from stroke has declined by 30-50% since 1975 and this is most noticeable in countries like Iceland, Italy, Austria and Germany [14, 36]. The burden of stroke seems to be shifting to the developing world and currently two-thirds of stroke mortality cases occur in sub-Saharan Africa [14, 21], where poverty, malnutrition and communicable diseases such as HIV/AIDS also exert their greatest toll [36]. Stroke data on sub-Saharan Africa indicates an annual stroke incidence rate of up to 316 per 100, 000, a prevalence rate of 315 per 100, 000 and a fatality rate of 84% [38]. The disability adjusted life years (DALYs) due to stroke in sub-Saharan Africa are about seven times higher than what is observed in high income countries [14]. In the next few decades, the burden of stroke in sub-Saharan Africa is likely to increase substantially owing to the epidemiological transition in the region from infectious diseases to non-communicable diseases [39].

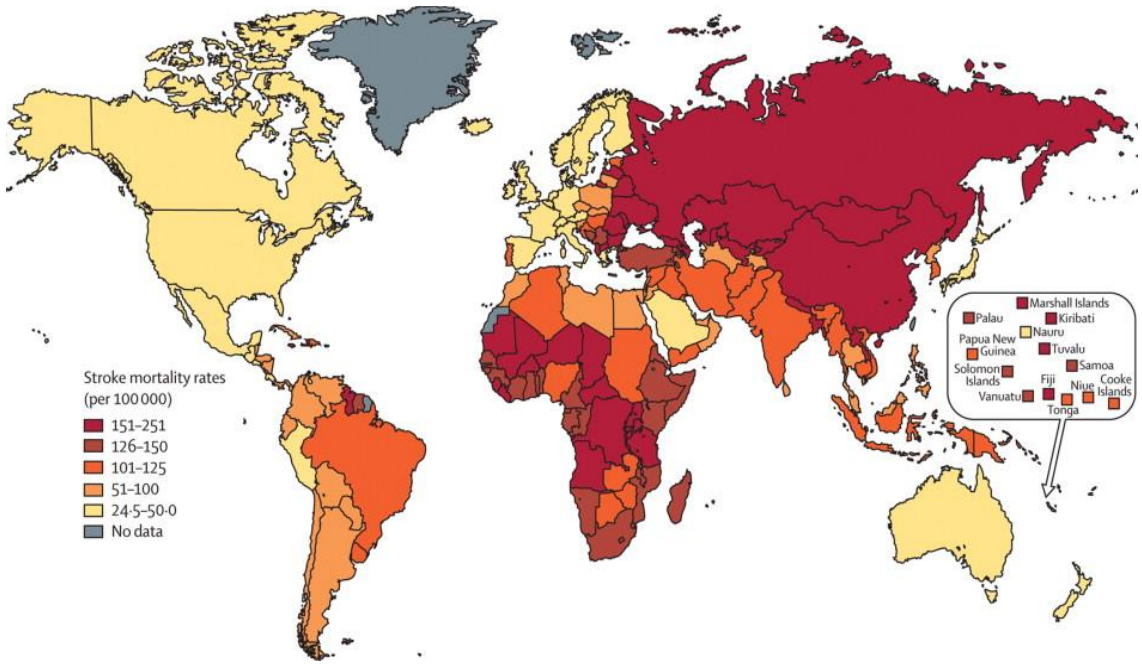

Figure 1A: Global distribution of stroke mortality rates

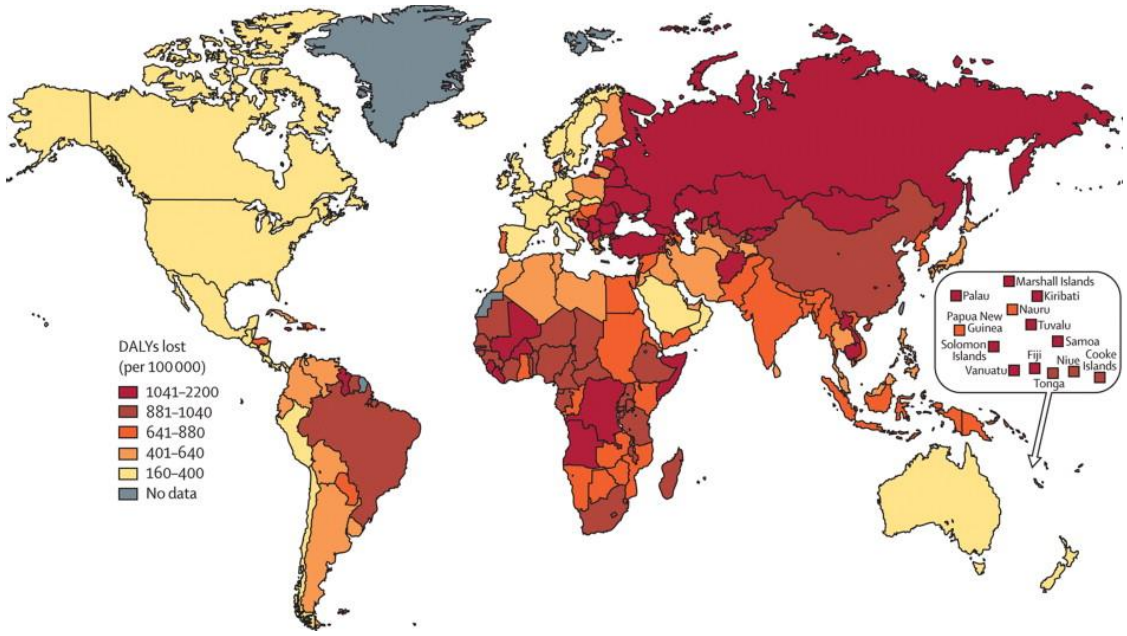

Figure 1B: Global distribution of DALY loss due to stroke

(Source of Figures 1A and 1B: Johnston *et al*. [12])

In Ghana, stroke ranks among the top three causes of mortality, and is probably the most important cause of disability [9]. A five year study on autopsy cases at the Korle-Bu Teaching Hospital in Ghana showed that mortality from stroke constituted 11% of autopsies and haemorrhagic stroke was more common (61%), with males being more likely to die from haemorrhagic stroke than females [9]. A one year retrospective study of in-patients with stroke admitted to another teaching hospital in Ghana, namely Komfo Anokye Teaching Hospital showed that stroke constituted 9.1% of the total medical adult admissions and 13.2% of all medical adult deaths [40]. There is an epidemic of hypertension in Ghana [41, 42], which indicates that the public health burden of stroke in Ghana is likely to increase unless urgent measures are taken to control the problem of hypertension in the country. Currently, there is no data on the economic cost of stroke in Ghana and other sub-Saharan African countries. In the United States the overall monetary lifetime cost of each stroke was calculated to be an average of $103,576 in the 1990s [43].

The high burden of stroke is partly due to poor community knowledge of stroke risk factors and its warning signs. This is supported by the evidence that increased awareness of stroke risk factors leads to improved compliance with stroke prevention practices while lack of recognition of stroke warning signs is an important causal factor of delay in hospital reporting of stroke [44, 45]. Evidence from studies in developed and developing countries show that respondents' recognition of any of the established stroke risk factors or warning signs are generally less than 50% [46-52]. In sub-Saharan Africa, a study in Benin showed that the most commonly identified stroke risk factor was hypertension (34.5%) while the most often cited warning signs of stroke were paralysis and hemiplegia (34.4%). Similar poor recognition of stroke risk factors and warning signs have been reported in Nigerian [47, 48], though one study showed good knowledge of stroke risk factors among university staff with 91.7% recognizing hypertension [53].

1.3 PATHOPHYSIOLOGY OF STROKE

The brain, which is the main organ affected by stroke, is metabolically active and needs about 50ml/100g/min blood flow with an oxygen metabolic rate of 3.5cc/100g/min [4, 54]. If the blood flow drops below 10ml/100g/min, brain cell functions are severely affected, while neurons are

unable to survive long at levels below 5ml/100g/min [4, 54]. Generally, there is some alteration in brain metabolism if blood flow is interrupted for 30 seconds [4]. In ischemic stroke, disruption of blood flow to the brain for a few minutes causes hypoxia and hypoglycemia which leads to infarction of brain tissues [4, 54, 55]. A vicious cycle (ischemic cascade) ensues due to accumulation of sodium, calcium and water in the injured brain cells which leads to release of excitatory neurotransmitters causing further cell injury [54, 55]. In haemorrhagic stroke, the haematoma causes compression of tissue resulting in tissue injury [56, 57]. The brain's regulatory mechanism attempts to maintain equilibrium by increasing blood pressure but the increased intracranial pressure forces out cerebrospinal fluid causing damage to circulation [56, 57]. The blood from brain hemorrhage exerts some direct toxic effects on brain tissue and vasculature [56]. Mass effect ensues with neuronal damage resulting from excitotoxicity, free radicals, apoptosis, ischemia, diaschisis, neuropathic products and pressure necrosis [4, 57].

1.4 STROKE AND HEALTH RELATED QUALITY OF LIFE

In 1948 the World Health Organization defined health as 'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity' [58]. Later in 1984, the WHO indicated in a revised statement that any health measure must take into consideration 'the extent to which an individual or a group is able to realize aspirations and satisfy needs and to change or cope with the environment' [59]. In connection with this, the WHO quality of life group in 1993 defined 'quality of life' as 'an individual's perception of his/her position in life in the context of the culture and value systems in which he/she lives, and in relation to his/her goals, expectations, standards and concerns' [60].

The concept of Health Related Quality of Life (HRQoL) is used as an important parameter for measuring outcome in modern medicine and is highly important in the assessment of the multifaceted impact of disease on the patient's life and evaluation of the utility and disability associated with various health states [61, 62]. HRQoL measures encompass emotional, physical, social and subjective feelings of well being and hence can be used in identifying and prioritizing areas of need of individual patients and patients with special needs [63, 64]. HRQoL measures are also useful in the evaluation of the effectiveness and cost-benefit of various old and emerging

prophylactic, therapeutic and rehabilitative interventions [62-64]. These instruments facilitate patient caregiver communication, clinical decision making, and uncover hidden problems.

As a result of new therapies, the number of people who survive stroke and live with its consequences is increasing especially in the western world. In the United States, about 85% of stroke victims now survive and currently, there are approximately four million people in the United States alone, who live with the sequelae of stroke [65, 66]. The improvement in survival of stroke patients has necessitated the measurement of the health outcomes associated with stroke prevention, treatment and rehabilitation. Evidence from stroke studies that have applied HRQoL indicates that, outcome measures are important in the identification of determinants of good and poor prognosis in stroke patients [61, 63]. Generally, few stroke studies have applied HRQoL and these studies were mainly carried out in the developed world. In a study of stroke patients in Auckland, HRQoL was observed to be relatively good for stroke patients compared to normal individuals, and despite significant ongoing physical disability, stroke patients appeared /to adjust well psychologically to their illness [67]. On the contrary, a Canadian study showed multidimensional impairment of all HRQoL domains with the exception of the autonomy and purpose of life dimensions [68]. This is supported by the Kansas City study which showed that even in stroke survivors considered to have recovered, stroke still affected hand function as well as activities of daily living and participation [69, 70]. In a Nigerian study, stroke exerted a multidimensional impact on HRQoL which was most pronounced in the physical, psychological, cognitive and social interaction domains [71]. Evidence from various studies indicates that determinants of HRQoL of stroke patients cover a wide spectrum including depression, social support, caregiver characteristics, social class, functional status, age, co-morbidity, laughter frequency and time elapsed after stroke [68, 72-74].

Measures of HRQOL could be generic or disease-specific [61]. Generic measures assess and compare HRQOL across populations or different diseases, while disease-specific measures are more valid, patient-centered, responsive and sensitive in assessing HRQOL in specific diseases and/or populations [75, 76]. Examples of generic HRQOL measures are SF-36 and EuroQol [76, 77]. Stroke-specific measures include the Niemi QOL scale Stroke Impact Scale (SIS), Stroke and Aphasia Quality of Life Scale -39 (SAQOL-39), Newcastle Stroke-Specific Quality of Life

Measure (NEWSQOL), Stroke-Specific Quality of Life Scale (SSQOL) and the Health Related Quality of Life in Stroke Patients (HRQOLISP) [78-82]. These measures have been preliminarily evaluated in stroke patients but require further studies to ascertain their psychometric suitability particularly in multicultural settings. So far, only the HRQOLISP instrument has been validated in sub-Saharan Africa, and was found to demonstrate good content, construct, and discriminant validity and internal consistency reliability [70, 71].

Disability has a profound effect on HRQoL in stroke [67-72]. The International Classification of Impairments, Disabilities and Handicaps (ICIDH) defined disability as any restriction or lack (resulting from an impairment) of ability to perform an activity within the range considered normal for a human being [83]. Disability measures include modified Rankin Scale, Barthel Index, AHA Stroke Outcome Scale and the Stroke Levity Scale [84, 85]. These instruments assess basic and daily functioning such as feeding, dressing, bathing, toileting and mobility. The major challenge of activities of daily living (ADL) measures is that no instrument can adequately represent the numerous ADL factors in each person and consequently a single case design has been proposed [85].

1.5 STROKE AND URINARY TRACT INFECTIONS

Urine samples are normally sterile and the presence of bacteria in urine defines bacteriuria which may be symptomatic or asymptomatic [86-88]. In urinary tract infection (UTI), the bacteriuria is accompanied by symptoms such as dysuria, pyuria and frequent urination [86, 87]. UTIs can be classified into lower tract (acute cystitis) or upper tract (acute pyelonephritis) infections [86-88]. Cystitis is associated with bladder mucosal invasion, whereas pyelonephritis is related to inflammation of the renal parenchyma, calices and pelvis [87, 89, 90]. UTIs are among the most commonly diagnosed infections in both hospital-acquired and community-acquired infections, and constitute an important cause of bacteremia [86, 91]. In asymptomatic bacteuria (ASB), the bacteriuria is without the accompanying symptoms of a UTI and is more common among elderly people, and in patients with diabetes, bladder catheters and spinal cord injuries [92, 93]. ASB does not directly affect health and is generally not treated, unless in cases where a UTI is particularly risky, such as in pregnancy or a condition that suppresses the immune system [88, 93].

Neurological impairment in stroke is known to cause immunodepression, and consequently stroke patients are relatively more susceptible to infections [94]. Urinary tract infection (UTI) is an important complication in stroke and a recent systematic review reported a UTI prevalence of 10% among stroke patients [95]. In Turkey, a study among stroke inpatients showed that UTI (27.3%) was more common than ASB (11.3%) [92]. Risk factors of UTI among stroke patients include stroke severity, depressed conscious level, increased post-void residual urine volume, catheterization and diabetes mellitus [95]. A number of bacterial pathogens have been implicated in UTI among stroke patients and the major ones include *Staphylococcus aureus* and gram-negative bacteria such as *Pseudomonas aeruginosa*, *Escherichia coli* and *Enterobacter* spp. [95]. It is thought that prophylactic antibiotics may offer some benefit against UTI in stroke patients caused by these organisms. However, the use of such drugs after stroke is still unclear, and questions concerning the risk of selecting resistant strains, defining the best antibiotic regimen, and determining which patients with stroke may benefit from prophylaxis remain unresolved [96].

1.6 RATIONALE OF THE RESEARCH PROJECT

Despite the high public health burden of stroke in Ghana, there are hardly any comprehensive epidemiological studies on the disease in the country. The few studies on stroke in Ghana seem to have focused on risk factors [9, 97, 98], and no study has investigated the quality of life of stroke survivors in the country. Owing to the increasing number of stroke survivors and the limited rehabilitation facilities in Ghana, it is essential to identify and modulate the factors affecting HRQoL in order to promote maximal HRQoL improvements in these patients. The high burden of stroke in Ghana has been partly attributed to poor community awareness of the disease, but there is limited information on community awareness of stroke in the country. For example, there is no study on awareness of stroke warning signs in Ghana, and information on awareness of stroke risk factors appears to be limited to only hypertension [99, 100]. In countries with high stroke mortality like Ghana, there is an urgent need to assess community awareness of the disease, as this would provide the basis and direction for the relevant health education on the subject. Although infections are common complications of stroke, in Ghana and generally sub-Saharan Africa, stroke related infections such as urinary tract infections have not been previously investigated. This information is vital in the overall management of stroke, especially in sub-

Saharan Africa where the brunt of most infectious diseases is borne. Recently, evidence based medicine has become a key priority of the Ghanaian health system, and it is imperative that studies aimed at understanding the nature of stroke in the Ghanaian population would contribute to management of the disease in the country [101].

CHAPTER TWO
2.0 AIM AND OBJECTIVES

The aim of the doctoral research project was to describe epidemiological profile of stroke survivors in southern Ghana, improve HRQoL of the stroke survivors, and understand community perceptions of stroke in Ghana.

The specific objectives were to

1. determine the distribution of stroke risk factors among stroke survivors in Southern Ghana.
2. determine the distribution of stroke subtypes among the stroke survivors
3. assess HRQoL of the stroke survivors
4. identify determinants of HRQoL of the stroke survivors.
5. evaluate the risk of community-acquired bacteriuria and UTI among the stroke survivors.
6. evaluate knowledge, attitudes and practices with respect to stroke in southern Ghana.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 THE STUDY AREA

The PhD project was carried out in southern Ghana from November 2011 to March 2014. Ghana is located in the west coast of Africa (Figure 1), occupies an area of 24,390 square kilometers and has a tropical climate [102]. The population of Ghana is about 24.2 million and there are about 70 different ethnic groups [102, 103]. Politically, Ghana is divided into 10 administrative regions, and the capital city namely, Accra is located in Southern Ghana. The World Bank considers Ghana as a lower middle income economy with a Gross National Income of USD 1,098 [103]. Ghana has a literacy rate of 71.5% and life expectancy of 65 years [102, 104]. There are over 100 hospitals in the country and a national health insurance scheme has been in operation since 2004 [102-104]. There is also a proliferation of herbal centres in Ghana, which offer non-orthodox medical services for a wide range of diseases including stroke. The Ghana Heart Foundation, a non-governmental organization, is the main organization involved in health education of stroke and other cardiovascular diseases in Ghana. There is currently an ongoing national collaboration with Wessex Hospital (UK) to improve stroke care in Ghana [101]. Two hospitals in Ghana namely, Korle-Bu Teaching Hospital (KBTH) and Tema General Hospital (TGH) were sites for data collection of the research project. KBTH is the premier and largest hospital in Ghana with a 1,500 bed capacity [105]. The hospital is located in Accra and is a major referral hospital in the country. TGH is located in Tema, the most industrialized city in Ghana. TGH has a bed capacity of 290 and is one of the largest hospitals in southern Ghana [106]. Stroke is a leading cause of admissions to the medical wards of both KBTH and TGH [105, 106]. Each of the two hospitals has a physiotherapy unit with a high stroke patient turnout throughout the year.

3.2 ORGANIZATION OF THE RESEARCH PROJECT

The doctoral research project was organized in three investigative studies as follows:

- Epidemiological profile and HRQoL of stroke survivors

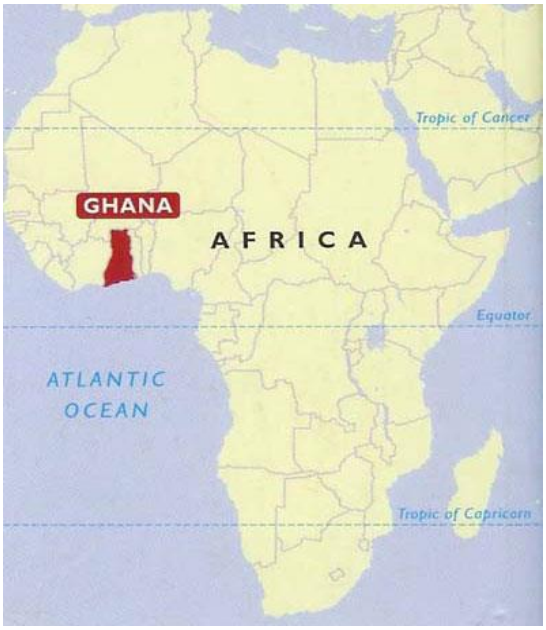

Figure 2A: Map of Africa showing the location of Ghana

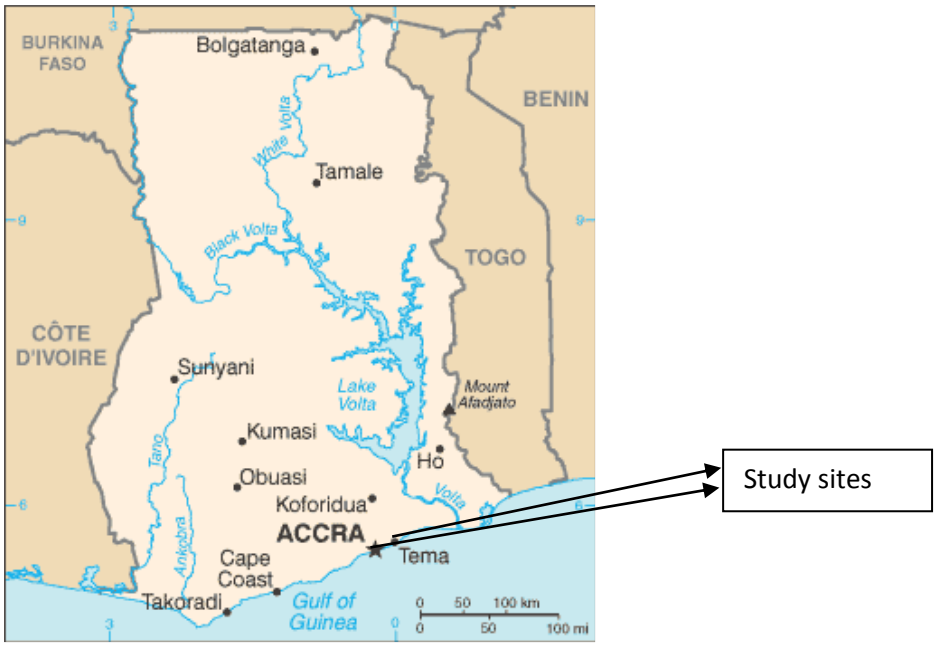

Figure 2B: Map of Ghana showing the study sites

(Source of Figures 2A and 2B: Ghana Demographics Profile [102])

- Stroke related bacteriuria and urinary tract infections
- Stroke knowledge, attitudes and practices

3.3 EPIDEMIOLOGICAL PROFILE AND HEALTH RELATED QUALITY OF LIFE OF STROKE SURVIVORS

3.3.1 Study design and sampling

This study was carried out at the physiotherapy units of KBTH and TGH from January 2012 to September, 2013. The study was a questionnaire-based, cross-sectional study comprising stroke patients and healthy controls. Using a 95% confidence level, 5% allowable error and 11% estimated stroke prevalence reported previously [9], 78 consecutive stroke patients who developed stroke at least one month prior to the time of interview were enrolled at each of the physiotherapy units. The absence of a cut-off point for maximum duration was to permit the determination of the influence of duration after stroke on HRQOL whilst the 1-month minimum duration was chosen to exclude acute cases of stroke that were yet to stabilize. The recruitment of stroke patients was based on definite clinical and/or radiological diagnosis of stroke, and patients with communication problems who had reliable proxies were also included in the study. Patients with ambiguous diagnosis of stroke were excluded from the study. A control group comprising 78 age- and sex- matched subjects, without clinical evidence of stroke or any history of the disease were recruited from the environs of each of the healthcare facilities. The main purpose of the control group was for comparison of HRQoL between stroke survivors and healthy individuals.

3.3.2 The study instrument

The questionnaire used in this study comprised three main sections and is shown in Appendix I. The first section was about respondents' demographic details including age, gender, marital status, religion, education and income. The second section of the questionnaire was on clinical and epidemiological information related to stroke, and was administered to only the stroke patients. This aspect of the questionnaire contained information on duration, side, subtype, severity and number of strokes. It also had information on stroke risk factors and neurological impairments. Data related to this part of the questionnaire was obtained through interviews and

information from clinic records of the patients. Information on stroke subtype was based solely on radiological diagnosis (CT scan). The third section of the study questionnaire was on HRQoL of stroke and the HRQOLISP-40 instrument was administered to both stroke patients and the healthy control group. The HRQOLISP-40 instrument used has two dimensions and seven domains. The physical dimension included physical, psycho-emotional, cognitive and eco-social domains whilst the spiritual dimension comprised soul, spirit and spiritual interaction domains [108].

3.4 STROKE RELATED BACTERIURIA AND URINARY TRACT INFECTIONS

3.4.1 Study design and sampling

This was a cross-sectional study comprising stroke patients and apparently healthy controls. The stroke patients were recruited from the physiotherapy clinic of KBTH from October 2013 to March 2014. Using a 95% confidence level, 5% estimated bacteriuria prevalence reported previously among stroke patients [95], and 5% allowable error, 70 consecutive stroke patients were recruited in the study. The recruitment of stroke patients was based on definite clinical and/or radiological diagnosis of stroke and patients with ambiguous diagnosis of stroke were excluded from the study. We also excluded stroke patients who were on admission and those who had taken antibiotics two weeks or earlier prior to the study. A control group comprising 83 age- and sex- matched subjects, without clinical evidence of stroke or any history of the disease were recruited from the environs of the Korle-Bu Teaching Hospital. Information on demographic features of the study participants were collected. For the stroke patients, information on stroke type, frequency, duration, and side of the body affected were also collected or extracted from their clinic records. A mid-steam urine sample was obtained from each of the study participants and analysed in the Bacteriology Laboratory of the University of Ghana Medical School, Accra, Ghana.

3.4.2 Laboratory analysis of urine specimens

Urine specimens were inoculated onto plates of Blood agar, MacConkey agar and Cysteine Lactose Electrolyte Deficient agar using a standard loop calibrated to hold 0.01 ml of urine. The plates were incubated at 37°C aerobically for 18-24 hours. After incubation bacterial colonies on

the agar plates were counted and the results multiplied by the loop volume. A bacterial count of $1x10^5$ per ml was considered as significant bacteriuria while counts less than $1x10^5$ per ml were considered as no significant bacterial growth [108, 109]. Bacterial isolates were identified based on colonial morphology, Gram stain and a battery of biochemical tests including catalase, coagulase, triple sugar iron, urease, indole and citrate utilization [108].

3.5 STROKE KNOWLEDGE, ATTITUDES AND PRACTICES

3.5.1 Study design and sampling

This study was carried out in Accra (capital city of Ghana) from April to October 2012. Administratively, Accra is divided into 11 sub metropolitan areas, each of which has 5-8 suburbs. This was a cross-sectional study with multi-stage sampling technique. First, one suburb was randomly selected in each sub-metropolitan area of Accra. Based on 95% confidence limits with an allowable error of 10%, 63 households were sampled in each selected surburb using a systematic sampling methodology. In each chosen household one person between 18 and 60 years of age was randomly selected for interview using a structured questionnaire (Appendix II). This age range was chosen to increase the likelihood of obtaining accurate responses from the study participants.

3.5.2 The study instrument

The study questionnaire was developed through a literature review of stroke awareness and hospital presentation in different geographical settings. It was pretested with twenty people to ascertain its validity. The final questionnaire comprised 4 sections and 21 items, most of which had been used in previous studies [46, 48, 49, 110].

The first section of the questionnaire was about respondents' demographic details including age, gender, marital status, religion, education and income. The second section of the questionnaire was about respondents' presence of stroke risk factors. Here the respondents were to indicate which of the following risk factors they had: hypertension, heart disease, previous stroke, diabetes, high cholesterol, smoking and alcohol. The third section investigated respondents' knowledge on stroke, including recognition of the organ involved in the disease, risk factors,

warning signs, information resources, awareness of any community stroke organization and stroke beliefs/perceptions. For the organ affected by stroke, respondents were asked to choose between the brain and heart, or mention any organ they thought was the correct answer. For recognition of stroke risk factors, respondents were presented with a list of factors and asked to identify those associated with stroke. For recognition of stroke warning signs, respondents were presented with a list of clinical signs and asked to identify stroke warning signs. For information resources, the respondents were to indicate whether they had learnt about stroke or not. Those who responded in the affirmative were asked to further indicate their sources of stroke knowledge. Concerning awareness of community stroke organization, the respondents were asked to indicate if they had ever come across a stroke campaign in Accra. Regarding stroke perceptions and beliefs, respondents were presented with six statements about stroke and asked to indicate whether in each case they agreed with the statement or not, or they were not sure. The statements included: I. Stroke is a preventable disease II. Lifestyle alterations can be made to reduce the risk of stroke III. Stroke affects only the elderly IV. Stroke is a top killer disease in Accra V. Stroke requires emergency treatment. VI. Stroke is a spiritual illness caused by evil spirits or witches. The fourth section of the questionnaire was about the respondents' response to a stroke attack, and they were to indicate whether they would visit the hospital, pharmacy, herbalist, or wait for stroke symptoms to subside. The respondents were also given the option of stating a planned response which was not indicated in any of the above choices.

The questionnaire was self-administered in English, and on the average it took 15 minutes to complete. For respondents who could not communicate in English, the questionnaire was administered in a Ghanaian dialect they understood. No clues to questions were provided to the respondents except to offer clarifications where necessary.

3.6 DATA ANALYSIS

Data were analysed using SPSS version 11.0 (SPSS Inc., Chicago, IL, USA). The strategies used to analyse the data are described as follows. Demographic variables were summarized and compared using the Student t-test for numeric variables and chi-square tests for categorical variables. Stroke risk factors, subtypes and other clinical parameters of stroke patients were described by prevalence rates and frequencies.

HRQoL data was analysed using gold standard methods widely reported in HRQoL literature. The HRQoL scores for each domain were computed by the Likert method, with a high score indicating better quality of life [60-62]. The Likert scale range was 1-5, and domain scores were transformed into a scale of 0 to 100, with 0 indicating worst health and 100 best health. The overall HRQoL score was computed by finding the arithmetic mean of the various domain scores each. Stroke severity was measured by the stroke levity scale which was computed based on the formula: stroke levity = maximum power in the dominant hand + maximum power in the weaker lower limb + mobility score-1 (if aphasia present) [84]. The scores were then stratified as severe stroke, moderate stroke and mild stroke.

Multiple regression analysis was performed to identify determinants of HRQoL. Variables included in the multivariable regression model were age, gender, post-stroke duration, type and number of strokes, stroke levity score, and Likert-scale responses to laughter frequency and negative feelings frequency. Logistic regression analysis to identify determinants of bacteriuria among the stroke patients were performed and variables included in the analysis were age, gender, post-stroke duration, type and number of strokes. Logistic regression analyses were also done to identify determinants of stroke awareness including recognition of stroke risk factors, stroke warning signs and the organ affected by stroke. In this case, for each regression model, response options for the dependent variable were categorized as either “know” or “do not know.” In the case of recognition of stroke risk factors/warning signs “know” corresponded to recognition of ≥1 established stroke risk factors/warning signs. The independent variables used in the regression analyses of stroke awareness were gender, age, religion, income, educational level, and the occurrence of at least one stroke risk factor. Missing data were excluded in all the regression analyses performed. The significance of predictor variables were assessed by p values, odds ratios and confidence intervals from Wald statistics; p values ≤ 0.05 were considered significant.

CHAPTER FOUR

4.0 RESULTS

4.1 STUDY I: EPIDEMIOLOGICAL PROFILE AND HEALTH RELATED QUALITY OF LIFE OF STROKE SURVIVORS

4.1.1 Demographic features of the study participants

The demographic features of the study participants are reported in Table 2. The gender distribution of the stroke survivors and healthy controls were the same, each comprising 97 males and 59 females. The age distributions of the two groups of study subjects were also very similar; mean age of stroke survivors was 58.0 (SD=11.4) years, while that of healthy controls was 57.6 (SD=12.0) years. While secondary education was the commonest educational level among the stroke survivors (49.0%), tertiary education was the commonest among the healthy controls (37.9%). Among both the stroke survivors and healthy controls, majority were Christians, married and had a monthly income range of GHC 100-999 (USD 50-500). Education, marital status and income were significantly different between the stroke survivors and healthy controls.

4.1.2 Clinical parameters and stroke risk factors

One hundred and thirty two of the stroke survivors (84.1%) had experienced stroke once, 23 (14.7%) had two stroke episodes, while 1 (1.2%) had three stroke episodes; overall, the recurrence of stroke was 15.4%. The period that the stroke survivors had lived with the disease ranged from 3 months to 25 years with a mean of 2 years 5 months. In 51.3% (79) of the stroke cases, the disease had affected the right half of the body, while for 48.7% (75) the left half of the body was affected. Aphasia and sexual dysfunction were reported in 34.2% (51) and 57.7% (90) of the patients, respectively, while negative feelings such as fear and depression were present in 83.3% (130) of cases. The drugs used by the stroke patients were mainly anti-hypertensives and pain killers, and none of the patients had thrombolytic therapy. The stroke levity scale classified stroke severity as follows: severe stroke-12.2% (19); moderate stroke-35.3% (55); mild stroke-52.6% (82). Based on radiological information (which was available for 32 patients), 18.8% of

Table 2: Demographic features of Ghanaian stroke survivors and healthy controls.

Variable	Stroke group n (%)	Control group n (%)	Significance
Gender			Identical
Male	97 (62.2)	97 (62.2)	
Female	59 (37.8)	59 (37.8)	
*__Age range (yrs)__			p>0.05
20-29	1 (0.6)	1 (0.6)	
30-39	8 (5.1)	8 (5.1)	
40-49	25 (16)	25 (16)	
50-59	51 (32.7)	51 (32.7)	
60-69	45 (28.8)	45 (28.8)	
70-79	20 (12.8)	20 (12.8)	
80-89	5 (3.2)	5 (3.2)	
Education			p<0.05
None	11 (7.1)	12 (7.9)	
Primary	14 (9.0)	47 (30.1)	
Secondary	76 (48.7)	39 (25.0)	
Tertiary	55 (35.3)	58 (37.2)	
Marital status			P<0.05
Married	112 (71.8)	108 (69.2)	
Single	9 (5.8)	16 (10.3)	
Separated	3 (1.9)	13 (8.0)	
Divorced	8 (5.1)	4 (2.6)	
Widowed	24 (15.4)	15(9.6)	
Religion			p>0.05
Christian	149 (95.5)	142 (91.0)	
Moslem	6 (3.8)	14 (9.0)	
Traditional religion	1 (0.6)	0 (0)	
Income			P<0.05
<100	7 (4.5)	19 (12.2)	
100-999	86 (55.1)	85 (54.5)	
1000-1999	9 (5.8)	22 (14.1)	
2000-2999	4 (2.6)	7 (4.5)	
≥3000	1 (0.6)	3 (1.9)	
Unemployed	49 (31.4)	21 (13.5)	

*Mean age of stroke survivors and healthy were control were 58.0 (SD=11.4) and 57.6 (SD=12.0) years respectively

the strokes were haemorrhagic, 78.1% were infarctions, while 3.1% were both haemorrhagic and ischaemic infarctions. The distribution of stroke risk factors among the stroke survivors is reported in Figure 3.

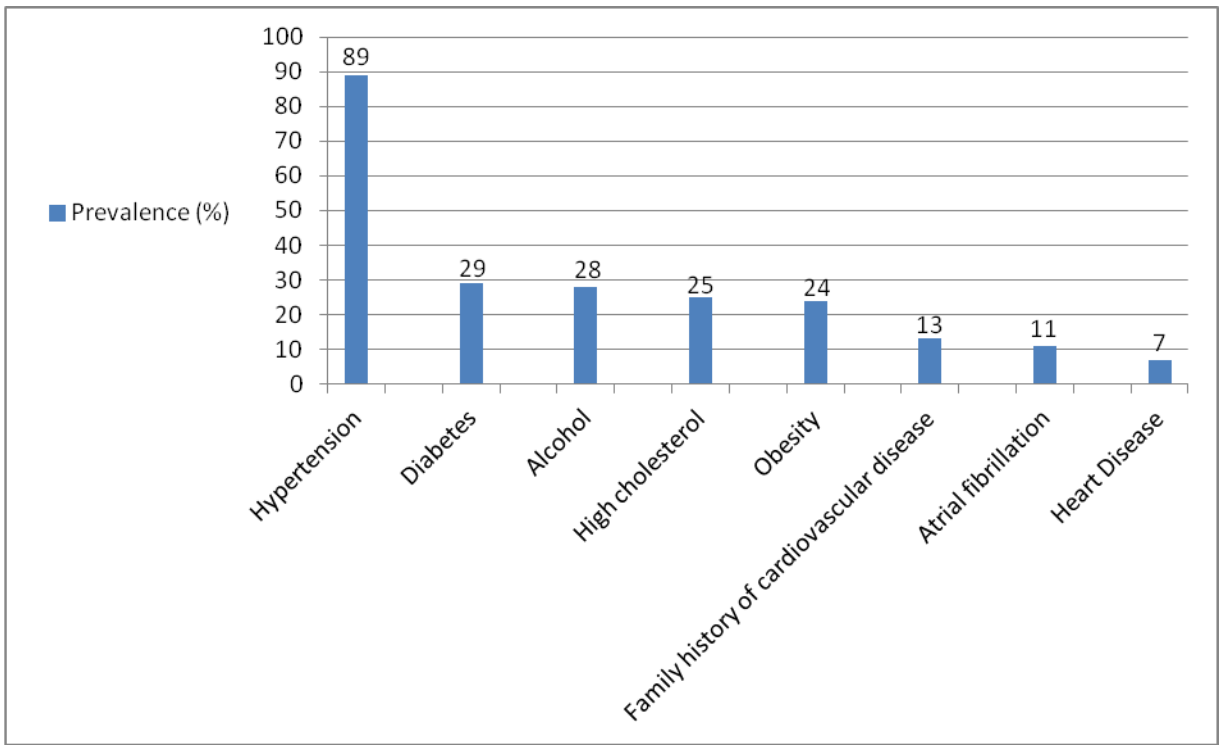

Figure 3: Distribution of stroke risk factors among Ghanaian stroke survivors

Overall, hypertension was the most common risk factor (89%), followed by diabetes (29%), alcohol consumption (28%), and high cholesterol (25%); the least prevalent risk factor was heart disease (7%).

4.1.3 Health related quality of life

Comparison of the mean HRQoL scores between stroke survivors and healthy controls are reported in Table 3. Among stroke survivors, the HRQoL scores ranged from 57.7% (cognitive domain) to 80.0% (Spirit domain), while HRQoL scores of the control group ranged from 65.6% (cognitive domain) to 85.3% (soul domain). For each HRQoL domain, significantly higher

Table 3: Health related quality of life scores of Ghanaian stroke survivors and healthy controls.

HRQoL domain	Stroke group	Control group	p value
	Mean ± SD	Mean ± SD	
Physical domain	62.8±15.8	83.1±12.7	<0.0001*
Psycho-emotional domain	58.2±15.7	78.4±12.2	<0.0001*
Cognitive domain	57.7±16.2	65.6±10.6	<0.0001*
Ecosocial domain	72.1±14.3	77.6±10.4	0.0001*
Soul domain	78.3±12.5	85.3±9.7	<0.0001*
Spirit domain	80.0±13.6	85.1±9.9	0.0002*
Spiritual interaction domain	73.8±14.8	81.2±11.0	<0.0001*
HRQoL sum	69±13.3	79.5±10.9	<0.0001*

* p value is significant

scores were observed for the control group compared to the stroke survivors. The most affected HRQoL domains of the stroke survivors were the physical, psycho-emotional and cognitive domains. Comparison of the mean HRQoL scores between stroke survivors at Korle-Bu Teaching Hospital and Tema General Hospital showed that there were no significant differences for the physical, soul, spirit and spiritual interaction domains (Table 4). However, stroke survivors at Tema General Hospital had significantly higher HRQoL scores for the psycho-emotional, cognitive and eco-social domains than stroke survivors at Korle-Bu Teaching Hospital (Table 4).

In the univariable analysis, HRQoL was significantly associated with several demographic features. Age was associated with the physical domain (p= 0.001), cognitive domain (p=0.006), ecosocial domain (p= 0.001), and soul domain (p= 0.008). There was no significant difference between males and females for any of the HRQoL domains. Income level and religion were respectively associated with ecosocial domain (p= 0.008) and psycho-emotional domain (p=0.026), while educational level was associated with both cognitive domain (p= 0.034) and ecosocial domain (p= 0.013). In the univariable analysis, HRQoL was also significantly associated with several clinical/psycho-emotional features. With the exception of cognitive domain and spirit interaction domain, stroke severity was associated with all the other HRQoL domains ($0.0001<p<0.043$). Stroke frequency was associated with cognitive domain (p= 0.006), psycho-emotional domain (p= 0.032) and ecosocial domain (p= 0.015), while stroke duration

Table 4: Health related quality of life scores of stroke survivors at Korle-Bu Teaching Hospital and Tema General Hospital.

HRQoL domain	Korle-Bu Teaching Hospital	Tema General Hospital	p value
	Mean ± SD	Mean ± SD	
Physical domain	60.4±15.5	65.1±15.7	0.0651
Psycho-emotional domain	55.5±15.0	60.9±16.2	0.0325*
Cognitive domain	50.8±13.7	64.6±15.7	<0.0001*
Ecosocial domain	65.8±11.6	78.5±14.0	0.0001*
Soul domain	76.6±11.6	80.0±13.3	0.0915
Spirit domain	78.1±12.6	81.9±14.4	0.0780
Spiritual interaction domain	74.5±13.0	73.0±16.3	0.5343
HRQoL sum	70.0±13.3	83.4±15.1	<0.0001*

* p value is significant

was associated with the spirit domain (p=0.008). Stroke subtype and the side of the body affected by stroke however, did not affect HRQoL. Among the various risk factors of stroke, only diabetes and heart disease affected HRQoL; diabetes was associated with physical domain (p=0.033) while heart disease was associated with cognitive domain (p=0.039) and ecosocial domain (p=0.044). Frequency of laughter was associated with all the HRQoL domains ($0.0001<p<0.024$), while negative feelings was only associated with psycho-emotional domain ($p<0.0001$).

Variables included in the multivariable regression model were age, post-stroke duration, type and number of strokes, stroke levity score, and Likert-scale responses to laughter frequency and negative feelings frequency. Independent determinants of HRQoL identified through the regression analysis are reported in Table 5. Younger age was associated with better physical and soul HRQoL domains. Shorter stroke duration was associated with better spirit HRQoL, while longer duration was associated with better psycho-emotional HRQoL. Lower frequency of stroke determined better cognitive HRQoL. With the exception of spiritual interaction domain, stroke severity (levity) was associated with all the HRQoL domains, with mild stroke determining better quality of life. Frequent negative feelings or emotions were associated with poorer psycho-emotional HRQoL. With the exception of physical and spiritual domains, frequency of laughter was associated with all the HRQoL domains, with higher laughter frequency determining better quality of life.

Table 5: Determinants of health related quality of life of Ghanaian stroke survivors identified through regression analysis

HRQoL domain	Determinant	t	p	β
Physical domain	Age	-2.454	0.016	-0.212
	Stroke levity	5.307	<0.0001	0.472
Psycho-emotional domain	Stroke levity	4.57	<0.0001	0.378
	Laughter frequency	6.302	<0.0001	0.495
	Negative feelings	3.973	<0.0001	0.296
	Stroke duration	3.993	0.028	1.088
Cognitive domain	Stroke levity	4.915	<0.0001	0.445
	Laughter frequency	2.669	0.009	0.23
	Stroke frequency or number	-2.246	0.027	-0.208
Ecosocial domain	Age	-0.209	0.041	0.041
	Stroke levity	4.329	<0.0001	0.388
	Laughter frequency	3.108	0.003	0.265
Soul domain	Age	-2.375	0.02	-0.218
	Stroke levity	2.807	0.006	0.265
	Laughter frequency	3.334	0.001	0.3
Spirit domain	Stroke levity	2.172	0.032	0.222
	Stroke duration	-3.125	0.002	-0.3
Spiritual interaction domain	Laughter frequency	2.585	0.011	0.266

B-coefficient, p- probability value, t- t statistic (coefficient divided by standard error).

4.2 STUDY II: STROKE RELATED BACTERIURIA

Prevalence of bacteriuria, UTI, ASB and causative organisms among the stroke patients and controls are reported in Table 6. Bacteriuria was significantly higher among stroke patients (24.3%, n=17) than among the control group (7.2%, n=6) and the relative risk was 3.36 (CI= 1.40-8.01). Among the 17 stroke patients who had bacteriuria, 15 had ASB while 2 had UTI: thus ASB and UTI prevalence among stroke patients were 21.4% and 2.9% respectively. All the 6 bacteriuria cases among the control group were asymptomatic; thus prevalence of ASB and UTI among the control subjects were 7.2% and 0% respectively. Prevalence of ASB was significantly higher among the stroke patients (21.4%) than the control group (7.2%). However, there was no significant difference in UTI prevalence between stroke patients (2.9%) and the control group (0%).

Table 6: Prevalence of bacteriuria and causative organisms among stroke patients and healthy controls

Parameter	Stroke		Control		Significance
	n	%	n	%	
Bacteriuria	17	24.3	6	7.2	p=0.0055*
Asymptomatic bacteriuria	15	21.4	6	7.2	p=0.0170*
Urinary tract infections	2	2.9	0	0	p=0.2077
Causative organisms					
Coagulase negative staphylococcus	9	12.9	2	2.4	p=0.0237*
Stapylococcus aureus	2	2.9	0	0	p=0.2077
viridans streptococci	2	2.9	2	2.4	p=0.1000
Escherichia coli	3	4.3	1	1.4	p=0.3325
Enterobacter spp.	1	1.4	1	1.4	p=0.1000
Proteus mirabilis	2	2.4	0	0	p=0.2027
Enterococcus faecalis	1	1.4	0	0	p=0.4575
Citrobacter kosei	1	1.4	0	0	p=0.4575

* p value is significant

A wide range of bacterial organisms were isolated from the urine samples that were positive for bacteriuria (Table 6). The causative organisms fell into three groups including enterobacteriaceae, staphylococci and streptococci. The enterobacteriaceae comprised four species (*Escherichia coli*, *Proteus mirabilis*, *Enterococcus faecalis*, *Cirobacter kosei* and *Enterobacter* spp.) and had prevalence of 1.4-4.3% among stroke patients and 0-1.4% among the control group. Coagulase negative staphylococcus was more predominant than *Staphylococcus aureus* which was isolated exclusively from stroke patients. Overall coagulase negative staphylococcus was the most predominant organism isolated and it showed prevalence of 12.9% among stroke patients and 2.4% among the control group. The streptococci isolated were all viridians streptococci and had similar prevalence rates for stroke patients (2.9%) and the control group (2.4%). Causative organisms of bacteriuria did not show any significant differences between the stroke patients and the control group except for coagulase negative staphylococcus.

The univariable analysis showed that several demographic features of the stroke patients including age and education did not have any effect on bacteriuria (Table 7). However, there was

Table 7: Factors associated with bacteriuria

Univariable analysis	***p value***	
Age	0.751	
Gender	0.003	
Education	0.209	
Marital status	0.014	
Presence of stroke	0.003	
Stroke duration	0.806	
Stroke subtype	0.254	
Stroke frequency	0.457	
Body part affected	0.257	
Hypertension	0.376	
Multivariable analysis	***p value***	**OR (95% CI)**
Gender	0.030	3.40 (1.12-10.30)
Marital status	0.507	1.26 (0.73-2.17)
Presence of stroke	0.009	0.24 (0.08-0.70)

significant difference in bacteriuria between males and females, and also among different categories of marital status of the stroke patients (Table 7). Female stroke patients were significantly associated with bacteriuria (p=0.003). Stroke patients who were "single" were less likely to have bacteriuria (p<0.01). None of the stroke parameters including stroke frequency, duration, subtype, side of the body affected and hypertension significantly affected bacteriuria in the univariable analysis (Table 7). In the multivariable analysis, female gender (OR= 3.40, CI= 1.12-10.30, p= 0.03) and presence of stroke (OR= 0.24, CI= 0.08-0.70, p= 0.009) were identified as predictors of bacteriuria (Table 7).

4.3 STUDY III: STROKE KNOWLEDGE, ATTITUDES AND PRACTICES

A total of 693 inhabitants of Accra were sampled in the study and their demographic features, as well as cardiovascular risk factor profile are summarized in Table 8. The mean age of the study respondents was 36.8±14.0 years, and majority of them were males (n=374, 54%) and Christians (n=554, 80%). Marital status of the respondents showed similar proportions for those married (n=267, 38%) and those who were single (n=28, 41%). Secondary level education was the commonest educational level attained by the respondents (n=360, 52%) and the rate of illiteracy

was 14% (n=97). Twenty eight percent of the respondents (n=194) were unemployed, and the most common income range was GHC 100-999 (USD 50-500) which corresponds to 39% (n=270) of the respondents. Forty percent of the respondents (n=274) had at least one stroke risk factor, and the commonest risk factor was alcohol intake (n=118, 17%), followed by hypertension (n=76, 11%).

Respondents' recognition, knowledge and awareness of stroke risk factors and warning signs are reported in Table 9. Lack of exercise was the commonest factor cited by the respondents as a stroke risk factor (n=256, 37%), while diabetes was least cited as a stroke risk factor (n=90, 13%). In the case of stroke warning signs, numbness on one side was the commonest warning sign cited by the respondents (n=304, 44%) while unspecified pain was the least cited (n=79, 11%). Analysis of correct answers provided by the respondents showed that, 159 (23%) correctly listed one established stroke risk factor, 145 (21%) correctly listed two established risk factors, 97 (14%) correctly listed three established risk factors, and 69 (10%) correctly listed four or more established risk factors for stroke. In the case of warning signs, 132 (19%) respondents correctly listed one established stroke warning sign, 139 (20%) correctly listed two established warning signs, 111 (16%) correctly listed three established warning signs, and 159 (23%) correctly listed four or more established warning signs for stroke. In the multiple logistic regression analysis (Table 10), having a stroke risk factor (OR= 2.37, CI=1.52-3.71, $p<0.001$) and Christian Religion (OR= 14.86, CI=1.37-161.01, p=0.03) were associated with higher levels of awareness of stroke risk factors. However, no significant associations were observed between awareness of stroke warning signs and any of the explanatory variables investigated. When asked which organ of the body was associated with stroke, 40% (n=277) of the respondents correctly mentioned the brain, 10% (n=69) mentioned the heart, 44% (n=305) mentioned other parts of the body which are not organs at all, and 6% (n=42) indicated they did not know the answer. In the multiple logistic regression analysis (Table 10), identification of brain as the organ affected by stroke was significantly associated with younger age, that is age <50 years (OR= 0.56, CI= 0.35-0.92, p= 0.021). Responses of the study participants to the six stroke beliefs and/or perceptions investigated are summarized in Table 11. Over 70% (n>485) of the respondents either believed that lifestyle alterations can be made to reduce the risk of stroke, or stroke is a preventable disease, or stroke

Table 8: Demographic features and stroke risk factor profile of sampled residents in Accra

Variable	Frequency	%
Age (mean=36.8±14.0 yrs)		
< 50 years	554	80
≥ 50 years	139	20
Gender		
Male	374	54
Female	319	46
Religion		
Christian	554	80
Moslem	111	16
Traditional religion	21	3
Other	7	1
Marital status		
Married	267	38
Single	281	41
Widowed	68	10
Separated	50	7
Divorced	27	4
Highest Education attained		
Illiterate	97	14
Primary	104	15
Secondary	360	52
Tertiary	132	19
Monthly income (Cedis)		
< 100	180	26
100-999	270	39
1000-1999	21	3
2000-2999	14	2
≥ 3000	14	2
Unemployed	194	28
Stroke risk factors		
Alcohol intake	118	17
Hypertension	76	11
Smoking	47	7
Previous stroke	43	6
High cholesterol	25	4
Heart Disease	19	3
Diabetes	17	2
At least one stroke risk factor	274	40

Table 9: Knowledge of stroke risk factors and warning signs in Accra

Variable	Frequency	%
Risk factors		
*Lack of exercise	256	37
*Hypertension	239	34
*Alcohol	231	33
*High Cholesterol	222	32
Family history of stroke	194	28
*Smoking	167	24
Stress	155	22
*Heart disease	125	18
*Obesity	97	14
Poor eating	83	12
*Diabetes	90	13
No knowledge of risk factors	139	19
Warning signs		
*Numbness (on one side)	304	44
*Weakness (on one side)	266	38
*Slurred speech	256	37
*Severe headache	173	25
*Numbness (on any side)	147	21
*Dizziness	117	17
*Weakness (on any side)	104	15
*Vision problems	103	15
Shortness of breath	90	13
Unspecified pain	79	11
No knowledge of warning signs	152	22

* established stroke risk factor or warning sign

Table 10: Predictors of stroke awareness identified through multivariable logistic regression

Variable	risk factors		warning signs		affected organ	
	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)
Age <50 years	0.87	0.96 (0.57-1.61)	0.92	1.03 (0.59-1.80)	0.02	0.57 (0.35-0.92)
Male gender	0.21	1.28 (0.87-1.88)	0.95	0.99 (0.65-1.49)	0.37	1.18 (0.82-1.72)
Christian religion	0.03	14.86 (1.37-161.01)	1.00	0.00 (0.00-23.09)	0.51	2.20 (0.21-23.30)
Tertiary level of education	0.26	1.58 (0.71-3.52)	0.25	1.66 (0.70-3.92)	0.09	1.89 (0.91-3.91)
Monthly income >GHC 3,000	0.16	4.8 (0.54-43.05)	0.37	2.67 (0.31-22.84)	0.08	4.33 (0.84-22.33)
Presence of a stroke risk factor	0.00	2.37 (1.52-3.71)	0.06	1.57 (0.98-2.52)	0.10	1.41 (0.94-2.10)

Table 11: Stroke beliefs in Accra

Stroke belief	Yes		No		Not sure	
	n	%	n	%	n	%
1. Lifestyle alterations can be made to reduce the risk of stroke	575	83	35	5	83	12
2. Stroke is a preventable disease	554	80	35	5	104	15
3. Stroke requires emergency treatment	536	77	46	7	113	16
4. Stroke is a top killer diseases in Accra	312	45	118	17	263	38
5. Stroke affects only the elderly	180	26	374	54	139	20
6. Stroke is a spiritual illness caused by evil spirits or witches	173	25	333	48	187	27

requires emergency treatment. Forty five percent of the respondents (n=312) agreed that stroke is one of the top killer diseases in Accra. The beliefs that stroke affects only the elderly and stroke is a spiritual illness caused by evil spirits or witches were shared by 26% (n=180) and 25% (n=173) of the respondents respectively. In the event of a stroke, 520 (75%), 55 (8%) and 14 (2%) of the respondents planned to visit the hospital, herbalist and pharmacy respectively. Sources of stroke information reported by the respondents were as follows: radio station- 277 (40%), television- 222 (32%), healthcare professional- 159 (23%), school- 69 (10%), medical textbook- 69 (10%), internet- 62 (9%), newspaper/magazine- 62 (9%), family/friends- 28 (4%), other sources- 35 (5%); a total of 180 (26%) of the respondents indicated that they had never learned about stroke. When asked whether the respondents had ever come across a stroke campaign in Ghana, 86% (n=596) responded in the negative, while 14% (n=97) responded in the affirmative.

CHAPTER FOUR
5.0 DISCUSSION

5.1 Epidemiological profile of stroke survivors in Ghana

The mean age of stroke survivors in this study (58 years) is similar to that reported by a Nigerian study in which the mean age of stroke survivors was 59 years [15]. By comparison, the mean age of stroke survivors in a German population was much greater at 69 years [15]. This disparity may be due to the relatively longer life expectancy in the western world and the fact that age-specific stroke incidence is relatively higher in younger age groups in sub-Saharan Africa. The male to female ratio of the stroke survivors was 1.6:1 which concurs with both a postmortem stroke study and an inpatient stroke study carried out in Ghana [9, 39]. In contrast, female predominance has been reported among stroke survivors in Chicago, Poland, and Melbourne [64, 67, 111].

The distribution of stroke subtypes in this study contrasts with previous studies in Ghana. Studies carried in 1954 and 1981 showed that haemorrhagic stroke was the predominant stroke subtype in Ghana and accounted for approximately 90% of stroke deaths [10, 112]. However, studies carried out in 1994 and 1998 showed that the proportion of haemorrhagic strokes had declined to 60% and cerebral infarction was becoming more common in the country [9]. The current study shows that cerebral infarction may be the predominant stroke type in Ghana accounting for about 78% of stroke cases. A similar evolution of the distribution of stroke subtypes has been previously reported for England and Wales [113]. Despite the small size, our data on stroke subtype agrees with an international stroke study of 3000 cases in which the prevalence of haemorrhagic and ischaemic infarctions were 22% and 78% respectively [8].

Hypertension was the most important stroke risk factor in this study, an observation which has been reported by several other studies in different parts of the world [8, 22, 114, 115]. In Ghana, there is a high prevalence of hypertension in the general population which may partly account for the trend of increasing stroke cases in the country [41, 115]. There is also a high level of undiagnosed hypertension and poor compliance to antihypertensive drugs in the country [10], which are important issues given the relationship between stroke and hypertension. While

prevalence of hypertension in this study (82%) is similar to that reported in a Nigerian study (87%), we observed significantly higher prevalence of other risk factors such as diabetes, smoking, alcohol consumption and atrial fibrillation in the Ghanaian study [15]. By comparison, prevalence rates of atrial fibrillation and ischaemic heart disease among stroke patients (20-30%) in the UK and Germany are higher than what we observed among the Ghanaian stroke patients (7-11%) [15, 22]. This highlights the racial disparity of stroke risk factors which is thought to be important in the geographical distribution of stroke subtypes [15, 16, 23]. We could not investigate the relationship between stroke risk factors and stroke subtypes due to the limited data on stroke subtypes in our sample. However, evidence from other studies shows that hemorrhagic stroke is more associated with hypertension [24-27], while ischemic stroke is more associated with smoking and cardiac disease [27, 28]. This disagrees with data from the current study which showed that ischemic stroke was the prevalent subtype and hypertension the most common risk factor. Further studies are required to explain this observation. However, it is important to note that, though hypertension is more associated with hemorrhagic stroke, it also causes ischemic stroke [18]. The adoption of western lifestyle in African countries such as Ghana may also partly explain the relatively higher prevalence of ischemic stroke observed in this study [15, 16, 23]. Additionally, there is the situation of having a bias of ischemic stroke as the chances of survival are better with ischemic stroke than hemorrhagic stroke. Stroke recurrence in this study was 15.4%, which is quite high and highlights the need for stroke secondary prevention efforts.

5.2 Stroke and health related quality of life

To the best of our knowledge, this study is the first on HRQoL of stroke survivors in Ghana and one of the very few to report on the subject in sub-Saharan Africa. As reported by other studies, we observed multidomain impairment of the stroke patients compared to the control group, particularly for the physical, psycho-emotional and cognitive domains [61, 67-69]. It is difficult to explain the differences in HRQoL of stroke survivors between the two study hospitals. However these differences probably indicate that HRQoL associated with stroke may be highly variable even within the same community. In the univariable analysis, though several

demographic features were associated with HRQoL, only age emerged as an independent predictor of HRQoL. While in this study and others, age was a determinant of HRQoL, in some studies age was not found to be a predictor of HRQoL [69, 71, 72, 116]. This shows that the association between HRQoL and age is not conclusive and further studies are required to elucidate the actual effects of age on HRQoL. This is also the situation of gender which was not a determinant of HRQoL in this study, but has otherwise been reported by several studies as a determinant of HRQoL [71-73, 117]. HRQoL is known to be affected by culture differences [70-73], and this may partly explain the variations in HRQoL and demographic factors.

Several clinical parameters were determinants of HRQoL in this study. Stroke severity was a very important determinant of HRQoL among the stroke survivors as it affected almost all the HRQoL domains. This observation concurs with other studies that have consistently reported mild stroke as a determinant of HRQoL [67, 71, 73, 118, 119]. In the light of this, it is encouraging that that majority of the stroke survivors in the current study (52.6%) had experienced mild stroke. The association of better psycho-emotional HRQoL with longer stroke duration may be due to response shift and coping strategies, which are developed over time [64, 120]. However, the reverse of this was observed for the spirit domain as longer stroke duration determined poorer HRQoL. This observation could be due to unfulfilment of expected recovery from stroke by spiritual methods with time. Contrary to other studies, the number of stroke affected HRQoL [71, 72]. The association of higher frequency of stroke attacks with poorer cognitive HRQoL is consistent with the observation that this domain was relatively more susceptible to impairment in a stroke attack as shown by its lowest HRQoL score (57.7±16.2). This may be further related to the fact that the brain, which is the seat of cognitive functions, is also the organ affected by stroke [121, 122]. The side of the body affected by stroke and stroke subtype did not show any relationship with HRQoL, an observation which concurs with other studies [72, 73, 117]. This implies that the evolution of stroke subtypes in Ghana as described previously in Section 5.1 has little relevance for HRQoL. In line with a Nigerian study [71], negative emotions determined poor psycho-emotional HRQoL, while higher frequency of laughter determined better HRQoL for a wide range of domains, making the latter an important determinant of HRQoL. Stroke risk factors appear to have little relationship with HRQoL as none of them emerged as independent determinants of HRQoL in this study.

There are a few limitations of this study. Though the stroke survivors and controls were age and sex matched, several factors including education, income level and marital status were significantly different between the two groups. This could have affected the HRQoL comparisons between the stroke survivors and controls. Additionally, unlike the stroke survivors, we did not investigate comorbidities such as hypertension among the control group. Another limitation of the study is that we assessed HRQoL of a few stroke survivors based on responses provided by their caregivers, as these stroke patients were unable to communicate. The information provided by a caregiver may not be a completely true representation of the subjective reflection of life experiences of the stroke patient.

5.3 Stroke related bacteriuria and urinary tract infections

In this study we investigated bacteriuria among stroke patients attending a physiotherapy clinic and compared the results with bacteriuria among healthy controls recruited from environs of the study hospital. The background of the study sampling indicates that the sample is more of a community sample and the bacteriuria cases are therefore community-acquired. Though evidence of bacteriuria occurred in 24.3% of the stroke patients, UTI occurred in only 2.9% and ASB was more common (21.4%). By comparison a study among stroke inpatients in a Turkey hospital reported bacteriuria prevalence of 39.1%, and UTI and ASB prevalence rates were 27.3% and 11.8% respectively [92]. A systematic review on infections among stroke inpatients reported UTI prevalence rate of 10% [95], which is higher than the 2.9% reported in our study. Thus hospital-acquired UTI appears to be a more common complication of stroke than community-acquired bacteriuria. However, further studies are required to confirm this.

We observed significantly higher prevalence of bacteriuria among stroke patients (21.4%) than the healthy controls (8.9%), which suggests that stroke predisposes an individual to community-acquired bacteriuria. The actual risk of community-acquired bacteriuria to a stroke patient was computed to be more than three-fold higher. While data on community-acquired bacteriuria and UTI of stroke patients are rare, there is some data on other risk populations such as diabetics and HIV patients. Boyko *et al*. [123] observed a significantly higher risk of UTI among postmenopausal women with diabetes than non-diabetics in Washington, USA; UTI incidence was 12.2% for diabetic women and 6.7% for nondiabetic women. Similarly, in a systematic

review, Renko *et al*. [124] reported that ASB was significantly higher among diabetics (12.2%) than healthy controls (4.5). On the contrary, Widmer *et al*. [125] did not observe any significant difference in ASB between HIV-positive pregnant women (9%) and HIV-negative pregnant women (7.9%) in Cape-Town, South Africa. Similar findings have been reported in Nairobi-Kenya where prevalence of bacteriuria among HIV-negative women (25%) was not significantly different from the prevalence among HIV-positive women (21%) [126]. Thus like our data on stroke, bacteriuria appears to be associated with diabetes, while this may not be the case for HIV infection.

The relatively greater susceptibility of stroke patients to infections can be attributed to several reasons. In the first place, the neurological impairment in stroke is known to cause immunodepression through several humoral and neural pathways [127]. The defects in immune function in stroke patients include reduced peripheral blood lymphocyte counts, impaired T- and natural killer cell activity, and reduced mitogen induced cytokine production and proliferation [127, 128]. Maximal neurological impairment occurs during the first three days of stroke [127], by which time the stroke patient is normally on admission in the hospital. This in addition to invasive hospital procedures (such as catheterization) may account for the higher prevalence of bacteriuria reported among stroke inpatients compared to our stroke patients who were outpatients. Secondly, stroke patients usually have co-morbidities which seem to make them more susceptible to infections [129]. The commonest co-morbidity among our stroke patients was hypertension but it did not show any significant association with bacteriuria. We were unable to investigate the relationship between diabetes and bacteriuria among our stroke patients owing to the few cases of diabetes in our dataset.

In this study, the aetiology of bacteriuria was similar in stroke patients and the healthy controls, and involved three groups/genera of organisms. *Streptococcus* species are indicative of community-acquired infections rather than hospital-acquired infections [95, 130]. The isolation of viridians streptococci from both stroke patients and controls reflects the background of our study sample as a community sample. *Staphylococcus* species isolated from humans can be classified into two groups based on the coagulase test. These two groups are coagulase-negative staphylococci and *S. aureus* which is coagulase positive [130]. *S. aureus* is the main staphylococcal pathogen and causes a wide range of infections such as UTI, septicaemia,

carbuncles, food poisoning and osteomyelitis [130]. Interestingly, in this study coagulase-negative staphylococci which are known to be less virulent, were more common in bacteriuria than *S. aureus*. Similar findings have been reported [131, 132], and highlight the importance of including coagulase-negative staphylococci in the surveillance of human pathogens as far UTI is concerned. Enteric bacteria such as *E. coli* and *Enterobacter* species were commonly implicated in bacteriuria which concurs with other studies [95, 133]. Enteric bacteria are part of the normal bacterial flora of the gastrointestinal tract and may be introduced into the urinary tract through faecal contamination. Antibiotic resistance has become a major problem with urinary isolates especially, with *E. coli* and other enteric bacteria. Owing to the small numbers of isolates of the different organisms, it was not statistically feasible to report on the antibiotic resistance patterns of our urinary isolates. In Ghana, *E. coli* isolated from urine of patients showed high percentage resistance of 13-22% for Nalidixic Acid, Nitrofurantoin, Cefuroxime and Gentamicin [134].

The significant association of bacteriuria with females in our study has previously been reported [93, 133], and is probably due to the proximity of the female urinary system to the anus which makes it easy for enterobacteria (common aetiological agents of UTI) to move to the urinary system.

Based on the results of this study, it is important to take a closer look at ASB in relation to stroke. Screening for ASB among stroke patients is rare at both hospital and community levels. However, the high prevalence of 18% in this study coupled with immunodepression in stroke patients seems to indicate that screening for ASB among stroke patients may be necessary, as well as its treatment. Our study was a cross sectional study, and therefore we were not able to evaluate if ASB among stroke patients actually progresses to UTI. We hypothesize that this may be the case, given the immunodepression of stroke patients and the evidence of UTI among some of our stroke patients. Further studies to address these issues are necessary.

5.4 Stroke knowledge, attitudes and practices

Data from this study indicates that generally, stroke is perceived as a serious illness (requires emergency treatment), is preventable and lifestyle alterations can be made to reduce its risk. However, the data also shows that there is poor community awareness of stroke risk factors and its warning signs. Poor awareness of stroke risk factors in this study is shown by the fact that,

hypertension which is the most important stroke risk factor in Ghana [135, 136], could not be recognized by majority (66%) of the respondents. This is also the case of major risk factors of stroke such as high cholesterol, diabetes, alcohol and smoking. “Lack of exercise” was the commonest risk factor cited by the respondents, and is probably because exercising is one of the major stroke rehabilitation methods, and thus it is commonly perceived that people who do not exercise are at risk of stroke. Poor community awareness of stroke risk factors has also been reported in Benin [45] and Nigeria [47]. However in Nigeria, a study among university staff and students reported appreciable level of awareness of stroke risk factors with majority of the respondents correctly identifying each of the major stroke risk factors [52]. Similar studies done outside Africa, have also reported poor community knowledge of stroke risk factors, and this is evident in data from Brazil [110], Ireland [48], Australia [49], Pakistan [50] and the United States [51]. Studies have shown that increased awareness of stroke risk factors among people at high risk for stroke leads to improved compliance with stroke prevention practices [43, 44]. In Ghana there is currently a stroke epidemic [137], and this could partly reflect the poor community awareness of stroke risk factors observed in this study.

Majority of the respondents could not recognize any of the basic stroke warning signs such as slurred speech and vision problems, an observation which has also been reported by studies carried out in both developed and developing countries [45, 46, 48, 49, 110]. In a stroke burdened country like Ghana, poor community knowledge of stroke warning signs is of serious concern, as recognition of the warning signs is a predictor of early hospital reporting of the disease [138, 139]. Although a large proportion of the respondents (75%) indicated that they would visit the hospital in the event of a stroke attack, this could be affected unfavourably by the poor recognition of stroke warning signs observed. Numbness or paralysis was the commonest stroke warning sign in this study, which concurs with studies done in Nigeria [46] and Benin [45] but contrasts with studies in Australia [49] and Ireland [48] where vision problems and slurred speech respectively were the commonest warning signs identified.

In addition to poor community awareness of stroke risk factors and warning signs in Accra, there are misconceptions about the organ involved in stroke, with only 40% of the respondents correctly identifying the brain as the organ affected by stroke; by comparison similar studies

reported 14% in Benin [45], 73% in Australia [49] and 52% in Pakistan [50]. In terms of the numbers of correct responses, we observed similar levels of knowledge of stroke risk factors and warning signs, unlike most studies which showed that respondents' knowledge of warning signs were significantly poorer than risk factors [48, 49, 51]. Predictors of stroke knowledge in this study also appear to be different from those of some other studies. While income and education were determinants of knowledge of stroke risk factors in studies carried out in Australia [49], Brazil [110] and Ireland [48], this was not the case with the Ghanaian data. Having a stroke risk factor was a strong determinant in the recognition of stroke risk factors in this study, and has also been reported in Ireland [48] but not Brazil [110]. These observations highlight the geographical and cultural variations in determinants of stroke knowledge, and may be important in planning health education of stroke. Though Christian religion was identified to be associated with increased awareness of stroke risk factors (OR 14.86), the large confidence interval of 1.37-161.01 will make one to be careful in interpreting this odds ratio even though it is statistically significant (p=0.03).

This study has not only revealed the poor community awareness of stroke risk factors in Accra, but has also shown a high general prevalence of self-reported risk factors (40%) which may explain the high morbidity of stroke in the city. Though stroke is one of the three most common causes of mortality in Ghana currently, minority of the respondents (45%) were aware of the fact the disease is a top killer. This is probably due to poor publicity given to the disease in Ghana compared to other diseases such as Malaria. Evidence partly in support of this is the fact that >80% of the respondents had never come across a stroke campaign in Ghana. Generally, the findings of the study highlight the necessity of public health education of stroke in Accra, and probably the whole of Ghana. Such a program should aim primarily at improving community awareness of stroke risk factors and warning signs, and also encouraging behavioural changes that would decrease risk of the disease. In this study, over 70% of the respondents had learnt some information about stroke through the radio or television, indicating that the two media would be very useful for dissemination of stroke information in a public health education programme.

CHAPTER SIX

6.0 CONCLUSIONS

This doctoral research project has provided valuable information on stroke in four areas of the disease in Southern Ghana, including epidemiology, HRQoL, risk of bacteriuria and community perceptions.

The population of Ghanaian stroke survivors investigated has a mean age of less than 60 years and about one-half of them have mild stroke. Ischemic stroke is the predominant stroke subtype among the stroke survivors, while hypertension is the predominant stroke risk factor. There is the need for efforts to control hypertension in Ghana, which would require studies aimed at understanding determinants of hypertension in the Ghanaian population.

The most impaired HRQoL domains of the stroke survivors are physical, psycho-emotional and cognitive domains. Determinants of HRQoL of the stroke survivors cover a wide spectrum of demographic, clinical and psychological features some of which are modifiable and can therefore be modulated to achieve improved HRQoL. Frequency of laughter appears to be a consistent modifiable determinant of HRQoL affecting almost all HRQoL domains.

Stroke patients have a significantly higher risk of bacteriuria which in most cases is asymptomatic. The aetiology of community-acquired bacteriuria is similar in both stroke patients and healthy controls. Community-acquired bacteriuria in stroke patients appears to have little or no relationship with clinical parameters such as hypertension and stroke subtype.

Though stroke is perceived as a serious and preventable disease in Southern Ghana, community awareness of the risk factors and warning signs is sub-optimal. We hypothesize that this reflects the trend in the whole of Ghana and is partly responsible for the high morbidity and mortality of stroke in the country. Community-based education programs to increase public awareness of stroke could contribute to decreasing the risk of stroke and to increasing the speed of hospital presentation after stroke onset.

REFERENCES

1. Warlow CP. Epidemiology of stroke. Lancet 1998;352:1-4.
2. Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors JJ, Culebras A, Elkind MS, George MG, Hamdan AD, Higashida RT, Hoh BL, Janis LS, Kase CS, Kleindorfer DO, Lee JM, Moseley ME, Peterson ED, Turan TN, Valderrama AL, Vinters HV; American Heart Association Stroke Council, Council on Cardiovascular Surgery and Anesthesia; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular and Stroke Nursing; Council on Epidemiology and Prevention; Council on Peripheral Vascular Disease; Council on Nutrition, Physical Activity and Metabolism. An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44(7):2064-89.
3. Rowland L. Merritt's Neurology. 10th Ed. Philadelphia: Lippincot Williams & Wilkins; 2000.
4. Caplan L. Caplan's stroke: a clinical approach. 3rd Ed. Woburn: 2000.
5. Nilsen ML. A historical account of stroke and the evolution of nursing care for stroke patients. J Neurosci Nurs 2010; 42(1):19-27.
6. Ashrafian H. Familial stroke 2700 years ago. Stroke 2010;41(4):e187.
7. Bamford J, Sandercock P, Dennis M, Burn J, Warlow C. Classification and natural history of clinically identifiable subtypes of cerebral infarction. Lancet 1991;337(8756):1521-1526.
8. 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. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case–control study. Lancet 2010; 376:112–23.
9. Wiredu EK, Nyame PK. Stroke mortality in Accra: A study of risk factors. Ghana Med J 2001; 35(4): 151–161.
10. Anim JT, Kofi AD. Hypertension, cerebral vascular changes and stroke in Ghana.1 - Microaneurysm formation and stroke. J Path 2005;143(3):177-182.

11. Adams HP Jr, Bendixen BH, Kappelle LJ, Biller J, Love BB, Gordon DL, Marsh EE 3rd. 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(1):35-41
12. Johnston SC, Mendis S, Mathers CD. Global variation in stroke burden and mortality: estimates from monitoring, surveillance, and modelling. Lancet Neurol. 2009; 8(4):345-354.
13. Merino JG, Warach S. Imaging of acute stroke. Nat Rev Neurol 2010; 6:560–571.
14. 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. Lancet 2006;367(9524):1747-1757.
15. Owolabi MO, Ugoya S, Platz T. Racial disparity in stroke risk factors: the Berlin–Ibadan experience; a retrospective study. Acta Neurol Scand 2009; 119: 81–87.
16. Connor MD, Walker R, Modi G, Warlow CP. Burden of stroke in black populations in sub-Saharan Africa. Lancet Neurol 2007;6(3):269-278.
17. Chobanian A, Bakris G, Black H, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 Report. JAMA 2003;289:2560-2572.
18. Iadecola C, Gorelick PB. Hypertension, angiotensin, and stroke: beyond blood pressure. Stroke 2004;35:348–350.
19. Ohene-Frempong K, Weiner SJ, Sleeper LA, Miller ST, Embury S, Moohr JW, Wethers DL, Pegelow CH, Gill FM. Cerebrovascular accidents in sickle cell disease: rates and risk factors. Blood 1998;91(1):288-294.
20. Merkel KH, Ginsberg PL, Parker JC Jr, Post MJ. Cerebrovascular disease in sickle cell anemia: a clinical, pathological and radiological correlation. Stroke 1978;9(1):45-52.

21. Bravata DM, Wells CK, Gulanski B, Kernan WN, Brass LM, Long J, Concato J. Racial Disparities in Stroke Risk Factors: the impact of socioeconomic status.. Stroke 2005;36:1507-1511.
22. Hajat C, Dundas R, Stewart JA, Lawrence E, Rudd AG, Howard R, Wolfe CD. Cerebrovascular risk factors and stroke subtypes: differences between ethnic groups. Stroke. 2001;32:37–42.
23. Markus HS, Khan U, Birns J, Evans A, Kalra L, Rudd AG, Wolfe CD, Jerrard-Dunne P. Differences in stroke subtypes between black and white patients with stroke: the South London Ethnicity and Stroke Study. Circulation 2007; 116(19):2157-2164.
24. Kim HC, Nam CM, Jee SH, Suh I. Comparison of blood pressure-associated risk of intracerebral hemorrhage and subarachnoid hemorrhage: Korea Medical Insurance Corporation Study. Hypertension 2005;46:393–397.
25. Ebrahim S, Sung J, Song YM, Ferrer RL, Lawlor DA, Davey SG. Serum cholesterol, haemorrhagic stroke, ischaemic stroke, and myocardial infarction: Korean National Health System Prospective. BMJ 2006;333:22.
26. Owolabi MO, Agunloye AM. Risk factors for stroke among patients with hypertension: A case-control study. J Neurol Sci 2013;325(1-2):51-56.
27. Owolabi MO, Agunloye AM. Which risk factors are more associated with ischemic rather than hemorrhagic stroke in black Africans? Clin Neurol Neurosurg 2013; 115(10):2069-2074.
28. Sacco RL, Ellenberg JH, Mohr JP. Infarcts of undetermined cause: the NINCDS Stroke Data Bank. Ann Neurol. 1989;25:382–390.
29. Manolio TA, Collins FS, Cox NJ. Finding the missing heritability of complex diseases. Nature. 2009;461:747–753.
30. Ikram MA, Seshadri S, Bis JC. Genomewide association studies of stroke. N Engl J Med. 2009;360:1718–1728.
31. Gretarsdottir S, Thorleifsson G, Manolescu A. Risk variants for atrial fibrillation on chromosome 4q25 associate with ischemic stroke. Ann Neurol. 2008;64:402–409.
32. Schunkert H, Gotz A, Braund P McGinnis R, Tregouet DA, Mangino M, Linsel-Nitschke P, Cambien F, Hengstenberg C, Stark K, Blankenberg S, Tiret L, Ducimetiere P, Keniry A, Ghori MJ, Schreiber S, El Mokhtari NE, Hall AS, Dixon RJ, Goodall AH, Liptau H,

Pollard H, Schwarz DF, Hothorn LA, Wichmann HE, König IR, Fischer M, Meisinger C, Ouwehand W, Deloukas P, Thompson JR, Erdmann J, Ziegler A, Samani NJ; Cardiogenics Consortium. Repeated replication and a prospective meta-analysis of the association between chromosome 9p21.3 and coronary artery disease. Circulation 2008;117(13):1675–1684.

33. Palm F, Urbanek C, Grau A. Infection, its treatment and the risk for stroke. Curr Vasc Pharmacol. 2009;7(2):146-52.
34. Nagel MA, Gilden D. Neurological complications of varicella zoster virus reactivation. Curr Opin Neurol 2014;27(3):356-360.
35. Murray CJL, Lopez AD. Mortality by cause for eight regions of the world: Global Burden of Disease Study. Lancet 1997; 349: 1269-1276.
36. Marsh JD, Keyrouz SG. Stroke prevention and treatment. J AM Coll Cardiol 56(9):683-691.
37. Howard VJ, Cushman M, Pulley L, Gomez CR, Go RC, Prineas RJ, Graham A, Moy CS, Howard G. The reasons for geographic and racial differences in stroke study: objectives and design. Neuroepidemiology. 2005;25(3):135-43.
38. Truelsen T, Heuschmann P, Bonita R, Arjundas G, Dalal P, Damasceno A, Nagaraja D, Ogunniyi A, Oveisgharan S, Radhakrishnan K, Skvortsoya VI, Stakhovskaya V. Standard method for developing stroke registers in low-income and middle-income countries: experiences from a feasibility study of a stepwise approach to stroke surveillance (STEPS Stroke). Lancet Neurol 2007;6:134–139.
39. Agyemang C, Attah-Adjepong G, Owusu-Dabo E, De-Graft Aikins A, Addo J, Edusei AK, Nkum B, Ogedegbe G. Stroke in Ashanti region of Ghana: an urgent need for action. Ghana Med J 2010; 46(2):12–17.
40. Pole D, Ikeme AC, Pobee JO, Larbi E, Williams H, Blankson J. The Mamprobi survey–a screening survey for cardiovascular disease and risk factors in Africa: methodology and validity. Bull World Health Organ 1979, 57:81–87.
41. Bosu WK. Epidemic of hypertension in Ghana: a systematic review. BMC Public Health 2010;10:418.
42. Taylor T, Davis P, Torner J, Holmes J, Meyer J, Jacobson M. Lifetime cost of stroke in the United States. Stroke 1996;27:1459-66.

43. Samsa GP, Cohen SJ, Goldstein LB, Bonito AJ, Duncan PW, Enarson C, DeFriese GH, Horner RD, Matchar DB. Knowledge of risk among patients at increased risk for stroke. Stroke 1997;28:916–921.
44. Kreuter MW, Strecher VJ. Changing inaccurate perceptions of health risk: results from a randomized trial. Health Psychol 1995;14:56–63.
45. Cossi MJ, Preux PM, Chabriat H, Gobron C, Houinato D. Knowledge of stroke among an urban population in Cotonou (Benin). Neuroepidemiology 2012;38(3):172–178.
46. Wahab KW, Okokhere PO, Ugheoke AJ, Oziegbe O, Asalu AF, Salami TA. Awareness of warning signs among suburban Nigerians at high risk for stroke is poor: a cross-sectional study. BMC Neurol 2008;8:18.
47. Ayanniyi O, Akande O, Mustapha AF. Knowledge and perception of stroke among adults in Osogbo, Nigeria. Afr J Med Med Sci 2006;35(4)**:**447–452.
48. Hickey A, O'Hanlon A, McGee H, Donnellan C, Shelley E, Horgan F, O'Neill D. Stroke awareness in the general population: knowledge of stroke risk factors and warning signs in older adults. BMC Geriatr 2009; 9:35.
49. Sug Yoon S, Heller RF, Levi C, Wiggers J. Knowledge and perception about stroke among an Australian urban population. BMC Public Health 2001; 1:14.
50. Aly Z, Abbas K, Kazim SF, Taj F, Aziz F, Irfan A, Sheikh R, Shakir M, Javed SM, Fatmi Z. Awareness of stroke risk factors, signs and treatment in a Pakistani population. J Pak Med Assoc 2009, 59(7)**:**495–499.
51. Reeves MJ, Hogan JG, Rafferty AP. Knowledge of stroke risk factors and warning signs among Michigan adults. Neurology 2002;59(10)**:**1547–1552.
52. Obembe AO, Olaogun MO, Bamikole AA, Komolafe MA, Odetunde MO. Awareness of Risk Factors and Warning Signs of Stroke in a Nigeria University. J Stroke Cerebrovasc Dis 2013;23(4):749-758.
53. Doyle KP, Simon RP, Stenzel-Poore MP. Mechanisms of ischemic brain damage. Neuropharmacology 2008;55:310–318.
54. Dirnagl U, Iadecola C, Moskowitz MA. Pathobiology of ischaemic stroke: an integrated view. Trends Neurosci 1999;22:391–397.
55. Lyden PD, Zivin JA. Hemorrhagic transformation after cerebral ischemia: Mechanisms and incidence. Cerebrovasc Brain Metab Rev.1993;5:1-16.

56. Hademenos GJ, Massoud TF. Biophysical mechanisms of stroke. Stroke 1997;28:2067-2077.
57. World Health Organization. The first ten years of the World Health Organization. Geneva: WHO; 1948.
58. World Health Organization. Health promotion: a discussion document. Geneva: WHO; 1984.
59. The WHOQOL Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. Psychol Med 1998;28(3):551-558.
60. Salter KL, Moses MB, Foley NC, Teasell RW. Health-related quality of life after stroke: what are we measuring? Int J Rehabil Res 2008;31(2):111-117.
61. Owolabi MO and Ogunniyi A. Profile of health-related quality of life in Nigerian stroke survivors. European Journal of Neurology 2009;16:54–62.
62. Hopman WM, Verner J. Quality of life during and after inpatient stroke rehabilitation. Stroke 2003;34(3):801-805.
63. Owolabi MO. Impact of stroke on health-related quality of life in diverse cultures: the Berlin-Ibadan multicenter international study. Health Qual Life Outcomes 2011; 9:81.
64. King RB. Quality of life after stroke. Stroke 1996;27(9):1467-72.
65. Tengs TO, Lin TH. A meta-analysis of quality-of-life estimates for stroke. Pharmacoeconomics 2003;21(3):191-200.
66. Hackett ML, Duncan JR, Anderson CS, Broad JB, Bonita R. Health-related quality of life among long-term survivors of stroke: results from the Auckland Stroke Study, 1991-1992. Stroke 2000;31(2):440-447.
67. Jaracz K, Kozubski W. Quality of life in stroke patients. Acta Neurol Scand 2003; 107(5):324-329.
68. Clarke P, Marshall V, Black SE, Colantonio A. Well-being after stroke in Canadian seniors: findings from the Canadian Study of Health and Aging. Stroke 2002; 33(4): 1016-21.
69. Lai SM, Studenski S, Duncan PW, Perera S. Persisting consequences of stroke measured by the Stroke Impact Scale. Stroke 2002; 33(7): 1840-1844.
70. Owolabi MO and Ogunniyi A. Profile of health-related quality of life in Nigerian stroke survivors. Euro J Neurol 2009;16:54–62.

71. Owolabi MOO. Determinants of health related quality of life of Nigerian stroke survivors. Trans Roy Soc Trop Med Hyg 2008;102:1219-1225.
72. Gokkaya NK, Aras MD, Cakei A. Health-related quality of life of Turkish stroke survivors. Int J Rehabil Res 2005;28:229-235.
73. Kong KH, Yang SY. Health-related quality of life among chronic stroke survivors attending a rehabilitation clinic. Singapore Med J 2006;47:213-218.
74. Evans RG. Patient centred medicine: reason, emotion, and human spirit? Some philosophical reflections on being with patients. Medical Humanities. BMJ Publishing Group & Institute of Medical Ethics 2003; 29: 8-14.
75. Williams LS, Weinberger M, Harris LE, Clark DO, Biller J. Development of a strokespecific quality of life scale. Stroke 1999; 30(7):1362-9.Dorman PJ, Waddell F, Slattery J, Dennis M, Sandercock P. Are proxy assessments of health status after stroke with the EuroQol questionnaire feasible, accurate, and unbiased? Stroke 1997;28(10):1883-7.
76. Dorman PJ, Waddell F, Slattery J, Dennis M, Sandercock P. Is the EuroQol a valid measure of health-related quality of life after stroke? Stroke 1997;28(10):1876-82.
77. Buck D, Jacoby A, Massey A, Steen N, Sharma A, Ford GA. Development and Validation of NEWSQOL((R)), the Newcastle Stroke-Specific Quality of Life Measure. Cerebrovasc Dis 2004;17(2-3):143-52.
78. Fernandez-Concepcion O, Verdacia-Fraga R, Alvarez-Gonzalez MA, et al. Stroke-specific quality of life scale (ECVI-38): an evaluation of its acceptance, reliability and validity. Rev Neurol 2005;41(7):391-398.
79. Lin JH, Wang WC, Sheu CF, Lo SK, Hsueh IP, Hsieh CL. A Rasch analysis of a self-perceived change in quality of life scale in patients with mild stroke. Qual Life Res 2005;14:2259-2263.
80. Ewert T, Stucki G. Validity of the SS-QOL in Germany and in survivors of hemorrhagic or ischemic stroke. Neurorehabil Neural Repair 2007;21(2):161-168.
81. Owolabi MO (2011) HRQOLSIP-26: a concise, multicultually valid, Multidimensional, Flexible and Reliable stroke specific measure. ISRN Neurology 2011:295096.
82. World Health Organization. International Classification of Impairments, Disabilities, and Handicaps. Geneva: WHO; 1980.

83. Kelly-Hayes M, Robertson JT, Broderick JP, Duncan PW, Hershey LA, Roth EJ, Thies WH, Trombly CA. The Am Heart Association Stroke Outcome Classification. Stroke. 1998; 29:1274–1280.
84. Owolabi MO, Platz T. Proposing the Stroke Levity Scale: a valid, reliable, simple, and time-saving measure of stroke severity. Eur J Neurol. 2008;15(6):627-633.
85. Ozer M. Management of persons with chronic neurological illness. Woburn: Butterworth-Heinemann; 2000.
86. Orenstein R, Wong ES. Urinary tract infections in adults. Am Fam Physician 1999; 59(5):1225-1234.
87. Nicolle LE. Update in adult urinary tract infection. Curr Infect Dis Rep 2011;13:552-560.
88. Schnarr J, Smaill F. Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy. Eur J Clin Invest 2008;38(2):50-57.
89. Nicolle LE. Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis. Urol Clin North Am 2008;35:1-12.
90. Warren JW, Abrutyn E, Hebel JR, Johnson JR, Schaeffer AJ, Stamm WE. Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. Clin Infect Dis 1999;29:745-758.
91. Hernández-Bou S, Trenchs V, Alarcón M, Luaces C. Afebrile very young infants with urinary tract infection and the risk for bacteremia. Pediatr Infect Dis J. 2014;33(3):244-247.
92. Ersoz M, Ulusoy H, Oktar MA, Akyuz M. Urinary tract infection and bacteriuria in stroke patients: frequencies, pathogen microorganisms, and risk factors. Am J Phys Med Rehab 2007;86:734-741.
93. Foxman B. The epidemiology of urinary tract infection. Nat Rev Urol 2010;7:653-660.
94. Kamel H, Iadecola C. Brain-immune interactions and ischemic stroke: clinical implications. Arch Neurol 2012;69(5):576-81.
95. van de Beek, D. Post-stroke infection: a systematic review and meta-analysis. BMC Neurol 2011; 11:110.
96. van de Beek D, Wijdicks EF, Vermeij FH, de Haan RJ, Prins JM, Spanjaard L, Dippel DW, Nederkoorn PJ. Preventive antibiotics for infections in acute stroke: a systematic review and meta-analysis. Arch Neurol 2009;66:1076-1081.

97. Acheampong JA. Stroke: Risk factors and factors predicting survival. Ghana Med J 2001;35(4): 148–149.
98. Akpalu AK, Nyame PK. Plasma Homocysteine as a Risk Factor for Strokes in Ghanaian Adults. Ghana Med J 2009;43(4):157–163.
99. Agyemang C, Bruijnzeels MA, Owusu-Dabo E. Factors associated with hypertension awareness, treatment, and control in Ghana, West Africa. J Hum Hypertens 2006; 20(1):67-71.
100. Awuah RB, Anarfi JK, Agyemang C, Ogedegbe G, Aikins AD. Prevalence, awareness, treatment and control of hypertension in urban poor communities in Accra, Ghana. J Hypertens 2014;32(6):1203-1210.
101. Gould A, Asare H, Akpalu A, Cullen L, Easton S, Jarrett D, Johnson L, Kirk H, Spice C, Williams J. Development of stroke care in Ghana. Int J Stroke 2011; 6(2):150-151.
102. Ghana Demographics Profile 2013. Index Mundi; 2013 [cited 30th July, 2013]. Available from: http://www.indexmundi.com/ghana/demographics_profile.html.
103. Population and Housing Census. Accra: Ghana Statistical Service; 2010 [cited 29 June 2012]. Available from: http://www.ghana.gov.gh/census/phc2010.pdf.
104. WHO African Region, Ghana. Geneva: World Health Organization; 2013 [cited 30th July, 2013]. Available from: http://www.who.int/countries/gha/en/.
105. Annual Report of the Korle-Bu Teaching Hospital, 2009. Published by the Korle-Bu Teaching Hospital, Accra, Ghana; 2010.
106. Tema General Hospital Profile. Published by the Tema General Hospital, Tema, Ghana; 2014.
107. Owolabi MOO. Measure psychometric properties of the HRQOLISP-40: a novel, shortened multiculturally valid holistic stroke. Neurorehabil Neural Repair 2010;24:814.
108. Fuller CE, Threatte GA, Henry JB. Basic examination of the urine. In: Henry JB, Davey FR, Herman CJ, McPherson RA, Pincus MR, Threatte GA, Woods GL. (Eds). Clinical diagnosis and management by laboratory methods. 20th Ed. Philadelphia: WB Saunders; 2001. Pp. 367-402.
109. Kass EH. Bacteriuria and the diagnosis of infections of the urinary tract. Arch Intern Med 1957;100:709-714.

110. Pontes-Neto OM, Silva GS, Feitosa MR, de Figueiredo NL, Fiorot JA Jr, Rocha TN, Massaro AR, Leite JP: Stroke awareness in Brazil: alarming results in a community-based study. Stroke 2008;39:292-296.
111. Paul SL, Sturm JW, Dewey HM, Donnan GA, Macdonell RA, Thrift AG. Long-term outcome in the North East Melbourne Stroke Incidence Study: predictors of quality of life at 5 years after stroke. Stroke 2005;36(10):2082-2086.
112. Edington GM. Cardiovascular disease as a cause of death in the Gold Coast African. Trans R Soc Trop Med Hyg. 1954;48(5):419-425.
113. Yates PO. A Change in the pattern of cerebrovascular disease. Lancet 1964;1(7324):65-69.
114. Bwala S. Stroke in a sub-Saharan Nigerian hospital– a retrospective study. Trop Doct 1989;19:11–14.
115. Amoah AB. Hypertension in Ghana: a cross-sectional community prevalence study in Greater Accra. Ethn Dis 2003;13:310–315.
116. Gurcay E, Bal A, Cakci A. Health related quality of life in first-ever stroke patients. Annals of Saudi Medicine 2009;29(1): 36-40.
117. Wyller TB, Holmen J, Laake P, Laake K. Correlates of subjective wellbeing in stroke patients. Stroke 1998;29:363-367.
118. Haacke C, Althaus A, Spottke A , Siebert U, Back T, Dodel, R. Long-term outcome after stroke evaluating health-related quality of life using utility measurements. Stroke 2006;37: 193-198.
119. M¨uller-Nordhorn J, Nolte CH, Rossnaggei K, Jungehulsing GJ, Reich A, Roll S, Villringer A, Willich SN, 2005. The use of the 12-item Short-Form health status instrument in a longitudinal study of patients with stroke and transient ischemic attack. Neuroepidemiology 2005;24:196-202.
120. Addington-Hall J, Kalra L. Who should measure quality of life? BMJ 2001;322:1417-1420.
121. Robinson RG. The clinical neuropsychiatry of stroke: cognitive, behavioural and emotional disorders following vascular brain injury. Cambridge University Press, New York; 2006.
122. Gurenlian JR, Kleiman C. Cerebrovascular accident. Access 2002;6(16):40-47.

123. Boyko EJ, Fihn SD, Scholes D, Abraham L, Monsey B. Risk of urinary tract infection and asymptomatic bacteriuria among diabetic and nondiabetic postmenopausal women. Am J Epidemiol 2005;161:557–564.
124. Renko M, Tapanainen P, Tossavainen P, Pokka T, Uhari M. Meta-analysis of the significance of asymptomatic bacteriuria in diabetes mellitus. Diabetes Care 2011;34:230-235.
125. Widmer TA, Theron G, Grove D. Prevalence and risks of asymptomatic bacteriuria among HIV positive pregnant women. South Afr J Epidemiol Infect 2010; 25:28-32.
126. Ojoo J, Paul J, Batchelor B, Amir M, Kimari J, Mwachari C, Bwayo J, Plummer F, Gachihi G, Waiyaki P, Gilks, C. Bacteriuria in a cohort of predominantly HIV-1 seropositive female commercial sex workers in Nairobi, Kenya. J Infect 1996;331:33-37.
127. Emsley HCA, Hopkins SJ. Acute ischaemic stroke and infection: recent and emerging concepts. Lancet Neurol 2008;7:341-53.
128. Chamorro A, Urra X, Planas AM. Infection after acute ischemic stroke: a manifestation of brain-induced immunodepression. Stroke 2007;38**:**1097–1103.
129. Johnsen SP, Svendsen ML. Ingeman A. Infection in patients with acute stroke. The Open Infect Dis J 2012;6:40-45.
130. Todar, K. Todar's Online Textbook of Bacteriology; Department of Bacteriology, University of Wisconsin-Madison: Madison, WI, USA; 2006.
131. Kumari N, Rai A, Jaiswal CP, Xess A, Shahi SK. Coagulase negative Staphylococci as causative agents of urinary tract infections-prevalence and resistance status in IGIMS, Patna. Indian J Pathol Microbiol 2001; 44(4):415-419.
132. Orrett FA, Shurland SM. Significance of coagulase-negative staphylococci in urinary tract infections in a developing country. Conn Med. 1998;62(4):199-203.
133. Alós JI. Epidemiology and etiology of urinary tract infections in the community. Antimicrobial susceptibility of the main pathogens and clinical significance of resistance. Enferm Infecc Microbiol Clin. 2005;23(4):3-8.
134. Odonkor ST, Mahami T, Addo KK. Antimicrobial sensitivity patterns of urine isolates from a large Ghanaian hospital. Int Res J Microbiol 2011; 2(7): 237-241.

135. Wiredu EK, Nyame PK: Stroke mortality in Accra: A study of risk factors. Ghana Med J 2001;35(4):151–161.
136. Nyame PK, Bonsu-Bruce N, Amoah AGB, Adjei S, Nyarko E, Amuah EA, Biritwum RB: Current trends in the incidence of cerebrovascular accidents in Accra. W Afr Med J 1994;3:183–186.
137. De-Graft Aikins A: Ghana's Neglected Chronic Disease Epidemic: A Developmental Challenge. Ghana Med J 2007; 41:154-159.
138. Zangerle A, Kiechl S, Spiegel M, Furtner M, Knoflach M, Werner P, Mair A, Wille G, Schmidauer C, Gautsch K, Gotwald T, Felber S, Poewe W, Willeit J. Recanalisation after thrombolysis in stroke patients: predictors and prognostic implications. Neurology 2007; 68**:**39-44.
139. Grond M. Clinical thrombolysis in stroke. Thromb Res 2001;103:135-142.

APPENDIX I: STROKE CLINICAL EPIDEMIOLOGY AND QUALITY OF LIFE QUESTIONNAIRE

Date: _____ **ID No. _____**

BIODATA

Sex: □ Male □ Female

Age_____

Highest education completed

□ Primary □ Secondary □ Tertiary □ None

Marital status

□ Married □ Single □ Separated

□ Divorced □ Widowed

Religion

□ Christian □ Moslem □ Traditional religion

□ Other (specify) _____

Occupation _____

Income in Ghanaian Cedis per month

□ < 100 □ 100-999 □ 1,000-1,999

□ 2,000-2,999 □ ≥3,000 □ Not working

STROKE TYPE, DURATION AND FREQUENCY

Are you on admission now? YES NO

When did you [first] develop stroke? ----------

How many times have you had stroke? ----------

Which side of the body is affected? ----------

C.T. scan / M.R.I. report: stroke type, extent and site ----------

---

STROKE SEVERITY

i	Best motor power in the dexterous hand/ upper limb	0 nil	1 flicker	2 gravity eliminated	3 against gravity	4 against resistance	5 normal
iia.	Best motor power in the affected upper limb	0	1	2	3	4	5
iib	Best motor power in the affected lower limb	0	1	2	3	4	5
iii.	Speech defect [aphasia]	nil 0	present 1’				

STROKE RISK FACTORS

_____

_____

HEALTH_RELATED QUALITY OF LIFE

INSTRUCTIONS

This assessment asks about how you perceive your current state of health, quality of life, or other areas of your life. **Please answer all the questions honestly**. If you are unsure about what response to give to a question, please choose the nearest most appropriate response.

Please keep in mind your standards, hopes, pleasures and concerns. Think about your life in the last two weeks. You should circle the number that best fits your response.

1	**PHYSICAL DOMAIN**	**Not at all 1**	**A little 2**	**A moderate amount 3**	**Very much 4**	**Extremely 5**
i	To what extent do you have difficulties gripping objects, turning door-knob, using cutlery, writing, opening jar/can, carrying heavy objects?	0	1’	2’	3’	4’
ii	To what extent do you have difficulties sitting/standing without losing your balance?	0	1’	2’	3’	4’
iii	To what extent do you think physical pain/discomfort /abnormal sensation/absent sensation prevent you from doing what you need to?	0	1’	2’	3’	4’
		Very dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied 3**	**Satisfied 4**	**Very satisfied 5**
iv	How satisfied are you with your ability to perform your daily living activities [feeding, bathing, toileting, dressing, grooming, e.t.c.]?	1	2	3	4	5
vi	How satisfied are you with your capacity for work?	1	2	3	4	5
vi	How satisfied are you with your sex life?	1	2	3	4	5
vii	**How important to you are the aspects of your life covered in questions iv-xiv in this section?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

2	**EMOTION/PSYCHOLOGICAL DOMAIN**	**Not at all/ Never 1**	**A little/ Seldom 2**	**Moderately/ Quite often 3**	**Mostly/ Very often 4**	**Completely/Always 5**
i	How often do you have negative feelings such as blue mood, anger, despair, anxiety, depression, fear?	0	1’	2’	3’	4’
ii	Do you have enough energy for everyday life?	1	2	3	4	5
iii	To what extent are you able to accept your bodily appearance?	1	2	3	4	5
iv	To what extent do you enjoy your work?	1	2	3	4	5
v	How often do you laugh?	1	2	3	4	5
vi	To what extent do you enjoy recreation/pastimes/leisure/rest /relaxation?	1	2	3	4	5
		Very dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied 3**	**Satisfied 4**	**Very satisfied 5**
vii	How satisfied are you with your feelings?	1	2	3	4	5
viii	**How important to you are the aspects of your life covered in questions i-xi in this section?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

3	**INTELLECTUAL/COGNITIVE DOMAIN**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much/ Mostly 4**	**Extremely /Completely 5**
i	How well are you able to concentrate?	1	2	3	4	5
ii	How available to you is the information that you need for your day-to-day life?	1	2	3	4	5
iii	To what extent are you able to communicate?	1	2	3	4	5

		Very dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied 3**	**Satisfied 4**	**Very satisfied 5**
iv	How satisfied are you with your ability to communicate?	1	2	3	4	5
v	How satisfied are you with your ability to think and learn?	1	2	3	4	5
vi	**How important to you are the aspects of your life covered in questions i-xi in this section?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

4	**SOUL DOMAIN**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very Much 4**	**Extremely 5**
i	How much confidence do you have in yourself?	1	2	3	4	5
ii	To what extent do you believe you have a purpose for living?	1	2	3	4	5
iii	To what extent are you interested in fulfilling your purpose for living?	1	2	3	4	5
iv	To what extent do you practice your religion/faith?	1	2	3	4	5
		Very dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied 3**	**Satisfied 4**	**Very satisfied 5**
v	To what extent are you satisfied with your faith in God?	1	2	3	4	5
vi	How satisfied are you with yourself?	1	2	3	4	5
vii	**How important to you are the aspects of your life covered in questions i-xxv in this section?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

5	**SPIRIT DOMAIN**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**
i	To what extent do you understand God?	1	2	3	4	5
ii	To what extent are you guided / motivated by God in your [daily] life?	1	2	3	4	5
iii	To what extent do you understand your religion/faith?	1	2	3	4	5
		Very Dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied 3**	**Satisfied 4**	**Very satisfied 5**
iv	To what extent are you satisfied with divine guidance in your life?	1	2	3	4	5
v	**How important to you are the aspects of your life covered in questions i-vi in this section?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

6	**ECOSOCIAL DOMAIN**					
i	Activities of daily living[feeding, bathing, toileting, etc]	Fully dependent **1**	Requires substantial help **2**	Requires minimal help **3**	Requires no help but not back to work **4**	Back to work **5**

		Not at all 1	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely/ Completely 5**
ii	How much respect do you get from others?	1	2	3	4	5
iii	How well are you able to manage your home and perform your domestic roles?	1	2	3	4	5
iv	To what extent do you have access to transport facilities?	1	2	3	4	5
		Very dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied? 3**	**Satisfied 4**	**Very satisfied 5**
v	How satisfied are you with your personal relationships?	1	2	3	4	5
vi	How satisfied are you with the support you	1	2	3	4	5

	get from your friends?					
vii	How satisfied are you with your access to health services?	1	2	3	4	5
viii	**How important to you are the aspects of your life covered in questions i – xxii in this section?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

7	**SPIRITUAL INTERACTION DOMAIN**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**An extreme amount/ Completely 5**
i	To what extent do you consider yourself close to God or your object of worship?	1	2	3	4	5
ii	To what extent do you discuss aspects of your faith/religion with people of the same religious interest/faith in order to strengthen your individual resolve?	1	2	3	4	5
		Very dissatisfied 1	**Dissatisfied 2**	**Neither satisfied nor dissatisfied 3**	**Satisfied 4**	**Very satisfied 5**
iii	How satisfied are you with your relationship with God or your object of worship?	1	2	3	4	5
iv	How satisfied are you with your effort to develop your faith/religion?	1	2	3	4	5
v	**How important to you are the aspects of your life covered in questions i-v above?**	**Not at all 1**	**A little 2**	**Moderately 3**	**Very much 4**	**Extremely 5**

APPENDIX II: COMMUNITY AWARENESS OF STROKE QUESTIONNAIRE

Date: _____ Area _____

Respondent's ID_____

SECTION I: BIODATA

Sex: □ Male □ Female

Age_____

Highest education completed
□ Primary □ Secondary □ Tertiary □ None

Marital status
□ Married □ Single □ Separated
□ Divorced □ Widowed

Religion
□ Christian □ Moslem □ Traditional religion
□ Other (specify) _____

Monthly income in Ghanaian Cedis
□ < 100 □ 100-999 □ 1,000-1,999
□ 2,000-2,999 □ ≥3,000 □ Not working

SECTION II: STROKE RISK FACTOR PROFILE

Which of the following apply to you?
□ Hypertension □ Cholesterol
□ Previous Stroke □ Smoking
□ Diabetes □ Drinking more than 2 glasses of alcohol a day
□ Heart disease □ None of the listed conditions

SECTION III: STROKE KNOWLEDGE, AWARENESS AND BELIEFS

Stroke affects which organ of the body?
□ Brain □ Heart □ Other (specify) _____

Which of the following do you think are potential risk factors of stroke? (you can choose more than one)
□ Hypertension □ Smoking □ Stress
□ Cholesterol □ Obesity □ Lack of exercise
□ Poor eating □ Family history of stroke □ Alcohol use
□ Heart disease □ Diabetes □ Do not know

What are the warning symptoms of stroke? (you can choose more than one)

□ Numbness (1 side) □ Shortness of breath □ Slurred speech
□ Numbness (any) □ Headache □ Pain, unspecified
□ Weakness (1 side) □ Vision problems □ Do not know
□ Weakness (any) □ Dizziness

Do you believe that.....

Stroke is a preventable disease
□ Yes □ Not sure □ No

Lifestyle alteration can be made to reduce the risk of stroke
□ Yes □ Not sure □ No

Stroke affects only the elderly
□ Yes □ Not sure □ No

Stroke is one of top killer diseases in Accra
□ Yes □ Not sure □ No

Stroke requires emergency treatment
□ Yes □ Not sure □ No

Stroke is a spiritual illness caused by evil spirits or witches
□ Yes □ Not sure □ No

Which of the following sources have provided you with your knowledge of stroke? (please tick all that apply)

□ Never learned about stroke □ Medical books
□ Internet □ Radio station
□ Newspaper/magazine □ Television
□ School □ Healthcare professionals
□ Other (please state)_____

Have you ever come across a stroke campaign?

□ Yes
□ No

SECTION IV: RESPONSE TO STROKE ATTACK

What would be your cause of action in the event of a stroke?

□ Visit the hospital □ Visit the pharmacy □ Visit the herbalist
□ Wait and observe symptoms to see if they subside
□ other_____