

ORIGINAL PAPER

# The Effect of Hypertension on Neurocognitive Functioning and Quality of Life

Lumbuka Kaunda<sup>1</sup>, J. Anitha Menon<sup>2</sup>, M. Shilalukey Ngoma<sup>3</sup>

<sup>1</sup>Department of Psychology, University of Zambia

<sup>2</sup>Department of Paediatrics and Child Health, University of Zambia

## ABSTRACT

**Objectives:** Hypertension has been reported as one of the most important etiologic factors in cardiovascular disease. The objectives of this study were to investigate the effect of hypertension on neurocognitive functioning and quality of life.

**Design:** The study was cross sectional, and clinic based. The sample comprised of 50 adult Zambians aged 40-65 years.

**Main outcomes:** The main outcomes were neurocognitive functioning and quality of life.

**Measures:** The measures used in this study were the Zambian neurobehavioral test battery as a measure of neuro cognitive functioning and the SF12 Health survey as a measure of quality of life.

**Results:** There was no significant difference in neuropsychological test performance on all the seven ability domains measured. On Global Deficit Scores impairment index, Chi square showed more impairment in the hypertensive group; however this was not statistically significant. Pearson's correlations test showed that at 0.05 sig. side effects correlated negatively with Physical functioning ( $r=0.593$ ) and mental health ( $r=0.598$ ) and at 0.01 sig. with vitality scale ( $r=0.6340$ ) and social functioning ( $r=0.618$ ) of the SF12 health survey domains.

**Conclusion:** Quality of life seems to be more affected than neurocognitive functioning in the hypertensives in this study.

## INTRODUCTION

Hypertension is an important etiologic factor in cardiovascular disease<sup>1</sup>. Hypertension can also affect neurocognitive functioning, and has been shown to cause changes in the domains of: executive functioning,

memory, and psychomotor speed<sup>2, 3, 4</sup>. These cognitive effects, combined with side effects of medication, can negatively affect the quality of life<sup>5</sup>.

The World Health Organisation criteria for hypertension is a blood pressure (BP) greater than or equal to 160/95 mmHg or the JNC 7 (Joint National Committee on Prevention, Evaluation, and Treatment report, 1997) criteria of blood pressure (BP) greater than or equal to 140/90 mmHg or self-reported use of antihypertensive drugs<sup>7</sup>. This study aims at finding out the impact of hypertension on neurocognitive functioning.

Hypertension is termed as a silent killer mainly because when it is uncomplicated, it is usually asymptomatic<sup>8</sup>. Untreated hypertension affects neurocognitive functioning even before clinical manifestations of cerebrovascular disease are seen<sup>4</sup>. These effect of hypertension is seen as subtle deficits in many domains of neuropsychological performance<sup>4</sup>. The effect of hypertension on neurocognitive functioning remains poorly understood<sup>4</sup>. The mechanisms that lead to cognitive decline in hypertensives are not fully understood yet, however knowledge in this area of study is on the rise<sup>9</sup>.

Decline in cognitive functioning more often than not affects the quality of life. The affects are three fold. Firstly hypertension itself leads to a change in lifestyle as patients must take steps to try and control the blood pressure levels<sup>8</sup>. This usually means a change in diet (i.e. decrease salt intake), and an increase in physical activity, if it is not in the acute stage. Secondly, even in its uncomplicated form, hypertension may still cause a decline in some cognitive deficits. Thirdly, when lifestyle modifications are not enough to control the blood pressure levels, medication is usually prescribed depending on the severity of the condition. Medications that are commonly prescribed are diuretics, adrenergic blockers, calcium blockers<sup>8</sup>. Wenger (1988) confirmed that the side effects from these medications negatively impact the quality of life<sup>10</sup>.

The increase in urbanisation, physical inactivity, poor diet being important factors has led to a rise in prevalence rates of hypertension even in the developing world like Zambia. This has led to an increase in the burden of non communicable diseases such as hypertension yet little research is going on this area. Further more there is need to realise the neurocognitive effects that result from this condition and how together with the side effects of the medication this leads to a reduction in the quality of life.

The objectives of this study were to investigate the effect of hypertension on neurocognitive functioning and quality of life.

## **METHODOLOGY**

### **Research design**

This was a cross sectional clinic based study carried out on Zambian adult population.

### **Participants**

The sample consisted of a total of 50 participants between the age of 40-65years recruited from selected urban and rural clinics under ministry of health. The first 36 participants were sampled randomly as part of a larger study and the other 14 were sampled purposefully to make sure the two groups were matched on age and gender. Hence hypertensives were recruited after normotensives in order to match the sample by age and gender.

In this study a population aged 40-65 was sampled because of the positive correlation between age and blood pressure. The rise in the systolic blood pressure is quite considerable in adults and the diastolic blood pressure rises between 40 and 60 years and thereafter begins to drop<sup>9</sup>.

## **MEASURES**

### **1. Blood Pressure**

Blood pressure was measured for the purpose of screening using a mercury sphygmomanometer with the assistance of a nurse

### **2. Neurobehavioral medical screen**

This a standardised questionnaire in the Zambia Neurobehavioral test battery which systematically reviews past medical and neurological histories, review of systems, history of any current or past medications and

their side effects .

### **3. Neurocognitive Assessment.**

The neurocognitive assessment was carried out using the Zambia Neurobehavioral test battery (Table 1) that consisted of tests of visual episodic memory, verbal episodic memory, fluency, abstraction/executive functions, attention/working memory, speed of information processing, and motor function.

### **4. SF 12 Health survey**

The SF12 Health survey is a 12 item questionnaire that measures the quality of life in hypertensives. SF12 stands for Short-form 12-item. This is the form that has been shortened from original SF-36 which was developed in the United States to measure the quality of life specifically for hypertensive patients. The 8 domains it measures include physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional and mental health. The SF-12 is a valid measure of health related quality of life<sup>5</sup>.

### **5. Hypertension questionnaire**

In addition participants filled in a questionnaire that was specifically designed for this study to capture information on the hypertension condition. The questions included information on the duration since diagnosed, medication, and its side effects and hence the side effect variable in the data management which is a continuous variable that includes responses on the questionnaire.

### **Procedure**

The data for this study was collected as a part of a larger project of the Norad Masters Program. Recruitment of the participants was done by the clinic staff from urban clinics in Lusaka district( Kalingalinga, UNZA, Mtendere, and Chilenje ) and rural clinics (Chibombo, Chongwe, and Kafue) through the ongoing Voluntary Counselling and HIV testing campaign. HIV negative participants who were hypertensive (based on clinic records) and falling within the stated age range were given information about the study and requested to take part. Before the data collection the participants gave informed consent. The normotensives were also recruited through the ongoing HIV voluntary test campaign by the clinics staff in the various clinics mentioned above.

Before administering the Zambia Neurobehavioral test, blood pressure of the participants was measured with the help of a nurse; if it was found to be stable on the day of assessment (less than 180 systolic pressure and less than

110 diastolic pressure, WHO/ISH Classifications (1999), The Neurobehavioral medical screen was administered. If the participants were found neurologically normal, HIV negative and without a history of cardiac condition, thyroid disease, renal failure and diabetes mellitus then the entire Zambia neurobehavioral test battery, the SF12 and the hypertension questionnaire was administered.

**Table 1 : Zambia Neuropsychological Test Battery**

<p><b>Speed of Information Processing</b> WAIS-III Digit Symbol WAIS-III Symbol Search Trail Making Test Part A</p> <p><b>Abstraction/Executive Functioning</b> Wisconsin Card Sorting Test (64-item version) Colour Trails Stroop Colour Word Test Category Tests – computer version</p> <p><b>Learning and Delayed Recall (2 domains)</b> Hopkins Verbal Learning Test, Revised - II Brief Visuospatial Memory Test – Revised</p>	<p><b>Attention/Working Memory</b> Paced Auditory Serial Addition Test WMS-III Spatial Span</p> <p><b>Language</b> Word Sound Fluency Category Fluency (Animals, Action)</p> <p><b>Motor</b> Grooved Pegboard (Dominant and Non dominant)</p> <p><b>Screening for Effort</b> Hiscock Memory Test <b>Medical Screening Interview</b> <b>Behavioural Notes Summary</b> <b>Academic Skills Questionnaire</b></p>
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**Ethical Considerations**

Approval was obtained from The University of Zambia Biomedical Research Ethics prior to the commencement of the research. We ensured confidentiality, voluntary participation, coding data such that during data management no names were used.

**Data management and analysis**

The data was analysed using SPSS computer software (version 15,); t-test was carried out to compare the neurocognitive performance in hypertensives and normotensives on the seven ability domains of the NPS battery.

Hypertension status versus GDS impairment: The global deficit scores of hypertensives and normotensives were compared using chi-square test Individuals were considered impaired if they had a GDS of 0.5 or higher.

Pearson's correlation test was carried out to determine if there was any correlation between side effects variable and SF12 domains.

T scores corrected for age, education, rural/urban residence, was used for all analysis.

**RESULTS**

**Response rate:**

The response rate was quite good; out of 50 participants we recruited 21 hypertensives and 29 normotensives

**Characteristics of the participants**

Hypertensives were slightly older than normotensives, P=0.195, while normotensives had a slightly higher mean education at P=0.309, however this was not statistically significant. Equal variances were assumed.

**Neurocognitive performance**

Neurocognitive performance of hypertensives and normotensives were compared on all the seven domains and from the mean scores, there were no statistically significant differences in performance between hypertensives and normotensives on the seven neuropsychological domains ps 0.356).

Further analysis done to determine whether there was any significant difference in the global deficit score between the hypertensives and normotensives revealed that there was a higher percentage (14.3%) of impairment within the hypertensive group as compared to the normotensives group (6.9%), however this finding was not significant ( $\chi^2 = 0.74, p=0.390$ ).

**Relationship between Quality of Life and side effects of medication.**

Side effects of medication as determined by the hypertension questionnaire were correlated with the SF12 scores and it was found that side effects of medication score negatively correlated with physical functioning(r=0.593) and mental health (r=0.598)vitality scale(r=0.634) and the social functioning(r=0.618).

**Table 6 : Correlation table between side effects and Quality of life**

SF12 Domains	r	p
General functioning	-0.383	0.129
Physical functioning	-0.593*	0.012
Role physical scale	-0.260	0.313
Bodily pain	0.039	0.882
Vitality scale	-0.634**	0.006
Social functioning	-0.618**	0.008
Role emotional scale	-0.345	0.175
Mental health	-0.598*	0.011

\*Correlation is significant at 0.05 level (2 tailed)

\*\*Correlation is significant at 0.01 level (2 tailed)

## DISCUSSION

The main objectives in this study were: To establish if there is there a significant difference in neurocognitive functioning between normotensives and hypertensives, and to determine if there is a relationship between side effects of medication for hypertension and the hypertensives' quality of life.

We found that there was no statistically significant differences in neurocognitive functioning between hypertensives and normotensives on the tests of attention, fluency, motor dexterity, visual episodic memory, verbal episodic memory, executive functioning. This result can be looked in the light of the argument by Blumenthal and Madden (1989) that various forms of neuropsychological test batteries have revealed neuropsychological hypertension related deficits on some measures and it was not clear why such deficits could appear on some tests and not on others<sup>13</sup>. The present study was the first of its kind on this particular test battery; hence it could have been quite different from other test batteries used by other researchers. This is confirmed by Birns and Kalrd (2009). Consistent with the findings in this study, there are studies that have found no significant differences in performance between medicated hypertensives and normontensives<sup>12;15</sup>.

The methodological control over confounding variables such as age, education, rural urban status, alcohol abuse, and concurrent medical condition could have been done differently from what other researchers in the past have done. Another factor which may have influenced the results is the fact that the study sampled well controlled hypertensives and this could suggest that the condition might be in its mild stage and medication could be acting as a neuroprotector on drastic cognitive decline. Variations have been noted in the stage of the condition, differences in medication ,as these form a separate entity on cognitive impairment<sup>14; 12</sup>. Variations in results have been noted with mild, moderate and severe hypertension. There are studies that have found no significant differences in performance between medicated hypertensives and normotensives. Paran, Anson, Reuveni (2003) further confirm this in their study of blood pressure among the elderly<sup>16</sup>. They found that mild hypertension actually appeared to enhance cognitive functioning in their sampled population.

Further variations have been noted in studies that have sampled participants on different antihypertensive drugs as this form a separate entity on cognitive impairment<sup>14;12</sup>.

On global deficit scores impairment, more impairment was noted in the hypertensive group than the normotensives group by 7.9%,however this was not significant, $x^2=0.74,P=0.390$ .

The use of global deficit scores to predict impairment has been widely adopted by researchers to report impairment in different conditions (17). In 2010 Carey et al. carried out a study to explore the predictive validity of the Global deficit score approach in summarising neuropsychological test results, but their study was specifically in detecting HIV-related cognitive impairment. Their results supported the validity of the GDS as a clinically useful way of summarising Neuropsychological test results<sup>11</sup>.

We found that an increase in the side effects of the medication led to poorer physical functioning, mental health, social functioning and vitality. Our finding is consistent with Wenger (1988) who documented the domains of daily life that are usually affected, among them was the side effects of the medication. Wenger (1988) in the study on the quality of life issues in hypertension documented the domains of daily life that are usually affected. These include *side effects of the medication*, fatigue, libido levels, memory deficits, mood swings, alertness, sleep disorders, performance at work, and relations with family.

In many cases treatment of chronic illnesses is not curative therefore it becomes imperative to improve functioning and quality of life (18). Nearly all anti hypertensive medication has been associated with some side effects (19). In the present study most participants were on diuretics. And Dimsdale (1992) confirms that even patients treated on diuretics commonly report side effects.

## CONCLUSION

As seen in the results of this study, hypertensives are affected not only by the disease itself but also by the side effects of the medication thereby markedly reducing their quality of life. Therefore, we can conclude that in our study population quality of life was more affected than neurocognitive functioning.

This may suggest the need for interventions to improve quality of life in hypertensive individuals. These are mainly life style modifications as supported by Smith et al., (2010) who found that increased aerobic fitness and weight loss appeared to improve neurocognitive functioning (20).

### Strengths and Limitations of the study

Due to the non availability of CT and MRI scans in Zambia, this study did not have brain structure evidence in these participants. Additionally, screening for a history and/or presence of co morbid conditions that occur with hypertension was not done therefore we relied on participant's clinic record.

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