

QUALITY OF LIFE OF INDIVIDUALS WITH RIGHT HEMISPHERE  
DAMAGE RELEVANCE TO COGNITIVE COMMUNICATION  
DISORDERS

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*To my Parents*

## **CERTIFICATE**

This is to certify that this dissertation entitled “**Quality of life of individuals with Right Hemisphere Damage – Relevance to cognitive communication disorder**”

Is a bonafide work submitted in part fulfilment for the degree of Master of Science (Speech and Language Pathology) of the student Registration No: **09SLP001**. This has been carried out the under guidance of a faculty of this institute and has not been submitted earlier to any other university for the award of any diploma or degree.

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## **CERTIFICATE**

This is to certify that this dissertation entitled **“Quality of life of individuals with Right Hemisphere Damage – Relevance to cognitive communication disorder”** has been prepared under my supervision and guidance. It is also certified that this dissertation has not been submitted earlier to any other university for the award of any diploma or degree.

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## **DECLARATION**

This is to certify that this master's dissertation entitled "**Quality of life of individuals with Right Hemisphere Damage – Relevance to cognitive communication disorder**" is the result of my own study under the guidance of Dr. Jayashree. C. Shanbal, Lecturer in Language Pathology, Department of Speech-Language Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other university for the award of any diploma or degree.

**Register No. 09SLP001**

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June, 2011

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## CHAPTER 1: Introduction

For most people, the right hemisphere is the non dominant hemisphere for speech and language. Individuals who are right hemisphere dominant are usually left handed or ambidextrous. (Only about 15% of left handed persons are right hemisphere dominant for speech and language). Because the right hemisphere usually plays only a secondary role in language processing, patients were not routinely treated by speech-language pathologists until recently. It is currently recognized that, while RHD patients do not typically have the types of language problems seen in aphasia, they frequently have both communicative and cognitive deficits which can be addressed in speech/language therapy. There are some similarities between closed head injury and right hemisphere lesions.

It should be noted that fewer statements about site of lesion can be made concerning the impairments associated with right hemisphere damage (RHD) than in regard to the aphasic syndromes caused by left hemisphere damage. This is the case because relatively little is known about localization of function in the right hemisphere. According to Brownwell (1995), some believe that the right hemisphere is "less focally organized" than the left.

### **Deficits Associated with Right Hemisphere Damage**

According to Myers (1994), impairments of **perception** and **attention** are the underlying causes of the extra-linguistic, linguistic and nonlinguistic deficits manifested by patients with RHD. According to Love and Webb (2001), neglect, inattention and

denial are three major characteristics of right hemisphere syndrome. There are also characteristics of executive function difficulty (Marshall, 1998).

### **Linguistic Deficits**

As stated previously, right hemisphere patients typically do not have the kinds of language problems seen in aphasia. However, as some do have specific linguistic problems, RHD patients should be given an aphasia battery like the Boston. RHD patients might display deficits on the following Boston subtests: Responsive naming- patients give one word answers to spoken questions. Difficulty with auditory comprehension may affect results. It is important that naming is tested using several modalities. The following areas may be affected (Myers & Mackisack, 1990, in LaPointe, 1990):

*Visual confrontation naming*

*Body Part Naming*

*Auditory Comprehension of Complex Material*

*Word Fluency*

*Writing (RHD patients may substitute or omit graphemes)*

*Auditory comprehension of difficult material*

*Oral sentence reading*

## **Extralinguistic Deficits**

Again, RHD patients are unlikely to display the kinds of phonological, syntactic or semantic problems associated with aphasia. However, although they do not typically have many specific language problems, they definitely have difficulty communicating. This impairment seems to follow from an inability to integrate information; RHD patients apparently do not make adequate use of context in their interpretations of linguistic or nonlinguistic messages. They have difficulty distinguishing significant from unimportant information.

### *Attention Deficits*

An individual with RHD may exhibit difficulty concentrating on a task and paying attention for more than a few minutes at a time. Doing more than one thing at a time may be difficult or impossible.

### *Memory*

Individuals with RHD demonstrate problems remembering information, such as street names or important dates, learning new information, and retrieving it.

### *Organization*

Individuals with RHD often exhibit trouble telling a story in order, giving directions, or maintaining a topic during conversations.

### *Literal Interpretations*

RHD patients may be able to comprehend only the literal meaning of language. Thus, they will often fail to understand many jokes, metaphors, irony, sarcasm, and common sayings that include figurative language.

These problems with figurative language may be viewed as one manifestation of the inability to base interpretations on context.

*Difficulty identifying relevant information:* When listening to a conversation or reading, an RHD patient may fail to abstract the main point contained in the information being shared. This happens in spite of the fact that, unlike an aphasic, the patient can understand all the individual words and grammatical structures used. For RHD patients, it appears that their comprehension of everyday language is impaired by a failure to distinguish important information from irrelevant detail and also by an inability to integrate. According to Blake 2007, RH patients have difficulty comprehending non-literal language, humor, and multiple interpretations. Furthermore, Blake says that their difficulty with language production includes: impulsivity, inefficiency, and egocentricity. Blake also notes that the same problems are seen in traumatic brain injury.

*Inability to interpret body language and facial expressions:* In a conversation, RHD may miss out on important cues that should tell them about the emotional state and true intention of the person with whom they are interacting. This inability to interpret body language and facial expression may be related to an overall failure to use context in the interpretation of individual pieces of information. Problems with the interpretation of facial expression may also be due to the fact that RHD patients often fail to maintain eye contact with their conversation partners.

*Flat effect:* RHD patients may fail to display a wide range of facial expressions themselves. Also their speech is frequently aprosodic, or lacking variations in pitch and stress. Some patients will sound "robot-like," and thus be unable to express emotion or changes in meaning via changes in intonation. These patients will no longer be able to vary pitch to signal the difference between a question and a statement or use word stress changes within a sentence to signal a difference in meaning.

*Problems with Conversational Rules:* RHD patients may fail to follow conversational rules, including those governing turn-taking, the initiation and closure of a conversation. RHD patients may tend to dominate conversations, as they are frequently verbose. They may also fail to properly estimate levels of shared knowledge, failing to give the listener enough background information to understand their statements. According to Myers and Mackisack (1990), RHD patients appear to not care about the needs of the listener. They, like children in an early developmental phase, may assume too much knowledge on the part of the listener; or not enough. They appear to answer without adequate search for the right answer. They also may fail to pick up on non verbal cues that signal listener's reactions.

### *Impulsivity*

RHD patients may exhibit poor judgment and problem solving abilities. They may require constant supervision due to a tendency to attempt tasks of which they are no longer physically capable. This may be related to anosognosia. They may also exhibit impulsivity in the sense of failing to censor the statements they make to other people.

*Confabulation:* RHD patients may make untrue statements. These do not usually seem to be deliberate lies. According to Brownwell et al. (1995), this may be the patient's way of responding to his own confusion rather than attempts to mislead the listener

RHD patients may also occasionally have hallucinations.

### **Nonlinguistic Deficits**

*Disorientation to Time and Direction :* RHD patients may exhibit disorientation to time and and direction. RHD patients may also have difficulty following directions or finding their way around a building. They will know where they are in a general sense (e.g., in the hospital), but have trouble finding their way to specific locations (e.g., the dining room). This deficit, known as topological disorientation, is a product of their general inability to process spatial information. Some patients with left hemisphere parietal lobe lesions have similar problems

*Left side neglect:* Patients with neglect may fail to eat food on the left side of their plates, begin reading in the middle of sentences and in other ways seem to completely ignore the neglected side. RHD patients with left neglect may also have difficulty with left side detail in visuo-constructional tasks. For example, if drawing a picture or building a model, they might leave out details on the left side. The severity of neglect is usually an indication of the size of lesion and the overall severity of the patient's condition.

According to Myers (1994), most theories of neglect consider it a deficit in attention.

*Anosognosia:* This is the failure to recognize the symptoms of one's own illness. RHD patients may deny that they have had a stroke. They may appear to be unaware of their hemiplegia or their cognitive deficits (Love and Webb, 2001). It is not uncommon for right hemisphere patients to state that they are perfectly capable of walking, driving and returning to work immediately despite all evidence to the contrary. Anosognosia may be described as severe denial. The source of this denial appears to be cognitive rather than emotional; it seems as though patients are unable rather than unwilling to recognize their deficits.

Because RHD patients do not fully comprehend the extent of their impairment, they are frequently less depressed than those with left hemisphere damage. It could also be the reason why they fail to seek medical or rehabilitative counsel in spite of persisting deficits. This type of executive function difficulty can also appear in aphasic patients with left hemisphere lesions.

*Visuospatial Deficits:* RHD patients have difficulty processing many types of visual stimuli. These problems are apparently due to an inability to integrate information. RHD patients have trouble with figure-ground problems, recall of visual forms and mental rotation, or the ability to imagine how a figure would look if its orientation in space were changed.

*Prosopagnosia:* It is the inability to recognize familiar faces, is one of the most striking visuospatial processing deficits manifested by RHD patients. This does not represent a difficulty with vision itself. A patient with prosopagnosia is able to describe the features

of familiar faces, including eye and hair color, type of nose, etc. An artistic patient will even be able to draw the faces of family members and friends accurately yet be unable to recognize them. Rather, the problem seems to be related to the integration of visual perceptions and their association with information stored in memory. According to Love and Webb (2001), patients with this disorder usually have lesions in the right occipital-temporal lobe region.

### **Quality Of Life of individuals with RHD**

The term quality of life is used to evaluate the general well-being of individuals and societies. The term is used in a wide range of contexts, including the fields of international development, healthcare, and political science. Quality of life is not to be confused with the concept of standard of living, which is based primarily on income. Instead, standard indicators of the quality of life include not only wealth and employment, but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging.

Quality of Life has been defined by the World Health Organization as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept incorporating in a complete way the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of the environment.



This definition reflects the view that quality of life refers to a subjective evaluation, which is embedded in a cultural, social and environmental context. As such, quality of life cannot be simply equated with the terms health status, life style, life satisfaction, mental state, or well-being. Rather, it is a multidimensional concept incorporating the individual's perception of these and other aspects of life.

The World Health Organization Quality Of Life – 100 (WHOQOL-100)(1991) quality of life assessment was developed by the WHOQOL Group with fifteen international field centers, simultaneously, in an attempt to develop a quality of life assessment that would be applicable cross-culturally. The WHOQOL group comprises a coordinating group, collaborating investigators in each of the field centers and a panel of consultants.

It is anticipated that the WHOQOL assessments will be used in broad-ranging ways. They will be of considerable use in clinical trials, in establishing baseline scores in a range of areas, and looking at changes in quality of life over the course of interventions. It is expected that the WHOQOL assessments will also be of value where disease prognosis is likely to involve only partial recovery or remission, and in which treatment may be more palliative than curative.

For epidemiological research, the WHOQOL assessments allows detailed quality of life data to be gathered on a particular population, facilitating the understanding of diseases, and the development of treatment methods

In clinical practice the WHOQOL assessments will assist clinicians in making judgments about the areas in which a patient is most affected by disease, and in making treatment decisions. In some developing countries, where resources for health care may be limited, treatments aimed at improving quality of life through palliation, for example, can be both effective and inexpensive (Olweny, 1992).

The core WHOQOL instruments can assess quality of life in a variety of situations and population groups. In addition, modules are being developed to allow more detailed assessments of specific populations (e.g. cancer patients, refugees, the elderly and those with certain diseases, such as HIV/AIDS).

Although the language disorders that are present in individuals with RHD are, on the whole, different to those seen in patients with left hemisphere damage (LHD), this does not make them any less significant from a clinical point of view. A patient with RHD can, amongst other things, show difficulty transmitting communicative intentions based on emotions, on modulation of speech parameters, and on indirect meanings of discourse or figurative language. This has consequences not just for the affected individual, but also for those around them, and the functional and psychological impacts on the person's life can be considerable. Language disorders constitute a significant obstacle to developing and maintaining satisfactory interpersonal relationships, and they can be detrimental to the resumption of an active social and professional life. Despite their difficulties in processing the elemental structures of language, aphasic patients can often make use of contextual keys in order to communicate. Those with

RHD have the opposite problem: although their phonological and syntactic abilities remain intact, they have serious difficulties in establishing adequate relationships between language and the context in which it is being used (Abusamra, Martínez Cuitiño, Wilson, Jaichenco, & Ferreres, 2004). As a consequence, problems caused by RHD cannot be assessed using classic aphasia evaluation batteries.

Today, advances in theoretical and clinical knowledge allow us to better recognize the presence of communication disorders linked to impairment of the right cerebral hemisphere. However, affected individuals still go unnoticed by health professionals.

Therefore there is a need for a simple, easy to administer tool to help obtain an overview of the cognitive, psychological, linguistic and speech deficits that hamper communication following RHD and affect the patients quality of life.

### **Aim of the study**

The primary aim of the present study was to develop a quality of life questionnaire for individuals with Right Hemisphere Damage. The study also aims to investigate its relevance to cognitive communication deficits.

## CHAPTER 2: Review of Literature

The systematic scientific study of the brain began during the Renaissance. However, for several centuries, the specific roles of the two hemispheres were not differentiated. It was not until the middle of the 19th century that the studies on the neurological impairment of language conducted by Marc Dax (1836) and Paul Broca began to demonstrate the asymmetrical nature of the brain's functional organization. For almost a century afterwards, control of the language function was assigned exclusively to the left hemisphere, which was also thought to be the only cause of aphasia as a result of brain damage. As such, while the concept of cerebral dominance was asserted the right hemisphere too on the unsure status of 'the minor hemisphere'. With the exception of the specific roles attributed to it by a few authors (such as Jackson, 1879), the right hemisphere was downcast in a century of obscurantism and the theory of cerebral dominance denied it any role in the maintenance of linguistic behavior.

In the 1960s the right hemisphere began to be assigned a role in linguistic abilities as a result of two groups of observations, one clinical and the other experimental. The first suggestions emerged from detailed clinical observation of patients with brain damage (Eisenson, 1959; 1962; Critchley, 1962; Weinstein, 1964). Nevertheless, these pioneers did not manage to create a precise, detailed description of right hemisphere function and stayed within the conceptual frameworks of the time. Eisenson (1962) talked of impairments to the supra-ordinal aspects of language whereas Critchley noted the loss of subtle abilities but was unable to classify them in more detail.

The clinical impressions of Eisenson and Critchley are in keeping with the impairments in lexico-semantics, prosodic, discursive, and/or pragmatic skills that are described today.

In 1970s, two other techniques, dichotic listening and hemi field tachistoscropy, allowed researchers to examine the functions of each hemisphere in non brain damaged people. Differences between the two hemispheres began to be analyzed not only in terms of function but also in terms of cognitive style and cognitive strategies for processing information. In these conceptualizations the right hemisphere was not only considered important in visuo-spatial processing, but in holistic, nonlinear, or parallel processing. It was considered important to information synthesis apprehending the 'gestalt' or whole picture, and dealing with novel input for which there are no rules.

Thus RH became to be considered the seat of artistic capacity and creativity, less bound by rules, more fluid and flexible, and more adept at managing novel input than the Left Hemisphere. By the mid- 1980s came up the newer models of connectionist or neural network and the most recently interhemispheric inhibition, models of how the brain processes information emphasize cooperation among areas in the brain, including the two hemispheres. The significance of nonverbal processing in cognition in general, and in communication in particular, and the contribution of the Right Hemisphere to intellectual function had been recognized.

The second set of events that connected the right hemisphere with language abilities took place some years later. At the end of the 1960s and during the 1970s, systematic studies of the language capacities of each of the hemispheres began, amongst others, on individuals with surgical section of corpus callosum (Code, Wallesch, Joannette, & Lecours, 2002). These observations, together with others carried out with a different

methodological focus, confirmed the predominance of the left cerebral hemisphere in language. At the same time they allowed the right hemisphere's capacities in the treatment of word meaning and other aspects of language to be identified.

The language deficits associated with right hemisphere damage, while often quite socially handicapping (Tompkins et al 1998), are little understood. Such individuals may have difficulties, with some basic language tasks- but are not generally considered to have aphasia, because phonology, morphology, syntax, and many aspects of semantics are largely intact. About 50% of adults with right hemisphere damage have a verbal communication disorder (Joanette et al., 1990). In one study, 93% of 33 adults with Right hemisphere damage in a rehabilitation center had at least one cognitive deficit with the potential to disrupt communication and social interaction (Blake *et al.*, 2002).

Heterogeneity typifies the population of adults with Right hemisphere damage : not all will have all characteristic communicative problems and some will have no discernible problems. This heterogeneity often is unaccounted for in sample selection or data analysis, and its potential effects are compounded by the small samples in most studies of language in patients with right hemisphere damage. A related difficulty involves control group composition in research on language deficits associated with right hemisphere damage. Non brain damaged samples typically comprise individuals who do not have complications associated with being a patient. Individuals with left brain damage often are excluded because they cannot perform (the more complex tasks that are most revealing of language functioning after left hemisphere damage, and because differences in impairment profiles make it difficult to equate groups for severity. Consequently, it is impossible to determine whether observed deficits are specific to right

hemisphere damage. There also exists, a scarcity of information about the predictors of recovery because the thrust of research has been in deficit description and identification. Recovery data is more available for deficits such as neglect than for cognitive/communicative impairments, but even there the evidences are yet to be examined in detail.

Another major issue is the lack or consensus on how to define or even what to call language deficit associated with right hemisphere damage (Myers. 1999). Either in totality, or as individual workings of an aggregate syndrome. Conceptual and terminological imprecision, and apparent overlap, are common in referring to targets of inquiry such as nonliteral language processing, inferencing, integration, and reasoning from a theory of mind (Blake *et al*, 2002). Conclusions about language deficits after right hemisphere damage also are complicated by intra-individual performance variability, whether due to factors such as differential task processing requirements (e.g., Tompkins and Lehman. 1998), or to time following onset of injury (Colsher *et al*. 1987). Finally, many language difficulties ostensibly related to right hemisphere damage stem from or are exacerbated by other perceptual and cognitive impairments, some of which are as yet unidentified but others of which have not been evaluated consistently. Chief among these complications are hemispatial neglect, other attentional difficulties, and impairments of working memory and related processing resources.

Abusamra, Vote, Joannette & Ferreres 2009 offered an overview of the verbal communication deficits that can be found in right-hemisphere-damaged individuals. They noted that these deficits can interfere, at different levels, with prosody, the semantic processing of words and discourse and pragmatic abilities.

## **Deficits in Right Hemisphere Damage**

For most individuals, the right hemisphere is the non dominant hemisphere for speech and language. People who are right hemisphere dominant are typically left handed or ambidextrous. (Only about 15% of left handed persons are right hemisphere dominant for speech and language). As the right hemisphere typically plays only a secondary role in language processing, patients were not always treated by speech-language pathologists until recently. It is currently recognized that, while RHD patients do not typically have the types of language deficits seen in aphasia, they often have both communicative and cognitive deficits which can be addressed in speech and language therapy. There are some similarities between closed head injury and right hemisphere lesions.

It should be noted that fewer statements about site of lesion can be made about the impairments associated with right hemisphere damage (RHD) than with regard to the aphasic syndromes caused by left hemisphere damage. This is because relatively little is known about localization of function in the right hemisphere. According to Brownwell *et al.* (1995), some believe that the right hemisphere is "less focally organized" than the left. Right hemisphere damage can cause serious disruptions to verbal communication and may affect the prosodic, lexico-semantic, discursive, and pragmatic components of language. These elements are not impaired in all patients with RHD, but approximately 50% of patients are believed to have been affected in one or more of them, which could constitute a significant disability (Joanette, Goulet, & Daoust, 1991).



According to Myers (1994), impairments of perception and attention are the underlying causes of the extra-linguistic, linguistic and nonlinguistic deficits manifested by patients with RHD. Love and Webb (2001), stated that neglect, inattention and denial are three major characteristics of right hemisphere syndrome. There are also characteristics of executive function difficulty. (Marshall *et al*, 1998)

**Characteristics of RHD:** Various characteristics of RHD have been reported in literature. These characteristic features may include the following,

- Neglect
- Attention deficit
- Prosodic deficit
- Linguistic deficit
- Discourse deficit
- Affective deficits

#### Neglect

Patients with neglect fail to respond to information presented on the side opposite their brain lesion. That is they fail to respond to contralateral or contralesional input, in case of RHD it is the input from the left. Neglect or *left sided neglect* is often considered as a hallmark of RHD. Typically thought of as a deficit in spatial attention, it appears to be related to other attentional impairments. Very often patients with neglect appear to be less aroused and less responsive than do RHD patients without neglect. Neglect can be a good indicator of impaired cognitive and communicative processing. Although it can

appear in LHD patients, it is more frequent, more severe and longer lasting with RH lesion ( Brain,1941)

### Manifestation of neglect

RHD patients with left side neglect typically ignore all manner of input from the left, be it the food on their plates, their left limbs, the telephone ringing, or people standing on their left. Commonly observed left neglect behaviors in moderate to severe neglect include

### Problems in

- Responding to people and objects to the left of their body midline.
- Attending to the left while conducting self care activities(grooming, bathing, eating, dressing)
- Moving, attending to, and recognizing their left limbs
- Navigating through halls and doorways without bumping into left sided walls
- Reading the left half of printed materials
- Appropriate use of margins and spacing when writing
- Following presentations in films, videos or on TV.
- Localizing sound emanating from the left
- Insight into and awareness of deficits including hemiplegia and neglect

- Actively participating in the rehabilitation process

Patient with auditory neglect may not answer the telephone or notice people talking to them on their left side. Because sound reaches both ears in free field, their failure may be attributed to a motor problem in that they simply fail to reach towards the left to get the telephone or fail to turn their heads to the left to talk to the people. However there appears to be directional component in auditory neglect, which suggest patients may less responsive to left sided auditory input. RHD patients with posterior lesion may have trouble localizing the sound ,regardless of where it occurs (Ruff *et al*, 1981), suggesting that sound localizing may be a problem independent of neglect. In some cases the subjects mistakenly localize the sounds heard in left hemispace to right hemispace in a disorder called alloacusis (Heilman and valenstein, 1972). Typically patients with auditory neglect also has visual neglect, but not always.

Tactile neglect may take several forms. Extinction to competing touch stimuli, inability to manually search in space etc. Tactile neglect of hands may reduce patient's ability to explore the environment manually and may affect self-care activities as well. Patients may be less aware of somatosensory feedback on their left side even when the sensation is intact. Reduced tactile awareness on the left can extend to eating and swallowing, a factor to consider in dysphagia patient with neglect may be unaware of food being collected on left side of the mouth and may not swallow as often as they should while eating.

Extinction of olfactory sensation consists of reduced sensitivity to sensory input to one nostril when a competing stimulus is presented to the other nostril. Olfactory

control is majorly ipsilateral. But neglect in RHD patient is found to be in left nostril and it shows that neglect is independent of sensation

Patients with left neglect may omit letters and strokes in writing and use inappropriate use of margins because of neglect. This disorder is sometimes called neglect dysgraphia or spatial agraphia. Patients with left neglect also may ignore the left side of the words, sentences or the page of written text. This disorder is sometimes referred to as neglect dyslexia. It may be seen associated with visual neglect or in isolation. They may also have associated neglect dysgraphia. Some patients with neglect ignore the left half of the words when presented horizontally but can read the words when it is presented vertically and read from top to bottom. Others may have problems in both formats, suggesting that they not only has left neglect, but a lower quadrant neglect that interferes with attention to the lower half of the display.

omission of left most letters order for disorder

Omission of left half of the compound words (house for green house)

Initial letter substitutions fine for pine

Left-most letter substitutions and additions compute for refute

**Motor neglect:** Underutilization of contralateral extremities in the absence of primary motor deficit. **Directional hypokinesia:** difficulty in moving ipsilesional limb into or towards the contralesional space.

### **Attention Deficits**

The most common attentional operations include arousal, orienting, vigilance, maintenance and selective attention. Proponents of RH consider RH, not the LH, dominant for attention. One of the predictions of this hypothesis is that RH lesions could disrupt attention in ipsilateral as well as contra lateral space. Although the RH is considered dominant for arousal and orienting, other attentional operations can be affected by RHD, including vigilance, sustained, and selective attention.

Concerning the attention there exist many hypothesis which includes LH dominance hypothesis – postulates that in the intact brain the rightward directional orienting tendencies of the LH are dominant, that is LH is dominant in mediating attention. RH dominance hypothesis- considers RH to be superior not because it has stronger orienting bias to left hemisphere, but because it has the capacity to attend to stimuli in both left and right hemisphere.

Arousal as well may be impaired in RHD patients, this characterization comes not only from behavioral observation, but from physiological indicators of arousal and neurochemical evidence suggesting that the RH plays a dominant role in arousal and attentional orienting.

**Deficits in vigilance and sustained attention:** RT task not only require the individual to be alert and aroused but also in a state of vigilance until the appearance of an expected target. The effect of vigilance in RT tasks is measured in subjects with RHD, over the duration of the task and across the interstimulus interval. Whitehead (1991) concluded that RH specialization in RT tasks is most commonly observed when a task requires continuous processing. Several studies have found that RH is critical for maintaining

performance levels over time in RT tasks. Bub *et al.*, (1990) studied the RTs to auditory stimuli and found that, the RT performance for NBD and LHD subjects improved as the task progressed, whereas performance of RHD subjects deteriorated about 10 minutes into the task, indicative of impaired attentional maintenance. Intact RH is also adept in maintaining attention across a longer inter-stimulus duration.

Thus RHD patients have problems in attentional maintenance independent of their capacity to shift attention (Ladavas *et al.*, 1989; Cohen *et al.*, 1990).

RHD patients may not be able to maintain attention for long periods of time and, even within short time frames, may be unable to sustain the level of attentional alertness required by cognitive and communicative events.

**Deficits in selective attention:** selective attention can be automatic, as demonstrated by habituation and orientating to novel input. Studies of selective attention, however typically focus on voluntary or cognitively driven selective attention, which is assumed to require effort and conscious control. Studies of both NBD adults and those with focal brain damage suggest that the RH plays an important role in voluntary selective attention. Right frontal areas including the right cingulate gyrus, appear to be particularly active in tasks such as the Stroop task. Segregation of attentional operations into discrete categories like selective or sustained attention is somewhat artificial. It is difficult to know if RHD differentially affects selective attention or if impaired selective attention is the byproduct of attentional deficits in arousal, orienting, and vigilance.

Attentional deficits subsequent to RHD can have a significant impact on cognitive and communicative performance and can affect the pragmatic aspects of communication as well.

### **Prosodic Deficits**

The clinical presentation of prosodic production impairments in RHD is a flattened monotone pattern that is characterized by attenuated variation in stress, duration, and fundamental frequency (Duffy, 1995). The mechanisms of RHD prosodic deficits are not clearly known. However most often impairments exist in the absence of other motor speech disturbances, linguistic processing deficits, hence these cannot be considered reasons for the resulting impairment in prosody. Neither are the prosodic errors in these individuals characterized by false starts or groping which rules out the involvement of motor programming component.

The prosodic deficits associated with the RHD needs to be carefully examined because there are several other disorders with which similar disturbances occur including motor speech disorders such as Parkinsonism, or language impairment like aphasia or even in cases of psychiatric conditions like schizophrenia.

Prosody generally can be either linguistic which contributes to the meaning of spoken language such as the stress distinguishing the compound noun from noun phrase (eg. Lighthouse v/s light house) and the other is emotional prosody which helps us in determining the speakers attitude and emotion associated with the spoken utterance.

### **Emotional prosodic production deficits**

Prosodic production problems are evident in both emotional and non emotional conversational contexts. Reduced prosodic expressivity may be the outcome of a dominant role of the right hemisphere in emotional expression, but it appears that factors other than those involved in encoding emotional behavior play a role in prosodic production impairments. That is, prosodic processing may be compromised, independent of affective behavior and encoding. Use of prosody is more apparent when conveying emotion, but it has been found that RHD patients may have difficulty using prosody for linguistic purposes as well. Tucker *et al* (1977) compared the ability of RHD and NBD subjects to produce neutral sentences with specified prosody but the RHD individuals could not produce the appropriate prosodic pattern for the specified emotion.

These deficits were initially hypothesized as the result of the change in the subject's emotional experience. That is it was thought that, it was the change in the patient's emotional state which resulted in their flat prosodic patterns produced by these subjects. However this hypothesis was later criticized due to evidence from many studies regarding the self reports of these patients, wherein they reported/ complained of difficulty making tone of voice match their mood.

This led to the second hypothesis which considers that it is the display of emotions impaired rather than the emotions themselves. Disturbances were basically in encoding emotional behavior.

### **Linguistic prosodic production deficits**

RHD individuals also have problems in using prosody for linguistic purposes also.

### **Emphatic stress: phrase level**



In normal production, stressed syllables generally are greater in amplitude and duration and have higher fundamental frequency than unstressed syllables (Behrens, 1988). In general, RHD does not appear to affect the ability to produce the contrastive stress necessary to distinguish between compound nouns and noun phrases. Behrens (1988) however found that RHD patients use fewer of the cues available to signal contrastive stress. Intersyllabic cue was most commonly used cue and syllabic duration the least used cue by NBD subjects.

### **Emphatic stress: sentence level**

RHD patients may not use emphatic stress normally in spontaneously elicited sentences, although they may be able to do so on command. However Behrens opined that prosodic production of stress in both phrases and sentences is affected minimally, if at all, by RHD. The clinical impression, however, is that patient with prosodic production deficits seem to rely more on an increase in volume than on alterations in pitch or duration in both spontaneous and elicited sentences.

### **Distinguishing sentence types**

Abnormalities noted were (a) an abnormally flat pitch pattern in declarative, and (b) less than normal variability and fluctuation in pitch in interrogatives (Behrens, 1989). Spontaneous speech usually sounds more abnormal with lower overall pitch and reduced range of intensity and pitch. In general it appears that prosodic impairments secondary to RHD may have an impact on linguistic prosodic production at the sentence level. Patients may not have normal levels of pitch variation and may use fewer and less salient cues to signal emphatic stress.

### **Emotional prosodic comprehension deficits**

RHD patients have trouble interpreting the mood conveyed by prosodic contour when prosody is isolated from or is incongruent with semantic content. The same patients who have difficulty interpreting emotional prosody typically are able to interpret the emotional valence of linguistic information in simple sentences and stories, suggesting that their problems are specific to the interpretation of prosodic and other paralinguistic information as opposed to the interpretation of emotions.

### **Linguistic prosodic comprehension deficits**

The fact that RHD can interfere with nonemotional prosodic processing suggests that prosodic comprehension deficits are not restricted to emotional processing. It further suggests that the function of prosody as either a linguistic or emotional marker may be less important than its acoustic and perceptual characteristics. RHD clients have been found to be impaired relative to NBD subjects in the following tasks:

- Distinguishing compound words from noun phrases (eg. Green house from greenhouse)
- Discriminating nouns from verbs based on syllabic stress (eg. Convict versus convict)
- Determining if two identical sentences were said with the same stress pattern (eg. Steve is driving the car versus Steve is driving the car)
- Identifying stressed words in sentences,
- Discriminating correct from incorrect use of stress in a sentence, and

- Discriminating imperative and interrogative from declarative sentences (Bryan, 1989; Weintraub *et al.*, 1981)

Prosodic comprehension deficits have been associated with both anterior and posterior cortical lesions, with an emphasis on posterior lesions. The majority of studies suggested a parietal lobe involvement (Heilman, Bowers *et al.*, 1984; Van Lanker & Sidtis, 1992). A variety of lesions have been cited in studies of prosodic production deficits. The areas of involvement in linguistic prosodic deficits include frontal, temporal and parietal areas as well as caudate nucleus, the internal capsule, and the thalamus (Behrens, 1988; Weintraub *et al.*, 1981). According to Cancelliere and Kertesz (1990), the basal ganglia appear to play a significant role in prosodic impairments. Basal ganglia have also been associated with deficits in emotional prosodic comprehension. However few authors related basal ganglia to motor control.

### **Linguistic Deficits**

Linguistic deficits can be divided into convergent and divergent tasks. Where convergent processing refers to relatively straight forward linguistic tasks in which the number of responses is limited. Divergent tasks on the other hand elicit a wide range of meanings which may diverge from a single semantic concept to include non-dominant meanings that are alternate, connotative, and/or less familiar.

Convergent semantic processing involves auditory comprehension to single words, sentences and multistage commands. Linguistic comprehension problems in RHD patients surface at the *single word* or sentence level, but not at the phonemic level of processing. Phonological discrimination is almost always intact subsequent to RHD

(Cappa, Papagno & Vallar, 1990; Lesser, 1988). Some studies find RHD patients perform normally in single word comprehension (Kertesz & Dobrowolski, 1981; Van Lancker & Kempler, 1987). For the most part however, comprehension of the dominant meanings of single words does not appear to pose problems for RHD patients in conversational speech. A number of studies have demonstrated normal sentence comprehension by RHD subjects on aphasia batteries including the Boston Diagnostic Aphasia Examination (BDAE), Western Aphasia Battery (WAB) and Minnesota Test of Differential Diagnosis of Aphasia (MTTDA). *Sentence comprehension* has been tested in various studies by asking subjects to follow commands, answer questions, and match sentences to pictured scenes in a multiple choice paradigm. Performance on these tasks is varied, but it does seem that RHD can affect sentence comprehension under certain conditions. *Multi-stage commands* without supporting context may present problems, especially if syntactic structure is complex. Reduced arousal also may interfere with a patient's ability to mobilize the effortful attention required for comprehension of complex commands and sentences presented without supportive context.

Divergent semantic processing involves *accessing semantic relationships in collective noun naming*. Meyers and Brookshire (1995) found that, RHD subjects had particular problems in naming pictures of collective nouns. Generating a list of objects rather than a group name suggests a problem in appreciating how items are related, possibly because of a deficit in deducing and organizing semantic principle to link them to a superordinate category. These patients also have problems in determining whether two items were related in a lexical judgement task (Chiarello & Church, 1986). *Accessing semantic relationships in verbal fluency tasks*: this task requires people to generate

members of a given category within a time limit. Unlike picture naming and other convergent tasks that limit the response set, the verbal fluency tasks are designed to activate a broad semantic field. RHD appears to have a negative impact on divergent language operations such that RHD patients may be less facile in understanding intended meaning because they have problems generating, maintaining, or inhibiting additional, alternate, and related meanings when the dominant meaning is inappropriate to the context.

### **Discourse deficits** (Myers, 1999)

Discourse consists of communicative events in which information is conveyed by a speaker to a listener or among participants in conversational speech. Discourse can take various forms, including procedural, expository, narrative, and conversational.

**Procedural discourse** Describes the procedures involved in performing an activity

**Expository discourse** Conveys information on a single topic by a single speaker.

**Conversational discourse** Conveys information between a speaker and listeners, or among several speakers and listeners.

**Narrative discourse** is a description of events. Whether one is explaining how to fry an egg, expounding on the pros and cons of eggs in the diet, having a conversation about what to have for breakfast, or telling a story about a chicken and an egg, information is being exchanged in a process called discourse.

Discourse deficit occurs in both comprehension and expression. Indeed it is often difficult to distinguish between the two.

**Major problem areas underlying discourse deficits associated with RHD** (Myers, 1999)

- Reduced ability to generate inferences
- Reduced ability to comprehend and produce main concepts and central themes
- Reduced level of informative content
- Reduced ability to manage alternative meanings
- Reduced ability to communicate context

**Discourse comprehension deficit associated with RHD** (Myers, 1999)

Reduced sensitivity to

- The gist of written and spoken narratives
- Intended and implied meanings
- New information and revision of old information
- Emotional content
- Paralinguistic information (body language, facial expression, prosody )
- Shared knowledge
- Conversational rules and conventions
- Communicative settings, purpose and role of the participants

**Discourse production deficits associated with RHD** (Myers, 1999)

- Impaired ability to generate a macrostructure

- Reduced level informative content
- Reduced specificity
- Reduced flexibility
- Reduced capacity to generate alternative meanings
- Reduced use of conversational conventions
- Excessive speech output
- Unelaborated speech output.

Not all RHD patients have discourse deficits, and among those that do, not all situations are problematic. When the information is highly redundant, straight forward and explicit, RHD patients may be quite able to negotiate main ideas and details.

### **Inference deficit**

An inference is an interpretation that is based on earlier interpretation and beliefs. The brain expends much of its energy interpreting incoming sensory signals. Visual signals for example are integrated at some stage of processing into patterns that are interpreted as discrete objects. Auditory signals are integrated and interpreted as environmental sounds or as words and sentences. Level of inferential difficulty rests in part of how ambiguous the information is or on the degree

Assuming adequate sensory and perceptual ability, inference is a complex process involving a number of operations. Among the most obvious are

- Attention to individual cues
- Selection of relevant cues
- Integration of relevant cues with one another
- Association of those cues with prior experience or world knowledge

These operations probably operate in parallel. Attention to individual elements in a narrative, conversation, pictured scene or ongoing situation, is of course a crucial first step in interpretation. RHD patients miss important information because they are hyperaroused or have problem sustaining attention. RHD patients can manage simple inferences, inference deficit tend to occur when implicit information is somewhat ambiguous, open to more than one interpretation, unfamiliar, requires revision, or requires integration on several levels.

### **Macrostructure deficit**

A macrostructure is an overarching inference about the theme or central message of a narrative, conversation, procedure, explanation, pictured event, situation, film, TV show, news story or any other communicative event. It enables us to extract meaning from individual sentences and integrate the meaning into the context supplied by the other sentences in the narrative (Hough 1990).



RHD adults may have trouble generating, macrostructures both as listeners and as speakers. They may miss the main point of what someone is saying to them, when they speak they may have difficulty getting the gist of their message across to their listeners. Studies have found RHD patient impaired in apprehending and or maintaining central concepts in narratives and conversational discourse and in pictured stories and events (Wapner et al., 1981). It impedes their ability to follow conversation and other forms of discourse. It may impair their understanding of the gist of nonverbal material as well. Possible factors involved in macrostructure impairment include, impaired appreciation of discourse structure, impaired integration of discourse features, and attentional impairment.

### **Reduced level of informative content**

The conversational speech of RHD patients have been characterized as verbose and excessive in some patient and abrupt and perfunctory in other patients. In either cases RHD may not provide an appropriate amount of information and conversational speech becomes inefficient and may burden the listener .They may have impoverished or unelaborated output, Excessive or over elaborated output, Deficits in appreciating non literal meaning. They have difficulty to appreciate figurative language, indirect requests, humor. Difficulty may be at functional level and theoretical level. On functional level RHD patients may miss information because they may have problems using and interpreting, irony, sarcasm, joking, indirect requests, and other forms of nonliteral language that are sprinkled throughout standard conversation .On theoretical level the deficit in processing figurative language are of interest because of what they tell us about underlying cause of some discourse deficits.

### **Deficit in processing alternate meaning**

Impaired ability to manage alternate meaning also may affect the capacity of RHD patients to revise initial inferences, a skill crucial to following discourse. Factors contributing to impaired processing of alternate meaning include 1) Reduced attentional capacity or mislocated attentional resources. 2) Rigidity 3) a deficit in activate alternate meaning 4) a deficit in adequately suppressing irrelevant alternate meaning.

### **RHD and theory of mind deficit**

may impair the capacity to adopt a theory of mind or theory about internal mental state of other people-their motivation, emotional state, beliefs, intentions and knowledge. These deficits may result in impaired social cognition skills or social disconnection and thus interfere with the pragmatic aspects of communication and possibly with the structural components of discourse as well.

### **Pragmatic deficits associated with RHD (Myers, 1999)**

Request for information from a conversational partner

Interest in the effect of a response on a conversational partner

Ability to weigh plausibility of fact

Sensitivity to paralinguistic information

Sensitivity to indirect speech acts

Use of conventional signaling turn-taking and topic initiation

Topic maintenance

Use of conventions for conversational termination and initiation

Use of conversational advancers

Level of elaborative content

Eye contact during conversation

### **Affective deficits**

There are several theories existing which discuss about the emotional sensitivity and its lateralization to the RH. One such theory is the *right hemisphere dominance theory*. This theory hypothesizes that RH is dominant for the perception, comprehension, and expression of emotion (Tucker 1981). Support for this hypothesis comes from various physiological studies such as electroencephalographic (EEG) data suggest that there is preferential RH activity during emotionally evocative experience. Stronger support for the RH dominance theory comes from studies of patients with unilateral hemispheric damage, particularly RHD patients. Gainotti (1972) found that RHD and LHD patients responded differently to psychological stress induced by failure during task performance. LHD patients had catastrophic reactions tears swearing etc. whereas RHD patients appeared inappropriately indifferent. There existed another hypothesis called *valence hypothesis*. It holds that both hemispheres are differentially important in emotional behavior, depending on positive or negative valence of emotions being processed (Borod, 1992; Silberman & Weingartner, 1986). Proponents of this hypothesis speculated that there may be some evolutionary basis for emotional specialization. The

global scanning and arousal functions of RH may make it ideal for quickly determining threats from the environment and thereby for negative emotions. The more analytic, focused and linguistic functions of LH may be linked to interactive and communicative behaviors and more for positive emotions.

Emotional communication can be further divided into:

- **Nonverbal emotional communication:** includes production and comprehension of emotion as conveyed in facial expression, body language, and gesture. Most studies of comprehension of emotion conveyed by facial expressions have found that RHD patients are impaired relative to both NBD and LHD subjects (Dekoksky *et al*, 1980; Benowitz *et al.*, 1983). There are also fair amount of evidence suggesting a reduced facial expressivity subsequent to RHD. These individuals produce lesser facial expressions both on demand, spontaneously or in natural conversation (Borod *et al.*, 1990; Martin *et al.*, 1990).
- **Verbal emotional communication:** these patients have difficulty perceiving emotions conveyed in conversational speech and written materials. They also have problems in conveying emotion through written and spoken language (Borod *et al.*, 1985) found that compared to LHD and NBD subjects, RHD subjects had reduced prosodic contour as they talked about emotionally evocative slides. However the amount of affective content they produced in their descriptions was not less than that of NBD subjects. Thus impaired comprehension of affective materials both verbal and nonverbal may contribute to inappropriate verbal expression of emotions.

## **Delusions and confusional states**

Although they are rare, agitated confusion, disorientation, and various psychotic states can occur with focal RH lesions and do so more often than with focal LHD. Mechanisms proposed to account for the occurrence of these symptoms include: (a) disruption of pathways between limbic structures and tertiary cortical association areas in the RH that serve to integrate visual information and (c) attentional impairments that interfere with the level of arousal and environmental scanning. Specific delusions associated with RHD include a variety of misidentification syndromes. Patients may misidentify persons, places (reduplicative paramnesia) or body parts.

## **Assessment of RHD**

It is even more important than usual to focus on establishing rapport and building trust during initial contact with right hemisphere involved patients. Since RHD patients are frequently unaware of their cognitive and communicative impairments, and are not usually having any trouble finding words, using grammar, or articulating, they may be reluctant to participate in speech therapy. Also, according to Myers (1997), RHD patients might realize that they are having some trouble thinking and communicating but be afraid to admit it for fear of seeming unbalanced. In this case, the patient may be reassured when told that many people who suffer RHD experience the same kinds of symptoms and that they are not a sign of mental illness.

## **Commercially Available Instruments**

Several standardized tests have been developed for use with RHD patients. One such test is the **Mini Inventory of Right Brain Injury** by Pimental and Kingsbury (1989). Among other things, this battery examines body image, visual scanning, reading, writing, visuomotor skills and speech intonation. It is a very thorough test. **The Right Hemisphere Language Battery** (Brian, 1989) tests mainly for extralinguistic problems, evaluating comprehension of metaphors and inferred meanings, appreciation of humor, and the production of emphatic stress as well as other communication abilities, such as discourse analysis

### **1) Right hemisphere language battery (RHLB)**

Developed by Bryan, 1989 and consists of 7 subtests. They are:

Metaphor picture matching, written metaphor choice, Inferred meaning comprehension, Humor appreciation, Lexical semantic recognition, Emphatic stress production, & Discourse production.

Each section score ranges from 0-4 rating scale and thus total score range from 0-44.

### **2) The mini inventory of right hemisphere damage (MIRBI) - Pimentel & Kingsburg**

It is a 27 item-screening tool. It consists of 10 subsections, 8 of which are measured with fewer items. The subsections are:

Visual scanning, Integrating of gnosis, Integrity of body image/body schema-examiner observing patients for signs of neglect, Visuoverbal processing- oral reading & reading comprehension, spontaneous writing & writing to dictation, Visuosymbolic

processing, Integrity of praxis- drawing a clock and indicating a specific time, Affective language- repeating a neutral sentence in a happy and then a sad voice, Hyper language skills- understanding and interpreting humorous statements and conversations, explaining incongruities, figurative language and similarities, Emotion & affect processing- examiner observing patient for flat affect, General behavior & psychic integrity- examiner observing patient for impulsivity, distractibility and poor eye contact.

The 27-item test was developed after analyzing the performance of 50 RHD adults on a 63 item. The current test was standardized on 30 subjects with RHD (presumably unilateral and more than 25% of whom had sub cortical damage).

**Other standardized measures** include the rehabilitation institute of Chicago Clinical Management of Right Hemisphere Dysfunction (Halper, Cherney, & Burns, 1996). This is the most comprehensive test of all assessment tools used. A fourth test instrument, The Burns Brief Inventory of Communication and Cognition (Burns, 1997), contains a section for assessing right hemisphere communication disorders as well as an inventory for left hemisphere disorders and disorders associated with complex neuropathology.

### **Assessing discourse deficits**

*Discourse comprehension* the stimuli here may be a story or a paragraph read aloud by the clinician or silently by the patient. Thus the stimuli would require the patient to draw inferences and should be sufficiently detailed to require his/her focused attention. One formal test used for this is Discourse Comprehension Test (Brookshire & Nicholas, 1993) which is very useful for probing the ability to comprehend both explicit and implied information. Stories are followed by questions that probe the patients ability to

draw inferences from the material and to remember explicitly stated main ideas and details. In addition to stories expository materials can also be given.

**Discourse production** goal here is to measure how informative, efficient, pragmatically appropriate, and inferentially assured is the patient's expression. It is however difficult to measure discourse production. Areas to measure include the ability to express main concepts, supportive detail, inferences and how efficient and informative the patient's message is. Stimuli for discourse production need not always be pictured of course. One can ask divergent or open ended questions, designed to encourage the patient to express and support an opinion.

#### **Assessing pragmatic deficits:**

Conversational analysis can be made informally by recording a conversation with the patient and a person familiar to them. Problems with shared knowledge can be assessed by observing the number of times the patient introduces unshared knowledge without identifying the referent or by failing to connect the new information to the original topic. Patients with topic maintenance either stay on a given topic after the conversation has moved on or switch too abruptly. Turn taking cues might also be missed by these clients.

#### **Assessing neglect:**

There are several published tests of neglect. The most well known ones are verbal and non verbal cancellation test (Weintraub & Mesulam, 1985) consists of a packet of standardized cancellation tests that vary in difficulty and in spatial arrangement, the Behavioral inattention test (Wilson, Cockburn, & Halligan, 1987) is most complete



assessment of neglect that includes functional tasks such as reading a menu, and Test of visual field attention.

**Informal measures include:**

Line bisection, cancellation and drawing similar to the one mentioned in the screening procedure.

*Reading* can be assessed at single word, sentence, and paragraph level by asking the patient to read printed material out loud. Single words can vary in length and error types also listed in the analysis. Sentences are still more difficult than single words. Level of difficulty can be varied by embedding a phrase within a sentence. A sensitive test of neglect in reading was developed by Caplan (1985). He suggested varying the leftward margin so that patients do not have a physical border to use as a cue.

*Writing* the patient can be asked to copy a sentence, compose a brief paragraph or write a series of words horizontally or vertically. Response characteristics to observe are use of margins, slant of the line, perseverative strokes, omitted strokes, omitted punctuation and failure to cross t's and dot i's.

**Assessing Attention deficits**

*Informal measures*

*Arousal* Generally through clinical observation, one can distinguish patients who are hypo aroused from those who are more alert by noting their ability to maintain attention for more than a few minutes, their tendency to be very slow to respond and in need of constant prompting, and by their flattened affect. Computerized reaction time tasks can

be used for this purpose. [Note their mobility to maintain attention for more than a few secs.]

***Vigilance and sustained attention*** Observe the reaction time.

Eg: Signaling the presence of a target in a series. Another test is Paced Auditory Serial Selection Task (Gronwell, 1977), which requires patient to add each number to one preceding it as the numbers are called out by the examiner.

***Selective Attention***

Tasks used for neglect such as cancellation can be used here. Matching tasks in which targets are increasingly similar to foils can also be used

Several formal tests exist which include: Everyday Attention (Robertson, Ward,& Ridgeway, 1994), Stroop task (Stroop, 1935), Trail making Test (Reitan, 1958) and several other computerized tests.

### **Assessing Affective Deficits**

***Production of Non-verbal Emotional Expression:***

it is difficult to quantify changes in non verbal expression and hence this procedure is problematic. Facial affect is judged usually. It can be noted in the overall evaluation and discussed with the patient's family without reference to numbers and scores.

***Comprehension of Nonverbal Emotional Expression:***

It can be done as follows:

A) Discriminative Facial Expression:

Goal: Discriminate (same/ different) emotional expressions

Stimuli: Pairs of photographs or other pictures of faces expressing an emotion (eg: happiness, sadness, anger)

Task: 1. State whether or not the expression are the same or different

2.Group photographs into sets that show the same expression

Scoring: +/-

B) Identification of facial expression

Goal: Identify (name) emotional expression

Stimuli: Photographs of faces with various expressions

Task: Name the expression conveyed in the photograph

Scoring: +/-

***Comprehension of verbal emotional expression***

Here we can have patients read or listen to short paragraphs or sentences that contain emotional content. Patients can be asked to name the emotional state of the main character, to answer questions about the emotions conveyed by the story, or to infer the overall mood of a setting or plot.

***Production of verbal emotional expression***

One can ask the patients to describe an emotional situation from their personal experience. It is best tested by measures of prosodic production or observation of facial expression, gestures and body language.

### **Assessing prosodic deficits**

#### ***Comprehension***

- Identify emotional prosody in sentences.
- Determine the emotional tone of spoken sentences through prosodic contour.
- Identify emphatic stress: Compound nouns versus noun phrases. Discriminate between compound nouns and noun phrases through stress.
- Identify emphatic stress: (Sentences) Identify stressed words in spoken sentences.
- Distinguish sentence types: interrogative versus declarative.
- Use prosodic contour to identify sentence type

#### ***Production***

- Imitate Emotional Prosody in sentences
- Measure the ability to imitate the emotional contour of spoken sentences.
- Produce emphatic stress in sentences
- Measure control over emphatic stress production.

- Distinguish declaratives from interrogatives. Use prosody to convey differences in intonational contour.

A study on description of clinical communication impairment profiles following RHD (Payer, Giroux & Joannette, 2007) aimed to explore the clinical profiles of communication impairments subsequent to a right hemisphere lesion. A total of 28 French-speaking individuals with a right-hemisphere lesion were evaluated using the *Protocole MEC* (Joannette, Ska, & Cote, 2004), a normalized battery allowing the assessment of communication deficits after RHD. A hierarchical cluster analysis was used to group participants according to similarities in their results on the 14 tasks. Four subgroups of RHD individuals were identified on the basis of the overall similarities of performance on the 14 tasks of the *Protocole MEC*. Participants in the first cluster showed impairments in all four language components evaluated, whereas the second cluster of participants was also impaired in prosodic, lexical-semantic, and pragmatic abilities, but was characterized by a relative preservation of discourse abilities. The third cluster of participants did not show any abnormal results. Finally, two individuals were mainly characterized by some lexical-semantic deficits.

The *Protocole MEC* used in conjunction with a cluster analysis provided a first step towards the identification of communication impairment profiles among the population of individuals with RHD. In the study it was not possible to clearly identify the relationship between a given profile and factors such as lesion site, age, or education. Incidence of communication impairments was estimated to be higher in a rehabilitation centre setting than the generally accepted 50% in the literature.

. The right hemisphere in right-handed people has also proved to contain some skills for processing certain components of language, more related to content than to form. Along these lines, it has been proved that RHD can cause impairments to prosody, the semantic processing of words, and discursive and pragmatic skills. Although the exact origins of this disorder remain unknown, it is thought that they may correspond to specific deficits in patients with RHD, to impairments that can be present both in individuals with RHD and LHD, or even to a non-specific impact on the limited availability of cognitive resources. Although the rate of occurrence of communication disorders in patients with RHD is yet to be determined, no estimates place it below 50%. In clinical practice, these patients tend to be under-diagnosed, which is due as much to a lack of clinical suspicion as to the fact that the batteries which evaluate aphasia do not detect their impairments. The specific evaluation tools that are now available allow non-select populations of patients with RHD to be studied. This will allow the occurrence rate of communication impairments to be reliably determined, which will, in turn, have an impact on the development of treatment techniques and the adaptation of relevant health policies.

Kamlesh and Chengappa (1999) Studied impairment in pragmatic use of language in the RHD and aimed to identify the inappropriate pragmatic features seen. In 5 adults with RHD, The pragmatic protocol was used to judge the pragmatic skills. The protocol was completed after observing the individuals engaged in spontaneous, unstructured conversation with a communicative partner .The experimenter observed 15min of conversation online for aspects that rely on principles of language usage that are relatively independent of language structure i.e. nonverbal aspects (body posture, eyegaze

etc).The conversation was audio taped to assess the verbal and paralinguistic aspects of language. After the experimenter observed the interaction protocol was completed. The aspects of the text were classified under Verbal Aspects that included speech act, topic maintenance, turn taking, lexical selection/use across speech acts, stylistic variation, paralinguistic aspects that included intelligibility and prosody and non verbal aspects that consisted of kinesics and proxemics.

Results showed that there were variable pattern of pragmatic impairment seen across patients. But most of them were consistently impaired in cohesion and coherence, prosody, eye gaze, variation turn taking contingency, turn taking adjacency, and quantity/conciseness. Parameters such as topic selection, topic introduction, topic change other turn taking skills were also found to be deficient in 2 of the 5 subjects. Thus it was deduced that although the right hemisphere damage patient evidence adequate linguistic skill, they are poor communicators and there is obvious detraction from the communicative exchange.

### **Quality of life of individuals with RHD**

The terms, such as social well-being, social welfare, and human development are often used as equivalent or comparable terms. Quality of Life (QOL) is seen as the product of the interaction of a number of different factors -- social, health, economic, and environmental conditions -- which cumulatively, and often in mysterious ways, interact to affect both human and social development at the level of individuals and societies. It is the "the notion of human welfare (well-being) measured by social indicators rather than by ""quantitative" measures of income and production." (United Nations Glossary, 2009).

One of the most popular aggregate measures of the quality of life of an individual is his/her view of his/her happiness. Aristotle in *Etica nicomahica* used for the first time the term *eudaimonia* (free for happiness). Russell elaborated the notion of happiness as a relative sense of joy that varied from one culture to another and also from one individual to another. In the country of Bhutan, Gross National Happiness (GNH) is the main index for defining the quality of life in a more holistic and psychological term.

The Social Indicators Movement in the 1970's brought about a new impetus in assessment with indicators such as; public educational, social, ecological programs were initiated, and quantitative indicators to measure their success (or failure) were of great need. Two types of the quality of life measures, or indicators, are distinguished, namely, subjective and objective ones. So, each of the mentioned properties and measures, being expressed via a system of statistic indicators, should then be integrated into a measure of the overall quality of life.

### **The World Health Organization Quality of Life – 100 (WHOQOL – 100)**

The WHOQOL-100 quality of life assessment was developed by the WHOQOL Group with fifteen international field centres, simultaneously, in an attempt to develop a quality of life assessment that would be applicable cross-culturally

WHO's initiative to develop a quality of life assessment arose for a number of reasons. In recent years there has been a broadening in focus in the measurement of health, beyond traditional health indicators such as mortality and morbidity (e.g. World Bank, 1993; WHO, 1991), to include measures of the impact of disease and impairment on daily activities and behaviour (e.g. Sickness Impact Profile; Bergner, Bobbitt, Carter



*et al*, 1981), perceived health measures (e.g. Nottingham Health Profile; Hunt, McKenna and McEwan, 1989) and disability / functional status measures (e.g. the MOS SF-36, Ware *et al*, 1993). These measures, whilst beginning to provide a measure of the impact of disease, do not assess quality of life *per se*, which has been aptly described as "the missing measurement in health" (Fallowfield, 1990). Second, most measures of health status have been developed in North America and the UK, and the translation of these measures for use in other settings is time-consuming, and unsatisfactory for a number of reasons (Sartorius and Kuyken, 1994; Kuyken, Orley, Hudelson and Sartorius, 1994). Third, the increasingly mechanistic model of medicine, concerned only with the eradication of disease and symptoms, reinforces the need for the introduction of a humanistic element into health care. By calling for quality of life assessments in health care, attention is focused on this aspect of health, and resulting interventions will pay increased attention to this aspect of patients' well-being. WHO's initiative to develop a quality of life assessment arises from a need for a genuinely international measure of quality of life and a commitment to the continued promotion of an holistic approach to health and health care.

The WHOQOL-100 development process consisted of several stages. In the first stage, concept clarification involved establishing an agreed upon definition of quality of life and an approach to international quality of life assessment.

*Quality of life is defined as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.*

This definition reflects the view that quality of life refers to a subjective evaluation which is embedded in a cultural, social and environmental context. Because this definition of quality of life focuses upon respondents' "perceived" quality of life, it is not expected to provide a means of measuring in any detailed fashion symptoms, diseases or conditions, but rather the effects of disease and health interventions on quality of life. As such, quality of life cannot be equated simply with the terms "health status", "lifestyle", "life satisfaction", "mental state" or "well-being". The recognition of the multi-dimensional nature of quality of life is reflected in the WHOQOL-100 structure.

In the second stage of development, exploration of the quality of life construct within 15 culturally diverse field centres was carried out to establish a list of areas/facets that participating centres considered relevant to the assessment of quality of life. This involved a series in meetings of focus groups which included health professionals, patients and well subjects. A maximum of six specific items for exploring each proposed facet were generated by each centre's focus group. To enable the collaboration to be genuinely international the 15 field centres were selected world-wide to provide differences in level of industrialisation, available health services, and other markers relevant to the measurement of quality of life (e.g. role of the family, perception of time, perception of self, dominant religion).

In the third stage of development, questions from each centre were assembled into a global pool. After clustering semantically equivalent questions, 236 items covering 29 facets were included in a final assessment. Pilot work involved administration of this standardised assessment to at least 300 respondents within each centre.

Following field testing in these 15 centres, 100 items were selected for inclusion in the WHOQOL-100 Field Trial Version. These included four items for each of 24 facets of quality of life, and four items relating to the [overall quality of life and general health facet. The method by which these 100 items were selected is fully documented elsewhere (The WHOQOL Group, in preparation). The WHOQOL-100 Field Trial Version is currently being tested in new centres world-wide (these centres are outlined on page 6 of this document). The initial conceptual framework for the WHOQOL-100 proposed that the 24 facets relating to quality of life should be grouped into 6 domains. Recent analysis of available data, using structural equation modeling, has shown a four domain solution to be more appropriate.

### **Domains and Facets incorporated within domains**

#### *1. Physical health Activities of daily living*

Dependence on medicinal substances and medical aids

Energy and fatigue

Mobility

Pain and discomfort

Sleep and rest

Work Capacity

#### *2. Psychological Bodily image and appearance*

Negative feelings

Positive feelings

Self-esteem

Spirituality / Religion / Personal beliefs

Thinking, learning, memory and concentration

*3. Social relationships Personal relationships*

Social support

Sexual activity

*4. Environment Financial resources*

Freedom, physical safety and security

Health and social care: accessibility and quality

Home environment

Opportunities for acquiring new information and skills

Participation in and opportunities for recreation / leisure activities

Physical environment

It is evident the management of patients with right hemisphere damage (RHD) presents a challenge to the allied health clinician. Damage to the right hemisphere results in a cluster of cognitive deficits that reduces the patient's effective and efficient participation in activities of daily living (ADLs), including the use of communication

skills.<sup>1</sup> The cognitive areas that may be impaired include the processes of attention, perception, memory, organization, reasoning, and problem solving. Due to the fact that the performance of any functional behavior or activity is dependent on the integrity of the underlying cognitive processes required for execution of that task, breakdown in one or more cognitive processes manifests in difficulty performing the ADL or participating appropriately in a communication activity. In addition to impairments in specific cognitive areas, some patients with RHD may not always be aware that there have been physical, cognitive, or behavioral changes. Other patients may not be aware of the extent of the changes or that the changes have occurred as a consequence of the brain damage. Deficits that are obvious to family and caregivers are often not acknowledged by the patient or are considered to be trivial and unimportant.

In a Self-report of indifference and anxiety among persons with right hemisphere stroke study (Williams, 1992), Persons with right hemisphere stroke reported themselves as being substantially less anxious and somewhat more socially indifferent than did those with left hemisphere stroke. Lack of appropriate anxiety may contribute to the clinical descriptions of indifference, failure to make expected recovery, and difficulty in relationships with others.

A study was conducted on functional outcomes in patients with RHD (Odell, Wollack & Flynn, 2005). The objective of this study was to document, in a single population of patients with RHD, selected functional outcomes at the termination of inpatient treatment. Of particular interest were cognitive performance and its influence on motor and overall recovery. Functional outcomes were retrospectively examined in 101 RHD patients, at discharge from an in-patient rehabilitation programme. The Functional

Independence Measure (FIM; Center for Functional Assessment Research, 1993) was the measurement tool. The five outcomes examined were: final functional status, amount of gain, efficiency of gain, length of stay (LOS), and discharge placement. FIM scores, produced on an ordinal rating scale, were statistically transformed by the Rasch method (Rasch, 1960) to generate interval-level data for regression analyses.

Results revealed that Gains were evident in cognitive and motor realms, with greater and more efficient improvement in the latter. Regression analysis indicated that final functional status was best predicted by age, initial motor severity (FIM motor score), and initial total cognitive severity (FIM cognitive scores); amount of gain was best predicted by age, evidence of previous neurological incident, and gender; efficiency of gain by initial cognitive item scores, initial motor severity (FIM score) and age; LOS by initial motor severity (FIM score); and discharge placement by age, marital status, and initial severity (FIM status). Major predictors tended to be age and the family of cognitive FIM scores, especially Problem Solving (PS). Memory and PS were the most challenging cognitive items for these patients, as indicated by scores on admission and discharge reflecting less than functional ability. A sizeable number of patients began and ended rehabilitation with functional levels of ability in comprehension, expression, and social interaction. Significant differences existed between patients with neglect and those without, but neglect was not a significant predictor of any outcome measure. Low initial cognitive FIM scores, presence of neglect, and older age were associated with poorer performance in motor and cognitive realms. Previous neurological episodes were negatively associated with amount of gain. Number of co morbidities was not statistically associated with outcomes.

The authors therefore concluded that Initial severity levels and age were the most influential factors on these outcomes. The presence of neglect had a relatively minor impact on most outcomes. Performance on the cognitive items was less impaired than motor items, and registered less gain and less efficient gain than motor items, but did predict various final status and gain-related measurements in overall and motor realms. Analyses in this study revealed that the FIM scale is less sensitive to cognitive change than to motor change.

A study on the effect of unilateral visual neglect on mobility status and quality of life in stroke patients (Altin & Geleck, 2006) found that the disability status was poorer in the stroke patients with UVN which has affected many subgroups of HRQOL negatively. As a consequence, it is required to develop appropriate treatment modalities for this complex, multifactorial syndrome in further studies.

In a study on depression and intra hemispheric location of lesion in Right hemisphere stroke patients (Finset, 1989) 42 stroke patients with verified right hemisphere lesions were studied. Depressed mood was measured by means of a global rating scale, and an inventory administered as a structured interview. As measured by the global ratings and one of the inventory subscales, patients with deep, retrorolandic lesions showed significantly more depressed mood than other patients. The findings are discussed in the light of current relevant research, and implications for management of depressed mood in stroke patients are suggested. There exist rating scales and questionnaires to measure the quality of life for individuals with various disorders.

Among them the Stroke and Aphasia Quality of Life Scale-39 (SAQOL-39) is an acceptable, reliable, and valid measure of HRQL in people with long-term aphasia.

There is, however a dearth in literature regarding the Quality of life in individuals with Right hemisphere Damage. Hence the present study aimed at developing a quality of life questionnaire for individuals with Right Hemisphere Damage. The study also aimed to investigate its relevance to cognitive communication deficits from a Speech Language pathologist's perspective.



## CHAPTER 3: Method

The aim of the present study was to develop a quality of life questionnaire for individuals with Right Hemisphere Damage. The study also aimed to investigate its relevance to cognitive communication deficits from a Speech and Language Pathologist's (SLPs) perspective.

### Participants

The clinical group consisted of 10 participants with known history of Right Hemisphere Damage (RHD). The participants were chosen irrespective of etiology who report of communicative problems post morbidly and having received no intervention since onset. Participants selected were in the age range of 37 – 60 years. The insult had occurred between 1- 4 years previously. All the participants had a working knowledge of the English language. Six participants reported to have had shifted to jobs of lower position as a consequence of Right Hemisphere Damage (RHD2, RHD3, RHD4, RHD5, RHD8, RHD10).

Table 3.1: *Data of the individuals with RHD*

	RHD 1	RHD 2	RHD 3	RHD 4	RHD5	RHD 6	RHD7	RHD8	RHD9	RHD10
Age/Gender	59y/ M	49y/ M	53y/ M	40y/ M	42y/ M	60y/ M	53y/ F	58y/ F	46y/ F	37y/ F
Cause of RHD*	Stroke	Stroke	TBI SDH	TBI SDH	TBI SDH	Stroke	Stroke	Stroke	Stroke	Stroke
Duration of post-onset injury (Yrs)	3	2	2.5	3	1.5	1	2.5	4	2	2
Lesion site#	Rt T	Rt FT	Rt FTP	Rt FTP	Rt FTP	Rt F	Rt T	Rt TP	Rt TP	Rt FT

Language s^ known pre- morbidity	K,E, H	K,E, Tl	K, E	K	M,K,E	K,T, E	Ta,E	Ta,E,K	H,E,K	Tg,K,E
Language s known post- morbidity	K,E, H	K,E, Tl	K, E	K	M,K,E	K,T, E	Ta,E	Ta,E,K	H,E,K	Tg,K,E
Education	Mco m	BE	BE	BA	BE	MA	BSc	MA	Mcom	BCom
Vocation	Govt Servi ce	Proje ct Staff	Govt Servi ce	Syste m Adm in	Market ing Rep	Govt Serv ant Rtd.	Homem aker	Homem aker	Homem aker	Corporate relations. Staff
Socio- economic status	M	M	M	M	UM	M	M	M	UM	LM
Marital status	M	M	M	M	Widow er	M	M	M	M	Spinster
Family (Nuclear/J oint)	Nucl ear	Nucl ear	Nucl ear	Nucl ear	Nuclea r	Joint	Joint	Nuclear	Nuclear	Joint

Note:\* TBI – Traumatic Brain Injury, SDH – Sub Dural Hematoma

# Site of Lesion (Lobes) F – Frontal, T – Temporal, P – Parietal

^Languages: E – English, K – Kannada, Ta – Tamil, Tg – Telugu, H - Hindi

## Materials

A self rating questionnaire to address the individual's quality of life was constructed in English which was derived from the World Health Organization Quality of Life - 100 (1995). Considerations were made in the questionnaire to accommodate the Indian context. Questions were included to assess the cognitive and communicative deficits commonly seen following Right Hemisphere Damage. The questions were framed after reviewing literature on the deficits seen in persons with RHD. The initial draft of the questionnaire which consisted of 155 questions had a rating scale arranged in no particular hierarchy. The rating varied from question to question. Higher scores did

not necessarily indicate a better quality of life and in order to procure an accurate view of the individual's it was necessary to analyse each question independently.

### ***Content Validity***

The first draft of the questionnaire was rated for validity by three post graduate Speech language pathologists (SLPs) and feedback was obtained regarding the ordering of the questions and scoring patterns. Necessary modifications were made based on the findings obtained on the validity rating by professionals. The modifications included the arrangement of the questions, removal of questions deemed redundant (such as how satisfied are you with your ability to move around and how much do any difficulties in mobility bother you) modification of their scoring pattern and simplifying of lengthy questions.

The final version of the questionnaire comprised of 115 questions accompanied by a 5 point rating scale (0, 1, 2, 3, 4). The questions were framed such that higher scores indicated a better quality of life in a hierarchy. The Questionnaire consisted of 115 questions in the following five domains:

- Physical health
- Psychological
- Social
- Environmental
- Cognition/Communication

*Physical health domain:* Consisted of 19 questions addressing:

- Activities of daily living

- Dependence on medicinal substances and medical aids
- Energy and fatigue
- Mobility
- Pain and discomfort
- Sleep and rest
- Work Capacity

*Psychological Domain:* Consisted of 21 questions that addressed:

- Bodily image and appearance
- Negative feelings
- Positive feelings
- Self-esteem

*Social relationships:* Consisted of 11 Questions that pertaining to:

- Personal relationships
- Social support
- Sexual activity

*Communication/Cognition:* Consisted of 32 questions addressing the following areas:

- Attention :Attention is the most commonly impaired cognitive function in RHD (Lehman Blake, 2002) All aspects of attention may be compromised (Burrell, 1996; Hjaltason, 1996; Ruff, 1992) Deficits in sustained attention can contribute to poor eye contact, difficulty comprehending lengthy conversations and poor

topic maintenance (Murray,2000). Questions addressing aspects of how the well the patient was able to attend to his activities were used to obtain information regarding how attention reflected on the patients quality of life.

- Memory: Short term and long-term recall for verbal and non verbal material is affected Tompkins (1994) found that individuals with RHD performed more poorly than non brain damaged participants on a auditory verbal working memory task Non verbal material was found to be more difficult to recall than verbal material (Lange, Waked, Kirshblum, & DeLuca, 2000). Furthermore, working memory deficits result in poor performance in discourse comprehension task that involve resolving contextual discrepancies or revising linguistic inferences. Questions that queried into the aspects of memory in the persons' daily life were framed to assess the role of memory in shaping the quality of life of the individual.
- Decision making. RHD patients may exhibit poor judgment and problem solving abilities (McCaffrey.2000). Questions regarding how the person felt about his/her ability to make decisions, the time taken to make them and to correct them if necessary were used.
- Discourse/organization: Cognitive deficits (e.g., attention, working memory) cause or contribute to the pragmatic and discourse impairments of patients with RHD (Lehman Blake, 2003) or individuals with RHD may have difficulty suppressing word meanings or discourse interpretations that are irrelevant or incompatible with the communicative context (Fassbinder & Tompkins, 2001).

Questions relating to how well the person felt he/she was able to organize and explain were used to arrive at the individuals rating of how affected his/her abilities were and how satisfied he/ she was with them.

- Naming: Some studies suggest deficits at the level of lexical semantic comprehension and production level, but often these difficulties reflects problems in perception or other areas of cognition than in lexical-semantic process per se (Fassbinder & Tompkins, 2001) Attentional problems also may contribute to apparent lexical-semantic breakdowns as several studies have indicated that patients with RHD display more difficulties with word finding under more complex attention conditions (Murray, 2000) . Questions regarding how the person felt about his/her ability to communicate were used with references to his/her ability to retain, retrieve, and utilize or explain information effectively.
- Comprehension: Deficits in perceiving either visual or auditory information frequently occur following RHD (Cummings & Burns, 1996; Lehman Blake, Duffy, Meyers, & Tompkins, 2002; Vignolo, 2003) Perceptual problems may be the underlying basis of some language symptoms (McDonald, 2000; Nicholson, 2003; Peper & Irle, 1997) Persons with RHD exhibit a decreased ability to profit from non verbal cues such as facial expressions or hand gestures. Questions in this section addressed how well the person was able to comprehend conversations, instructions or information in general in his day to day activities.

*Environment:* Consisted of 32 questions relating to:

- Financial resources

- Freedom, physical safety and security
- Health and social care: accessibility and quality
- Home environment
- Opportunities for acquiring new information and skills
- Participation in and opportunities for recreation / leisure activities
- Physical environment (pollution / noise / traffic / climate)
- Transport

### **Procedure**

The participants were interviewed in their homes or in a hospital set up in a relatively quiet setting using the Right Hemisphere Damage and Quality of Life– Self rating questionnaire (RHDQOL) (See Appendix 1) developed in the present study. Clinical data was abstracted from the medical reports, the participant and the family members by a trained speech language pathologist after obtaining their informed consent. The variables concerned were age, sex, and etiology and recovery periods. The participants were then given the questionnaire along with detailed instructions on how to answer the questions (See appendix 1). The participants filled the questionnaire while the SLP stood by during the entire process of answering the questionnaire to provide assistance whenever necessary. The participants were also informed that they could take breaks between questions whenever they felt the need to do so.

### **Analysis of Data**

The scores thus obtained were tabulated after referring to an interpretation copy of the questionnaire (See Appendix 2), which indicates the domain the questions belong to. It was then possible to assess each participant's score in each of the domains as well as the total score. The scores were converted to percentage for further analysis.

The data collected from the ten RHD individuals was subjected to quantitative analysis using the SPSS (18.0) version. The following statistical analyses were used in the analysis of the data. Repeated measure ANOVA was employed to compare the five domains (physical, social, environmental, cognition/communication and psychological) within the RHD group for pair wise comparison of the domains. Pearsons correlation coefficient was used to study the relationships between the domains. A qualitative analysis of individual participant data was also carried out.



## CHAPTER 4: Results and Discussion

The aim of the present study was to develop a quality of life questionnaire for individuals with Right Hemisphere Damage. The study also aimed to investigate its relevance to cognitive communication deficits from a Speech and Language Pathologist's (SLPs) perspective. The Right Hemisphere Damage Quality of Life (RHDQOL) questionnaire, a self-rating questionnaire was rated by a total of ten individuals with RHD with RHD between the age range of 37 – 60 years. The RHD – QOL consisted of questions related to the physical, social, psychological, environmental and cognitive communicative aspects of the individual's life with RHD. The raw scores obtained on all the domains were converted into percentage and the mean was calculated.

The data collected from the ten individuals with RHD was subjected to quantitative analysis using the SPSS (18.0) version. Repeated measures ANOVA was employed to compare the five domains (physical, social, environmental, psychological and cognition/communication) within the RHD group for pair wise comparison of the domains. Quality of life functioned as the independent variable with it consisting of the domains (Physical, Social, Environmental, Psychological and Cognition/Communication) that functioned as the dependent factors as within subject factors.

Results of the present study are explained under the following sections:

- I. Comparison of overall performance of individuals with RHD on RHDQOL
- II. Comparison of the performance of individuals with RHD across domains of RHDQOL

### III. Content validity of the RHDQOL tool

#### I. Comparison of overall performance of individuals with RHD on RHDQOL

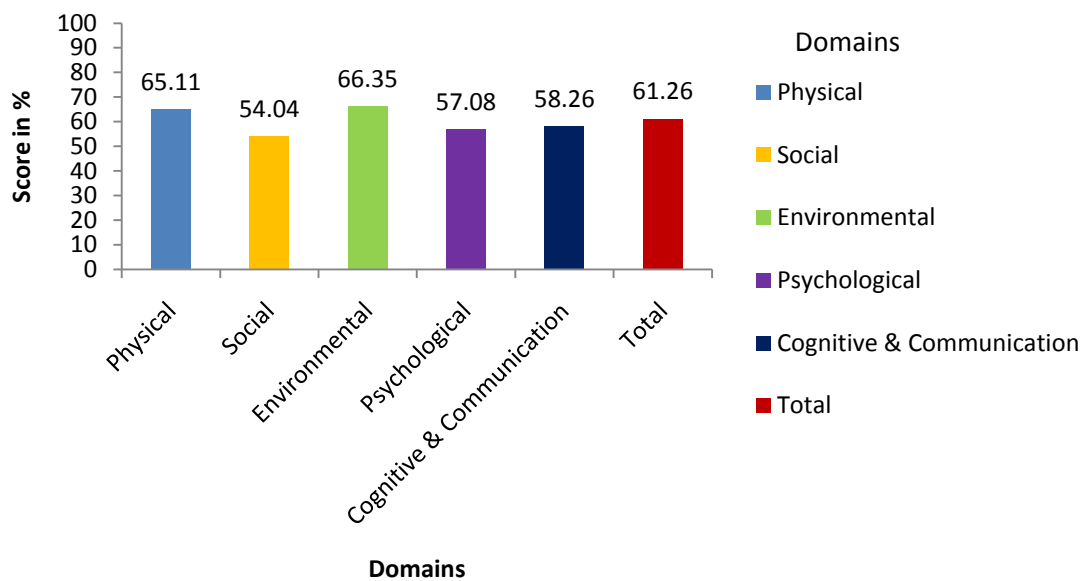
The scores obtained by the individuals with RHD were converted to percentage scores. Table 4.1 shows the overall performance of all individuals with RHD across domains- physical, social, environmental, psychological and cognition/communication

Table 4.1: *Mean and standard deviation scores on RHDQOL measures*

Domain	Mean	SD
Physical	65.11	17.61
Social	54.04	20.35
Environmental	66.35	16.57
Psychological	57.08	18.27
Cognition/communication	58.26	17.83
Total	61.26	15.64

Analysis of the results revealed that overall the highest scores was obtained on the environmental domain (Mean=66.35; SD=16.57) followed by the physical domain (Mean=65.11; SD=17.06). The cognition/communication domain ranked third (Mean=58.26; SD=17.83 followed by the psychological domain (Mean=57.09; SD=18.27) and the lowest scores were obtained on the social domain (Mean=54.04; SD=20.34). Pair wise comparisons using repeated measure ANOVA revealed a statistically significant difference only between the social and the environmental domains at  $p < 0.05$  level of significance. All other comparisons revealed no statistical significance.

This finding indicated that overall individuals with RHD opined that the damage caused greater effect on the social life of the individuals followed by psychological disturbances, cognitive communication, physical and the least affected was their environmental factors. The findings suggest that ratings reflecting poor quality of life obtained for questions both from the social domain such as “how satisfied are you with your family’s understanding of your problems” and “how satisfied are you with your personal relationships” and the psychological domain “how often do you experience negative feelings” and “how much do you regret what happened” Whereas the questions from the environmental domain in general were not so greatly affected as observed from the data obtained. For e.g. “how uncomfortable is the place where you live” and “How concerned are you with the noise in the area you live in”



*Figure 4.1:* Overall performance of individuals with RHD in terms of quality of life measures across all the domains

In the RHDQOL questionnaire the physical domain consisted of questions addressing activities of daily living, pain and discomfort, sleep and rest as well as medical dependence. Chief factors affecting this domain that the individuals with RHD complained of included pain stemming from the surgical procedures consequent to RHD and restricted activities of daily living due to paralysis and paresis. Individuals with RHD reported that pain and lack of sufficient dexterity prevented them from performing activities they could otherwise perform with ease. In general studies have been reported in literature that individuals with RHD often suffered from physical problems such as difficulties in performing routine activities, pain and medical dependency. This is in support with a study conducted on functional disability and rehabilitation outcome in right hemisphere damage by Katz, (1999) which noted that that nearly all participants demonstrated significant neuromotor deficits affecting activities of daily living negatively.

The social domain addressed questions related to personal relationships, social support and sexual activity. Factors affecting this domain consisted mainly of personal relationships. Sexual activity was less affected than the other factors. Individuals with RHD reported that their personal relationships were strained following the RHD with problems arising from their insecurities, their reported problems in expressing how they feel and in being unable to comprehend other's feelings as easily as they used to. The individuals with RHD and their families also reported changes in personality with respect to temper, tolerance levels and irritability. This trend was also seen in a self report study in RHD individuals by Williams (1992), in which the participants had difficulty in relationships with others. This is also in concordance with a study by Blake *et al.*, 2002 in

which 93% of 33 adults with Right hemisphere damage in a rehabilitation center had at least one cognitive deficit with the potential to disrupt communication and social interaction

The environmental domain addressed factors such as financial resources, physical environment and transport. The factors that affected this domain consisted primarily of financial resources with six of the ten individuals with RHD (RHD2, RHD3, RHD4, RHD5, RHD8, and RHD10) who had to shift to positions with a lower pay grade following the RHD. Difficulties in transport also contributed to financial difficulties as some individuals with RHD reported of being unable to commute independently or as well as they previously could. However, most individuals with RHD reported that they were satisfied with the homes they were staying in and the amenities available to them.

The psychological domain addressed factors such as confidence, feelings and self image. Reported problems included regret regarding the RHD, a feeling of unfairness and depression. Individuals with RHD and their family members reported that they are generally irritable and prefer to keep to themselves and avoid social contact when possible. Individuals with RHD with bone flap replacements following craniotomy and persisting paralysis/paresis reported of being conscious of their appearance and consequently being less confident. Some individuals with RHD also reported having had had contemplations of suicide. A study (Ahern & Schwartz, 1985) of the localization of emotion in uninjured brains provided interesting evidence of the brain's organization. The use of EEG spectral analysis revealed that in frontal zones, there was greater left hemisphere activation or positive emotional reactions (e.g., excitement and happiness) and relative right hemisphere activation for negative emotions (e.g., fear and sadness).

Although there appear to be conflicting results on laterality of emotion, this disagreement seems to reflect the way emotions are measured. Many studies have found lateralized differences (Ahern & Schwartz, 1979), and most studies have linked the mediation of negative and positive emotions to the right and left hemispheres respectively. Suicidal persons demonstrate structural abnormalities in the right hemisphere, and right hemisphere injury may increase suicidal tendencies.(Altshuler, Casanova, Goldberg & Kleinman, 1990)

The cognition/communication domain consisted of questions addressing memory, attention, decision making and expressive skills. The individuals with RHD reported problems in failing to comprehend long or complex sentences as they find themselves quickly losing interest. Issues related to learning new information as well as being able to retrieve and explain newly learnt information were reported. Problems in general communication included failing to comprehend directions or difficulty in providing directions when instructing others regarding a task. Individuals with RHD and their families reported an increase in the frequency of communication breakdowns arising from the individual with 's impatience or irritability and poor coherence of information. Frequent instances of miscommunication were reported. Cognitive deficits (e.g., attention, working memory) cause or contribute to the pragmatic and discourse impairments of patients with RHD (Lehman Blake, 2003) . In a study of individuals with RHD it was observed that they may have difficulty suppressing word meanings or discourse interpretations that are irrelevant or incompatible with the communicative context (Fassbinder & Tompkins, 2001). Deficits in perceiving either visual or auditory information frequently occur following RHD (Cummings & Burns, 1996; Lehman Blake,

Duffy, Meyers, & Tompkins, 2002;) Vignolo in 2003 noted that perceptual problems may be the underlying basis of some language symptoms (McDonald, 2000; Nicholson, 2003; Peper & Irle, 1997) Persons with RHD exhibit a decreased ability to profit from non verbal cues such as facial expressions or hand gestures. Deficits in perceiving either visual or auditory information frequently occur following RHD (Cummings & Burns, 1996; Lehman Blake, Duffy, Meyers, & Tompkins, 2002; Vignolo, 2003) Perceptual problems may be the underlying basis of some language symptoms (McDonald, 2000; Nicholson, 2003; Peper & Irle, 1997) Persons with RHD exhibit a decreased ability to profit from non verbal cues such as facial expressions or hand gestures

urther Pearson's correlation analysis was done to explore the relationship between the domains on RHDQOL measures. Table 4.2 shows the results of correlational analysis between domains in terms of correlation coefficients and their significance values.

Table 4.2: *Pearson's correlation coefficient to assess the correlation between the domains*

	Physical	Social	Environmental	Psychological	Cognition and communication
Physical	-	0.701*	0.781**	0.537	0.673*
Social	0.701*	-	0.864**	0.870**	0.696*
Environmental	0.781**	0.864**	-	0.690*	0.796**
Psychological	0.537	0.870**	0.690*	-	0.655*
Cognition Communication	0.673*	0.696*	0.796**	0.655*	-

Note.\*p< 0.05, \*\*. <0.01

Analysis of results revealed a strong positive significant correlation of the physical domain with social domain ( $r=0.701$ ;  $p<0.05$ ), cognitive and communication domain ( $r=0.673$ ;  $p<0.05$ ), psychological domain ( $r=0.537$ ) and the environmental domain ( $r=0.781$ ;  $p<0.01$ ). Correlation analysis results showed that on the social domain there was significant correlation with the physical ( $r=0.701$ ;  $p<0.05$ ) and cognitive and communication domain ( $r=0.696$ ;  $p<0.05$ ) and significant correlation with the environmental domain ( $r=0.864$ ;  $p<0.01$ ), the psychological domain ( $r=0.870$ ;  $p<0.01$ ) and the cognition and communication domain ( $r=0.796$ ;  $p<0.01$ ). Correlation analysis results showed that on the psychological domain there was significant correlation with the environmental domain ( $r=0.690$ ;  $p<0.05$ ) and cognitive and communication domain ( $r=0.655$ ;  $p<0.05$ ) and significant correlation with the social domain ( $r=0.864$ ;  $p<0.01$ ). There was no statistically significant correlation between the psychological and physical domains. Correlation analysis showed that on the environmental domain there was significant correlation with the psychological domain ( $r=0.690$ ;  $p<0.05$ ) and significant correlation with the physical domain ( $r=0.781$ ;  $p<0.01$ ), and the social domain ( $r=0.864$ ;  $p<0.01$ )

Of particular interest in this study was the relationship between the cognitive communication domain and the other domains. Correlation analysis results showed that on the cognition and communication domain there was significant correlation with the physical ( $r=0.673$ ;  $p<0.05$ ), social ( $r=0.696$ ;  $p<0.05$ ) and psychological domain ( $r=0.655$ ;  $p<0.05$ ) and significant correlation with the environmental domain ( $r=0.796$ ;  $p<0.01$ ). The cognitive communication domain had the highest correlation coefficient with the social domain. This implies that the factors that affect an individual's scores in the



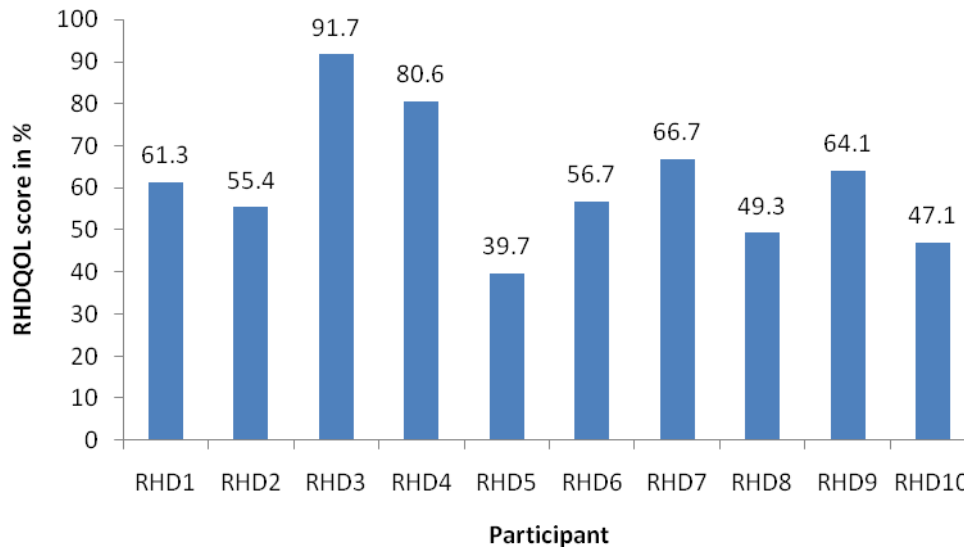
cognitive communication domain has a greater effect on his social domain. The factors may be communicative such as the ability to express one's feelings if an individual with RHD has difficulty expressing oneself, it may directly affect his social skills and thereby his social domain which may lead to an affected QOL. Studies have found RHD patient impaired in apprehending and or maintaining central concepts in narratives and conversational discourse and in pictured stories and events (Wapner *et al.*, 1981). It impedes their ability to follow conversation and other forms of discourse. It may impair their understanding of the gist of nonverbal material as well. A cognitive factor such as a poor attention span may affect an individual's social life by resulting in the individual being a poor listener or having inadequate topic maintenance consequently making him less sociable, thereby affecting his QOL scores on the social domain. A study in which 93% of 33 adults with Right hemisphere damage in a rehabilitation center had at least one cognitive deficit with the potential to disrupt communication and social interaction (Blake *et al.*, 2002).

This indicated that the cognition and communication domain interacts with the other domains and plays a significant role in determining an individual's quality of life.

## **II. Comparison of the performance of individuals with RHD across domains**

The total score of the individuals with RHD was calculated after taking all the five domains into consideration. The mean score of the ten individuals with RHD was 61.2 (SD=15.6) suggesting a considerable effect on the quality of life of persons with

RHD. Figure 4.2 shows the overall performance of each individual with RHD on RHDQOL.



*Figure 4.2:* Overall performance of each individual with RHD on RHDQOL

Analysis of performance of each individual with RHD on RHDQOL was done. The results revealed that RHD 3 obtained the highest QOL score (91.7%), followed by RHD 4(80.6%). RHD 7 had the third highest score (66.7%), followed by RHD 9 (64.1%). RHD 1 had the fifth highest QOL score (61.3%). This was followed by RHD 6 (56.7%). RHD 2 stood at the seventh place (55.4%). RHD 8 stood the eighth place (49.3%). RHD 10 had the ninth place (47.1%) and RHD 5 had the lowest score (39.7%).

Qualitative analysis of the data of performance of individuals with RHD on RHDQOL was done to provide comprehensive information about the multiple factors that affected quality of life of individuals with RHD and their interplay in the life of a person with RHD.

*Performance of RHD 1: Case Summary:* Individual with RHD was a 59 year old male; 3 years post RHD resulting from Hemorrhage in the Right temporal lobe. RHDQOL score: 61.3% (refer Table 4.3 for scores in each domain) RHD1 was the sole earning member of a family of four. The individual with RHD reported feelings of depression and helplessness following the Stroke. RHD1 reported of being unable to socialize as well as he previously could as he was insecure about his abilities. Individual with RHD reported of no pain or related problems. RHD1 did however, have problems of transport as he was advised to refrain from commuting on two wheelers. The individual with RHD is reported to have experienced changes in personality, with family members reporting that he is irritable and short tempered a majority of the time. The Individual with RHD is also reported as being careless or absent minded by self and family members. His son reports that he is no longer able to guide him with matters both educational and otherwise as well as he used to. The individual with RHD reported feeling hostile toward his friends when they attempted to assist him during the initial periods of recovery even though he understood that they meant well.

*Performance of RHD 2: Case Summary:* Individual with RHD was a 49 year old male; two years post RHD resulting from a Right Frontotemporal Hemorrhage. RHDQOL score: 55.4% (refer Table 4.3 for scores in each domain). On initial observation individual with RHD appeared indifferent and skeptical about the questionnaire. He then proceeded to explain in great detail about the events that lead up to the Stroke and ignored the clinician on more than one occasion when attempts were made to obtain clarifications or to shift topics. The individual with RHD expressed deep regret about what had happened and stated that he constantly felt life was being unfair to him. The individual with RHD

had to relinquish his standing as Assistant Team Leader in his workplace to continue as Project Staff. This was following the company's realization that he could no longer perform and organize projects as well as before. He reported (in confidence) that he felt his friends gained from his loss and that his family did not comprehend how he felt. The spouse reported marital discord following the stroke.

*Performance of RHD 3: Case Summary:* Individual with RHD was a 53 year old male; 2.5 years post RHD resulting from an alleged RTA which led to an acute Frontotemporoparietal Subdural Hematoma. RHDQOL score: 91.7% (refer Table 4.3 for scores in each domain) Individual with RHD was cooperative during administration of the questionnaire and expressed genuine interest in the study. Majority of the problems he reported arose from the pain from the craniotomy site. Family members reported that the individual with RHD had become slightly short tempered following the incident, but not significantly so. The individual with RHD reported that he was not satisfied with his friend's reaction to his predicament when it occurred. No memory or attention problems were reported. The individual with RHD reported of no depression or negative feelings affecting him following the incident and generally seemed to have a positive outlook on life.

*Performance of RHD 4: Case Summary:* The individual with RHD was a 40 year old male; 3 years post RHD resulting from an acute Frontotemporoparietal Sub Dural hematoma following an alleged RTA. RHDQOL score: 80.6% (refer Table 4.3 for scores in each domain).The individual with RHD was cooperative and talkative on observation. Frequent deviations from topic were observed though the individual with RHD linked the topics together fairly well. The individual with RHD reported of feeling clumsy and not

as organized as he previously was with scheduling maintenance and diagnostics in his job as a System Administrator which consequently led to a pay cut. He also reported difficulties in managing his finances which led to him handing over the management of the family's finances to his spouse. The individual with \_\_\_\_\_ reported that he occasionally expressed regret over the incident, but also said that things could have been worse.

*Performance of RHD 5: Case Summary:* The individual with RHD was a 42 year old male; 1.5 years post RHD resulting from an alleged RTA which led to an acute Frontotemporoparietal Sub - Dural Hematoma. RHDQOL score: 39.7% (refer Table 4.3 for scores in each domain).The alleged accident resulted in the death of his wife and child. The individual with RHD maintained a reserved composure throughout the administration of the questionnaire and did not initiate conversation with the clinician. As reported by his parents the individual with \_\_\_\_\_ expresses deep survivor's guilt and was diagnosed with Post Traumatic Stress Disorder (PTSD). He is under medication for depression. The individual with RHD reportedly quit his job as a Marketing Representative following the incident. He expressed discontent in nearly all the domains and repeatedly stated that he does not feel anything anymore, and that nobody understands him. His parents report that he needs to be told to perform his routine activities and he requires minimal assistance in performing them. He reported of not being interested in friends or gatherings or other social activities. The parents reported that he has since become withdrawn and keeps to himself. The individual with RHD confessed having had suicidal thoughts as he constantly feels his life is meaningless.

*Individual with RHD 6:* Case Summary: The Individual with RHD was a 60 year old male, 1 year post RHD resulting from an acute hemorrhagic infarct in his Right frontal lobe. RHDQOL score: 56.7% (refer Table 4.3 for scores in each domain). The individual with RHD was cooperative and verbose during the entire process of administering the questionnaire. The individual with RHD reported that he suffered fairly frequently from pain stemming from the craniotomy performed to relieve intracranial pressure. The individual with RHD also has compromised renal function, which necessitates biweekly haemodialysis. The individual with RHD and his family report that he tires easily and suffers from impaired memory occasionally. This meant that he needed repeated instructions or assistance to perform an activity. He reports of being more bothered by dust and untidiness than before the stroke. He insisted that things placed haphazardly or untidy things bothered him. He reported of being unable to plan and carry out activities satisfactorily, often needing assistance with things he could previously do independently. He missed his daughter's wedding. He reported as having had to cut down on his social life owing to his health and that his family, while very supportive, refrain him from venturing out unaccompanied. The individual with RHD reported of occasionally feeling negative about the way his life is progressing, but reported that he remains grateful and positive most of the time.

*Performance of RHD 7:* Case Summary: The individual with RHD was a 53 year old female; 2.5 years post RHD resulting from a Hemorrhagic infarct in the Right temporal lobe. RHDQOL score: 66.7% (refer Table 4.3 for scores in each domain). The individual with RHD was passive and withdrawn through most of the duration of administration of the questionnaire. Family members reported that she no longer expressed interest in

social functions or entertaining guests. She reported that she no longer feels confident in interacting with people. She reported suffering from occasional headaches that prevent her from performing her activities (Individual with RHD is a homemaker). She reported having occasional problems with remembering names of people and things. She expressed discontent over how she felt she could no longer take part in the decision making processes of the family. She insisted that others could make better decisions than she could. She reported that she constantly felt her life was meaningless and that she wasn't contributing enough to the family.

*Performance of RHD 8: Case Summary:* The individual with RHD was a 58 year old female; 4 years post RHD resulting from a Hemorrhagic stroke affecting the Right Frontotemporal region. RHDQOL score: 56.7% (refer Table 4.3 for scores in each domain) The stroke occurred when the individual with RHD was residing in Singapore. The individual with RHD had suffered from intubation trauma to her vocal cords and consequently could only speak softly. She was a diabetic and suffered from hypertension. The individual with RHD required assistance from her spouse in rating the questionnaire. Throughout the administration of the questionnaire, the individual with RHD appeared distracted and talked in length about things irrelevant to the context (education, language and music) The husband reported that her level of mental functioning had been greatly altered following the stroke and that she was unaware of a significant amount of problems that happened to her. He stated that while she is able to carry out her routine activities, she was unable to follow complex instructions, had difficulties with orientation to time and location. (This was observed when the individual with RHD asked the clinician how many dollars he earned per month). The husband also noted significant

changes in personality and a near total lack of awareness of her deficits. The individual with RHD was unaware of the changes in lifestyle that took place around her (Moving back to India, No longer being able to play the sitar). It was both observed by the clinician and reported by the husband that in her current state, the individual with RHD expressed very little negativity or depression.

*Performance of RHD 9:*

Case Summary: The individual with RHD was a 46r year old female; 2 years post RHD resulting from a Right Temporoparietal Hemorrhagic stroke. RHDQOL score: 64.1% (refer Table 4.3 for scores in each domain).The individual with RHD was cooperative albeit tense throughout the duration of completing the questionnaire. She reported of occasionally feeling sad about the stroke and that the mild left paresis made her conscious when around people. She reported feeling guilty about her family members having to make adjustments owing to her condition (Not being able to go out as often as they previously did). She reported her social life having suffered as she found herself refraining from talking to others and having difficulty expressing how she felt. She reported that her attempts to explain how she felt often ended in misunderstandings. The family members reported that she exhibited irritability and stubbornness in refusing to accept assistance and insisting that she do everything independently.

*Performance of RHD10: Case Summary:* The individual with RHD was a 37year old female; 2 years post RHD resulting from a hemorrhagic stroke affecting the Right Frontotemporal region. RHDQOL score: 47.1% (refer Table 4.3 for scores in each domain) She suffered the stroke a week before her engagement. The individual with RHD



has persisting left hemiparesis and mild slurring of speech. She reported significant amount of pain and distress arising from her paresis. She also stated that the stroke had seriously affected her social life. She admitted to avoiding people and finding ways to quickly end conversations. She reported alternate arrangements in commuting that were necessitated due to the stroke had also affected her financially. She reported being less able to manage multiple activities and experienced difficulty in organizing and planning things. Consequently, she had to change her job from Floor Manager to corporate Relations Staff resulting in a loss of income. The individual with RHD reported being very aware of her appearance and regretting what happened to her. She reported of problems in expressing herself clearly if the content of what she wanted to express was complex. She reported of constantly feeling depressed and reported to have had suicidal thoughts.

The qualitative description of the problems faced by the individuals with RHD with RHD corresponds closely with their scores on the corresponding domains in the RHDQOL. It was noted that a majority of the individuals with RHD suffered from impairments in cognition and communication which in turn played a role in determining their . As with all the domains that determine an individual's quality of life it is not possible to assign cognition and communication a certain level of importance in any hierarchy. What we can be certain is that Cognition and communication interact in complex ways with the other domains and play a significant role in shaping an individual's quality of life.

ossible reasons for 's scores and qualitative findings revealed that it could be attributed to factors such as the individual not remembering the events leading

to his condition, immediate medical care following the alleged accident, healthy lifestyle and supportive environment at both the home and work place, the patient also had a generally positive outlook on life as reported by the family members. His poor scores could possibly be attributed to the circumstances leading to the RHD (Alleged accident which resulted in the death of wife and child), Post traumatic Stress disorder, Poor support from the family members (Parents unable to optimally support him) and poor motivation leading to resignation from work.

It is therefore evident that a multitude of subjective factors come into play in determining an individual's quality of life.

The performance of each individual with RHD across domains was analyzed statistically. The raw scores were converted percent scores. The scores obtained in each domain by each of the individuals with RHD are presented in Table 4.3

Table 4.3 Scores (in %) obtained by individuals with RHD on each domain

Domains	RHD 1	RHD 2	RHD 3	RHD 4	RHD 5	RHD 6	RHD 7	RHD 8	RHD 9	RHD 10
Physical	80.2	71	82.8	82.8	46.6	47.3	78.9	46	75	40.7
Social	52.2	38.6	88.6	79.5	25	54.5	61.3	54.5	59	27.2
Environmental	54.6	68.7	92.1	87.5	45.3	64.8	79.6	50.7	71.8	48.4
Psychological	64.2	51.1	94	70.2	27.3	66.6	46.4	57.1	53.5	40.4
Cognition & Communication	57.8	50	92.9	79.6	42.1	49.2	61.7	30.4	58	60.9

Analysis of the results revealed that the Individual with RHD 1 had highest scores on the physical domain (80.2%), followed by the psychological domain (64.2%). This was followed by the cognitive and communication domain (57.8%) and then by the environmental domain (54.6%). Amongst the domains, RHD1 had the lowest score on

the social domain (52.2%). Individual with RHD 2 had highest scores on the physical domain (71%) followed by the environmental domain (54.6%). This was followed by the psychological domain (51.1%). and then by the cognitive and communication domain (50% scores). RHD2 had the lowest score on the social domain (38.6%). Individual with RHD 3 had highest scores on the psychological domain followed by the cognitive (94%) and communication domain (94%) This was followed by the environmental domain (92.992.1%) and then by the social domain (92.1%) Amongst the domains, RHD3 had the lowest score on the physical domain (82.8%). Individual with RHD 4 had highest scores on the environmental domain (87.5%) followed by the physical domain (82.8%). This was followed by the cognitive and communication domain (79.6%) and then by the social domain (79.5%). Amongst the domains, he had the lowest score on the psychological domain (70.2%). Individual with RHD 5 had highest scores on the physical domain(46.6%) followed by the environmental domain (45.3%). This was followed by the cognitive and communication domain and then by the psychological domain (42.1%). Amongst the domains, RHD 5 had the lowest score on the social domain (25%). Individual with RHD 6 had highest scores on the psychological domain (66.6%) followed by the environmental domain (64.8%). This was followed by the social domain (54.5%) and then by the cognitive and communication domain (49.2%). Amongst the domains, RHD 6 had the lowest score on the physical domain (47.3%). Individual with RHD 7 had highest scores on the environmental domain (79.6 %) followed by the physical domain (78.9%). This was followed by the cognitive and communication domain (61.7%) and then by the social domain (61.3%). Amongst the domains, RHD 7 had the lowest score on the psychological domain (46.4%)

Individual with RHD 8 had highest scores on the psychological domain (57.1%) followed by the social domain (54.5%). This was followed by the environmental domain (50.7%) and then by the physical domain (46%). Amongst the domains, she had the lowest score on the cognition and communication domain (30.4%). Individual with RHD 9 had highest scores on the physical domain (75%) followed by the environmental domain (71.8%). This was followed by the social domain (59%) and then by the cognitive and communication domain (58%). Amongst the domains, RHD 9 had the lowest score on the psychological domain (53.5%). Individual with RHD 10 had highest scores on the cognitive and communication domain (60.9%) followed by the environmental domain (48.4%). This was followed by the physical domain (40.7%) and then by the psychological domain (40.4%). Amongst the domains, RHD 10 had the lowest score on the social domain (27.2%)

The scores obtained by each individual with RHD in each of the domains is shown in Figure 4.3

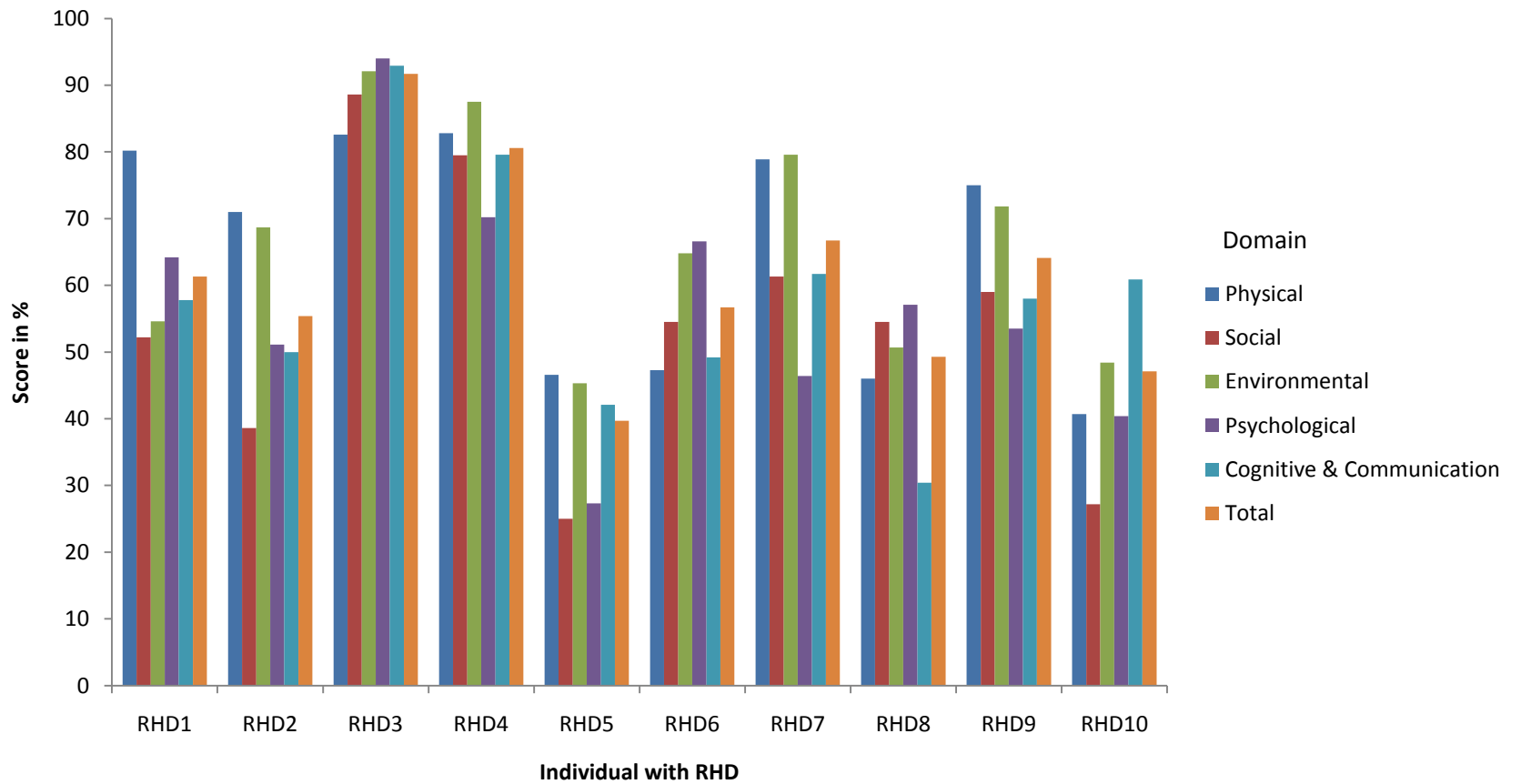


Figure 4.3: Performance of each individual with RHD across domains

### III. Content validity of the RHDQOL tool

Content validity of the developed tool was first performed by three post graduate Speech Language pathologists the first draft of the questionnaire was rated for validity and feedback was obtained regarding the ordering of the questions and scoring patterns. Necessary modifications were made based on the findings obtained on the validity rating by professionals. The modifications included the arrangement of the questions, their scoring pattern and simplifying of lengthy questions.

After administering the questionnaire on the individuals with RHD and obtaining the required data, the instrument was further assessed for validity of content by examining the affected parameters. The questions in which a majority of the individuals with ' scores fell below on the rating scale were deemed significant to the target population. These questions are highlighted in Table 4.4.

Table 4.4: *Content validity with questions addressing areas not significantly affected in bold.*

Domain	Rating				
	0	1	2	3	4
1.Physical	Percentage of Individuals with RHD				
1.1	0	10	30	50	10
1.2	0	10	10	80	0
1.3	0	10	20	30	40
1.4	0	10	0	50	40
1.5	0	10	20	40	30
1.6	10	20	20	40	20
1.7	10	0	20	50	20
<b>1.8</b>	10	0	0	30	60
1.9	0	10	30	50	10
1.10	0	10	40	20	30
1.11	0	30	10	40	20

1.12	0	10	10	40	40
1.13	0	10	20	50	20
1.14	0	20	0	30	50
1.15	20	10	30	30	10
1.16	0	30	10	50	10
1.17	0	10	10	80	0
1.18	10	30	20	40	0
1.19	0	20	20	50	10
2. Psychological					
2.1	10	20	40	20	10
2.2	10	0	50	20	20
2.3	0	30	40	10	20
2.4	0	20	50	10	20
2.5	0	20	50	10	20
2.6	10	0	50	20	20
2.7	0	10	50	30	10
2.8	0	10	30	40	20
2.9	10	10	10	30	40
2.10	0	10	10	30	50
2.11	0	10	20	50	20
2.12	0	10	40	40	10
2.13	0	20	30	40	10
2.14	10	20	10	50	10
2.15	0	20	40	30	10
2.16	0	0	40	50	10
2.17	0	10	50	30	10
2.18	10	10	10	60	10
2.19	0	40	30	20	10
2.20	10	50	10	10	20
2.21	30	10	40	0	20
3. Environmental					
<b>3.1</b>	20	0	10	20	50
3.2	0	0	10	50	40
3.3	10	20	30	10	30
3.4	0	10	30	20	30
3.5	10	0	40	30	20
3.6	0	0	10	70	20
<b>3.7</b>	10	10	0	20	60
3.8	0	20	10	20	50

3.9	0	10	10	40	40
3.10	0	10	10	70	10
3.11	0	0	30	40	30
3.12	0	10	30	20	40
3.13	0	10	30	40	30
3.14	0	0	20	70	10
3.15	0	10	10	30	50
<b>3.16</b>	0	10	10	20	60
3.17	0	10	40	30	20
3.18	0	10	30	30	30
3.19	10	20	0	40	30
3.2	0	10	20	30	40
3.21	10	10	20	50	10
3.22	0	20	30	20	30
3.23	0	10	30	40	30
3.24	10	10	20	30	30
3.25	10	10	20	30	30
3.26	0	10	0	80	10
3.27	0	0	20	60	20
3.28	0	10	30	50	20
3.29	10	20	10	50	10
3.30	20	10	40	30	0
3.31	30	30	20	20	0
3.32	10	30	20	20	10
4.Social					
4.1	10	20	30	10	30
4.2	0	0	40	30	30
4.3	0	10	60	30	0
4.4	0	20	60	10	10
4.5	30	0	30	10	30
4.6	0	30	50	10	10
4.7	0	10	40	50	0
4.8	0	30	40	20	10
4.9	20	30	10	20	20
4.10	10	30	20	20	20
4.11	10	20	10	30	30
5. Cognitive & Communication					
5.1	10	10	20	40	20
5.2	20	10	40	20	10



5.3	10	30	30	10	20
5.4	10	30	10	20	20
5.5	10	50	20	10	10
5.6	30	20	40	0	10
5.7	20	20	40	10	10
5.8	0	70	20	0	10
5.9	0	60	20	10	10
5.1	0	20	20	50	10
5.11	0	20	40	30	10
5.12	0	0	20	30	50
5.13	0	0	10	60	30
5.14	0	0	20	50	30
5.15	0	10	20	40	30
5.16	20	30	30	10	10
5.17	10	10	50	20	10
5.18	0	20	10	30	40
5.19	0	0	10	50	40
5.2	10	0	20	40	30
5.21	0	10	30	30	30
5.22	0	10	40	30	10
<b>5.23</b>	10	0	10	0	80
5.24	10	20	30	30	10
5.25	10	10	0	50	30
5.26	0	20	20	50	10
5.27	10	10	30	40	10
5.28	0	20	20	50	10
5.29	10	50	10	30	0
5.3	20	40	10	20	10
5.31	20	20	30	10	20
5.32	0	0	20	60	20

Analysis of percentage of individuals with RHD who performed on each of the questions of RHDQOL revealed that on the Physical domain, maximum number of individuals agreed that their quality of life was affected for nearly all the questions (Questions 1.1,1.2,1.3, 1.4, 1.5,1.6, 1.7,1.8,1.9,1.10,1.11,1.12,1.13,1.14,1.15,1.16,1.19

with the exception of 1.8) on the domain. Example of a question in the physical domain; 1.2 - How much pain or discomfort do you experience on a regular basis? (Refer Appendix 2) This indicates that a majority of the participants were affected due to RHD on their physical measure.

On the psychological domain, majority of the individuals with RHD rated poorly on all the questions (Refer Appendix 2) (Questions 2.1 to 2.21). An example of a question from the psychological domain; 2.11 - How much do you regret what happened? This indicates that from the present data on the psychological domain, all the questions were found to be valid for the quality of life measure.

On the Environmental domain, scores of the majority of individuals with RHD reflected that their quality of life was affected negatively as was reflected by nearly all the questions (Questions 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.17, 3.18, 3.19, 3.20, 3.21, 3.22, 3.23, 3.24, 3.25, 3.26, 3.27, 3.28, 3.29, 3.30, 3.31 and 3.32) (Refer Appendix 2). An example of a question in the environmental domain; 3.8 – How worried are you about the safety and security of the environment you're living in

All questions (Refer Appendix 2) on the social domain (4.1 to 4.11) indicated that the individuals with RHD had factors affecting their quality of life that the questions addressed. Example of a question in the social domain; How satisfied are you with the support you receive from your family? This indicates that from the present data on the social domain, all the questions were found to be valid for the quality of life measure.

On the cognitive communication domain, a majority of the individuals indicated that their quality of life was affected in nearly all the questions (questions 5.1,5.2, 5.3, 5.4, 5.5, 5.6, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.17, 5.18, 5.19, 5.20, 5.21, 5.22, 5.24, 5.25, 5.26, 5.27, 5.28, 5.29, 5.30, 5.31) Example for a question in the cognitive domain; 5.29 – How satisfied are you with your ability to retrieve and explain new information? (Refer Appendix 2)

Certain questions (1.8, 3.1, 3.7, 3.16, and 5.23) were rated 4 by a majority of the individuals with RHD indicating that those areas were relatively unaffected in them. (Refer Appendix 2)

Majority of the individuals with RHD scored poorly on most of the questions. This reflected that their QOL was affected in those domains that the questions addressed. Therefore it may be inferred that the content in the questionnaire possesses a degree of validity in testing the QOL of individuals with RHD.

The communication and cognition domain was the third most affected domain in the participant group. Questions relating to memory, attention, organization skills and expressive and receptive abilities revealed that a majority of the participants had difficulties in these areas.(refer table 4.2 and figure 4.3) Very few studies have dealt with the occurrence rate of communication impairments and the possible clinical profiles in patients with RHD. However, clinical experience clearly demonstrates that not all patients with RHD have trouble with the communication deficits described thus far. According to Joannette et al. (1991), approximately 50% of patients may be affected by

one or more communicative impairments. This proportion is similar to that of people with who suffer persistent language disorders (aphasias). When present deficits seem to be the result of cortical damage, generally in the perisylvian area, as is the case with aphasia. However, a recent study on a random group of patients with RHD found that around 80% of the sample showed communication impairments when diagnosed using structured clinical observation as well as formal evaluation (Côté, Payer, Giroux, & Joannette, 2007).

To summarize the findings of the present study, it was found that individuals with RHD were greatly affected by factors in the social domain followed by the psychological domain, this was followed by the cognitive communicative domain, the physical domain and it was found that the environmental domain was the least affected. It was also found that there was a significant positive correlation between the cognitive communication domain and the social, psychological, physical and environmental domains. The quantitative and qualitative analysis of the data revealed that RHD 5 was greatly affected in comparison to others in all the domains. Factors that led to this may be attributed to the social, psychological, cognitive communication and environmental factors. The content validity of the RHDQOL revealed that the RHDQOL is a valid tool for extracting vital information regarding the Physical, social, environmental, psychological and cognitive communication domains that contribute to the quality of life of an individual with RHD as well as cognitive communication disorder which is essential for a professional such as Speech Language Pathologists (SLPs) in the field of assessment and intervention of CCD due to RHD.

## **Summary and Conclusion**

The aim of the present study was to develop a quality of life questionnaire for individuals with Right Hemisphere Damage. The study also aimed to investigate its relevance to cognitive communication deficits from a Speech and Language Pathologist's (SLPs) perspective. The Right Hemisphere Damage Quality Of Life (RHDQOL) self rating questionnaire was developed after taking into consideration the deficits seen in RHD. The questions were framed so as to address specific domains (physical, social, environmental, psychological and cognitive/communication) thought to play a role in determining QOL. The questionnaire was then rated by ten individuals with RHD and the results were analyzed.

The results revealed that QOL was significantly affected in individuals with RHD and that the QOL scores varied from participant to participant. This implied that individuals with RHD form a heterogeneous group and that QOL is a highly subjective

measure. Each of the domains considered contributed to the overall QOL and some domains were more affected than others in individuals with RHD. The social domain was found to be most affected in individuals with RHD followed by the psychological, cognitive communication, physical and environmental domains when arranged in order of severity. Analysis of content validity revealed that the RHDQOL is a valid tool to obtain information regarding the domains contributing to quality of life in an individual with RHD. With relevance to the cognition and communication domain, it was seen that poor scores on this domain contributed to a poor QOL. Factors such as memory, attention, organization of thought and discourse and the ability to express and comprehend intentions and emotions were seen to play a role in shaping an individual's QOL.

### **Implications of the study**

The RHDQOL self rating questionnaire has its relevance in the following areas:

#### *In Assessment*

In clinical practice the instrument may be used with other forms of assessment, giving valuable information that can indicate areas in which a person is most affected and help the practitioner in making the best choices in patient care. In addition, it may be used to measure change in quality of life over the course of treatment.

#### *Improving the Clinician-patient relationship*

By increasing the clinician understands of how disease affects a patient's quality of life, the interaction between patient and doctor will change and improve. This gives more

meaning and fulfillment to the work of the clinician and leads to the patient being provided with more comprehensive health care. Because a more complete form of assessment covering different aspects of patients' functioning is being carried out, patients themselves may find their health care more meaningful.

*In assessing the effectiveness and relative merits of different treatments*

The proposed instrument can form a part of the evaluation of treatments used for RHD. By using the Quality of Life to look at changes in the person's well being over the course of treatment, a more complete picture can be gained.

*In research*

The questionnaire provides new insights into the nature of the disorder by assessing how Right Hemisphere Damage impairs or impacts the subjective well being of a person across a whole range of areas.

*In Counseling:*

The questionnaire can help raise the patient and the family members' awareness and help them be better prepared in facing the shortcomings or deficits in a life following Right Hemisphere Damage.

The questionnaire can be administered on a greater number of individuals with RHD in an attempt to obtain data that may help determine if there exist any other predominant factors that can affect the quality of life in RHD.

### **Limitations of the study**

The study has its drawbacks in the number of participants. With RHD being described as a heterogeneous group, ten participants provide little strength in establishing norms or cut off values in terms of the QOL score or percentage. The etiology, together with the site of lesion was not taken into consideration and no attempts were made to study the QOL in individuals with RHD based on these variables.

The drawback of the RHDQOL lies in its length. At 115 questions long, the questionnaire may task the possibly already affected attention span of an individual with RHD. The greater number of questions and their arrangement the questionnaire also makes obtaining the results a moderately lengthy procedure.



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## Right Hemisphere Damage- Quality of Life Questionnaire (RHD-QOL)

### Instructions

This questionnaire asks how you feel about your quality of life, health, and other areas of your life. Please answer all the questions. If you are unsure about which response to give to a question, please choose the one that appears most appropriate. This can often be your first response.

Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life in the **last two weeks**.

For example, thinking about the last two weeks, a question might ask:

How much do you worry about your health?

0. An extreme amount
1. Very much
2. A moderate amount
3. A little
4. Not at all

You should tick the number that best fits how much you have worried about your health over the last two weeks. So you would tick the number 4 if you worried about your health "A little", or tick 0 if you have worried "An extreme amount" about your health.

Feel free to take your time with the questionnaire. Please read each question, assess your feelings, and tick the number on the scale for each question that you feel is the best answer.

Thank you for your cooperation.

## Right Hemisphere Damage- Quality of Life Questionnaire (RHD-QOL)

We would like to know **how you are doing** with **activities** or **feelings** that can sometimes be **affected by head injuries**.

Each question asks about a **specific activity** or **feeling**.

For each question, try to think about how you have been **in the past two weeks**.

And then **tick (✓)** the number that you think **best fits** your situation **according to the rating** indicated.

	Rate the following questions	0	1	2	3	4
	<b>0 - An extreme amount</b> <b>1 - A great deal</b> <b>2 - A moderate amount</b> <b>3 - A small Amount</b> <b>4 - Not at all</b>					
1	How much do you worry about your pain or discomfort?					
2	How much pain or discomfort do you experience on a regular basis?					
3	Does physical pain prevent you from doing what you need to do?					
4	Do you have any difficulties with sleeping?					
5	How much do any sleep problems worry you?					
6	How much are you unable to enjoy life?					
7	How much do you regret what happened?					
8	How much do you experience negative feelings in your life?					
9	Have you lost any self-confidence?					
10	Is there any part of your appearance which makes you feel uncomfortable?					
11	How much do any feelings of sadness or depression interfere with your everyday functioning?					
12	To what extent do you have difficulty in performing your routine activities?					
13	How much do you need any medical treatment to function everyday?					
14	To what extent does your quality of life depend on the use of medical substances or medical aids?					
15	How much do you dislike where you live?					
16	How much do you worry about your safety and security?					
17	Do you have financial difficulties?					
18	How much are you unable to enjoy your free time?					
19	How unsatisfied are you with your ability to move around?					
20	How concerned are you with the noise in the area you live in?					

	<b>Rate the following:</b> 0 – Extremely 1 – Very 2 – Moderately 3 – Slightly 4 – Not at all	0	1	2	3	4
21	How easily do you get tired?					
22	How Negative do you feel about the future?					
23	Do you feel inhibited by your looks?					
24	How alone do you feel in life?					
25	How unfulfilled are your sexual needs ?					
26	How difficult is it for you to remember routes to places, landmarks etc?					
27	How unsafe do you feel in your daily life?					
28	How worried are you about the safety and security of the environment you're livin in					
29	How uncomfortable is the place where you live?					
30	How difficult is it for you to get good medical care?					
31	How unhealthy is your physical environment (e.g., pollution, climate, noise, attractiveness)?					
32	To what extent do you feel your life to be meaningless?					

	<b>Rate the following:</b> 0 – Not at all 1 – Slightly 2 – Somewhat 3 – To a great extent 4 – Completely	0	1	2	3	4
33	Do you have enough energy for everyday life?					
34	Do you have enough motivation for everyday activities?					
35	Are you able to accept the changes in or loss of your senses? (sight, hearing, smell, touch and taste)					
36	How well are you able to carry out your daily activities?					
37	Do you get the kind of support from others that you need?					
38	To what extent can you count on your friends when you need them?					
39	To what degree does the quality of your home meet your needs?					
40	To what degree are you not upset about/bothered by things(dust/cleanliness/arrangement of things) in your home?					
41	Have you enough money to meet your needs?					
42	How well are you able to manage the money to meet your needs?					
43	How available/accessible to you is the information you need in daily life?					
44	To what extent do you have the opportunity for leisure activities?					
45	How much are you able to relax and enjoy yourself?					



46	To what extent do you have adequate means of transport?					
	<b>Rate the following:</b> <b>0 – Very Dissatisfied</b> <b>1 – Fairly satisfied</b> <b>2 – Neither Satisfied nor dissatisfied</b> <b>3 – Satisfied</b> <b>4 – Very satisfied</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
47	How satisfied are you with the quality of your life?					
48	How satisfied are you with your health?					
49	How satisfied are you with your energy level?					
50	How satisfied are you with your motivation?					
51	How satisfied are you with your sleep?					
52	How satisfied are you with your ability to make decisions?					
53	How satisfied are you with the time you take to make decisions?					
54	How satisfied are you with your ability to correct wrong decisions?					
55	How satisfied are you with your ability to manage time?					
56	How satisfied are you with your capacity for work?					
57	How satisfied are you with your ability to multitask?					
58	How satisfied are you with your ability to plan, organize and execute an activity?					
59	How satisfied are you with yourself?					
60	How satisfied are you with your abilities?					
61	How satisfied are you with the way your body looks?					
62	How satisfied are you with your ability to perform everyday activities?					
63	How satisfied are you with your personal relationships?					
64	How satisfied are you with your ability to share your feelings??					
65	How satisfied are you with your ability to understand other's feelings?					
66	How satisfied are you with your sex life?					
67	How satisfied are you with your family's understanding of the problems you face??					
68	How satisfied are you with the support you receive from your friends?					
69	How satisfied are you with your friends' reaction to your problem?					
70	How satisfied are you with your ability to provide for or support others?					
71	How satisfied are you with your physical safety and security?					
72	How satisfied are you with your living conditions?					
73	How satisfied are you with the amount of money you have?					
74	How satisfied are you with your access to health services?					
75	How satisfied are you with the social care services?					

76	How satisfied are you with your opportunities to acquire new skills?					
77	How satisfied are you with your opportunities to learn new information?					
78	How satisfied are you with the way you spend your spare time?					
79	How satisfied are you with your physical environment (e.g., pollution, climate, noise, attractiveness)?					
80	How satisfied are you with your transport?					
81	How satisfied are you about your relationship with your family members?					
	<b>Rate the following Questions</b> <b>0 –Very poor</b> <b>1 – Poor</b> <b>2 – Neither good nor poor</b> <b>3 – Good</b> <b>4 – Very good</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
82	How would you rate your overall quality of life?					
83	How would you rate your sex life?					
84	How would you rate your memory?					
85	How would you rate your ability to attend to things without getting distracted?					
86	How would you rate your motivation to work?					
87	How would you rate your ability to work?					
	<b>Rate the following:</b> <b>0 –Always</b> <b>1 –Frequently</b> <b>2 – Neither infrequently nor frequently</b> <b>3 – Infrequently</b> <b>4 – Never</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
88	How often do you suffer physical pain?					
89	Do you generally feel discontented/ unsatisfied?					
90	How often do you have negative feelings, such as blue mood, despair, anxiety, depression?					
	<b>Rate the following:</b> <b>0 – Not at all</b> <b>1 – Slightly</b> <b>2 – Somewhat</b> <b>3 – To a great extent</b> <b>4 – Completely</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
91	Are you able to work?					
92	Are you able to work as well as you used to?					
93	Are you able to carry out all your duties?					
94	Are you able to carry out your duties without confusions, procrastination, distractions?					

	<b>Rate the following:</b> <b>0 – An extreme amount</b> <b>1 – A great amount</b> <b>2 – A moderate amount</b> <b>3 – A small amount</b> <b>4 – Not at all</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
95	Do your communicative abilities make you feel uncomfortable?					
96	How much are you bothered by any Communicative limitations in performing everyday living activities?					
97	Do communication problems contribute to your financial difficulties					
98	How much do communication problems restrict your life?					
99	How often do you feel misunderstood?					
100	Do others feel you often misunderstand them?					
101	How difficult is it for you to indicate/express that you are experiencing pain or discomfort?					
102	How dependent are you on others for communication?					
103	To what extent is it difficult for you to communicate to acquire the information that you feel you need?					
104	How difficult is it for you to follow directions?					
105	How difficult is it for you to give directions?					
106	To what extent does communication affect your ability to move around?					
107	To what extent does communication affect your quality of life negatively?					
	<b>Rate the following:</b> <b>0 – Very Dissatisfied</b> <b>1 – Fairly satisfied</b> <b>2 – Neither Satisfied nor dissatisfied</b> <b>3 – Satisfied</b> <b>4 – Very satisfied</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
108	How satisfied are you with your ability to learn new information?					
109	How satisfied are you with your ability to retain/remember the new information					

110	How satisfied are you with your ability organize the new information					
111	How satisfied are you with your ability to utilize the information					
112	How satisfied are you with your ability to retrieve and explain the new information					
113	How satisfied are you with your ability to share your feelings??					
114	How satisfied are you with your ability to understand other's feelings?					
115	How satisfied are you with your capacity to communicate during work?					

**Thank you for your patience.**

## **Appendix 2**

### **Right Hemisphere Damage- Quality of Life Questionnaire (RHD-QOL)**

<b>1. Physical Domain</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
1.1	How much do you worry about your pain or discomfort?				
1.2	How much pain or discomfort do you experience on a regular basis?				
1.3	Does physical pain prevent you from doing what you need to do?				
1.4	Do you have any difficulties with sleeping?				
1.5	How much do any sleep problems worry you?				
1.6	To what extent do you have difficulty in performing your routine activities?				
1.7	How much do you need any medical treatment to function everyday?				
1.8	To what extent does your quality of life depend on the use of medical substances or medical aids?				
1.9	How easily do you get tired?				
1.10	How difficult is it for you to get good medical care?				
1.11	Do you have enough energy for everyday life?				
1.12	Are you able to accept the changes in or loss of your senses? (sight, hearing, smell, touch and taste)				
1.13	How well are you able to carry out your daily activities?				
1.14	How satisfied are you with your sleep?				
1.15	How satisfied are you with your capacity for work?				
1.16	How satisfied are you with your ability to perform everyday activities?				

1.17	How often do you suffer physical pain?					
1.18	How satisfied are you with your health?					
1.19	How satisfied are you with your energy level?					

<b>2. Psychological Domain</b>		0	1	2	3	4
2.1	How much are you unable to enjoy life?					
2.2	How satisfied are you with your motivation?					
2.3	How satisfied are you with yourself?					
2.4	How satisfied are you with your abilities?					
2.5	How satisfied are you with the way your body looks?					
2.6	How would you rate your overall quality of life?					
2.7	How would you rate your motivation to work?					
2.8	Do you generally feel discontented/ unsatisfied?					
2.9	How often do you have negative feelings, such as blue mood, despair, anxiety, depression?					
2.10	Are you able to carry out your duties without confusions, procrastination, distractions?					
2.11	How much do you regret what happened?					
2.12	How much do you experience negative feelings in your life?					
2.13	Have you lost any self-confidence?					
2.14	Is there any part of your appearance which makes you feel uncomfortable?					
2.15	How much do any feelings of sadness or depression interfere with your everyday functioning?					
2.16	How Negative do you feel about the future?					
2.17	Do you feel inhibited by your looks?					
2.18	How alone do you feel in life?					
2.19	To what extent do you feel your life to be meaningless?					
2.20	Do you have enough motivation for everyday activities?					
2.21	How satisfied are you with the quality of your life?					

<b>3. Environmental Domain</b>		0	1	2	3	4
3.1	How much do you dislike where you live?					
3.2	How much do you worry about your safety and security?					
3.3	Do you have financial difficulties?					
3.4	How much are you unable to enjoy your free time?					
3.5	How unsatisfied are you with your ability to move around?					
3.6	How concerned are you with the noise in the area you live in?					
3.7	How unsafe do you feel in your daily life?					
3.8	How worried are you about the safety and security of the environment you're living in?					
3.9	How uncomfortable is the place where you live?					
3.10	How unhealthy is your physical environment (e.g., pollution, climate, noise, attractiveness)?					
3.11	To what degree does the quality of your home meet your needs?					
3.12	To what degree are you not upset about/bothered by things (dust/cleanliness/arrangement of things) in your home?					
3.13	Have you enough money to meet your needs?					
3.14	How well are you able to manage the money to meet your needs?					
3.15	How available/accessible to you is the information you need in daily life?					
3.16	To what extent do you have the opportunity for leisure activities?					
3.17	How much are you able to relax and enjoy yourself?					
3.18	To what extent do you have adequate means of transport?					
3.19	How satisfied are you with your physical safety and security?					
3.20	How satisfied are you with your living conditions?					
3.21	How satisfied are you with the amount of money you have?					
3.22	How satisfied are you with your access to health services?					
3.23	How satisfied are you with the social care services?					
3.24	How satisfied are you with your opportunities to acquire new skills?					
3.25	How satisfied are you with your opportunities to learn new information?					
3.26	How satisfied are you with the way you spend your spare time?					
3.27	How satisfied are you with your physical environment (e.g., pollution, climate, noise, attractiveness)?					
3.28	How satisfied are you with your transport?					
3.29	Are you able to work?					
3.30	Are you able to work as well as you used to?					
3.31	Are you able to carry out all your duties?					
3.32	How would you rate your ability to work?					

<b>4. Social Domain</b>	0	1	2	3	4
4.1 Do you get the kind of support from others that you need?					
4.2 To what extent can you count on your friends when you need them?					
4.3 How unfulfilled are your sexual needs?					
4.4 How satisfied are you with your personal relationships?					
4.5 How satisfied are you with your sex life?					
4.6 How satisfied are you with your family's understanding of the problems you face??					
4.7 How satisfied are you with the support you receive from your friends?					
4.8 How satisfied are you with your friends' reaction to your problem?					
4.9 How satisfied are you with your ability to provide for or support others?					
4.10 How satisfied are you about your relationship with your family members?					
4.11 How would you rate your sex life?					

<b>5. Cognitive Communication Domain</b>		0	1	2	3	4
5.1	How difficult is it for you to remember routes to places, landmarks etc?					
5.2	How satisfied are you with your ability to make decisions?					
5.3	How satisfied are you with the time you take to make decisions?					
5.4	How satisfied are you with your ability to correct wrong decisions?					
5.5	How satisfied are you with your ability to manage time?					
5.6	How satisfied are you with your ability to multitask?					
5.7	How satisfied are you with your ability to plan, organize and execute an activity?					
5.8	How satisfied are you with your ability to share your feelings??					
5.9	How satisfied are you with your ability to understand other's feelings					
5.10	How would you rate your memory?					
5.11	How would you rate your ability to attend to things without getting distracted?					
5.12	Do your communicative abilities make you feel uncomfortable?					
5.13	How much are you bothered by any Communicative limitations in performing everyday living activities?					
5.14	Do communication problems contribute to your financial difficulties					
5.15	How much do communication problems restrict your life?					
5.16	How often do you feel misunderstood?					
5.17	Do others feel you often misunderstand them?					
5.18	How difficult is it for you to indicate/express that you are experiencing pain or discomfort?					
5.19	How dependent are you on others for communication?					
5.20	To what extent is it difficult for you to communicate to acquire the information that you feel you need?					
5.21	How difficult is it for you to follow directions?					
5.22	How difficult is it for you to give directions?					
5.23	To what extent does communication affect your ability to move around?					
5.24	To what extent does communication affect your quality of life negatively?					
5.25	How satisfied are you with your ability to learn new information?					
5.26	How satisfied are you with your ability to retain/remember the new information					
5.27	How satisfied are you with your ability organize the new information					
5.28	How satisfied are you with your ability to utilize the information					
5.29	How satisfied are you with your ability to retrieve and explain the new information					
5.30	How satisfied are you with your ability to share your feelings??					
5.31	How satisfied are you with your ability to understand other's feelings					
5.32	How satisfied are you with your capacity to communicate during work?					