Assessment of Unilateral Spatial Neglect Post Stroke in Acute Care Hospitals:

Are we neglecting neglect?

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ABSTRACT

Timely and accurate assessment of unilateral spatial neglect (USN) post stroke is a critical component of best practice, given that a recent Clinical Practice Guidelines for stroke has recommended the standardized assessment of USN within 48 hours of regaining consciousness following a stroke. This multi-centered, retrospective study using data from medical charts of a representative sample of individuals admitted to 10 Ontario acute care hospitals from July 15th to December 15th 2002, examined the prevalence, timing and frequency of use of standardized assessments to evaluate USN post stroke. Out of the 248 subjects who should have received a USN assessment, 37.5% received an assessment; only 13.31% with a standardized visual perception tool and of these, only 0.81% (n=2) with a standardized tool specific to USN assessment. All clients receiving a standardized assessment were evaluated for USN in the near extrapersonal space, the hemispace within reaching distance of the patient: no patient received a standardized assessment for USN in the personal space or far extrapersonal space. Three standardized visual perception tools that include a USN component were used: the Clock Drawing Test (n=22), the Ontario Society of Occupational Therapists (OSOT) Perceptual Evaluation (n=8) and the Motor-Free Visual Perception Test (n=1). Only 8 (3.23%) of the 248 clients were screened with a standardized tool within the 2-day critical period as recommended by Stroke Guidelines. Reassessment was rare, even in those with detected USN, such that only 1 subject was ever reassessed with a standardized tool.

RÉSUMÉ

L'évaluation, juste et opportune, de l'héminégligence visuelle après un AVC est un aspect crucial traité dans les meilleurs guides de pratiques cliniques, principalement depuis la récente parution des Guides de pratiques cliniques pour les personnes ayant subi un AVC qui recommande une évaluation standardisée de l'héminégligence visuelle dans les 48 heures suivant la reprise de conscience lors d'un AVC. Cette étude rétrospective a analysé les données se trouvant dans les dossiers médicaux d'un échantillon représentatif de clients admis dans 10 hôpitaux de soins aigus en Ontario entre le 15 juillet et le 15 décembre 2002. L'étude visait à identifier la prédominance, la distribution et la fréquence d'utilisation de tests standardisés pour évaluer l'héminégligence visuelle après un AVC. Sur les 248 sujets qui auraient dû être testés pour l'héminégligence visuelle, 37,5% ont été évalués, mais seulement 13,31% l'ont été avec une évaluation standardisée et de cette proportion, seulement 0,81% ont reçu une évaluation standardisée spécifique pour l'héminégligence visuelle. Tous les clients évalués pour l'héminégligence visuelle l'ont été dans l'espace péripersonnel proche, i.e. l'hémi-espace visuel déterminé par la portée de bras du client. Aucun client n'a été évalué pour l'héminégligence visuelle de l'espace personnel (hémicorps) et de l'espace extrapersonnel éloigné. Les trois outils utilisés pour l'évaluation de la perception visuelle incluant l'héminégligence, sont les suivant : Test de l'horloge (n=22), Ontario Society of Occupational Therapists (OSOT) Perceptual Evaluation (n=8) et Motor-Free Visual Perception Test (n=1). Seulement 8 (3,23%) des 248 clients ont été évalués avec un test standardisé à l'intérieur de la période critique de 2 jours, tel que recommandé par les Guides de

pratiques cliniques pour les personnes ayant subi un AVC. Les réévaluations étaient rares, malgré que certains clients démontraient des signes d'héminégligence, de telle sorte qu'un seul client a été réévalué avec un test standardisé.

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PREFACE

This study focuses on the assessment of unilateral spatial neglect (USN) in clients following a stroke, given that this common deficit can impact on virtually all skills required for functional performance and participation in society. **Chapter 1** begins with an extensive review of the literature to understand the complexities of this impairment, its effects on functional recovery and return to community living, and the evidence for assessment and treatment interventions that have been recommended as "best practice" in the management of USN. A recent manuscript has been included in Appendix A that examined 61 standardized and non-standardized assessment tools that exist to evaluate USN, along with a **USN ASSESSMENT SUMMARY GUIDE** to facilitate clinical decision-making regarding assessment procedures. **Chapter 2** summarizes the literature on USN and rationalizes the importance of assessing this impairment early on post stroke.

The objectives of the current study, being to examine the prevalence timing and frequency of USN assessment in acute patients post stroke, along with its operational definitions and hypotheses are listed in **Chapter 3 and 4**. **Chapter 5** describes how the sampling frame of medical charts coded with stroke was created and how acute care hospitals in Ontario were randomly selected to provide charts for data collection. The important variables used to measure the study outcomes, such as the types of assessments or the potential explanatory variables of the client and hospital site, are defined in **Chapter 6**. **Chapter 7** presents the descriptive, univariate and multivariate analyses that will be used to explore the association between the various potential explanatory variables and assessment of USN. **Chapter 8** describes the results of the statistical analysis

with tables to illustrate the significant relationships. Finally, **Chapter 9** discusses the findings, explains the limitations of this study and provides direction for future research in this area. A list of references in order of appearance in the text concludes the main portion of the thesis (**Chapter 10**).

Prior to collecting data from the charts, the Institutional Review Board of McGill University and the ethics committees of the participating hospitals reviewed and approved the study protocol. Copies of these approvals are included in the Appendix. A **CHART ABSTRACTION FORM** was developed, along with a **USER GUIDE** for the purposes of training chart abstractors. To gain an understanding of the health professionals typically involved with USN assessment, a brief survey was performed with a convenience sample of Canadian hospitals. This survey and the two forms for data collection are found in the Appendix as well. A glossary of terms and abbreviations is also included in the Appendix.

CONTRIBUTION OF CO-AUTHOR

During the initial stages of preparing the manuscript entitled "*Evaluating Unilateral Spatial Neglect Post Stroke: Working Your Way Through the Maze of Assessment Choices*" (Appendix A), the candidate and her supervisor met to discuss the process of reviewing the literature and method of critically appraising articles related to the psychometric testing of standardized and non-standardized tools for USN. The candidate performed the literature search, reviewed all articles pertaining to USN assessment, compiled a list of existing tools and categorized them as either standardized or non-standardized. The template of the tables for the ***USN ASSESSMENT SUMMARY GUIDE*** was then designed by both the supervisor and candidate to provide a user-friendly reference guide that categorized standardized assessment tools for USN according to their: (1) purpose (2) psychometric properties and (3) client appropriateness. The candidate classified the standardized tools according to the hemispace assessed, and summarized the psychometric properties of these tools (reliability, validity and responsiveness) and references to their studies in the Guide. The candidate composed the manuscript (Appendix A) with ongoing conceptual and editorial feedback from her supervisor for various drafts of the manuscript. The candidate, however, is responsible for the scientific quality of the research, the originality of the ideas, the accuracy of the data, and the quality of reporting.

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CHAPTER 1 LITERATURE REVIEW

1.1. Search Strategy for Literature Review

Unilateral spatial neglect (USN) is an impairment that occurs following a stroke and can impact on virtually all skills required for functional performance and participation in society. The goal of this literature review was to understand the complexities of this deficit and how it affects functional recovery post stroke, the interventions used to treat the symptoms and, most importantly, the evidence for assessment practices that have been recommended for USN. The primary investigator (A.M.) conducted a comprehensive review of the medical literature from 1966 to July 2002 using electronic databases (MEDLINE, CINAHL, HealthSTAR, PsychINFO and Health and Psychosocial Instruments) in search of articles relating to USN. The following key terms were used: neurology /stroke/ CVA/ cognition/ visual-perceptual/ visual-inattention/ hemi-inattention/ unilateral spatial neglect/ unilateral neglect/ spatial neglect/ assessment/ evaluation/ measurement/ screening tools/ psychometric properties/ neurological examination/ psychometrics/ reliability/ validity/ sensitivity. The Cochrane Library[1] was also explored for systematic reviews using the same key terms. Reference sections of all journal articles retrieved were reviewed in search of other pertinent articles. In addition, all major authors working in the area of USN were also searched according to their citation indexes, using the ISI Web of Science[2] database, to verify that all publications relevant to the assessment of USN were obtained. Textbooks that pertained to unilateral spatial neglect were also included in this review.

1.2. *Introduction*

Stroke has been identified as one of the leading causes of serious and long-term disability for adults in Canada, with more than 300,000 stroke survivors living with impairments and functional disabilities[3]. Sequelae post stroke depend on the location of brain involvement and, can impact on virtually all skills required for functional performance and participation in society[4]. In addition to motor, sensory and communicative deficits, patients may also experience cognitive and perceptual impairment[5].

Unilateral spatial neglect (USN) is one of the disabling features of a stroke, and is defined as a failure to report, respond, or orient to stimuli presented to the side opposite a brain lesion[6]. Many terms are used interchangeably in the literature to describe USN, such as unilateral neglect, hemi-inattention, visual neglect and hemi spatial neglect. It is estimated that as many as 30% of patients have either hemianopsia or USN following a stroke[7]. Clinically, the presence of severe USN is apparent when a patient often collides into his/her surroundings, ignores food on one side of the plate, and attends to only one side of his/her body[8]. However, as noted by several authors[9,10], symptoms of USN have to be quite severe for this impairment to be easily observed during functional activities. More subtle forms of USN may go undetected in a hospital setting but are a major concern for client function and safety upon return home to a more dynamic environment. These mild symptoms of USN become apparent during high-level activities such as driving, working or assuming child rearing roles as a grandparent.

1.3. Subtypes of USN

A client with USN is unable to attend to either one side of his/her body (personal neglect), the space within reaching distance (near extrapersonal neglect), the space beyond reaching distance (far extrapersonal neglect) or to a combination of these three spaces in the environment[11,12]. Recent neuroimaging studies[13-18] and clinical studies using assessment tools specific to the three hemispaces[19-22] have revealed that separate neural mechanisms are involved in exploring each hemispace. These findings support the importance of evaluating each of these spaces individually with the use of valid and reliable assessment tools specific to each space[13-22].

Another subtype of USN, referred to as representational neglect, can also be observed when a patient experiences difficulty in describing mental images from his long-term memory. In this case, the patient can accurately describe details on the right side of a familiar environment from memory, but omits objects that appear on the left side of the mental image. Other than the sensory manifestations of USN as described above, neglect can also affect the patient's ability to use their hemiplegic limb despite having minimal or no paralysis, which is known as motor neglect. This can cause marked deviation of their head, eyes, and truck away from the affected side and difficulty initiating movement towards the neglected hemispace[12].

1.4 USN and Side of Stroke Lesion

Positron emission tomographic (PET) scan analyses[23] and a systematic review of 17 studies[24] have substantiated the dominance of the right hemisphere

in regulating attention. Neuroanatomical findings have identified that the left hemisphere is responsible for modulating arousal and attention for the right visual field, whereas the right hemisphere controls these processes in both right and left visual fields[25]. This may explain why USN is not typical for those with a left hemisphere damage (LHD) post stroke because the intact right hemisphere is capable of compensating for attentional deficits that result from a LHD[25]. The presence of aphasia may also account for the low incidence rate of USN reported in those with a LHD post stroke. Language impairments can easily influence the validity of assessments that require receptive and expressive speech, such that this population can often be excluded in studies evaluating USN. However, there is evidence that this finding may be an artifact resulting from a failure to screen for USN in those with LHD. For example, when assessed with the Rivermead Perceptual Assessment Battery[26], 47% of non-dysphasic subjects with LHD post stroke were identified as having USN[27]. Once those with language deficits were included in the sample, almost every dysphasic subject (97%) with a LHD was screened positive for USN within 48 hours post stroke[27], suggesting that the lack of assessment of those with aphasia may account, in part, for the low incidence of USN reported in those with a LHD. In summary, USN continues to be commonly associated with a right stroke, but evidence from the literature suggests that all patients with stroke might benefit from USN screening.

1.5 Impact of USN on Functional Recovery and Return to Community Living

The presence of USN has been strongly associated with an increased risk for injury and with poor functional outcome. Ugur and colleagues studied 293

individuals admitted to a stroke unit and found that those with right hemisphere lesions were more likely to fall during their hospitalization compared to those with left hemisphere lesions, 36.6% versus 24.1%[28]. The authors suggested that the presence of USN might, in part, explain these findings. Kalra and collaborators explored the influence of USN on functional outcomes within a week post stroke by comparing 47 subjects with neglect to a matched control group[29]. Both groups had moderate stroke severity as well as similar demographic characteristics, pre-stroke function, and post stroke motor strength in the affected arm and leg. Subjects with neglect were found to have lower median functional scores on the Barthel Index[30], a scale used to measure basic activities of daily living (ADL), at both admission and discharge. When 27 individuals were assessed within a week of a right hemisphere stroke and followed over time, there was a positive correlation between recovery from USN, as measured by the Rivermead Behavioral Inattention Test[31] and improved functional performance on the Barthel Index after one month[32]. Improvements in their ability to attend to the neglected hemispace carried over to gains in functional performance during ADL. These individuals continued to show significant improvement in ADL up to three months post stroke[32].

The effects of USN extend beyond the basic skills for self-care (bathing, dressing, walking, etc.) to instrumental activities of daily living (IADL) that are crucial for successful reintegration into community living. These complex activities include performance of domestic chores, menu reading, using a map, telephone dialing and ambulating outdoors. Jehkonen and collaborators assessed motor, sensory and cognitive impairments in 57 subjects within 10 days

of a right hemisphere stroke: USN as assessed on the Rivermead Behavioral Inattention Test[31] was the strongest predictor of functional recovery at one-year post stroke on the Frenchay Activities Index[33], a measure of performance in IADL. The presence of USN explained 73% of the total variance in IADL at a three-month follow up, 64% at 6 months and 61% at one-year post stroke[34]. In summary, the strong correlation between the presence of USN and both a higher risk for injury and a poor functional outcome in ADL/IADL clearly substantiates the need for early identification of this impairment following a stroke.

1.6 Best Practice vs. Actual Practice for Assessment of USN

Clinical Guidelines for Stroke have recommended that it is "best practice" for acute care clinicians to screen for cognitive deficits, which include visual perception and USN, during routine neurological examination within 48 hours of the client regaining consciousness post stroke[35]. Clinicians have the responsibility to systematically screen all clients for cognitive impairments and disabilities post stroke, including USN, with the use of standardized assessment tools and stroke scales designed for screening purposes[35-38].

Various standardized and non-standardized tools are available to assess USN in each of the hemispaces at both impairment and disability levels. In a recent manuscript, based on a comprehensive review of the literature, 61 standardized and non-standardized assessment tools that exist to evaluate USN were identified (refer to Appendix A). Each standardized tool was critically appraised according to its purpose (hemispace assessed), psychometric properties (test-retest reliability, inter-rater reliability, internal consistency,

construct validity, criterion validity, and responsiveness to clinical change) and client appropriateness. The findings indicated that there are a number of reliable and valid tools available to assess USN in all three hemispaces. In addition, these tools are easy to administer by the bedside in a busy acute care setting once the patient was sufficiently alert, able to hold a pencil and use his/her eyewear. There are tools that require the patient to draw in order to detect USN, however therapists must be cautious in that the presence of constructional apraxia, aphasia, motor deficits and other visual perception deficits can falsify the results. Tools that are appropriate for a rehabilitation setting often require additional skills such as writing, reading, letter recognition, visual memory, visual discrimination and visual perception, along with unilateral voluntary movement and control of the upper limb. In sum, there are many tools with strong psychometric properties available for use with clients at various phases of their functional recovery both during an acute care and rehabilitation admission.

1.7 If detected, can USN be successfully treated?

Detection of USN is now more important than ever, given that seven systematic reviews have concluded that patients with USN have demonstrated significant improvements in visual scanning with associated functional recovery following cognitive rehabilitation[12,39-44]. Furthermore, there is evidence from a meta-analysis of six prospective, randomized clinical trials (N=286) and eight well-designed studies with controls (N=248) that cognitive rehabilitation, defined as training with graded visual material to promote scanning of the affected hemispace, is more effective than conventional occupational therapy to improve

visual scanning in patients with a right hemisphere stroke[45]. Consequently, these authors have recommended that cognitive rehabilitation should be routinely prescribed for all patients identified with USN post stroke. Cognitive rehabilitation emphasizes principles of anchoring (supplying a cue on the affected side to indicate the starting position), pacing (controlling the speed that responses are generated in order to deal with impulsive actions), modifying density (increasing the distance between two targets to facilitate correct responses and minimize an overload of information) and providing feedback regarding their performance[46]. The goals of cognitive rehabilitation are to remediate the impairment or reduce the impact of the deficit through repetitive exercises and compensatory strategies that teach patients a new method of response. The conventional occupational therapy interventions are directed more towards restoring normal muscle tone, movement patterns, and motor activity along with encouraging early participation in functional activities of daily living.

Other treatment modalities with the goal of improving visual attention and scanning on an impairment level have been attempted. The use of biofeedback incorporating auditory[47] and visual systems[48], as well as limb activation to encourage awareness of the contralateral hemispace[29] demonstrated conflicting evidence for its effectiveness. Other approaches to treating USN, including caloric stimulation[49], Frensel prisms[7], eye patching[50], dynamic stimulation[51], and optokinetic stimulation[52], produced short-term gains in visual scanning but no recovery of functional skills.

Although there have been some improvements in visual scanning with the use of these various treatment interventions, generalization of these skills to an

improved performance in activities of daily living has not been reported[39]. Six studies included a measure of disability, such as the Functional Independence Measure[53] or the Barthel Index, and they all found minimal changes in the patient's functional ability following cognitive rehabilitation[7,29,54-57]. Possible reasons for these findings may be that methodological flaws, small study populations, different interventions, and various outcome measures with questionable validity characterized these studies, making it difficult to draw conclusions regarding the effectiveness of treatments on ADL[39].

CHAPTER 2 RATIONALE

Unilateral spatial neglect typically results from an acute right hemisphere stroke[23,24] and can affect three levels of hemispace within the environment[11,12]. Being a strong predictor of functional outcome at one-year post stroke[34], it is not surprising that this deficit has many negative effects on patients, causing them to collide into their surroundings, ignore food on the plate, or attend to only one side of their body. These patients are often incorrectly identified in the early hospital period as either having a cognitive problem, being non-compliant or unmotivated to respond. Given that those with USN are at a greater risk for falls[28] and poor functional outcome[29], it is important to identify USN as soon as possible following admission to promote safety during hospitalization and a successful return of functional abilities.

Best practice guidelines for stroke have recommended that all patients be assessed for USN with the use of standardized tools within 48 hours of regaining consciousness following an acute care admission post stroke[35]. Currently there is

an increased demand placed on therapists to use standardized assessment tools to obtain a baseline profile, set treatment goals, plan treatment programs and monitor patient status and the quality of care provided[35-38]. Timely and accurate assessment of USN is critical and can lead to several important actions such as identifying the need for further perceptual assessment, commencing treatment interventions involving visual-perception rehabilitation, enforcing safety measures, and referring patients for continued rehabilitation following discharge.

In addition, detection of USN is critical given that recent clinical trials have substantiated the effectiveness of cognitive rehabilitation to improve visual attention and scanning on an impairment level[12,39-44]. Once the hospital staff and family are aware of the impairment, behaviors by the patient, such as ignoring a family member on the left side of the bed or attending to only one side of the body, can be accurately understood as symptoms of USN. Inasmuch as the assessment of USN is a critical component of care for stroke, it would be expected that information would be available in the literature regarding typical assessment practices including the frequency of use, timing of use and the tools most commonly applied. Yet, an extensive review of the literature has found no prevalence studies examining the common assessment practices to detect USN during the acute phase post stroke. More specifically, the timing, frequency and choice of tools used to evaluate USN post stroke in acute care hospitals is unknown. It is hypothesized that USN is likely to go undetected in the health care system due to lack of assessment of this impairment, inappropriate choice of tools, or timing of assessment that is incongruent with "best practice" guidelines.

CHAPTER 3 OBJECTIVES

From the research gaps identified in the literature review, it was only fitting that the objectives of this study were:

1. To estimate the **prevalence** of use of standardized and non-standardized assessments to detect unilateral spatial neglect (USN) within the three hemispaces (personal, near and far extrapersonal space) in patients admitted to acute care hospitals with an acute episode of stroke.
2. To estimate the initial **timing**, subsequent timing, and **frequency** of assessment of USN.
3. To identify potential explanatory variables including those of the client and those of the hospital associated with use of standardized assessments to identify USN.

3.1 Operational Definitions for the Objectives

Unilateral Spatial Neglect (USN): USN was defined as a failure to report, respond, or orient to novel or meaningful sensory stimuli presented to the side opposite a brain lesion[6]. Deficits of USN occured to either one side of the body (personal neglect), the space within reaching distance (near extrapersonal neglect), the space beyond reaching distance (far extrapersonal neglect) or to a combination of these specific hemispaces in the environment[12].

Acute episode of stroke: Stroke is defined as a sudden interruption of blood flow to the brain (an ischemic stroke) or the rupture of cerebral blood vessels (a hemorrhagic stroke), causing brain cells of the affected area to die[3]. This non-

convulsive neurological deficit that persist for >24hours excludes cases of transient ischemic attacks. Hospital codes derived from the International Statistical Classification of Diseases and Health Related Problems- ninth revision (ICD-9)[58] will be used to identify medical charts with a primary diagnosis of stroke (see details of the coding in Section 5.2).

Admission to an Acute Care Hospital: Defined as the date when admitted to an acute care hospital bed, including admission to a general medical unit, rehabilitation unit, geriatric assessment unit, emergency unit, or any other acute care unit of the hospital.

Assessment of USN: Defined as written evidence in a medical chart of a standardized or non-standardized assessment declaring the presence/absence of USN in the patient's medical chart.

Standardized Assessment: A standardized assessment tool had published procedures for administration, scoring and interpretation, as well as evidence of reliability and validity specifically when used with individuals experiencing USN post stroke. To verify that a standardized tool was used according to its specified administration procedures, the reported score was examined for its correct measurement scaling. When there was no score documented in the chart or the measurement scaling used was incorrect, the standardized tool was then classified as non-standardized.

Non-Standardized Assessment: *A* non-standardized assessment tool had no or very few published procedures for administration, scoring and interpretation, and

had no or very minimal evidence of reliability and validity in studies on clients with USN. If a standardized tool was used but there was no score documented in the chart or the measurement scaling used was incorrect, such that the health professional did not comply to published guidelines for scoring of the tool (refer to Appendix A for scoring procedures of USN tools), it was then classified as non-standardized. Evaluations of USN during an ADL assessment, a neurological examination or through general observations of the client were also classified in this category. An extensive review of the literature concluded that there were no published methods for administration, scoring and interpretation of these clinical evaluations to assess USN, along with no psychometric testing of reliability and validity for this study population. "Homegrown" assessment tools developed by clinicians for use within their hospital setting and with no or minimal information on its psychometric properties were included.

CHAPTER 4 STATEMENT OF HYPOTHESES

1. It is hypothesized that the prevalence of use of standardized assessments to evaluate USN will be below 40% in patients admitted to acute care hospitals post stroke.
2. It is hypothesized that an "*assessable*" patient is not commonly screened for USN using standardized tools within the two-day assessment period, as recommended by the Clinical Practice Guidelines for Stroke[35].

3. It is hypothesized that there will be a greater prevalence of use of standardized tools to assess the near extrapersonal space for the presence of USN in comparison to the other two spaces.
4. It is hypothesized that one or more potential explanatory variables may be associated with use or lack of use of standardized assessments to evaluate USN.

CHAPTER 5 METHODS AND PROCEDURES

5.1 Sampling Frame

This was a multi-centered, retrospective cross-sectional study using data from medical charts of a representative sample of individuals admitted to acute care hospitals in Ontario from July 15th to December 15th 2002, to examine whether those coded with a primary diagnosis of stroke were routinely assessed for USN. A retrospective chart review was chosen as a study design for a number of reasons: (1) to eliminate the potential for contamination if the study was performed prospectively in a close-knit community of clinicians who might become aware of the study's purpose; (2) the number of stroke admissions to each hospital could be obtained retrospectively with this study design to ensure a sample size sufficiently large to estimate the prevalence of use of standardized tools for USN assessment; (3) to eliminate the potential for social desirability bias if an interview format was used to question clinicians regarding their assessment practices for USN.

To construct the sampling frame for this study, all acute care hospitals within a 200-km range from the three Ontario cities; Toronto, London and Ottawa,

(Appendix B) were stratified as either a teaching site or community-based site. A teaching hospital was defined as a hospital that also functioned as a formal centre of learning for the training of physicians, nurses, and other health professionals, and has affiliations with a university. A community-based hospital was defined as a hospital with a minimum of 150 beds that served the local community but does not provide any formal training for health care professionals and was not affiliated with a university. Within these strata, hospitals were assigned a sequential identification number and 12 sites were randomly selected using a table of random numbers. From these 12 hospitals, a minimum of 20 charts had to be randomly sampled from each institution for two reasons: 1) to generate a representative pattern of how patients were screened for USN at the hospital and, 2) to ensure that adequate information was retrieved regarding assessment practices when clients were identified with USN, since only 30% of clients have either hemianopsia or USN following a stroke[7]. However, gathering data from more than 35 charts from a particular site was deemed unlikely to provide any additional information on whether screening for USN was routinely performed.

5.2 Study Population

To accrue a representative sample of charts from each hospital site, computerized records for all admissions between July 15th to December 15th 2002 maintained by a provincial administrative database (Med2020) and classified with an ICD-9 or ICD-10 diagnostic code for acute stroke, were obtained from each site. Acute stroke was defined as a sudden interruption of

blood flow to the brain (an ischemic stroke) or the rupture of cerebral blood vessels (a hemorrhagic stroke), causing brain cells of the affected area to die[3]. This non-convulsive neurological deficit that persisted for >24hours excluded cases of transient ischemic attacks. Med2020 categorized acute stroke with the following ICD-9 diagnostic codes: intracerebral hemorrhage (431), occlusion of cerebral arteries (434), or acute but ill-defined cerebrovascular disease (436), and matching ICD-10 codes for the identical diagnoses: I61, I63, I64. For this study, only diagnostic codes that had a high probability of identifying true acute stroke were chosen. This was based on recent findings of several investigators regarding the accuracy of ICD-9 stroke codes[59,60]. These validation studies examined whether a diagnosis of stroke, as recorded by neurologists and trained abstractors on stroke registries and medical charts, was compatible with their assigned ICD-9 discharge codes (Appendix C).

The following inclusion and exclusion criteria were used to determine whether the patient was eligible for the study:

Inclusion Criteria

- Individuals with a primary diagnosis of stroke admitted to an Ontario acute care hospital between July 15th to December 15th, 2002. Admission to hospital was defined as the date when admitted to an acute care hospital bed, including admission to a general medical unit, rehabilitation unit within the hospital, neurology unit, or any other acute care unit of the hospital. Stroke admissions occurring in pediatric hospitals with patients under the age of 18 years were excluded from this sampling frame.

- Individuals who were "*assessable*" for at least 2 consecutive days during the hospital stay. The term "*assessable*" was operationally defined as written evidence in the chart that the patient was alert, awake with their eyes open, fully aware of normal external and internal stimuli, and was not declared legally blind or comatose. There had to be some period of hospitalization without coma, and periods of alertness to enable meaningful interactions with the clinician[61]; perceptual testing requires the individual to be mentally alert and oriented at the time of evaluation[62]. Examples of statements in the chart to describe the patient as being assessable included: *eyes open, awake, responsive, alert and oriented, fully conscious or responds/ head turn towards verbal/visual stimuli.*

Exclusion Criteria

- Individuals with a secondary diagnosis of stroke, such as an individual with a brain tumour.
- Hospitals in which the collection of information on the assessment of USN was performed solely within the context of a research project, as the data may not represent usual practice of clincians. The Director of Professional Services (DPS) of each hospital site, or the individual generally involved in providing approval for the conduct of research projects, was contacted and details of the project were explained to verify that there was no information being currently collected on the assessment of USN.

- Each patient was counted only once in the study, including those who experienced a second acute episode of stroke during the current hospitalization or during another admission within the study period.

5.3 Sample Size

A comprehensive review of the literature regarding the assessment practices for USN within the three hemispaces (personal, near and far extrapersonal space) revealed no studies involving the exposure and outcome variables of this study. However, a recent multi-centered study with a similar study design, examining the prevalence and factors associated with use of standardized outcome measures in those with low back pain, revealed a prevalence of 31%[63]. With an anticipated prevalence of use of standardized assessments to assess USN of approximately 40%, to be 95% confident that the estimated prevalence reflects the true prevalence of use of standardized assessments to detect USN, the maximum discrepancy accepted between the sample and population proportions was ± 6 percent. The following is a formula to calculate sample size for a single proportion[64] to have adequate power to make inferences on the stroke population admitted to acute care hospitals in Ontario:

N = sample size

$Z_{\alpha/2}$ = confidence level =1.96

p = proportion of sample population = 0.40

q = (1 — p) = 0.60

M = margin of error = ± 6% = ± 0.06

$$N = \frac{(Z_{\alpha/2})^2(pq)}{M^2}$$

Using an estimated prevalence of 40%, a sample size of **256 charts** would permit inference of the study findings to the stroke population admitted to acute care hospitals in Ontario, with a confidence interval of 95% and a maximum discrepancy accepted between the sample and population proportions of ± 6 percent. Even if the estimated prevalence was lower than the actual prevalence for the use of standardized assessments to evaluate USN, the sample was sufficiently large to confidently infer the findings (Appendix D presents sample size calculations for various proportions).

5.4 Ethics Approval

The McGill University Institutional Review Board (IRB) in Montreal, Canada approved the research study and a copy of the ethics certificate is included in Appendix E. The Director of Professional Services (DPS) of each randomly chosen hospital site, or the individual generally involved in providing approval for the conduct of research projects, was contacted and the project was briefly explained. All 12 randomly selected hospitals required ethics approval from their own Review Boards and the necessary steps were taken to complete this process. Copies of the ethics certificate for the 10 hospitals finally included in the study are also included in Appendix E.

To maintain confidentiality during the study, chart numbers rather than nominal data were used. Hospital sites were assigned a code in order to maintain confidentiality of the data pertaining to each hospital. While the protocol was designed such that a hospital would be replaced with another randomly selected one within the same stratum (teaching/community-based) if the Ethics Committee

refused participation, there were no hospitals that refused and as such, this step was not required.

5.5 Randomization and Selection Process

A list of charts coded with acute stroke (ICD-9/ICD-10) admitted to each of the ten hospital sites from July 15th to December 15th, 2002 was requested from the health records department. Each chart was assigned a sequential identification number and was hereafter acknowledged by this number to maintain confidentiality. When a hospital had more than 35 charts coded with stroke admitted within the study period, a table of random numbers was used to randomly select 35 charts. If a site had less than 35 charts, then all charts were included for review. Charts were initially screened to verify whether they met the inclusion/exclusion criteria for recruitment in the study. Those that did not were replaced by randomly selecting more charts until a total of 35 charts for the site was attained.

5.6 Training of Chart Abstractors

Four research assistants with an expertise in stroke were recruited in Ontario as chart abstractors and underwent training in use of the **CHART ABSTRACTION FORM** (Appendix F). To ensure consistency of data collection among the abstractors throughout the study, a **USER GUIDE** explaining and interpreting each question on the form was made available (Appendix G). Additional coaching by the primary investigator (A.M.) was provided to each abstractor when they conducted their first ten chart reviews. One potential area

for discrepancy was classifying the client and hospital characteristics. To ensure that there was consistency amongst the raters when collecting the data and categorizing variables, two small inter-rater reliability studies were undertaken. Study 1 was composed of three trained abstractors (A.M., J.B. and M.R.) who independently collected data from seven charts in the London and Toronto regions. Study 2 involved two trained abstractors (A.M. and A.G.) who independently collected data from seven charts in the Ottawa region. Abstractors from Study 1 and Study 2 had perfect agreement when classifying the clients' and hospitals' variables in six out of the seven charts. There was also complete agreement in six out of the seven charts among abstractors from Study 1 and Study 2 when distinguishing whether or not the patient was assessable during the hospital stay and determining the date at which they were assessable. The term "*assessable*" was operationally defined as written evidence in the chart that the patient was alert, awake with their eyes open, fully aware of normal external and internal stimuli, and was not comatose, or declared legally blind. Similar findings were documented in both studies, where six out of the seven charts had perfect accord when recording whether or not USN was detected with the use of standardized and non-standardized assessments, along with the date of assessment from the charts. Perfect agreement was found among abstractors in Study 1 for six out of the seven charts reporting whether or not USN was observed during non-standardized assessment. However, this was not the case for Study 2 where only four out of the seven charts had 100% accord for the same variables. Additional coaching by the primary investigator (A.M.) was immediately provided to the discordant abstractor using another ten charts but

there were still omissions, such that the primary investigator reviewed all of these charts to ensure that data was consistently abstracted. The type of data presentation from non-standardized assessments required more careful scanning of each chart, whereas the documentation of standardized assessments was more easily obtained from the consultation report.

5.7 Data Verification

On an ongoing basis throughout the study, the primary investigator (A.M.) verified all completed forms for any obvious omissions or inconsistencies, and confirmed that there were no discrepancies or missing information in the forms. A research assistant then entered the data from the questionnaires into a computerized database. Using a team of two research assistants, the computerized data were verified against the original **CHART ABSTRACTION FORMS**. The data were then analyzed using SAS System for Windows V8 (1999-2000)[65].

CHAPTER 6 MEASUREMENT OF VARIABLES

The **CHART ABSTRACTION FORM** (Appendix F) was created to systematically document the data collected from the chart review, which included the main study variables of interest, along with the potential explanatory variables of the client and of the hospital. A comprehensive list of tools to assess both visual perception and USN was also included in the **USER GUIDE** as a reference for the chart abstractors.

Members of the research team performed numerous revisions to the **CHART ABSTRACTION FORM**. It was then validated by three occupational therapists

with experience in stroke from acute care hospitals not involved in the study. They reviewed the completeness of the form, the list of assessment tools, and the crude classifications of the variables related to the client and the hospital site to identify omissions, errors, redundancies, and to correct any abbreviations used. One of these therapists pilot tested the **CHART ABSTRACTION FORM** with a medical chart, and provided written feedback regarding this process. The feedback suggested by all these health professions was incorporated into the final version of the Form.

The following three sections have listed the study variables that were abstracted from the charts:

6.1 Variables related to USN Assessment

Presence of Unilateral Spatial Neglect: Presence of USN was defined as a failure to report, respond, or orient to stimuli presented to the side opposite a brain lesion[4]. Many terms, such as unilateral neglect, hemi-inattention, visual neglect and hemi spatial neglect, were used interchangeably in the chart to indicate the presence of USN.

Standardized Assessment: A **standardized tool** had published procedures for administration, scoring and interpretation, as well as evidence of reliability and validity specifically with individuals experiencing USN post stroke. To verify that a standardized tool was used according to its specified administration procedures, the reported score was examined for its correct measurement scaling, based on published guidelines for scoring of the tool (refer to Appendix A for scoring of

tools). A further classification of standardized tools was performed according to whether the tool was specific to the assessment of USN or visual perception. For example, in the **USER GUIDE**, the Single Letter Cancellation Test[66] and Rivermead Behavioral Inattention Test[67] were categorized as tools specific to USN. The Motor-Free Visual Perceptual Test[68] and Rivermead Perceptual Assessment Battery[69] have items that assess patients for the presence of USN in addition to other visual perceptual skills, such that they were classified as tools specific to visual perception. A preliminary analysis of the data revealed that only 2 charts indicated the patient had been assessed using tools specific to USN detection. Thus, for purposes of statistical analysis, standardized tools that specifically evaluate USN (n=2) or visual perception (n=31) were combined into one category. Clients can potentially receive one or more standardized assessments of USN during their hospital stay. When identifying the standardized assessments most commonly used, if one assessment was used repeatedly in a client, it was counted only once to determine its prevalence of use for all clients receiving a USN assessment.

Non-Standardized Assessment: A **non-standardized tool** had no or very few published procedures for administration, scoring and interpretation, and had no or very minimal evidence of reliability and validity in studies on clients with USN. Non-standardized tools that specifically assess USN (n=4) or visual perception (n=2) were combined into one category for the same reasons applied to standardized tools. If a standardized tool was used but there was no score documented in the chart or the measurement scaling used was incorrect, such

that the health professional did not comply to published guidelines for scoring of the tool (refer to Appendix A for scoring procedures of USN tools), it was then classified as non-standardized. Clinical evaluations involving an assessment of USN were also classified as **non-standardized assessments** and included the following three types of evaluations: 1) *ADL assessment with observation of USN reported in the chart*: A non-standardized assessment of USN during activities of daily living was defined as when the health professional observed the patient perform daily activities and documented any impairments or disabilities, including the presence of USN. Possible statements of USN symptoms reported in the chart were as follows: *client tends to ignore or does not wash the left/right side of the body, eats only half of the food on the meal tray, does not groom the left/right side of the face, bumps into obstacles on the left/right side of the environment, does not respond to verbal or visual stimuli on one side, or ignores family members and hospital staff in room.* 2) *Neurological Examination with testing for presence of USN reported in the chart*: This examination was typically performed by a neurologist but was also completed by other health professionals to identify neurological impairments post stroke. Possible statements of USN symptoms reported in the chart were as follows: *positive signs of visual neglect, observed signs of visual neglect during neurological examination, presence of neglect during visual field testing, visual extinction, etc.* 3) *Observation of USN reported in the chart*: General observations of USN were defined as symptoms of USN reported in the chart by hospital staff, physicians, and rehabilitation specialists or based on concerns raised by the family. These statements regarding the presence of USN were similar to the observations reported from ADL

assessments as previously described. An extensive review of the literature concluded that there were no published methods for administration, scoring and interpretation of these three clinical evaluations to assess USN, along with no psychometric testing of reliability and validity for this study population. "Homegrown" tools developed by clinicians for use within their hospital setting that had no or minimal information on psychometric properties were also classified as non-standardized assessments. Subjects can potentially receive one or more types of non-standardized assessments of USN during their hospital stay. When identifying the non-standardized assessments most commonly used, if one assessment was used repeatedly in a client, it was counted only once to determine its prevalence of use for all clients receiving a USN assessment.

Date first seen in Emergency: This date was defined as the date when the client was first seen upon admission to the emergency unit by a health professional such as a physician, nurse or rehabilitation professional, to screen for existing impairments and determine a diagnosis. The brief triage done by a nurse upon first contact to the emergency unit in order to prioritize the severity of the client's symptoms was not included. This date was often similar to the date of admission of the client.

Assessable: The chart was reviewed from admission to discharge to determine whether the client was "*assessable*" for at least 2 consecutive days during this admission. The term "*assessable*" was operationally defined as written evidence in the chart that the patient was alert, awake with their eyes open, fully aware of normal external and internal stimuli, and was not comatose, or declared legally

blind. There had to have been some period of hospitalization without coma, and periods of alertness to generate meaningful interactions with the clinician for assessment purposes. If a patient was assessable throughout their hospitalization, the patient was considered assessable on the date of admission to emergency. Interruptions from the "*assessable*" period due to a coma, heart attack, or recurrent stroke, during which the client could not have potentially been assessed for USN, were recorded.

Date of USN assessment: The date of USN assessment was defined as the day on which the client was assessed for USN by a health professional as indicated in the chart. If this information was not available, the date on which the results of an examination were documented in the chart by a health professional was used as the best available estimate.

Delay to Assessment of USN: To obtain the delay to initial USN assessment, the date when the client was deemed "*assessable*" was subtracted from the date when the client was assessed for USN by a health professional as reported in the chart. If interruptions from the "*assessable*" period occurred, during which the client could not have potentially been assessed for USN, the date when he/she recovered and were "*assessable*" for more than 2 consecutive days thereafter was the date when the client was deemed "*assessable*" for USN. While the protocol was designed to account for clients who had fluctuations in their medical status such that they were not penalized for a longer delay to USN assessment, there were no clients of this type and as such that this step was not required.

Reassessment: Reassessment was defined as documentation in the chart that the client was assessed for a second time with the use of a standardized or non-standardized assessment some point during the hospital stay.

Hemispace assessed: USN occurred to either one side of the body (personal space), the space within reaching distance (near extrapersonal space), the space beyond reaching distance (far extrapersonal space) or to a combination of these specific hemispaces in the environment[12]. Both standardized and non-standardized tools have been classified according to the hemispace(s) they assessed (see **USER GUIDE** Appendix E). Abstractors determined which hemispace was evaluated when a patient received a non-standardized evaluation of USN during an ADL assessment, neurological examination, or through general observations of USN, by interpreting statements of USN symptoms reported in the chart. Both standardized and non-standardized assessments were capable of evaluating USN in one or a combination of hemispaces, such that clients were potentially assessed for USN in one or more hemispaces.

6.2 Variables Related to the Client

Age: Client's age in years at the time of admission

Sex: Sex of the client, as reported in the chart

Side of lesion: Side of the brain that was primarily affected by the stroke; right, left or bilateral as indicated in the chart.

History of stroke: A past history of stroke, as reported in the chart

Mobility status during the "assessable" period: The mobility status of the client was crudely classified according to written evidence in the chart during the "assessable" period. Clients who were ambulatory without assistive devices or assistance were classified as having a normal mobility status. Those who were ambulatory with aid from an assistive device (cane or walker) or from an individual were classified as mild-to-moderate. Severe cases were defined as being non-ambulatory or wheelchair-bound.

Presence of Aphasia during the "assessable" period: Deficits in producing receptive or expressive speech during the "assessable" period were crudely classified as being absent, mild-to-moderate or severe. Aphasia was coded as absent when there was no documentation on deficits in receptive or expressive speech in the chart. Mild-to-moderate aphasia was operationally defined as documentation of presence of language impairments. "Severe aphasia", a term commonly recorded in charts, described the complete inability to produce receptive or expressive speech.

Presence of Motor Deficits of the Upper Extremity during the "assessable" period: The motor skills of the client during the "assessable" period were crudely classified from documentation in the chart as normal, mild-to-moderate or severe. Normal was identified as normal muscle tone in the affected upper extremity. Mild-to-moderate was defined as hemiparesis of the affected upper extremity. hemiplegia of the affected upper extremity was defined as severe. The patient was also classified as having severe motor deficits if their dominant hand was hemiparetic.

Presence of Cognitive Deficits during the "assessable" period: Cognitive function was categorized as normal when written evidence in the chart indicated that the patient was oriented to time, place and person during the "assessable" period. A mild-to-moderate cognitive deficit was identified as the individual being oriented to two out of the three areas (time, place and person). Those who were oriented to only one or none of the three areas were identified as having severe cognitive impairments.

Presence of Hemianopsia during hospital stay: The presence of hemianopsia was crudely classified as *present* or *absent*, where *present* was defined as written evidence of hemianopsia or a visual field deficit during in the hospital stay.

Discharge Destination: The discharge destination is defined as the location to which the client was discharged (home, rehabilitation center, long term care, or other locations). If the client had not been discharged as of the date of chart abstraction or had been admitted for more than 120 days in the hospital, they were classified as being discharged to long term care because they were no longer in the acute phase.

6.3 Variables Related to the Hospital

Location of Hospital Site: Sites were classified as either urban or rural. A hospital located within a 30-km radius from a major city (Toronto, London or Ottawa) was defined as an urban site, while sites located further than 30-km was classified as rural.

Total Number of Hospital Beds: The total number of hospital beds per site was obtained from the hospital administration department.

Annual Number of Stroke Admissions: The number of clients admitted to the hospital in 2002 with a diagnosis of stroke was obtained from the health records department of each hospital.

Type of Hospital: Hospitals were stratified as either teaching sites or community-based sites. A teaching/university-affiliated hospital was defined as a hospital that also functioned as a formal centre of learning for the training of physicians, nurses, and other health professionals, and had affiliations with a university. A community-based hospital was defined as a hospital with a minimum of 150 hospital beds that served the local community but does not provide any formal learning for health care professionals and was not affiliated with a university.

Primary Location of Stroke Care during the "assessable" period: The primary location of stroke care where the client stayed for the most part of their "assessable" period, as identified by the room number, was abstracted from the chart. Their room number indicated the medical unit where the client mainly received stroke care (general medical unit, neurology unit, rehabilitation unit within the hospital, or any other acute care unit).

Discipline assessing USN: The discipline of the health professional who was responsible for evaluating USN at initial and each subsequent assessment was documented from the chart. A pilot survey conducted in October 2002 of a convenience sample of 21 teaching/university–affiliated acute care hospitals

across Canada by the primary investigator (A.M.) suggested that neurologists commonly screened for USN during their neurological examination in the emergency room, whereas occupational therapists typically assessed USN once patients were admitted to a hospital unit. Details of this survey are described in Appendix H.

Number of Occupational Therapists and Neurologists The human resources and payroll departments of each hospital were contacted to obtain the number of occupational therapists and neurologists working full-time or part time with a stroke clientele.

CHAPTER 7 ANALYSIS

The primary objectives of this study were to estimate the prevalence, timing and frequency of use of **standardized assessments** to evaluate USN in acute patients with a diagnosis of stroke. To estimate the prevalence of use of standardized assessments to evaluate USN, a ratio was created: the numerator was subjects within the sample where the use of one or more standardized assessments to detect USN was documented and the denominator was the subjects within the sample that were "assessable" for USN for at least 2 consecutive days during the hospital stay. A preliminary review of the data revealed that only 2 patients received a **standardized tool** specific to USN. Therefore, as mentioned earlier in Section 6.1, standardized tools specific to USN assessment (n=2) and standardized tools for visual perception assessment with a USN component (n=31) were grouped together to create the category

"standardized tools". Figure 1 is an equation to calculate the prevalence of use of "standardized tools" to assess USN:

Figure 1: Equation to Calculate Prevalence of Use of "Standardized Tools" to Assess USN

$$\text{Prevalence of use of "standardized tools" to assess USN} = \frac{\text{Clients who received } \geq 1 \text{ "standardized tools" to assess USN}}{\text{Clients who were "}\textit{assessable}\text{" for USN}}$$

A similar equation was used to determine the prevalence of use of **non-standardized assessments** (non-standardized tools, standardized tools reported in a non-standardized manner, evaluation of USN during an ADL assessment or neurological evaluation, general observations of USN symptoms reported, and "home-grown" tools) to evaluate USN. As described earlier, non-standardized tools specific to USN assessment (n=4) and non-standardized tools for visual perception assessment with a USN component (n=2) were combined together to create the category "non-standardized tools". Finally, the prevalence of USN evaluation within the three hemispaces (personal space, near extrapersonal space and far extrapersonal space) was also examined when clients received either standardized or non-standardized assessments.

The delay (in days) to initial assessment of USN was calculated as the date when the patient was first assessed for USN by a health professional as reported in the medical chart subtracted from the date when the patient was deemed "*assessable*" for at least 2 consecutive days (Figure 2).

Figure 2: Equation to Calculate Initial Timing of USN Assessment

Initial timing of assessment of USN	=	Date when client was *"assessable"*	___	Date when client was first assessed for USN

Best practice guidelines for stroke recommend that all patients be assessed for USN within 2 days of regaining consciousness following an acute care admission post stroke with the use of standardized tools[35]. Descriptive statistics were used to indicate the proportion of subjects assessed for USN within this two-day period, as well as outside of this two-day period.

Frequency distributions were used to indicate the most commonly used standardized assessments to evaluate USN. When identifying the standardized assessments most commonly used, if one assessment was used repeatedly in a client, it was counted only once to determine its prevalence of use for all clients receiving a USN assessment. These tools were ranked in descending order from most to least commonly used at initial assessment (within 2 days of the "*assessable*" period). Prevalence of use of these tools to reassess clients at any point during hospitalization was also calculated. The frequency of use and average delay to reassessment for the client were also computed for these standardized tools.

To explore the association between assessment of USN and the potential explanatory variables related to the client and hospital, univariate analyses were performed with the following variables listed in Figure 3:

Figure 3: Potential Explanatory Variables of the Client and Hospital

Client	*Hospital*
• Age/Sex • Mobility status • Aphasia • Motor skills • Cognition • Hemianopsia • Side of lesion • Previous history of stroke • Length of Stay/Discharge destination	• Location of hospital site • Annual number of stroke admissions • Total number of hospital beds • Type of hospital • Location of stroke care • Discipline assessing USN • Number of occupational therapists (OTs) employed • Number of neurologists employed

The initial protocol of this study also indicated the use of a multiple logistic regression to identify the client and hospital variables that most explained use of standardized tools to assess USN. Early analysis of the data suggested that the low prevalence of use of standardized tools would limit the potential for this type of multivariate analyses, such that this procedure was deemed inappropriate.

A more encompassing term was also created for the purposes of data analyses where assessment of USN was defined as "*ever assessed*", that is use of either standardized assessments (standardized tools for USN or for visual perception) or non-standardized assessments (non-standardized tools, evaluation of USN during an ADL assessment, neurological examination or through general observations). Univariate analyses were then used to examine the association between the explanatory variables related to the client and hospital, and whether the client was "*ever assessed*" for USN as either *yes* or *no*. A Bonferroni correction was made to account for multiple correlations (n=19) among the explanatory variables and whether the client was *ever assessed* for USN, given that the probability of making at least one Type I error in 19 tests was much larger than α=0.05. With 19 correlations and the overall Type I error rate of

no more than α=0.05, each individual test was conducted at a Type I error rate of 0.05/19, such that the level of significance was set at p=0.0026 [70].

CHAPTER 8 RESULTS

Twelve hospitals within a 200-km range from three Ontario cities Toronto, London and Ottawa were randomly selected to participate. While no hospital administrator refused to participate, one community-based site was seriously involved with the Severe Acute Respiratory Syndrome (SARS) epidemic and one teaching site was unable to complete the ethics approval process within the time limits of the data collection period. Thus, four teaching hospitals and six community-based hospitals were involved in the study.

At each site, 30-to-35 charts were randomly selected and out of the 324 that were examined for their eligibility, 275 were deemed eligible and reviewed in detail using the CHART ABSTRACTION FORM. Of these, 27 charts (9.82%) had written evidence that the client was not *"assessable"* for at least 2 consecutive days throughout the hospitalization, such that the client was not alert or fully aware of normal external and internal stimuli (n=19), was declared blind (n=1) or in a coma state (n=7). Thus, data from the 248 charts of individuals who were *"assessable"* (n=248) and remained so throughout their hospital stay constituted the denominator for all analyses regarding the prevalence of use of standardized and non-standardized assessments for USN.

Of the 248 subjects who were *"assessable"* for USN, only 13.31% (C.I. 95%, 9.08-17.54%) were assessed using a "standardized tool"; 2.42% were assessed using a "non-standardized tool" (Table 1). Of those who were evaluated

Table 1: Prevalence, Initial Timing and Frequency of Use of Standardized and Non-Standardized Assessments to Detect Unilateral Spatial Neglect (USN) in Assessable Clients (n=248)

Type of Assessment	Prevalence of Use N (%)	≤2 days of assessable period N (%)	> 2 days of assessable period N (%)	Reassessment for USN N (%)
Standardized Assessment (n=33)				
Clock Drawing Test	22 (8.87)	7 (2.82)	15 (6.05)	0 (0)
OSOT* Perceptual Evaluation	8 (3.23)	0 (0)	8 (3.23)	0 (0)
Motor Free Visual Perceptual Test	1 (0.40)	1 (0.40)	0 (0)	1 (0.40)
Line Bisection Test	1 (0.40)	0 (0)	1 (0.40)	0 (0)
Single Letter Cancellation Test	1 (0.40)	0 (0)	1 (0.40)	0 (0)
Non-Standardized Assessment (n=115)				
Non-Standardized tools for USN or visual perception	6 (2.42)	0 (0)	6 (2.42)	0 (0)
Evaluation of USN during ADL** assessment	42 (16.94)	21 (8.47)	21 (8.47)	10 (4.03)
Assessment of USN during neurological examination	34 (13.71)	27 (10.89)	7 (2.82)	11 (4.44)
General observation of USN reported in chart	33 (13.31)	18 (7.26)	15 (6.05)	8 (3.23)
"Ever Assessed" for USN	93 (37.50)	22 (8.87)	71 (28.63)	25 (10.08)

* *Ontario Society of Occupational Therapists*
** *Activities of daily living*

with a standardized tool, 36.36% (n=12/33) were screened positive for the presence of USN. Two standardized tools specific to USN; Line Bisection Test[70] (n=1) and Single Letter Cancellation Test[66] (n=1) and three standardized tools specific to visual perception with a USN component; Clock Drawing Test[71] (n=22), Ontario Society of Occupational Therapists (OSOT) Perceptual Evaluation[72] (n=8) and Motor-Free Visual Perceptual Test[68] (n=1), were reported in 248 charts. The Clock Drawing Test was most commonly used, accounting for 66.67% of standardized assessment use (n=22/33). At least 39.39% of the clients evaluated for USN with a standardized tool (n=13/33) were located at one hospital site. There were 7 of the 10 hospitals in the study where two or fewer subjects received a standardized assessment of USN: 3 of these sites were categorized as teaching hospitals within urban regions.

Of the 248 clients who were assessable for USN, only 37.50% were "ever assessed" for USN using any form of standardized or non-standardized assessment (Table 1). USN was detected in 63.44% of these subjects (n=59/93). The most commonly used non-standardized assessment was the screening of USN during an ADL evaluation, accounting for 36.52% of non-standardized assessment use (n=42/115). There were five sites where more than 60% of clients were "ever assessed" for the presence of USN and another five sites where less than 15% of clients were "ever assessed".

The delay to USN assessment was analyzed according to whether or not tools were administered within the first 2 days of the "assessable" period as recommended by Clinical Practice Guidelines for Stroke[35] (Table 1). Only 8 clients (3.23%) received a standardized assessment of USN within the 2-day

critical evaluation period. In comparison to other types of non-standardized assessments, USN was most often screened during a neurological examination (n=27) within the recommended 2-day evaluation period.

Reassessment for USN was uncommon: only one client (0.40%) who received a standardized assessment of USN was reassessed on the following day. For subjects who were "*ever assessed*" for USN, of the one-quarter (n=25/93) who received a reassessment during their hospital stay, three-quarters of these subjects (n=19/25) were previously identified as having USN at initial evaluation.

Table 2 summarizes the findings according to hemispaces evaluated (personal space, near extrapersonal space or far extrapersonal space). All 33 clients who received a standardized assessment were screened for USN in only one of the three hemispaces, specifically the *near extrapersonal space* (the area within reaching distance of the client). No subject received a standardized assessment for the *personal space* and *far extrapersonal space.* For those who were "*ever assessed*" for USN, *personal space* was screened in 22.58% of the 248 clients (n=56); the *far extrapersonal space* was seldom assessed (n=8).

Univariate analyses explored the client and hospital variables associated with those who did or did not receive a standardized assessment for USN. These results will be presented as descriptive information; the numerical differences can be found in Tables 3 and 4. When comparing patients who did or did not receive a standardized assessment for USN, those who received a standardized assessment were slightly younger in age, had a right hemisphere stroke, and had a mild-to-moderate stroke severity when taking mobility, cognitive status, and

Table 2: Prevalence of Unilateral Spatial Neglect (USN) Assessment within the Three Hemispaces (Personal Space, Near Extrapersonal Space, Far Extrapersonal Space) in Assessable Clients (n=248)

	Hemispace		
	Personal Space (N%)	Near Extrapersonal Space (N%)	Far Extrapersonal Space (N%)
Type of Assessment			
Standardized Assessment (n=33)			
Standardized tools for USN and visual perception	0 (0)	33 (13.31)	0 (0)
Non-Standardized Assessment (n=115)			
Non-standardized tools for USN and visual perception	0 (0)	6 (2.42)	0 (0)
Evaluation of USN during ADL* assessment	27 (10.89)	31 (12.50)	7 (2.82)
Assessment of USN during neurological examination	23 (9.27)	31 (12.50)	1 (0.40)
General observation of USN reported in chart	22 (8.87)	27 (10.89)	1 (0.40)
"Ever Assessed" for USN (n=93)	56 (22.58)	83 (33.47)	8 (3.23)

** Activities of daily living*

***** Note that standardized and non-standardized assessments often screened for USN in one or a combination of hemispaces, such that n's may vary***

Table 3: Client Characteristics According to Type of Unilateral Spatial Neglect (USN) Assessment

	Standardized Assessment of USN (n=33)		*"Ever Assessed"* for USN = Yes (n=93)		*"Ever Assessed"* for USN = No (n=155)		Chi-Square	P value
CLIENT CHARACTERISTICS								
Age in years (mean, SD***)	68.35	(±14.36)	73.04	(±13.35)	75.47	(±11.77)	n/a	0.1491
	n	**%**	**n**	**%**	**n**	**%**		
Gender								
Male (n=115)	13	(11.30)	35	(30.43)	80	(69.57)	4.567	0.05
Female (n=133)	20	(15.04)	58	(43.61)	75	(56.39)		
Side of Lesion* *(not available in chart n=43)*								
Right (n=104)	17	(16.35)	49	(47.12)	55	(52.88)	3.290	0.10
Left (n=101)	11	(10.89)	35	(34.65)	66	(65.35)		
Previous Stroke* *(not available in chart n=28)*								
Yes (n=91)	7	(7.69)	39	(42.86)	52	(57.14)	1.166	1.00
No (n=129)	23	(17.83)	46	(35.66)	83	(64.34)		
Mobility Status* *(not available in chart n=3)*								
Mild (n=56)	9	(16.07)	17	(30.36)	39	(69.64)	3.127	1.00
Moderate (n=111)	18	(16.22)	40	(36.04)	71	(63.96)		
Severe (n=78)	6	(7.69)	35	(44.87)	43	(55.13)		
Aphasia* *(not available in chart n=3)*								
Mild (n=113)	18	(15.93)	37	(32.74)	76	(67.26)	2.068	1.00
Moderate (n=91)	14	(15.39)	38	(41.76)	53	(58.24)		
Severe (n=41)	1	(2.44)	17	(41.46)	24	(58.54)		
Cognition* *(not available in chart n=21)*								
Mild (n=138)	19	(13.77)	42	(30.44)	96	(69.57)	11.111	0.01
Moderate (n=51)	10	(19.61)	29	(56.86)	22	(43.14)		
Severe (n=38)	0	(0)	14	(36.84)	24	(63.16)		
Motor Skills* *(not available in chart n=6)*								
Mild (n=76)	14	(18.42)	26	(34.21)	50	(65.79)	7.058	0.05
Moderate (n=114)	13	(11.40)	38	(33.33)	76	(66.67)		
Severe (n=52)	6	(11.54)	28	(53.85)	24	(46.15)		
Hemianopsia* *(not available in chart n=100)*								
Yes (n=45)	8	(17.78)	24	(53.33)	21	(46.67)	0.183	1.00
No (n=103)	21	(20.39)	51	(49.52)	52	(50.49)		
Length of Stay in days (mean,SD)	18.68	(21.24)	21.25	(24.53)	17.70	(22.84)	n/a	0.2592
Discharge Destination* *(not available in chart n=5)*								
Home (n=105)	14	(13.33)	27	(25.71)	78	(74.29)	19.336	0.001**
Rehabilitation (n=54)	13	(24.07)	31	(57.41)	23	(42.59)		
Long term care (n=43)	4	(9.30)	16	(37.21)	27	(62.79)		
Deceased (n=18)	0	(0)	4	(22.22)	14	(77.78)		
Other (n=23)	2	(8.70)	12	(52.17)	11	(47.83)		

***Note: Some n's may vary due to data not available in the chart** **The distribution is significant* ***Standard Deviation*

Table 4: Hospital Characteristics According to Type of Unilateral Spatial Neglect (USN) Assessment

HOSPITAL CHARACTERISTICS	Standardized Assessment of USN (n=33)		*"Ever Assessed"* for USN = Yes (n=93)		*"Ever Assessed"* for USN =No (n=155)		Chi-Square	P value
	n	%	n	%	n	%	X^2	p ≤
Type of Hospital								
Teaching (n=89)	9	(10.11)	56	(62.92)	33	(37.08)	38.276	0.001*
Community (n=159)	24	(15.09)	37	(23.27)	122	(76.73)		
Location of Hospital Site								
Rural (n=122)	11	(9.02)	46	(37.71)	76	(62.30)	0.004	1.00
Urban (n=126)	22	(17.46)	47	(37.30)	79	(62.70)		
Number of Beds								
<250 beds (n=154)	23	(14.94)	59	(38.31)	95	(61.69)	0.114	1.00
≥250 beds (n=94)	10	(10.64)	34	(36.17)	60	(63.83)		
Annual Number of Stroke Admissions								
<150 clients (n=106)	17	(16.04)	41	(38.68)	65	(61.32)	0.110	1.00
≥150 clients (n=142)	16	(11.27)	52	(36.62)	90	(63.38)		
Number of Occupational Therapists employed (full-time/part-time) (mean,SD****)	6.74	(3.82)	6.09	(4.16)	8.55	(4.38)	n/a (t=-4.42)	0.00001*
Number of Neurologists employed (full-time/part-time) (mean,SD)	3.03	(1.17)	3.04	(1.52)	3.10	(2.19)	n/a (t=-0.25)	0.40
Location of Stroke Care** *(not available in chart n=9)*								
General Medical Unit (n=177)	24	(13.56)	68	(38.42)	109	(61.58)	6.644	0.10
Neurology (n=22)	1	(4.55)	5	(22.73)	17	(77.27)		
General Rehab unit in Hospital (n=22)	6	(27.27)	12	(54.55)	10	(45.46)		
Other units (n=18)	1	(5.56)	4	(22.22)	14	(77.78)		
Discipline assessing USN								
Occupational Therapist (n=50)	29	(58.00)	50	(100.00)	***		***	***
Neurologist (n=34)	1	(2.94)	34	(100.00)	***			
Other health professionals (n=9)	3	(33.33)	9	(100.00)				

The distribution is significant* *** Note: Some n's may vary due to data not available in the chart*** ****Not applicable: Clients were not assessed for USN* ***** Standard deviation*

aphasia into consideration. These clients typically had normal muscle tone in the affected upper extremity. Those who received a standardized assessment were often discharged to a rehabilitation center for further assessment and treatment, compared to those who did not receive a standardized assessment. An anomalous finding was that hospitals where clients were assessed for USN with the use of standardized tools were primarily community-based sites.

Univariate analyses were performed to explore the client and hospital variables associated with whether clients were "ever assessed" for USN, dichotomized as either *yes* or *no* (Tables 3 or 4). Of the 11 client variables, 4 were strongly associated with clients who were "ever assessed" for USN but, these variables did not achieve significance. When comparing subjects who were "ever assessed" for USN as either *yes* or *no*, subjects who were "ever assessed" (usually female) had moderate-to-severe cognitive impairments and, had either hemiplegia of the affected upper extremity or hemiparesis of the dominant hand. There was a significant association between patients "ever assessed" for USN and their discharge destination, such that these patients were typically discharged to a rehabilitation center for continued assessment and treatment. Of the 8 hospital variables, 2 variables were significantly associated with clients who were "ever assessed" for USN: these clients were from teaching hospitals but were managed by a small number of occupational therapists, which was also an unusual finding.

CHAPTER 9 DISCUSSION

9.1 Prevalence of USN Assessment

The objectives of this study were to estimate the prevalence, timing and frequency of use of standardized assessments to evaluate USN within the three hemispaces in patients admitted to acute care hospitals post stroke. The findings from this multi-center cross-sectional study indicated that USN was not routinely assessed in acute care patients with stroke. An extensive review of the recent literature revealed no similar study to date. It was, thus, impossible to compare this study to those of others. Nonetheless, with a large sample size for this study (n=248) and despite the actual prevalence of use of standardized tools to detect USN post stroke (13.31%, C.I. 9.08-17.54%) being far below the estimated prevalence of 40%, the study had adequate power to produce results with 95% confidence. It was possible to accurately generalize the prevalence of use of standardized assessments to evaluate USN to acute care sites across Ontario due to a narrow margin of error of ±4.23% obtained from this study sample. It is likely that this pattern of low use of standardized USN tools is also prevalent across the Canadian provinces, given that Ontario is considered a leader in the area of evidence-based practice for stroke rehabilitation[73]. There have been a number of exciting initiatives to ensure equitable access to stroke care across the province and to develop a coordinated, client-focused approach. The Heart and Stroke Foundation of Ontario has put major efforts in improving quality of care by creating a web site designed for stroke care providers with the purposes of assisting regional stroke centers, district stroke centers, hospitals, and other

organizations to develop and provide organized stroke care and evidence-based approaches for clinical practice[73].

Given the low prevalence of standardized assessment use, when clients who were "*ever assessed*" for USN were examined, its prevalence of use was comparable to the hypothesized prevalence of 40% projected prior to initiation of the study. Interestingly, USN was detected in more than 60% of these subjects, emphasizing the importance of screening for this impairment in all clients with a diagnosis of stroke.

Moreover, the reported use of standardized tools specific to USN was extremely low compared to tools assessing visual perception with a USN component. The need to amalgamate USN and visual perception into one category raises a serious issue, in that health professionals may have overlooked the complexities of USN and the importance of screening for this deficit in the three hemispaces with the use of standardized tools. Neuroimaging studies[13-18] and clinical studies related to USN assessment[19-22] have supported the importance of evaluating each of these spaces individually with the use of valid and reliable tools specific to USN. There are 61 standardized and non-standardized tools with published psychometric properties that are available to assess USN in each of the hemispaces (Appendix A), but only five of these tools were reported in 248 charts. Cognitive rehabilitation has been strongly recommended for all clients identified with USN post stroke[45], but tools specific to USN are required to quantitatively identify the areas of impairment and disability. Therefore findings from this study have clearly demonstrated that use of standardized tools warrants further emphasis among health professionals.

Of those who received a non-standardized assessment of USN, the majority of these subjects were screened for USN during an ADL assessment (36.52%). With the use of clinical evaluations, the impact of USN on the functional performance of the patient may be observed; however health professionals still have the responsibility to quantitatively document their observations using standardized assessment tools[35-38]. Furthermore, as noted by several authors[8,9], symptoms of USN have to be quite severe (patient collides into his/her surroundings, ignores food on one side of the plate, and attends to only one side of his/her body) for this impairment to be easily observed during functional activities.

While it was hypothesized that the *near extrapersonal space* (area within reaching distance of the subject) was the hemispace most often assessed, it was not anticipated that it would be the only hemispace evaluated using standardized assessments. Of the 28 standardized tools with well-documented psychometric testing (Appendix A), at least 20 of these tools primarily assess the *near extrapersonal space*. Standardized tools such as the Albert's Test[74], Line Bisection Test[70], and Single Letter Cancellation Test[66] are widely available and universally recognized as tools that assess USN in this hemispace. This may explain why this hemispace was most commonly assessed. Surprisingly, not even 1 of the 248 clients was assessed for USN within all three hemispaces with the use of standardized tools. A possible explanation may be that there are only 6 published standardized tools that combine two or more hemispaces (Appendix A). Another important finding was that few patients were assessed for USN in the *far extrapersonal space* (the area beyond reaching distance of the client)

regardless of the type of assessment used. This poses a serious hazard for safe ambulation and reintegration into the community. The strong correlation between the presence of USN and a higher risk for falls during hospitalization[28] clearly substantiates the need for early identification of this impairment in the *far extrapersonal space*, along with the other hemispaces following a stroke.

9.2 Timing of USN Assessment

Clinical Guidelines for Stroke have recommended that it is "best practice" for health professionals to screen for cognitive deficits, including visual perception and USN[35-38]. They recommend the use of standardized tools within 48 hours of the client regaining consciousness post stroke[35]. In this study, only 8 of the 248 clients received a standardized assessment for USN within the 2-day critical evaluation period. If patients were systematically screened within the 2-day period, the necessary steps to promote safety during hospitalization and a successful return of functional abilities could have been taken. Furthermore, detection of USN decreases the likelihood that a patient will be incorrectly identified in the early hospital period as having a cognitive problem, being non-compliant or unmotivated to respond. Of additional concern is the number of patients being discharged directly home who may resume high-risk activities, such as driving, with an undetected USN of the far extrapersonal space.

9.3 Frequency of USN Assessment

The standardized tools most commonly used to screen for USN were the The Clock Drawing Test (CDT)[71] , the Ontario Society of Occupational Therapists

(OSOT) Perceptual Evaluation[72] and much more rarely, indeed only once each, the Motor-Free Visual Perceptual Test[68], the Line Bisection Test[70] and the Single Letter Cancellation Test[66]. The Ontario Society of Occupational Therapists (OSOT) Perceptual Evaluation consists of 18 tests that measure scanning, neglect, apraxia, body awareness, visual agnosia, spatial relations and stereognosis. The items of this tool assess USN primarily in the *near extrapersonal space* as well as representational neglect, which is when an individual omits objects that appear on the left side of the mental image (body awareness). The battery is a broad screening tool for perceptual dysfunction in areas related to basic living skills. It is also used to evaluate the degree of impairment, to monitor change and to measure the effects of treatment and/or spontaneous recovery. Inter-rater reliability has shown very high agreement (93.1%) and good internal consistency with this tool[72]. What was most interesting was that the OSOT Perceptual Evaluation, developed by an Ontario team, along with the other standardized tools were used in 39.39% of the subjects located in one hospital site. Frequent use of this tool within that particular hospital site may be due to the positive results of a knowledge translation strategy implemented by local advocates. Translating new science regarding assessment and treatment protocols is a difficult process. The use of local advocates or key stakeholders (patients, consumers, policy makers and researchers) may be the most effective way of applying evidence-based clinical knowledge to initiate change in hospital policies and procedures, as described by the Pathman-PRECEED model for knowledge translation[75,76].

Another standardized tool most commonly used was the Clock Drawing Test (CDT)[71]. This tool is a quick paper-and-pencil task where the client is simply asked to place numbers inside a circle to make a face of a clock. The rapidity of administration may explain why this tool was most often used (66.67%, n=22/33) among the other standardized tools. Omissions or misplaced numbers on the clock are scored to identify the presence of USN in the *near extrapersonal space.* The presence of constructional apraxia, aphasia, motor deficits and other visual perception deficits can falsify the results of this tool. CDT has received mixed reviews for its construct and criterion validity[71,77,78]. When 4 traditional tests such as Line Bisection[70] or Albert's Test[74] were compared with the CDT, it was found to be least sensitive (42%) in detecting those with USN[77,78]. However, using a structured scoring procedure, more accurate and consistent scoring of the CDT was shown[79].

One important point was that constructs measured by both the CDT and the OSOT Perceptual Evaluation can accurately identify perceptual impairments in general, along with components of USN. However, there is no psychometric information published on whether these two tools are capable of detecting USN within the three hemispaces in acute clients post stroke. These tools were not completely appropriate for the target population of this study, such that use of standardized assessments specific of USN would have been more suitable.

Patients who received an initial assessment of USN were rarely reassessed in this study. As would be expected, those few in whom USN was detected during the initial assessment were more likely to be reassessed for USN. A recent study substantiated the importance of follow-up assessments,

such that when clients assessed within a week of a right hemisphere stroke were followed over time, they demonstrated improvements in USN and gains in functional performance during ADL[32]. These significant improvements in ADL continued up to three months post stroke[32], which emphasizes the importance of monitoring USN with evaluative tools during the acute and post-acute phases of recovery.

9.4 Client and Hospital Variables Associated with Assessment of USN

Clients diagnosed with a right hemisphere stroke were more likely to receive a standardized assessment of USN compared to those with a left hemisphere stroke. Positron emission tomographic (PET) scan analyses[23] and a systematic review of 17 studies[24] have suggested the right hemisphere is dominant in regulating attention and this, in part, may explain why clinicians were more likely to assess for USN in patients with a right hemisphere stroke. When comparing patients who did or did not receive a standardized assessment of USN, those who received a standardized assessment were slightly younger in age and had a mild-to-moderate stroke severity. They were, thus, potentially easier to assess. These clients also had normal muscle tone in the affected upper extremity, such that they were capable of holding a pencil to complete the Clock Drawing Test[71], Line Bisection Test[74] and Single Letter Cancellation Test[66].

When comparing whether subjects were "ever assessed" for USN as either *yes* or *no*, subjects who were "ever assessed" had moderate-to-severe cognitive impairments and, had either hemiplegia of upper extremity or hemiparesis of the dominant hand. They were, thus, potentially harder to assess

with standardized assessments that require them to hold a pencil, but were capable of receiving non-standardized assessments for USN. These patients were generally discharged to a rehabilitation centre, where USN detection may have led to several subsequent actions such as identifying the need for further perceptual assessment and commencing treatment interventions involving visual-perception rehabilitation. However a large number of clients who should have potentially received a USN assessment were also discharged home. These individuals may have experienced more subtle forms of USN that may have gone undetected. This lack of detection becomes a major concern for functional performance and safety upon return home to a more dynamic environment.

Admission to a teaching hospital was significantly associated with a greater chance of being "ever assessed" for USN. Teaching sites typically emphasize evidence-based clinical practice, such that comprehensive assessments are systematically performed to obtain a baseline profile, set treatment goals, plan treatment programs and monitor patient status and the quality of care provided[35-38].

There were a few results from this study that were difficult to interpret. One finding was where patients from community-based sites were more likely to receive a standardized assessment of USN compared to those from teaching sites. A possible explanation may be that 39.39% of clients who were assessed for USN with a standardized tool were located in one community-based site. The characteristics of this particular hospital may have driven the results for all hospitals where clients received a standardized assessment. Another unusual finding was that clients who were "ever assessed" for USN were located in

hospitals with a small number of occupational therapists employed. Recent studies have substantiated the effectiveness of organized stroke care (stroke units), made up of an extensive team of specialized health professionals, including occupational therapists, to reduce mortality, length of hospital stay and functional dependence in patients post stroke[81]. Moreover, the small proportion of clients who were "ever assessed" for USN may not be substantial enough to make any definite inferences regarding these hospital characteristics.

One important finding in this study was that health professionals within a hospital had similar practice patterns. There were five sites where more than 60% of clients were "ever assessed" for the presence of USN. In another five sites, less than 15% of clients were "ever assessed" for USN. These results demonstrate that similar practice patterns for the assessment of USN seemed to occur within a given site, such that once advocates can target individual hospitals that require professional education, they can work on emphasizing the routine use of standardized USN assessments.

9.5 Limitations of the Study

A retrospective, cross-sectional study design restricted data collection to what was available in the chart. A prospective study may have allowed clarification of assessment practices to screen for USN by consulting with the individual therapists. However, a prospective study may have introduced bias because knowledge of its objectives may have influenced practice patterns of health professionals. With the use of historical data from charts, the data for this

study were based on written evidence from a permanent record. This was actually a strong point of the study design.

The hospitals that were randomly selected for the study were from an equal distribution of urban and rural regions of Ontario. However, there was an uneven stratification of 4 teaching sites and 6 community-based sites, which could have been a potential source of bias. Further analysis of the hospital characteristics revealed that the 4 teaching hospitals randomly selected from the stratum had on average more hospital beds (295 beds vs. 274 beds) and had twice the annual rate of stroke admissions (370 admissions vs. 152 admissions in 2002), in comparison to the 6 community-based hospitals. Therefore, this uneven stratification had a positive impact in the study, such that a proportional sample was ultimately achieved with equal representation of both teaching and community-based sites.

Ascertainment of past exposure to assessment of USN could have been difficult because the data relied on the heath professionals' practice patterns of documenting information for data collection. However, it was assumed that health professionals were adhering to regulations of their provincial licensing bodies that required clear documentation of results of all evaluations/interventions in the medical chart[81].

CHAPTER 10 CONCLUSION

Even though USN is among the most disabling features of stroke and is one of the strongest predictors of functional outcome in these clients[34], health professionals in Ontario acute care hospitals have "neglected" the assessment of

USN with the use of standardized tools within the three hemispaces. It is likely that this pattern of low use of standardized USN tools is prevalent among the other Canadian provinces, given that Ontario has taken many leads to develop quality evidence-based practice and equitable access to stroke care across the province.

Once the findings of this study are disseminated, a team of researchers and local advocates for the acute care hospitals can be created to systematically plan assessment protocols for USN and ensure that routine assessment with the use of standardized tools is incorporated into daily practice.

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CHAPTER 12

APPENDIX A: Manuscript

Evaluating Unilateral Spatial Neglect Post Stroke: Working Your Way Through the Maze of Assessment Choices

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ABSTRACT

This study identified, using a comprehensive review of the literature, 61 standardized and non-standardized assessment tools that exist to evaluate unilateral spatial neglect (USN). Each standardized tool was critically appraised according to its purpose (hemispace assessed), psychometric properties, and client appropriateness. The findings on the 28 standardized tools were complied into a ***USN ASSESSMENT SUMMARY GUIDE*** to facilitate clinical decision-making regarding the standardized USN assessments that are appropriate for specific clients at different phases of their recovery post stroke.

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KEY WORDS: Stroke, Visual perception, Unilateral spatial neglect, Visual neglect, Inattention, Evaluation, Psychometric properties, Reliability, Validity, Assessment tools.

INTRODUCTION

Approximately 700,000 individuals experience a new or recurrent stroke each year, such that this disease has been identified as the leading cause of serious, long-term disability for adults in the United States[1]. While some patients recover completely post stroke, approximately 15-30% of patients are left with permanent functional impairments or disabilities, and 15-20% require institutional care three months post onset[2]. Sequelae post stroke depend on the location of brain involvement and, can impact on virtually all skills required for functional performance and participation in society. In addition to motor, sensory and communicative deficits, patients may also experience cognitive and perceptual impairment[3].

Unilateral spatial neglect (USN) is one of the disabling features of a stroke, and is defined as a failure to report, respond, or orient to stimuli presented to the side opposite a brain lesion[4]. Clinically, the presence of severe USN is apparent when a patient frequently collides into his/her surroundings, ignores food on one side of the plate, and attends to only one side of his/her body[5]. However as noted by several authors[6,7], symptoms of USN have to be quite severe for this impairment to be easily observed during functional activities of daily living. More subtle forms of USN may go undetected in a hospital setting but are a major concern for client function and safety upon return home to a more dynamic environment.

What is USN?

USN is a serious deficit post stroke because its symptoms are often complex and not immediately recognized by a clinician or client alike. The client is unable to attend to one side of his/her body (personal neglect), the space within reaching distance (near extrapersonal neglect), the space beyond reaching distance (far extrapersonal neglect) or to a combination of these three spaces in the environment[8,9]. Recent neuroimaging studies[10-15] and clinical trials using assessment tools specific to the three hemispaces[16-19] have revealed that separate neural mechanisms are involved in exploring each hemispace, which supports the importance of evaluating each of these spaces individually with the use of assessment tools. Many terms are used interchangeably in the literature to describe USN, including unilateral neglect, hemi-inattention, visual neglect and hemispatial neglect.

Why is it critical to assess USN?

The presence of USN has been associated with an increased risk for injury and with poor functional outcome. Ugur and colleagues studied 293 individuals admitted to a stroke unit and found that those with right hemisphere lesions were more likely to fall during their hospitalization compared to those with left hemisphere lesions, 36.6% versus 24.1% [20]. The authors suggested that the presence of USN might, in part, explain these findings. Kalra and collaborators explored the influence of USN on functional outcomes within a week post stroke by comparing 47 subjects with neglect to a matched control group[21]. Both groups

had moderate stroke severity as well as similar demographic characteristics, pre-stroke function, and post stroke motor strength in the affected arm and leg. Subjects with neglect were found to have lower median functional scores on the Barthel Index[22], a scale used to measure basic activities of daily living (ADL), at both admission and discharge. When 27 individuals were assessed within a week post right hemisphere stroke and followed over time, there was a positive correlation between recovery from USN, as measured by the Rivermead Behavioral Inattention Test[23] and improved functional performance on the Barthel Index after one month[24]. Improvements in their ability to attend to the neglected hemispace carried over to gains in functional performance during ADL. These individuals continued to show significant improvement in ADL up to three months post stroke[24].

The effects of USN extend beyond the basic skills for self-care (bathing, dressing, walking, etc.) to instrumental activities of daily living (IADL) that are crucial for successful reintegration into community living. These complex activities include performance of domestic chores, menu reading, using a map, telephone dialing and ambulating outdoors. Jehkonen and collaborators assessed motor, sensory and cognitive impairments in 57 subjects within 10 days of a right hemisphere stroke: USN as assessed on the Rivermead Behavioral Inattention Test[23] was the strongest predictor of functional recovery at one-year post stroke on the Frenchay Activities Index[25], a measure of performance in IADL. The presence of USN explained 73% of the total variance in IADL at a three-month follow up, 64% at 6 months and 61% at one-year post stroke[26].

Who should be assessed for USN?

It has long been assumed that perceptual deficits, including USN, are common in individuals with right hemisphere damage (RHD) and that routine screening for this deficit in those with RHD is time well spent. Positron emission tomographic (PET) scan analyses[27] and a systematic review of 17 studies[28] have substantiated the dominance of the left hemisphere in modulating arousal and attention for the right visual field, whereas the right hemisphere controls these processes in both right and left visual fields[29]. This is a plausible explanation for why USN is not typical in those with left hemisphere damage (LHD) because the intact right hemisphere is capable of compensating for perceptual deficits that result from a LHD[29]. However, there is evidence that the finding may be an artifact resulting from a failure to identify USN in those with LHD: when assessed with the Rivermead Perceptual Assessment Battery[30], 47% of non-dysphasic subjects with LHD post stroke were identified as having USN[31]. Once those with language deficits were included in the sample, almost every dysphasic subject (97%) with a LHD was screened positive for USN within 48 hours post stroke[31], suggesting that the lack of assessment of those with aphasia may account, in part, for the low incidence of USN reported in those with a LHD. In summary, USN continues to be commonly associated with a right stroke, but evidence from the literature suggests that all patients with stroke might benefit from screening.

Various standardized assessment tools (SAT) and non-standardized assessment tools (NSAT) are available to assess USN at the impairment and disability level in each of the hemispaces. Clinical Guidelines for Stroke have

recommended that it is "best practice" for acute care clinicians to screen for USN post stroke during routine neurological examination using standardized assessment tools/scales in a more consistent and systematic manner[32,33]. Clinicians have the responsibility to quantitatively document their observations using assessment tools and stroke scales that can evaluate the impairments and disabilities related to USN as well as document any clinical change over time.

Given that those with USN are at a greater risk for falls and poor functional outcome[20], and given that recent clinical trials have substantiated the effectiveness of cognitive rehabilitation to improve visual attention and scanning on an impairment level[34,35], timely and accurate assessment of USN is a critical component of best practice for those with stroke. Therefore the objectives of this study were to: (1) identify standardized and non-standardized assessment tools that exist to assess unilateral spatial neglect, (2) critically appraise the standardized assessment tools according to their purpose, psychometric properties and client appropriateness, and (3) create a ***USN ASSESSMENT SUMMARY GUIDE*** for clinicians to facilitate decision-making regarding the standardized USN assessments that are appropriate for specific clients post stroke.

METHODS

A comprehensive review of the medical literature was performed covering the period from 1966 to March 2003 using electronic databases (MEDLINE, CINAHL, HealthSTAR, PsychINFO, and Health and Psychosocial Instruments) to search for articles relating to USN assessment tools with the following key terms:

neurology /stroke/ CVA/ cognition/ visual-perceptual/ visual-inattention/ hemi-inattention/ unilateral spatial neglect/ unilateral neglect/ spatial neglect/ assessment/ evaluation/ measurement/ screening tools/ psychometric properties/ neurological examination/ psychometrics/ reliability/ validity/ sensitivity. The Cochrane Library[36] was explored for systematic reviews using the same key terms. Reference sections of all journal articles retrieved were reviewed in search of other pertinent articles. All major authors working in the area of USN were also searched according to their citation indexes using the ISI Web of Science[37] database to verify that all publications relevant to the assessment of USN were obtained. Textbooks that pertained to USN were also included in this review. The tools were compiled in a list, categorized as either standardized or non-standardized, and identified according to the specific hemispace assessed (personal space, near extrapersonal space and far extrapersonal space). An assessment tool was considered *standardized (*SAT*)* if it had published procedures for administration, scoring and interpretation, and evidence of reliability or validity specifically for individuals with USN post stroke. A tool was recognized as *non-standardized* (NSAT) when it had no or very few published procedures for administration, scoring and interpretation, and had no or very minimal evidence of reliability or validity in studies on clients with USN. "Homegrown" assessment tools developed by clinicians for use within their hospital setting that have no or minimal psychometric properties are included in this classification.

A ***USN ASSESSMENT SUMMARY GUIDE*** was then developed to provide a user-

friendly reference guide that categorized standardized assessment tools for USN according to their: (1) purpose (2) psychometric properties and (3) client appropriateness (Appendix A). Tools were also categorized according to the hemispace assessed and were described in five sections; A-I being those assessing only personal space, A-II being those assessing only near extrapersonal space, A-III being those assessing near and far extrapersonal space, A-IV being those assessing personal and near extrapersonal space and finally, A-V being those assessing all three hemispaces. The psychometric properties of these tools (reliability, validity and responsiveness) and references to their studies are included in the Guide. Skills required from the client to obtain valid testing results, other than visual perception, along with concerns for apraxia and aphasia that may influence a client's performance, are also described. The testing position and time for administration are included as a guide to whether the assessment tool is appropriate based on the client's phase of recovery and the setting.

RESULTS

A total of 61 published standardized and non-standardized assessment tools that assess USN at the impairment and disability levels were identified. 28 standardized tools were identified and are summarized in detail in the ***USN ASSESSMENT SUMMARY GUIDE*** (Appendix A): only two evaluate USN of personal space exclusively, 20 assess near extrapersonal space. Five tools combine the assessment of the two separate hemispaces. Only one tool was found to

incorporate the three hemispaces in the assessment, the Catherine Bergego Scale[38]. Tools were generally classified according to their psychometric strength in the order of strong to poor psychometric properties in the ***USN ASSESSMENT SUMMARY GUIDE***.

Assessment in the Acute Care Phase

Tools were evaluated for their possible use in the early acute care phase based on ease of bedside use and speed of administration, recognizing that the acute care occupational therapist may have only short periods of time to screen patients. The Comb and Razor Test[19] and the Semi-structured Scale for the Functional Evaluation of Hemi-inattention in Personal Space[18] both screen for USN in the personal space by assessing the client's performance in functional activities, such as using a comb or applying makeup. While easy to use, these tools have only minimal evidence of reliability and validity[18,19]. The Comb and Razor test has good test-retest reliability to ensure that the scores can be reproduced[19] and that the test can discriminate between those with and without neglect post right hemisphere stroke, those with a left hemisphere stroke, and the healthy controls[18]. Although the Semi-structured Scale for the Functional Evaluation of Hemi-inattention in Personal Space is not responsive to clinical change following rehabilitation interventions and does not correlate with other tests commonly used to detect USN, the items within this test do correlate with each other in that they measure the same construct[18]. Although the Comb and Razor test does have stronger psychometrics between the two tools, more testing

is required for both assessments prior to clinical use.

To evaluate USN in the near extrapersonal space, there are quite a few tests that are easy to administer by the bedside once the patient is sufficiently alert, able to hold a pencil and use his/her eyewear, such that these tools can be appropriate for a busy acute care setting. The Line Bisection Test[39] is quick test that requires the patient to cross through the center of a series of 18 horizontal lines. Numerous authors have evaluated the Line Bisection Test for its test-retest reliability; construct validity, convergent and divergent validity, and criterion validity, resulting in evidence of its strong psychometric properties in comparison to the other paper-and-pencil tests mentioned below[39-45]. The Albert's Test[46] requires the patient to cross through the center of 41 randomly oriented lines arranged on a page while the Single Letter Cancellation Test[47] requires the individual to cross out all "H's" presented on a page with six rows of 52 typed letters. These tools both have strong psychometric properties, including reliability and validity, in identifying USN in the near extrapersonal space[40-42,48-50]. Yet, in a study of 104 subjects with right brain damage who were tested on both the Albert's Test and the Single Letter Cancellation Test, the latter consistently produced higher estimates of USN in subjects, possibly because of the higher density of stimuli presented as compared to the former[50]. In contrast, the Albert's Test was more sensitive in detecting clinical change three months post stroke as compared to the Single Letter Cancellation Test, and that results from this test within 48 hours of admission were predictive of functional outcome at six months post stroke[48]. Although the two tests have good psychometric properties, they

differentiate in their sensitivity to detect USN and their ability to predict functional outcomes post stroke. The Star Cancellation Test[23] and the Bell's Test[51] are two cancellation tests where the patient is asked to cross out either stars or bells that are interspersed among a random array of distracters. These tests require the patient to visually discriminate the targets from surrounding distracters, which requires recruitment of additional visual perceptual skills. Both assessments have excellent construct and criterion validity[41,44,45,51-53], however no published data exist on their reliability and responsiveness. The two tests require test-retest reliability prior to their use in clinical practice to ensure that their results can be accurately reproduced when no change has occurred.

There are a number of tools that require the patient to draw in order to detect USN, however therapists must be cautious in that the presence of constructional apraxia, aphasia, motor deficits and other visual perception deficits can falsify the results of these tools. The Draw-A-Man Test[53] and the Rey Complex Figure Test[54] are well-known psychological assessments that are reliable and valid in evaluating perceptual organization, visual memory and visual motor skills post stroke[49,56-58]. When Chen-Sea developed scoring procedures specific to USN for the Draw-A-Man Test, it was found to have good test-retest reliability and its scores correlated with ADL performance on the Klein-Bell Scale[58]. The Rey Complex Figure Test also has good test-retest reliability and accurate detection, however its strong psychometrics properties are generalized to visual perception and not specific to USN. Furthermore, this tool requires that the client be seated in front of a table to administer the tool. The Clock Drawing

Test (CDT)[59], a quick paper-and-pencil task where the patient is asked to place numbers inside a circle to make a face of a clock, has received mixed reviews for its construct and criterion validity[41,59,60]. It is shown to be the least sensitive of a number of tools, detecting only 55.3% of those with USN as compared to other traditional tests such as Line Bisection or Albert's Test[60]. A possible explanation for this poor sensitivity is that the constructs measured with the CDT, similar to the Rey Complex Figure Test, are generalized to visual perception or cognition and not to USN. However, using a structured scoring procedure, more accurate and consistent scoring of the CDT has been shown[61].

There are two additional tools, the NIH Stroke Scale[62] and the Hemispheric Stroke Scale[63] that quantitatively measure motor, sensory, perceptual and speech impairments, with one item involving the assessment of USN for the personal space and near extrapersonal space. Both tools require less than 10 minutes to administer and have no evidence for reliability, although they do vary in terms of their psychometric strength: scores on the NIH Stroke Scale are predictive of CT-scan results at 7 days[64] and are responsive to clinical change following rehabilitation[65], whereas scores on the Hemispheric Stroke Scale are only shown to correlate significantly with the Barthel Index[22], a 10-item scale of performance in activities of daily living scale[63].

Functional measures to assess USN in the near extrapersonal space exclusively, such as the Baking Tray Task[66], where the patient is asked to pick up 16 "buns" and spread them as evenly as possible on a board, has been validated for this population[49]. But there is no published evidence for test-retest reliability,

where the results on this test can be reproduced even when no change has occurred. Finally, there are two functional assessments that combine the near and far extrapersonal space when evaluating USN: the Semi-structured Scale for the Functional Evaluation of Hemi-inattention in Extrapersonal Space[18] and the short version of the Rivermead Behavioral Inattention Test (RBIT)[67]. The Semi-structured Scale for the Functional Evaluation of Hemi-inattention in Extrapersonal Space is a tool comprised of four subtests: serving tea, card dealing, picture description and description of an environment. The client is asked to perform these activities with objects that are provided on a table. The short version of the RBIT involves three conventional subtests (line crossing, Star Cancellation Test and figure copying) and five behavioral subtests (picture scanning, menu reading, eating a meal, article reading and coin sorting). Both of these functional tests are quick to administer at the bedside and have some evidence of reliability and validity[18,68]. They are also responsive to clinical changes that occur spontaneously or following rehabilitative intervention[18,68]. Although these tools are quick to administer in a busy acute care unit and can be used for reassessment following treatment in a rehabilitation setting, they do require additional skills such as writing, reading, letter recognition, visual memory and discrimination and visual perception. It may be challenging for clients to perform these high-level activities early on post stroke, however these functional assessments become more useful upon discharge planning.

Assessment in the Rehabilitation Phase

A client receiving rehabilitation is usually medically stable and can tolerate a lengthier evaluation, one that may provide information on the specific deficits that require intervention. Most tools available to identify USN solely in the personal space[18,19] are used for screening and as such are not as responsive to change, nor do they provide the detailed evaluation required for treatment planning.

In the assessment of near extrapersonal space, the Raven Colored Progressive Matrices[69] is a visually administered test that requires picture matching, pattern completion and analogical reasoning. While numerous studies have documented the strong validity of this tool for evaluating USN and its responsiveness to clinical change[70-72], this review found no published evidence for its reliability. The Wundt-Jastrow Illusion Test[73] is a well-known psychological assessment tool where pairs of circular sections or "fans" are presented in 10 different sizes, two orientations (upward-downward convexity) and two directions (leftward-rightward) and the patient is asked to identify which of the two fans is larger. Although this tool has normative data to identify those with USN in the near extrapersonal space, only minimal validity has been documented[73] and no reliability studies have been published for the stroke population. Therefore, these two tools require further psychometric testing prior to their use to assess USN in a rehabilitation setting.

The Rivermead Perceptual Assessment Battery (RPAB)[30] and the Motor-Free Visual Perception Test (MVPT)[74] have recently been examined for their

psychometric properties to assess visual perception post stroke. Both assess the various components of visual perception, such as figure ground discrimination, visual discrimination, and spatial relations including visual spatial scanning, in a formal testing environment. The RPAB requires the patient to hold a pencil and read sentences during functional activities, whereas the MVPT only involves vision without any other movements or practical skills. The MVPT has normative data to identify USN[74] and has some evidence of validity for detecting perceptual deficits in general[75]. The RPAB has more published data regarding the strength of its reliability[30], construct validity[76,77] and responsiveness to change following treatment for USN[21,78]. However, the shortened version of the RPAB[67] with selected subtests such as copying words and shapes, cube copy, 3-D copy, cancellation, figure ground, sequencing pictures and body image, has not been evaluated for the detection of USN specifically but can accurately identify perceptual impairments in general[79]. In summary, the MVPT and the RPAB are useful tools to detect USN but they do require a number of additional skills from the client.

The Rivermead Behavioral Inattention Test (RBIT)[23] detects USN in the near and far extrapersonal space at the level of impairment and disability. This tool is comprised of six conventional subtests (line crossing, Single Letter Cancellation Test, Star Cancellation Test, figure/shape copying, Line Bisection Test and representational drawing) and nine behavioral subtests (picture scanning, telephone dialing, menu reading, article reading, telling and setting time, coin sorting, address and sentence copying, map navigation, and card

sorting). It is widely used in clinical studies to assess USN and has demonstrated excellent test-retest reliability and construct validity[23, 24,28,80]. Most importantly this tool is developed specifically to assess USN, such that its constructs address the various components of this impairment. It is therefore not surprising that this tool can predict functional outcome on the Frenchay Activities Index at a 3-month, 6-month and 12-month interval post stroke. It requires 30 minutes to administer and involves additional skills such as writing, reading, recognize letters, holding a pencil, visual memory and discrimination, along with unilateral voluntary movement and control of the upper limb. However, the above skills are important for successful reintegration into the community upon discharge, such that this tool is recommended for USN assessment during the rehabilitation phase.

Finally, there is one assessment tool that evaluates USN in all three hemispaces: the Catherine Bergego Scale[38]. It requires direct observation of a client post stroke with mild impairments in 10 everyday activities such as dressing, grooming, eating, mouth cleaning, personal belongings, safe mobility, gaze orientation, auditory attention, spatial orientation, and knowledge of left limbs. This scale can also be administered as a questionnaire to assess how the patient self-evaluates his/her neglect during ADL using the same scoring system thereby evaluating the extent of anosagnosia. This tool strongly correlates with the paper-and-pencil tools specific to USN[38,81], such as the Albert's Test and Bell's Test, along with performance in functional activities as measured by the Barthel Index. It is also responsive to clinical change following the use of spatio-motor cueing in clients with USN post stroke[82]. Although this tool requires control

of both the upper and lower limbs in various testing positions and at least 30 minutes to administer, its constructs specifically address the various components of USN. But there is no published evidence for test-retest reliability, such that results on this test cannot be reproduced even when no change has occurred, which one downfall for its use in clinical practice.

CONCLUSION

Unilateral neglect is a common deficit post stroke that leaves clients at a greater risk for falls and poor functional outcome, warranting the early detection and treatment of USN. It presents as a complex constellation of symptoms that can occur in three distinct hemispaces, such that the discriminating choice of standardized tools to detect and accurately measure this specific range of deficits is important. In a recent publication, Bailey and Riddoch reviewed eight tools that are commonly used to assess USN[83]. In the current study we identified 61 published tools for the assessment of USN, leading to the creation of the ***USN ASSESSMENT SUMMARY GUIDE*** that categorizes the 28 standardized tools according to their purpose, psychometric properties, client and environmental factors. It is anticipated that the Guide will facilitate clinical decision-making regarding the best assessment tools for clinicians to use in evaluating USN in clients post stroke.

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APPENDIX A: *UNILATERAL SPATIAL NEGLECT ASSESSMENT SUMMARY GUIDE*

A-1: PERSONAL SPACE

Assessment	Description	Reliability	Validity	Skills Required
Comb and Razor Test (Robertson & Beschin, 1997)	Patient is asked to demonstrate the use of two common objects for 30 seconds each: comb, razor/powder compact. Each object is placed at the patient's midline. **Scoring:** The number of strokes with the razor, comb or powder compact that are performed on the left, right or ambiguously, is recorded to calculate a mean percentage score for the three categories. A score less than 0.35 indicates USN.	**TEST-RETEST** R=0.94 (Robertson & Beschin, 1997) **INTER-RATER** No evidence **INTERNAL CONSISTENCY** No evidence	**CONSTRUCT VALIDITY** Known Groups: Significant differences in mean scores between those with neglect and a right stroke, no neglect and a right stroke, left stroke and controls. (Robertson & Beschin, 1997) **CRITERION VALIDITY** No evidence **RESPONSIVENESS** No evidence	**Skills:** Unilateral voluntary movement and control of shoulder, elbow and fingers **Testing Position:** Supine in bed or seated **Time:** 5 minutes **Concern:** Rule out apraxia
Semi-structured Scale for the Functional Evaluation of Hemi-inattention in Personal Space (Zoccolotti, Antonucci & Judica, 1992)	Patient is asked to demonstrate the use of three common objects: comb, razor/powder compact, eyeglasses. The objects are placed at the patient's midline. **Scoring:** Normal=0, slight asymmetry=1, clear omissions=2, significant reduction in space explored=3. Max. Score=9. A score greater than the cutoff of 1 indicates USN.	**TEST-RETEST:** No evidence **INTER-RATER** r=0.88 **INTERNAL CONSISTENCY** r=0.57-0.62 (Zoccolotti et al, 1992)	**CONSTRUCT VALIDITY** Convergent Validity All correlations with Line Cancellation Test, Letter Cancellation Test, Wundt-Jastrow Area Illusion Test, and Sentence Reading Test were negligible and non-significant. (Zoccolotti et al, 1992) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** Not responsive to clinical change following rehabilitation (Zoccolotti et al, 1992)	**Skills:** Unilateral voluntary movement and control of shoulder, elbow and fingers **Testing Position:** Supine in bed or seated **Time:** 5 minutes **Concern:** Rule out apraxia

APPENDIX A-II: NEAR EXTRAPERSONAL SPACE

Assessment	Description	Reliability	Validity	Skills Required
Line Bisection (Schenkenberg, Bradford & Ajax, 1980)	Patient is asked to place a mark with a pencil through the center of a series of 18 horizontal lines on an 11x 8½-inch page **Scoring:** Absolute mean millimeter deviation from center. A deviation of more than 6 mm from the midpoint indicates USN. Omission of two or more lines on one half of the page indicates USN.	**TEST-RETEST** r=0.84-0.93 (Schenkenberg, Bradford & Ajax, 1980) r=0. 93 (Chen-Sea & Henderson, 1994) **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Correlated with mean CT-scan damage r=-0.44 and CT-scan damage of temporal lobe r=-0.59, parietal lobe r=-0.37 and occipital lobe r=-0.42 (Egelko et al, 1988) Correlated with poor functional outcome, as measured by the Barthel Index (ADL), walking speed and discharge provenance, at discharge, 1 month, 3 months post stroke (Friedman, 1990) <u>Convergent validity</u> r=0.85 with Albert's Test Correlated with Star Cancellation Test: r=-0.33 (Agrell, Dehlin & Dahlgren, 1997) <u>Divergent validity</u> r=0.44 (right vs. left stroke) (Chen-Sea & Henderson, 1994) **CRITERION VALIDITY**: Sensitivity: 76.4% (when compared with other cancellation tests) (Bailey, Riddoch & Crome, 2000) **RESPONSIVENESS:** No evidence	**Skills:** Hold a pencil **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia

Albert's Test (Albert, 1973)	Patient is asked to place a mark with a pencil through the center of 41 randomly oriented lines 2 cm long arranged in six rows on an 11x 8½-inch page. The page is placed at the patient's midline. The five central lines are used for demonstration. **Scoring:** # of lines left uncrossed on each side of the sheet. If any lines are left uncrossed, and more than 70% of uncrossed lines are on the same side as the brain lesion, USN is indicated	**TEST-RETEST** r=0.79 (Chen-Sea & Henderson, 1994) **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Convergent validity r=0.85 with Line Bisection Correlated with Star Cancellation Test: r=0.63 (Agrell, Dehlin & Dahlgren, 1997) Divergent validity r=0.36 (right vs. left stroke) (Chen-Sea & Henderson, 1994) **CRITERION VALIDITY** Predictive Validity Test scores on this tool within 48 hours of admission were strongly associated with functional outcome at six months post stroke (as measured on a 4-point crude scale) (Fullerton, McSherry, Stout, 1986) **RESPONSIVENESS:** No evidence	**Skills:** Hold a pencil **Testing Position:** Supine in bed or seated **TIme:** <5 minutes **Concern:** Rule out apraxia

Single Letter Cancellation Test (SLCT) (Diller et al, 1974)	Patient is asked to look at an 11x 8½-inch page with six rows of 52 typed letters and to place a mark with a pencil through each H. The page is placed at the patient's midline. **Scoring:** # of letters crossed with a maximum score of 105. USN can be inferred by calculating the frequency of errors to the left or right of the center of the page. Normative data has been established for this population (Gordon et al, 1984).	**TEST-RETEST** R=0.63 (Gordon et al, 1984) **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Correlated with extent of CT-scan damage: r=-0.35 (Egelko et al, 1988) Correlated with other visuo-spatial tests (Albert's Test, Sentence Reading Test, Wundt-Jastrow Area Illusion Test) r= 0.36-0.69 and was most sensitive among these tests in detecting USN (4.1% to 25%) (Zoccolotti et al, 1989) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** No evidence	**Skills:** Recognize letters Hold a pencil **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia

Star Cancellation (Wilson, Cockburn & Halligan, 1987)	Patient is asked to place a mark with a pencil through all the small stars on an 11x 8½-inch page containing 56 small stars, 52 large stars, 13 letters and 10 short words. The two small stars in the middle are used for demonstration. The page is placed at the patient's midline. **Scoring:** Max. points=54 and the cutoff is <44 indicating USN. A Laterality Index or star ratio is calculated from the ratio of stars cancelled on the left of the page to the total number of stars cancelled. Scores between 0 and 0.46 indicates USN in the left hemispace. Scores between 0.54 and 1 indicate USN in the right hemispace	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** <u>Convergent validity</u> With ADL scores: r=0.55 With Line Crossing: r=0.68 With Line Bisection Test: r=-0.40 (Marsh & Kersel, 1993) Correlated with Barthel Index (ADL): r=0.48 (Agrell, Dehlin & Dahlgren, 1997) **CRITERION VALIDITY** Sensitivity: 100% (when compared with other cancellation tests) (Marsh & Kersel, 1993) Sensitivity: 76.4% (when compared with other cancellation tests) (Bailey, Riddoch & Crome, 2000) **RESPONSIVENESS:** No evidence	**Skills:** Hold a pencil Visual discrimination **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia

Bell' s Test (Gauthier, Dehaut, & Joanette, 1989)	Patient is asked to circle with a pencil all the 35 bells embedded within the 264 distracters on an 11x 8½- inch page. The page is placed at the patient's midline. **Scoring:** An omission of 6 or more bells on the right or left half of the page indicates USN.	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** 38.3% of patients were diagnosed with USN using the Bells Test, compared with 10.6% with the Albert's Test (Vanier et al, 1990) Known Groups: Difference in scores between right CVA and left CVA is statistically significant (Gauthier et al, 1989) **CRITERION VALIDITY** A significantly higher percentage of omitted targets compared to other cancellation tests (Star Cancellation Test and Line Crossing) (Ferber & Karnath, 2001) RESPONSIVENESS: No evidence	**Skills:** Hold a pencil Visual discrimination **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia

Double Letter Cancellation Test (DLCT) (Diller et al, 1974)	Patient is asked to look at an 11x 8½-inch page with six rows of 52 typed letters and to place a mark with a pencil through both letters C and E. The page is placed at the patient's midline. **Scoring:** # of letters crossed with a maximum score of 105. USN can be inferred by calculating the frequency of errors to the left or right of the center of the page. Normative data has been established for this population (Gordon et al, 1984)	**TEST-RETEST** R=0.62 (Gordon et al, 1984) **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Correlated with extent of CT-scan damage r=-0.35 (Egelko et al, 1988) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** No evidence	**Skills:** Recognize letters Hold a pencil Mental flexibility **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia

Random Letter Cancellation Test (Weintraub & Mesulam, 1985)	Patient is asked to look at an 11x 8½-inch page with a random array of over 300 letters and to place a mark with a pencil through each letter A. There are 60 target letters "A", 30 on the right half and 30 on the left half of the page. The page is placed at the patient's midline. **Scoring:** Number of "A" omissions with a maximum score of 60. More than 4 "A" omitted on the right or left half of the page indicates USN.	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** No evidence **CRITERION VALIDITY:** A significantly higher percentage of omitted targets compared to other cancellation tests (Bells Test, Star Cancellation Test and Line Crossing) (Ferber & Karnath, 2001) **RESPONSIVENESS:** No evidence	**Skills:** Recognize letters Hold a pencil **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia
Rey Complex Figure (Rey, 1959)	Patient is asked to draw a Rey figure from memory **Scoring:** There are 18 components of the drawing. One or two points are given to each component according to their placement and shape. If the component is absent, a score of 0 is given. Lezak (1995) provides a detailed description of the scoring methods. The cutoff score of less than 16 indicates perceptual deficits.	**TEST-RETEST** R=0.62 (Gordon et al, 1984) **INTER-RATER** r = 0.99 and 90% of discrepancies between raters were within two points (Carr & Lincoln, 1988) **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY:** No evidence **CRITERION VALIDITY** Sensitivity = 81 % Specificity = 83 % (Against the Rivermead Perceptual Assessment Battery as "gold standard") Good screening tool that is sensitive to perceptual impairments but not specific to USN (Lincoln, Drummond, Edmans, Yeo & Willis, 1998) **RESPONSIVENESS:** No evidence	**Skills:** Hold a pencil Visual memory **Testing Position:** Seated at a table **Time:** <5 minutes **Concern:** Rule out motor and constructional apraxia

Draw-A-Man Test (Goodenough, 1926)	Patient is given a blank piece of paper (8½ x11) entitled "Draw an Entire Man" and a pencil, and is asked to draw an entire man from memory **Scoring:** Drawings with homogenous unilateral body parts are categorized as USN. Those with homogenous bilateral body parts are considered normal.	**TEST-RETEST** R=0.62 (Gordon et al, 1984) **INTER-RATER** 95.45% for controls 100% for stroke patients (Chen-Sea, 2000) **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Significant correlations with poor ADL performance on Klein-Bell ADL Scale (Chen-Sea, 2000) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** No evidence	**Skills:** Hold a pencil Visual memory **Testing Position:** Supine in bed or seated at a table **Time:** <5 minutes **Concern:** Rule out motor and constructional apraxia
Wechsler Adult Intelligence Scale-revised Block Design (Weschler, 1981)	Patient is asked to arrange colored cubes to copy certain patterns as illustrated on 2-dimensional cards. **Scoring:** See test manual for scoring procedures (Weschler, 1981) Maximum Score = 48	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Convergent validity: When using factor analysis, WAIS-2r loaded significantly with tests of similar construct (Raven Colored Progressive Matrices and Letter Cancellation Test) (Sundet, Goffeng & Hofft, 1995) **CRITERION VALIDITY:** Predictive Validity: High scores of this tool were strongly associated with good outcome at two weeks post stroke (as measured on a 4-point crude scale) (Henley, Pettit, Todd-Pokropek, Tupper, 1985) **RESPONSIVENESS:** No evidence	**Skills:** Voluntary movement and control of elbow and fingers Cognition (problem-solving) Spatial relations **Testing Position:** Seated at a table **Time:** <5 minutes **Concern:** Rule out motor and constructional apraxia

Clock Drawing Test (Ishiai, Sugishita, Ichikawa, Gono & Watabiki, 1993)	Patient is asked to place numbers inside a printed circle 8 cm in diameter to make a face of a clock. **Scoring:** Maximum score=4 where 1 point is given for each correctly placed 3,6,9 relative to that of 12, and one point for the correct placement of other numbers with appropriate spacing. No cutoff score indicating USN was provided.	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY:** Poor correlation with: Line cancellation (r=-0.102), Line bisection (r=0.045), Copying (r=0.034) and performance WAIS-r subtests (r=0.217)(Ishiai et al, 1993) Significant correlation with WAIS-r Block Design (r=0.391) and all verbal subtests of the WAIS-r (r=0.745)(Ishiai et al, 1993) Correlated with Star Cancellation Test r=-0.47 and Line Bisection Test r=-0.34 (Agrell, Dehlin & Dahlgren, 1997) **CRITERION VALIDITY** Sensitivity: 55.3% CDT was least sensitive to detect USN, compared to the cancellation tests, copying and drawing tasks, and reading tests. (Maeshima et al, 2001) Sensitivity: 42% when compared to Star Cancellation Test, Albert's Test and Line Bisection Test (Agrell et al, 1997) **RESPONSIVENESS:** No evidence	**Skills:** Hold a pencil Visual memory **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out motor and constructional apraxia

Search-A-Word (SAW) (Gianutsos, Glosser, Elbaum, Georgine, Vroman, 1983)	The patient is asked to search 13x13 letter arrays typed on an 8.5 x 11 inch sheet for one specific target word at a time. **Scoring:** Median search times are compared for targets on the right and the left. Cutoff is 2 SD from the mean of the normal control group- Score >1.26 = Left USN Score <1.62 = Right USN	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Known Groups: Group difference in scores of normal, right strokes, left strokes, and bilateral strokes were statistically significant ($p<0.05$) (Gianutsos et al, 1983) Convergent Validity: Items that measured left-sided scanning using SAW loaded significantly in a factor analysis with the SRWL (0.85) (Gianutsos et al, 1983) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** No evidence	**Skills:** Reading **Testing Position:** Supine in bed or seated **Time:** ≈30 minutes **Concern:** Rule out aphasia

Speeded Reading of Word Lists (SRWL) (Gianutsos, Glosser, Elbaum, Georgine, Vroman, 1983)	Randomized sequences of high frequency monosyllabic nouns are presented on a screen of a 21-inch video monitor. The patient is asked to read the words aloud in each of the three parts of the test. The three parts vary according to presentation duration and layout. **Scoring:** Cutoff scores for the 3 parts are 2 SD from the mean of the normal control group	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Known Groups: Group difference in scores of normal, right strokes, left strokes, and bilateral strokes were statistically significant ($p<0.05$) (Gianutsos et al, 1983) Convergent Validity: Items that measured left-sided scanning using SRWL loaded significantly in a factor analysis with the SAW (0.83) (Gianutsos et al, 1983) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** No evidence	**Skills:** Reading **Testing Position:** Seated at a table in front of a video monitor **Time:** ≈ 30 minutes **Concern:** Rule out aphasia
Lateral Asymmetry in Visual Spatial Attention Test (Piasetsky, 1981)	This picture match test consists of a structured series of common, easily labeled objects and an unstructured series of geometric shapes not easily labeled. On each page a target in top center position is matched to one of the six figures below. **Scoring:** Maximum Score = 48	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Correlated with mean CT-scan damage $r=-0.37$ (Egelko et al, 1988) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS:** No evidence	**Skills:** Visual discrimination **Testing Position:** Seated at a table **Time:** ≈ 30 minutes

Wundt-Jastrow Area Illusion (Massironi et al, 1988)	Pairs of circular sections or "fans" are presented in 10 different sizes (ranging from 6° to 58°), 2 orientations (upward-downward convexity) and 2 directions (leftward-rightward) for a total of 40 trials. Two fans of identical shape and size that create an illusory effect are presented and the patient is asked to identify which of the two fans is larger. Scoring: "Expected responses" (consistent for normals) and "unexpected responses (those in the opposite direction) are computed. Those with USN have unexpected responses where fans are oriented towards the left. Laterality is calculated where the difference of unexpected responses when the two fans are oriented toward the left or right is computed over the total number of correct responses for both sides.	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Convergent validity with Albert's Test r=0.64, p=0.001 (Massironi et al, 1988) **CRITERION VALIDITY** Criterion Validity r=0.83 when correlated with clinical exam of a neuropsychologist (Massironi et al, 1988) **RESPONSIVENESS:** No evidence	**Skills:** Visual discrimination **Testing Position:** Seated at a table **Time:** <5 minutes

Raven Colored Progressive Matrices (Raven, 1965)	This 36-item visually administered test requires picture matching, pattern completion, and analogical reasoning. The patient is asked to select one of the six patterns to complete the picture **Scoring:** Proportion of right and left answers is calculated using the formula (R-L)/(R-L) x 100, so that now the scale ranges from 0-100, a higher score indicating extreme bias to one side. Total RCPM Score<19 =USN Maximum Score=36	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Known Groups: Difference in scores between right CVA and left CVA is statistically significant (z=2.51, p<0.01) (Sunderland, Wade & Hewer, 1987) Convergent Validity: When using factor analysis, RCPM loaded significantly with tests of similar construct (Block Design and Letter Cancellation Test) (Sundet, Goffeng & Hofft, 1995) **CRITERION VALIDITY**: When using a cut-off of <19, it gave a high sensitivity (91%) and adequate specificity (72%) (Blake, McKinney, Treece, Lee & Lincoln, 2002) **RESPONSIVENESS**: Responsive to clinical change over time (Sunderland et al, 1987)	**Skills:** Visual perceptual skills Analogical reasoning **Testing Position:** Seated at a table **Time:** ≈ 30 minutes

Rivermead Perceptual Assessment Battery (RPAB) (Whiting, Lincoln, Bhavnani & Cockburn, 1985)	16 subtests of visual perception that consist of picture, object and color matching, cancellation, figure ground, sequencing, body image, and copying shapes, words and three dimensional figures **Scoring:** The RPAB criterion score is defined as the number of subtests passed, with the criterion score ranging from 0 to 16. Subjects with criterion scores anywhere between 0 and 12 are classified as having perceptual deficits. Normative data for each subtest are also available by the authors. The criterion for visual perceptual deficits is a score of less than 2 standard deviations (<2SD) below the normative mean for each subtest.	**TEST-RETEST** r= 0.59-1.00 for most subtests except for one (Series subtest r=0.27) (Whiting et al, 1985) **INTER-RATER** r=0.72-1.00 (Whiting et al, 1985) **INTERNAL CONSISTENCY** No evidence	**CONSTRUCT VALIDITY** Scores on RPAB correlated significantly (r=0.40-0.70) with selected functional tasks- upper limb dressing, making a sandwich and setting the table (Donnelly, Hextell & Matthey, 1998) 5 of the 16 subtests correlated significantly with ADL (r=0.43-0.59) (Matthey, Donnelly & Hextell, 1993) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS** Responsive to clinical change following treatment for USN (spatiomotor cueing) (Kalra, Perez, Gupta & Wittink, 1997) Responsive to clinical change during the first 3 months post stroke (Friedman & Leong, 1992)	**Skills:** Hold a pencil Reading Visual perceptual skills **Testing Position:** Seated at a table **Time:** ≈ 30 minutes **Concern:** Rule out motor and constructional apraxia

Rivermead Perceptual Assessment Battery-shortened (Lincoln & Edmans, 1989)	Version A: Picture and object matching, size recognition, animal halves, right left copy shapes and words, 3-D copy and cube copy Version B: Copying words and shapes, cube copy, 3-D copy, cancellation, figure ground, sequencing pictures and body image Version C: Picture and color matching, sequencing pictures, body image, right left copy shapes, cube copy, 3-D copy, cancellation **Scoring:** Normative data for each subtest is also available by the authors with a cutoff of <2SD below the mean.	**TEST-RETEST** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY** Inter-correlation between each subtest and the total score: Version A=0.988 Version B= 0.998 Version C= 0.995 (Lincoln & Edmans, 1989)	**CONSTRUCT VALIDITY** No evidence **CRITERION VALIDITY** Version A: Sensitivity= 81% Specificity=100% Version B: Sensitivity= 59% Specificity=100% Version C: Sensitivity= 46% Specificity=100% Proportion of those tested who have a perceptual deficit when the criterion score on the short RPAB was compared with the full RPAB **RESPONSIVENESS:** Not very responsive to clinical change (Lincoln & Edmans, 1989)	**Skills:** Hold a pencil Reading Visual perceptual skills **Testing Position:** Seated at a table **Time:** ≈ 30 minutes

Motor-Free Visual Perception Test (Bouska & Kwatny, 1983)	A 36-item, two-dimensional multiple-choice test designed to evaluate spatial relations, visual discrimination, figure-ground perception, visual closure, and visual memory. Patient is asked to indicate one out of the 4 alternatives that match the test example. **Scoring:** Max. Score=36. Normative data available for presence of USN. Cutoff= 33 indicates visual perceptual impairment	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY:** No evidence **CRITERION VALIDITY** Convergent Validity: r=0.75, p<0.001 with visual skills screening battery (visual acuity, visual field, oculo-motor function, visual scanning and attention) (Cate & Richards, 2000) **RESPONSIVENESS:** No evidence	**Skills:** Visual perceptual skills **Testing Position:** Seated at a table **Time:** ≈ 30 minutes

Baking Tray Task (Tham & Tegner, 1996)	The "baking tray" consists of a 75x100cm board with an edge of 3.5 cm height. Patient is asked to pick up 16 "buns" (3.5 cm cubes) and spread them as evenly as possible all over the board as if they were buns on tray to be baked. The authors found that using an 8 ½ x11 sized tray was only slightly less sensitive. **Scoring:** The numbers of cubes in each half field are counted. Accuracy of measurement is 0.5 cm. If a cube is straddled in midline, a score of ½ is granted for each half field. Distributions skewed more than 7 in one half field and 9 in the other indicates USN.	**TEST-RETEST:** No evidence **INTER-RATER:** No evidence **INTERNAL CONSISTENCY:** No evidence	**CONSTRUCT VALIDITY** Data from this tool did not significantly correlate with other visuospatial tests (Line cancellation, Letter cancellation, figure copying or Line bisection test) (Tham & Tegner, 1996) Correlated with Star Cancellation Test (r=0.79) and Line Bisection Test (r=-0.66) (Bailey, Riddoch & Crome, 2000) From patients identified with USN using the cancellation tests, only 45% of those with right CVA and 25% of those with left CVA were correctly detected using this task. (Tham & Tegner, 1996) **CRITERION VALIDITY**: Sensitivity: 66.7% (when compared with other cancellation tests) (Bailey et al, 2000) **RESPONSIVENESS:** No evidence	**Skills:** Unilateral voluntary movement and control of shoulder, elbow and fingers **Testing Position:** Supine in bed or seated **Time:** <5 minutes **Concern:** Rule out apraxia

APPENDIX A-III: NEAR AND FAR EXTRAPERSONAL SPACE

Assessment Tool	**Description**	*Reliability*	*Validity*	*Skills Required*
Rivermead Behavioral Inattention Test (RBIT) (Wilson, Cockburn & Halligan, 1987)	**Conventional subtests (6):** Line crossing, letter and star cancellation figure and shape copying, line bisection and representational drawing **Behavioral subtests (9):** Picture scanning, telephone dialing, menu reading, article reading, telling and setting time, coin sorting, address and sentence copying, map navigation, card sorting **Scoring:** Scores for each subtest are summed to provide a score for the total test, as well as overall scores for the conventional and behavioral subtests. Maximum and Cutoff scores to indicate USN: -Conventional subtests: 129 out of 146 -Behavioral subtests: 67 out of 81 -Total test: 196 out of 22	**TEST-RETEST** r=0.99 (Wilson et al, 1987) **INTER-RATER** r=0.99 (Wilson et al, 1987) **INTERNAL CONSISTENCY** r=0.832 (Wilson et al, 1987)	**CONSTRUCT VALIDITY** Convergent validity Conventional and behavioral subtests of RBIT (r=0.92)(Hartman-Maier & Katz, 1995) Overall correlation between total BIT behavioral subtests and items on an ADL checklist (r=0.77)(Hartman-Maier & Katz, 1995) Correlation between BIT score and Barthel score at one month (r=0.642) (Cassidy, Bruce, Lewis & Gray, 1999) **CRITERION VALIDITY** Predictive Validity Behavioral subtests predicted poor functional outcome on the Frenchay Activities Index (FAI) at 3 months (r=-0.57); 6 months (r=-0.73) and 12 months (r=-0.71) (Jehkonen et al, 2000)	**Skills:** Writing Reading Recognize letters Hold a pencil Visual memory Visual discrimination Visual perceptual skills Unilateral voluntary movement and control of shoulder, elbow and fingers **Testing Position:** Seated at a table **Time:** ~30 minutes **Concern:** Rule out motor and constructional apraxia, as well as aphasia

Semi-structured Scale for the Functional Evaluation of Hemi-inattention in Extrapersonal Space (Zoccolotti, Antonucci & Judica, 1992)	The tool is comprised of four subtests: serving tea, card dealing, picture description and description of an environment. The patient is asked to perform these activities with objects that are provided on a table. **Scoring:** 4-point scale where 0=normal; 1=slight asymmetries, uncertainty or slowness in space explored; 2=clear omissions; 3=significant reduction in space explored. Maximum score=18, with a cutoff of 3 to indicate USN	**TEST-RETEST** No evidence **INTER-RATER** r= 0.96 (Zoccolotti et al, 1992) **INTERNAL CONSISTENCY:** r=0.44-0.71 (Zoccolotti et al, 1992)	**CONSTRUCT VALIDITY** Convergent validity: Significant correlations with Line Cancellation Test: Tau=0.60; Letter Cancellation Test: Tau= -0.52 (Zoccolotti et al, 1992) **CRITERION VALIDITY:** No evidence **RESPONSIVENESS** Responsive to clinical change following rehabilitative treatment (Zoccolotti et al, 1992)	**Skills:** Unilateral voluntary movement and control of shoulder, elbow and fingers Language Cognition Visual perceptual skills **Testing Position:** Seated at a table **Time:** 15 minutes **Concern:** Rule out motor apraxia and aphasia

Rivermead Behavioral Inattention Test (RBIT)- shortened version (Stone, Wilson & Rose, 1987)	**Conventional subtests (3):** Line crossing, star cancellation and figure copying **Behavioral subtests (5):** Picture scanning, menu reading, article reading, coin sorting and map navigation **Scoring:** The percentage of omissions for each subtest is calculated and graded: Grade 0=no neglect; Grade 1=up to 20% of items omitted on the test; Grade 2=21-40% of items omitted; Grade 3=41-60%; Grade 4= 61-80%; Grade 5= 81-100%	**TEST-RETEST:** No evidence **INTER-RATER** Two examiners agreed on presence or absence of neglect on 7 out of 8 tests (Stone et al, 1991) **INTERNAL CONSISTENCY** No evidence	**CONSTRUCT VALIDITY** Convergent Validity 16 out of 17 patients with neglect on the RBIT-short had neglect on the occupational therapist assessment of neglect in activities of daily living checklist (Stone et al, 1991) **CRITERION VALIDITY** No evidence **RESPONSIVENESS** Responsive to clinical change over 3 months (p= 0.02-0.05) (Stone et al, 1991)	**Skills:** Writing Reading Hold a pencil Visual memory Visual perceptual skills Unilateral voluntary movement and control of shoulder, elbow and fingers **Testing Position:** Supine in bed or seated at a table **Time:** 11 minutes **Concern:** Rule out motor and constructional apraxia, as well as aphasia

APPENDIX A-IV: PERSONAL AND NEAR EXTRAPERSONAL SPACE

Assessment Tool	Description	*Reliability*	*Validity*	*Skills Required*
National Institute of Health (NIH) Stroke Scale (Adams, Davis, Torner, Grimsman, & Berg, 1998)	This quantitative neurological assessment measures motor, sensory, perceptual and speech impairments **Scoring:** A higher score on this 14-item (3- or 4-point scale) test indicates greater deficit	**TEST-RETEST** No evidence **INTER-RATER** Moderate to substantial inter-rater and intra-rater agreement (mean kappa=0.69) **INTERNAL CONSISTENCY** No evidence (Brott et al, 1989)	**CONSTRUCT VALIDITY** No evidence **CRITERION VALIDITY** Convergent validity With CT scan at 7 days, r=0.74 (Brott et al, 1989) **RESPONSIVENESS** Responsive to the relative differences in the treatment and control group in intervention studies (Orgogozo, 1998)	**Skills:** No specific skills required **Testing Position:** Supine in bed or seated on a chair **Testing Endurance:** 10 minutes
Hemispheric Stroke Scale (Adams, Meador, Sethi,Grotta & Thomson, 1987)	It is a quantitative neurological assessment for stroke that measures motor, sensory, perceptual and speech impairments. It includes the Glasgow Coma Scale **Scoring:** Each subtest has a graded scoring system with a maximum score of 100. A higher score indicates greater deficit	**TEST-RETEST** No evidence **INTER-RATER** r=0.95 **INTERNAL CONSISTENCY** alpha= 0.88 (Adams, Meador, Sethi, Grotta & Thomson, 1987)	**CONSTRUCT VALIDITY** Convergent Validity: -global assessment r=0.89 -Barthel Scale r=0.95 (Adams, Meador, Sethi, Grotta & Thomson, 1987) **CRITERION VALIDITY** No evidence **RESPONSIVENESS** No evidence	**Skills:** No specific skills required **Testing Position:** Supine in bed or seated on a chair **Testing Endurance:** 10 minutes

APPENDIX A-IV: PERSONAL SPACE, NEAR AND FAR EXTRAPERSONAL SP APPENDIX A-IV: PERSONAL AND NEAR EXTRAPERSONAL SPACE

Assessment Tool	Description	*Reliability*	*Validity*	*Skills Required*
Catherine Bergego Scale (Azouvi et al, 1996)	A direct observation of the patient in 10 everyday activities such as knowledge of left limbs, dressing, safe mobility, grooming, eating, personal belongings, gaze orientation, auditory attention, spatial orientation, mouth cleaning This scale can also be administered as a questionnaire to assess how the patient self-evaluates his/her neglect during ADL using same scoring system (Anosognosia). **Scoring:** Each item is on a 4-point scale where 0 is no presence of neglect; 1 is mild neglect, 2 is moderate neglect and 4 is severe neglect. Specific criteria for each score are given. For the self-evaluation, the patient is asked to rate his/her difficulty for each item using a 4-point scale (0=no difficulty, 1=mild, 2=moderate, 3=severe) Anosognosia score= rater's CBS score-patient's self-evaluation score	**TEST-RETEST** No evidence **INTER-RATER** Kappa coefficient for each of the items ranged from 0.59-0.99 Spearman's rho= 0.96 (Azouvi et al, 1996) **INTERNAL CONSISTENCY** Spearman's rho= 0.58-0.88 between each item score and the total score • Personal hygiene = 0.58 • All other items were >0.69 • Mobility=0.88 • Dressing=0.86 (Azouvi et al, 1996) Principal component analysis of CBS: 1 factor explained 65.85 of total variance All items loaded on this factor with a range of 0.77-0.84 (Azouvi et al, 2003) Rasch-computed reliability is satisfactory (Azouvi et al, 2003)	**CONSTRUCT VALIDITY** Convergent Validity (Spearman rho) -With Albert's Test= 0.73 (Azouvi et al, 1996) Convergent Validity (Pearson) -With Bells Test: r= 0.76 -Figure Copying: r= 0.70 (Azouvi et al, 2003) Known Groups: Difference in scores between those identified with and without neglect is statistically significant (Azouvi et al, 1996) Correlates with anosognosia score r=0.79 (Azouvi et al, 2003) and Barthel Index (ADL) Spearman rho =-0.63 (Azouvi et al, 1996) **CRITERION VALIDITY** While incidence of USN identified on the Bells Test was 53.8% and Figure copying was 44.4%, the 10 items on the CBS had a range of 49.5% to 79.5%. (Azouvi et al, 2003) Sensitivity: 96% (using Bells Test, Figure copying and Text reading as "gold standard") **RESPONSIVENESS** Documents clinical change in severe neglect patients following visuo-spatio-motor cueing (Samuel, Louis-Dreyfus, Kaschel, 2000)	**Skills:** Unilateral voluntary movement and control of upper and lower limbs **Testing Position:** Seated in front of a table, standing and ambulating **Time:** >30 minutes **Concern:** Rule out apraxia

APPENDIX B: Map of Ontario

✦ = Hospital Location (Approximate)

APPENDIX C: Selection of ICD-9 Codes for Acute Stroke

ICD-9 Codes	Diagnosis	Proportion of hospital discharge with a high probability of being definite strokes	
		Mayo et al, 1994 (N=4277)	Liebson et al, 1994 (n=329)
430	Subarachnoid Hemorrhage	33-94.7%	100%
431	Intracerebral Hemorrhage	89.7-100%	87%
432	Other and unspecified intracranial hemorrhage	0-33%	0%
433	Occlusion and stenosis of precerebral arteries	12-59%	15%
434	Occlusion of cerebral arteries	64-95%	85%
435	Transient cerebral ischemic	14-21.6%	15%
436	Acute but ill-defined cerebrovascular disease/stroke	62-90.1%	86%
437	Other and ill-defined cerebrovascular disease	54.3-75%	22%
438	Late effects of cerebrovascular disease	0-16.7%	0%

Mayo, N.E., Chockalingam, A., Reeder, B.A., Philips, S. Surveillance for stroke in Canada. Health Reports. 1994; 6(1): 62-72.

APPENDIX D: Sample Size Calculations

Estimated Proportion for Sample Population	Sample Size
0.30	224
0.35	243
0.40	**256**
0.45	264
0.50	268

The following is a formula to calculate sample size for a single proportion:

$$N = \frac{(Z_{\alpha/2})^2(pq)}{M^2}$$

Where:

N = sample size

$Z_{\alpha/2}$ = confidence level =1.96

p = proportion of sample population (estimated prevalence)

q = (1 — p) = 0.60

M = margin of error = ± 6% = ± 0.06

Cochran, W.G. Sampling Techniques. 3rd ed. New York: Wiley. 1977.

APPENDIX E: Ethics Certificates

APPENDIX F: Chart Abstraction Form

CHART ABSTRACTION FORM

1. **Date of Abstraction:** _____ 2. **Abstractor:** _____ 3. **Assigned Hospital #:**_____

4. **Chart #:** _____ 5. **Client Age:** _____ 6. **Client Sex:** ☐ Male ☐ Female

7. **Date of Admission to Hospital (if applicable):** _____ 8. **Date of Discharge:** _____

9. **Discharge Destination:** ☐ Home ☐ Deceased ☐ Rehab center ☐ Long-term care

☐ Alternate level of care ☐ Another acute-care hospital ☐ Internal discharge from acute care

☐ Not available in chart

10. **Date first seen in Emergency by a physician, nurse or rehab professional:**

_____ ☐ Not available

11. **Stroke Diagnosis:** ☐ Yes if Yes, ICD-9 code: _____ ☐ No ☐ Not available

12. **Side of Lesion:** ☐Right ☐Left ☐Bilateral ☐Not available

13. **Past History of Stroke:** ☐Yes ☐No ☐Not available

14. **Was the patient ever "*assessable*" for USN during acute care admission, where "*assessable*" is defined as ever having eyes open, awake, responsive, alert, oriented, fully conscious, responds/ head turn towards verbal/visual stimuli?**
(If patient is assessable throughout their hospitalization, date when first assessable is the date of admission to emergency)

☐ Yes: if yes **Date when first assessable:** _____ ☐ No

15. **If Question 14 is YES, did the patient remain "*assessable*" thereafter?**

☐Yes ☐ No: specify _____

16. **If Question 14 is YES, what was the location of stroke care for the majority of the patient's "*assessable*" *period*?**

☐ Emergency unit ☐ Intensive care unit ☐General medical unit ☐ Designated Stroke unit

☐ Mobile Stroke team with no designated unit ☐ General Rehabilitation unit within hospital ☐ Not applicable

☐ Other: Specify _____

17. **Number of Occupational Therapists working with stroke clients at the hospital:**
Full-time _____ Part-time _____

18. **Number of Neurologists working with stroke clients at the hospital:**
Full-time _____ Part-time _____

STOP HERE if answer for question 11 or 14 are:
NO or NOT AVAILABLE IN CHART

19. Was the patient assessed for USN as reported in the chart?

☐ Yes: **Date of 1st USN assessment** (when performed or documented in chart): _____ ☐ No

20. If Question 19 is YES, location of stroke care on date of 1st USN assessment:

☐Emergency unit ☐ICU ☐General medical unit ☐Stroke unit

☐Mobile Stroke team with no designated unit ☐General Rehab unit within hospital ☐Other: Specify _____

21. If Question 19 is YES, how was the patient assessed for USN? ☐Clinical observation: ***PAGE 6&7***

☐Standardized USN Tools: ***PAGE 2&7*** ☐Non-standardized USN Tools: ***PAGE 3&7*** ☐Standardized Visual Perception Tools: ***PAGE 4&7*** ☐Non-standardized Visual Perception Tools: ***PAGE 5&7***

22. Presence of hemianopsia/visual field deficit: ☐ Present ☐ Absent ☐ Not available in chart

***Answer questions 23-26 using data from chart documented ± 2 days from* Date of 1st USN assessment:**

23. Stroke severity of patient:

- ☐ None *(ambulatory without aid)*
- ☐ Mild-to-Moderate *(ambulatory with aid from a cane, walker or an individual)*
- ☐ Severe *(non-ambulatory or wheelchair-bound)*
- ☐ Not available in chart

24. Degree of aphasia:

- ☐ None *(no language deficits)*
- ☐ Mild-to-Moderate *(some difficulty with language)*
- ☐ Severe (*severe language deficits*)
- ☐ Not available in chart

25. Degree of motor deficits in the upper limb:

- ☐ Normal *(normal muscle tone)*
- ☐ Mild-to-Moderate *(hypotonic/flaccid or hypertonic/spastic muscles)*
- ☐ Severe (*no active movements or the dominant hand has hypotonic/flaccid or hypertonic/spastic muscles*)
- ☐ Not available in chart

26. Degree of cognitive deficits:

- ☐ Normal *(oriented to time, place and person)*
- ☐ Mild-to-Moderate *(oriented to two out of the three areas- time, place and person)*
- ☐ Severe (oriented to one or none of the three areas)
- ☐ Not available in chart

STANDARDIZED ASSESSMENT TOOLS FOR UNILATERAL SPATIAL NEGLECT

Assigned Chart #: _____ Assigned Hospital #: _____ Abstractor #: _____

List the STANDARDIZED ASSESSMENT TOOLS used to evaluate unilateral spatial neglect and record the following data:

Assessment Tools	Date: 1st assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Reassessment Yes = 1 No = 0	Date:2nd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Date:3rd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)
Additional Comments: Hemispace assessed: Health professional involved in assessment:										

NON-STANDARDIZED ASSESSMENT TOOLS FOR UNILATERAL SPATIAL NEGLECT

Assigned Chart #: _____ Assigned Hospital #: _____ Abstractor #: _____

List the NON-STANDARDIZED ASSESSMENT TOOLS used to evaluate unilateral spatial neglect and record the following data:

Assessment Tools	Date: 1st assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Reassessment Yes = 1 No = 0	Date:2nd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Date:3rd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)
Additional Comments: Hemispace assessed: Health professional involved in assessment:										

STANDARDIZED ASSESSMENT TOOLS FOR VISUAL PERCEPTION

Assigned Chart #: _____ Assigned Hospital #: _____ Abstractor #: _____

List the STANDARDIZED ASSESSMENT TOOLS used to evaluate visual perception and record the following data:

Assessment Tools	Date: 1st assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Reassessment Yes = 1 No = 0	Date:2nd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Date:3rd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)
Additional Comments: Hemispace assessed: Health professional involved in assessment:										

NON-STANDARDIZED ASSESSMENT TOOLS FOR VISUAL PERCEPTION

Assigned Chart #: _____ Assigned Hospital #: _____ Abstractor #: _____

List the NON-STANDARDIZED ASSESSMENT TOOLS used to evaluate visual perception and record the following data:

Assessment Tools	Date: 1st assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Reassessment Yes = 1 No = 0	Date:2nd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)	Date:3rd assessment	Presence of USN Yes = 1 No = 0	Score: Yes=1 No=0 (If yes, indicate score)
Additional Comments: Hemispace assessed: Health professional involved in assessment:										

CLINICAL EVALUATION OF UNILATERAL SPATIAL NEGLECT

Assigned Chart #: _____ Assigned Hospital #: _____ Abstractor #: _____

List the CLINICAL EVALUATIONS used to assess unilateral spatial neglect and record the following data:

Clinical Evaluations	Hemispace(s) Assessed PS/NES/FES	Date: 1st eval.	Presence of USN Yes = 1 No = 0	Health Professional	Reassessment Yes = 1 No = 0	Date: 2nd eval.	Presence of USN Yes = 1 No = 0	Health Professional	Date: 3rd eval.	Presence of USN Yes = 1 No = 0	Health Professional
ADL assessment with observation of USN symptoms reported *Write the statements reported and the terms used to describe USN:*											
Neurological Examination with testing for presence of USN reported *Write the statements reported and the terms used to describe USN:*											
Observation of USN symptoms reported in the chart *Write the statements reported and the terms used to describe USN:*											
Other *Write the statements reported and the terms used to describe USN:*											

DATA ANALYSIS FORM

Assigned Chart #: _____ Assigned Hospital #: _____ Abstractor #: _____

	Use of Tool/Evaluation Yes=1 No=0	**Presence of USN at 1st assessment** Yes=1 No=0	**Reassessment of USN** Yes=1 No=0	**Timing of 1st assessment**		**Hemispace(s) Assessed** PS=Personal Space NES=Near Extrapersonal Space FES= Far Extrapersonal Space	**Health Professional typically involved** Occupational Therapist=1 Neurologist=2 Other=3
				Date of 1st USN assessment	Date when first assessable		
Standardized Tools for USN							
Non-Standardized Tools for USN							
Standardized Tools for V-P							
Non-Standardized Tools for V-P							
Clinical Evaluation							

CHECKLIST

Check the following box(es) that applies:

- □ Chart Abstraction form (pg.1) completed
- □ Standardized Assessment Tools for Unilateral spatial neglect (pg.2) completed
- □ Non-standardized Assessment Tools for Unilateral spatial neglect (pg.3) completed
- □ Standardized Assessment Tools for Visual perception form (pg.4) completed
- □ Non-standardized Assessment Tools for Visual perception form (pg.5) completed
- □ Clinical Evaluation of Unilateral spatial neglect form (pg.6) completed
- □ Data Analysis form (pg.7) completed

Signature of Abstractor:_____ **Date of Form Completion:** _____

APPENDIX G: User Guide

User Guide

FOR QUESTIONS OR CONCERNS DURING THE ABSTRACTION, PLEASE CONTACT

ANITA MENON

CELL: (514) 813-0878
HOME: (514) 333-4166
OFFICE: (514) 398-3050
FAX: (514) 398-8193
EMAIL: anita.menon@mail.mcgill.ca

******IMPORTANT:***

- Please answer **ALL** questions and if a **question not applicable**, write **n/a** as your answer. If an **entire page** is **not applicable**, put a **slash** through the page.
- For any uncertainties, place a **STAR** on the top corner of the page or next to the question, continue with the form and contact Anita afterwards.
- Charts that are eligible for the study are admissions between July 15th and December 15th 2002, of those coded with a primary diagnosis of stroke (ICD-9 code 431,434,436). You are asked to ***review the entire chart from the time of admission to time of discharge*** of the client. Do not stop the chart review even if you have past the admission window of July 15th to December 15th, 2002.
- Make sure the name of abstractor and chart number appear on every page of the form.

Chart Abstraction Form (page 1)

1. Date of Abstraction: Indicate the date that the medical chart was reviewed for abstracting data.
2. Abstractor: Name of the individual who reviewed and abstracted information from the chart.
3. Assigned hospital #: Indicate the assigned hospital number for the hospital where the chart is being reviewed. A list of all the hospitals and their assigned numbers can be found at the last page of this booklet.

4. Chart #: Indicate the chart number used by the hospital to identify the medical chart, which usually appears on the top corner of each page.

5. Client Age: Identify the client's age as of their date of admission.

6. Client Sex: Indicate the client's sex as recorded in the chart.

7. Date of Admission to Hospital: Date when the client was admitted to an **acute care** hospital bed (which can include admission to a medical unit, short-term geriatric unit, stroke unit, ICU or any other acute care unit, along with a mobile stroke team that provides stroke care for clients on other units). If the client was discharged directly from the emergency unit without being admitted to an acute care hospital unit, indicate not applicable (n/a) as an answer.

8. Date of Discharge: Date when the client was discharged from an acute care unit at the hospital. Discharge date can also be when the client was declared as long-term during this hospital stay. A client is considered discharge if they are transferred to a *rehabilitation center* but not if they are transferred to a *rehabilitation unit within the hospital.* If the client has not been discharged from the hospital as of the date of chart abstraction, indicate not applicable (n/a) as an answer.

9. Discharge Destination: Specify the location to which the client was discharged. This can include whether the client is deceased. . If the client has not been discharged from the hospital as of the date of chart abstraction, indicate not applicable (n/a) as an answer.

10. Date first seen in Emergency by a physician, nurse or rehab professional: Date when the client is first seen upon admission to the emergency unit by a health professional such as a physician, nurse or rehab professional, to screen for existing impairments and determine a diagnosis. The first brief triage done by a nurse upon first contact to the emergency unit in order to prioritize the severity of the client's symptoms is not included.

11. Stroke Diagnosis: Indicate whether the client was diagnosed with a stroke, defined as a sudden interruption of blood flow to the brain (an ischemic stroke) or the rupture of cerebral blood vessels (a hemorrhagic stroke), causing brain cells of the affected area to die. This non-convulsive neurological deficit that persist for >24hours excludes cases of transient ischemic attacks. Hospital codes derived from the International Statistical Classification of Diseases and Health Related

Problems- ninth revision (ICD-9) should be indicated if this is included in the chart. If the ICD-9 code is not included, not applicable (n/a) as an answer.

12. Side of Lesion: Indicate the side of the brain that was affected by the stroke.

13. Past History of Stroke: Indicate whether the client had a previous stroke.

14. Was the patient ever **"assessable"** for USN during acute care admission, where "assessable" is defined as ever having eyes open, awake, responsive, alert, oriented, fully conscious, responds/ head turn towards verbal/visual stimuli? Review the entire chart page by page from admission to discharge to determine whether the client was **"assessable"** during this admission. The term **"assessable"** is operationally defined as written evidence in the chart that the patient is alert, such that they are awake with their eyes open, fully aware of normal external and internal stimuli, and are not declared legally blind or comatose. There must be some period of hospitalization without coma, and periods of alertness to generate meaningful interactions with the clinician. If the client is assessable throughout their hospitalization, date when first assessable is the date of admission to emergency. If the client arrived to the emergency unit unconscious, medically unstable, unresponsive or comatose, the date at which the client is first considered as **"assessable"** based on the definition should be recorded as date when the client was first assessable. If the client remained unconscious, medically unstable, unresponsive or comatose throughout their hospital stay with no or minimal **"assessable"** periods, check the "no" box.

15. Did the patient remain assessable thereafter? IF QUESTION 14 IS YES, PROCEED- Review entire chart page by page from admission to discharge for any interruptions that may have occurred during the **"assessable"** period due to a coma, head attack, second stroke, etc., where the client could not have potentially been assessed for USN. Specify the date and duration of the interruptions from their "assessable" period. IF QUESTION 14 is NO, indicate not applicable (n/a) as an answer.

16. What was the location of stroke care during the majority of the patient's **"assessable"** period: IF QUESTION 14 IS YES, PROCEED- Indicate the hospital unit where the client remained during the *majority* of their **"assessable"** period. Among the typical units in the hospital, this includes a stroke team within a designated stroke unit or a mobile stroke team that attends to clients post stroke on

any acute care unit in the hospital. It also includes a *general rehabilitation unit within the acute care hospital* where the client is transferred within a few days of admission to the hospital or from emergency to receive active rehabilitation based on their diagnosis. IF QUESTION 14 is NO, indicate not applicable (n/a) as an answer.

17. Number of full-time and part-time Occupational Therapists working with stroke clients at the hospital: Speak to the Director of Patient Services or a medical records personnel hospital administrator regarding the number of full-time and part-time occupational therapists working with stroke clients at the hospital between July and December 2002. If these values are not available as per the hospital administrator, indicate not applicable (n/a) as an answer.

18. Number of full-time and part-time Neurologists working with stroke clients at the hospital: Speak to the Director of Patient Services or a hospital administrator regarding the number of full-time and part-time neurologists working with stroke clients at the hospital between July and December 2002. If these values are not available as per the hospital administrator, indicate not applicable (n/a) as an answer.

DO NOT proceed with rest of form if answers for question **11** or **14** are either **NO** or **NOT AVAILABLE IN CHART**

19. Was the patient assessed for USN as reported in the chart? Review entire chart page by page from admission to discharge for any evaluation of USN documented in the progress notes, consultation reports, nurses care plan, discharge summaries, etc. Keep note that other terms that are used interchangeably for USN are visual-inattention, hemi-inattention, hemi spatial neglect, visual-spatial neglect, unilateral neglect, spatial neglect, hemi-neglect, and visual neglect. Possible statements of USN symptoms reported in the chart are as follows: client tends to ignore the left/right side of their body, does not wash the left/right side of his/her body, eats half of his/her food on the meal tray, does not groom the left/right side of their face, bumps into obstacles on the left/right side of their environment, does not respond to verbal or visual stimuli on their left/right side, or ignores family members and hospital staff in room. Indicate the **Date of 1st USN assessment**, which is the date when the client was first assessed for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results

of an examination are documented by a health professional will be an acceptable estimate.

20. What was the location of stroke care on the date of 1st USN assessment: IF QUESTION 19 IS YES, PROCEED- Indicate the hospital unit where the client was received stroke care on the date of 1st USN assessment. Among the typical units in the hospital, this includes a stroke team within a designated stroke unit or a mobile stroke team that attends to clients post stroke on any acute care unit in the hospital. It also includes a *general rehabilitation unit within the acute care hospital* where the client is transferred within a few days of admission to the hospital or from emergency to receive active rehabilitation. IF QUESTION 14 is NO, indicate not applicable (n/a) as an answer.

21. How was the patient assessed for USN? IF QUESTION 19 IS YES, PROCEED- Review entire chart page by page from admission to discharge for any evaluation of USN using standardized and non-standardized assessment tools specific to USN or visual perception, or clinical evaluations performed by health professionals. **Refer to the list of assessment tools classified as standardized or non-standardized, and being either specific to the assessment of USN or visual perception. This list will identify which forms need to be filled out.** Some tools are specifically developed to assess USN whereas other tools that evaluate visual perception in general can be used to make inferences regarding the presence of USN. If a tool does not appear on the list provided in the back, place a **STAR** on the top corner of the form and enter the data on **page 3** regardless of whether the tool is specific to USN or visual perception. Check off the appropriate boxes (can be more than 1) and complete the pages of the form as indicated. IF QUESTION 19 is NO, indicate not applicable (n/a) as an answer.

    - If assessed with standardized tools specific to USN: **Complete pages 2 and 7**
    - If assessed with non-standardized tools specific to USN: **Complete pages 3 and 7**
    - If assessed with standardized tools specific to visual perception: **Complete pages 4 and 7**
    - If assessed with non-standardized tools specific to visual perception: **Complete pages 5 and 7**

- If assessed through clinical evaluation: **Complete pages 6 and 7**
- If not applicable (no assessment for USN as per chart): **Complete page 1 only**

22. Presence of hemianopsia/visual field deficit: Review the entire chart page by page from admission to discharge for any reports of the presence of hemianopsia or a visual field documented in the progress notes, consultation reports, nurses' care plan, discharge summaries, etc..

23. Stroke severity of patient: Use data from chart documented from the **"assessable" period**. If client was not assessed for USN, use data from the chart documented ± 2 days from **Date when first assessable.** Sequelae post stroke are crudely categorized as none, mild-to-moderate or severe. Patients who are ambulatory without assistive devices or assistance are classified as having no stroke symptoms. Those who are ambulatory with aid from an assistive device (cane or walker) or from an individual are classified as mild-to-moderate. Severe cases are defined as being non-ambulatory or wheelchair-bound at time of initial assessment of USN.

24. Degree of aphasia: Use data from chart documented from **"assessable" period.** If client was not assessed for USN, use data from the chart documented ± 2 days from **Date when first assessable.** Language deficits are crudely classified as being absent, mild-to-moderate or severe. The chart is categorized with an absent of speech impairments only when there is no documentation on language deficits upon review. Mild-to-moderate aphasia is operationally defined by documentation of presence of language impairments whereas "severe aphasia", a term commonly recorded in charts, describes the complete inability to produce receptive or expressive speech.

25. Degree of motor deficits in the upper limb: Use data from chart documented from **"assessable" period.** If client was not assessed for USN, use data from the chart documented ± 2 days from **Date when first assessable.** The majority of assessment tools for USN require some gross motor skills of the upper extremity and even hand dexterity. Motor skills will be crudely classified as normal, mild-to-moderate or severe motor deficits, where normal is identified as normal muscle tone in the affected upper extremity. Mild-to-moderate is defined as the affected upper extremity having hypotonic or hypertonic muscles. Flaccidity of the affected

upper extremity is classified as severe motor deficits. The patient can also be classified as having severe motor deficits if their dominant hand is hypertonic or hypotonic.

26. Degree of cognitive deficits: Use data from chart documented from **"assessable" period.** If client was not assessed for USN, use data from the chart documented ± 2 days from **Date when first assessable.** Cognitive deficits are roughly categorized as normal when there is written evidence in the chart that the patient is oriented to time, place and person during assessment. A mild-to-moderate cognitive deficit is identified as being oriented to two out of the three areas (time, place and person). Those that are oriented to one or none of the three areas are identified with severe cognitive impairments.

Standardized and Non-Standardized Assessment tools for unilateral spatial neglect/visual perception (pages 2-5)

Indicate your assigned chart number and assigned hospital code (a list of all hospitals and their assigned codes appear on the last page of the booklet), along with your name on the top of the form.

Refer to the list of assessment tools that are classified according to whether the tool is standardized and non-standardized, as well as whether the tool is specific to USN or visual perception, in order to fill the appropriate forms.

Box 1: Indicate the name of the assessment tool used to evaluate USN. Use the additional comments section to copy the statements recorded in the chart that describe the assessment of USN, such as the assessment process, any observations of the health professional, results of the evaluation, details of the administration, comments regarding the score of the assessment tool, whether the assessment sheet was included in the chart etc. Indicate the hemispace incorporated in the assessment of USN, where the **personal space (PS)** is the hemispace on the client's body, **near extrapersonal space (NES)** is the hemispace within the client's reaching distance or the space within arm's length, and **far extrapersonal space (FES)** is the hemispace beyond the client's reaching distance or the space beyond arm's length. Indicate the type of health

professional involved in assessment of USN (occupational therapist, neurologist, nurse, physiotherapist, etc.).

Box 2: Indicate the date of 1st USN assessment with the tool from the chart, which is the date when the client was first assessed for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results of an examination are documented by a health professional will be an acceptable estimate.

Box 3: Indicate whether the results of the assessment included a notation regarding presence of USN (1 for yes and 0 for no).

Box 4: Indicate whether a score was recorded in the chart (1 for yes and 0 for no) and if there is a score, include it in the box.

Box 5: Indicate whether the client was reassessed with the **same** assessment tool (1 for yes and 0 for no). If the client was reassessed, continue to fill the next three boxes along the same row. If the client was not reassessed, you may stop filling the boxes along the same row.

Box 6: If the client was reassessed with the same tool, obtain the date of 2nd USN assessment with the tool from the chart, which is the date when the client was reassessed for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results of an examination are documented by a health professional will be an acceptable estimate. If this was performed by another health professional, describe this in the additional comments section of the first box.

Box 7: Indicate whether the results of the reassessment included a notation regarding the presence of USN (1 for yes and 0 for no).

Box 8: Indicate whether a score was recorded in the chart (1 for yes and 0 for no) and if there is a score, include it in the box.

Box 9: If the client was reassessed for a third time with the same tool, obtain the date of 3rd USN assessment with the tool from the chart, which is the date when the client was assessed again for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results of an examination are documented by a health professional will be an acceptable estimate. If this was performed by another health professional, describe this in the additional comments section of the first box.

Box 10: Indicate whether the results of the assessment included a notation regarding presence of USN (1 for yes and 0 for no).

Box 11: Indicate whether a score was recorded in the chart (1 for yes and 0 for no) and if there is a score, include it in the box.

IF THE CLIENT WAS ASSESSED AGAIN WITH THE TOOL, PLEASE USE THE BACK OF THIS FORM TO DESCRIBE THE DATE OF ASSESSMENT, PRESENCE OF USN AND SCORE (Additional copies of the form will be provided if necessary)

Clinical Evaluation of unilateral spatial neglect (page 6)

Indicate your assigned chart number and assigned hospital code (a list of all hospitals and their assigned codes appear on the last page of the booklet), along with your name on the top of the form.

Box 1: Choose the type of clinical evaluation used to assess USN as provided in the boxes. The first three types of clinical evaluations are suggestions, such that any minor variations can be described in the space provided.

Here is a description of each type of clinical evaluation:

- ADL assessment with observation of USN symptoms reported: A non-standardized assessment of activities of daily living, where the health professional observes the client performing daily activities and documents any impairments or disabilities, including the presence of USN. Terms that are often used interchangeably for USN are visual-inattention, hemi-inattention, hemi spatial neglect, visual-spatial neglect, unilateral neglect, spatial neglect, hemi-neglect, and visual neglect. Possible statements of USN symptoms reported in the chart are as follows: client tends to ignore the left/right side of their body, does not wash the left/right side of his/her body, eats half of his/her food on the meal tray, does not groom the left/right side of their face, bumps into obstacles on the left/right side of their environment, does not respond to verbal or visual stimuli on their left/right side, or ignores family members and hospital staff in room. Please use this space to copy the statements recorded in the chart that describe the assessment of USN, such

as the assessment process, any observations of the health professional, results of the evaluation, details of the administration process, comments from family members, etc.

- Neurological Examination with testing for presence of USN reported: This examination is typically performed by a neurologist but can also be done by a rehabilitation professional to test for impairments following a stroke, which can included the assessment of USN. Possible statements of USN symptoms reported in the chart are as follows: positive signs of visual neglect, observed signs of visual neglect during neurological examination, presence of visual neglect during visual field testing, etc. Please use this space to copy the statements recorded in the chart that describe the assessment of USN, such as the assessment process, any observations of the health professional, results of the evaluation, details of the administration process, comments from family members, etc.
- Observation of USN symptoms reported in the chart: General observation of USN as reported by hospital staff, physicians, and rehabilitation specialists or as complaints of the family. Possible statements of USN symptoms observed by staff and reported in the chart are as follows: client tends to ignore the left/right side of their body, does not wash the left/right side of his/her body, eats half of his/her food on the meal tray, does not groom the left/right side of their face, bumps into obstacles on the left/right side of their environment, does not respond to verbal or visual stimuli on their left/right side, or ignores family members and hospital staff in room. There are other terms that are used interchangeably for USN, are visual-inattention, hemi-inattention, hemi spatial neglect, visual-spatial neglect, unilateral neglect, spatial neglect, hemi-neglect, and visual neglect, which may be documented in the chart. Please use this space to copy the statements recorded in the chart that describe the assessment of USN, such as the assessment process, any observations of the health professional, results of the evaluation, details of the administration process, comments from family members, etc.
- Other: If the assessment of USN does not fit in the above categories, please use this space to copy the statements recorded in the chart that describe how USN was assessed, such as the assessment process, any observations of

the health professional, results of the evaluation, details of the administration, process, comments from family members, etc.

Box 2: Indicate the hemispace incorporated in the assessment of USN, where the **personal space (PS)** is the hemispace on the client's body, **near extrapersonal space (NES)** is the hemispace within the client's reaching distance or the space within arm's length, and **far extrapersonal space (FES)** is the hemispace beyond the client's reaching distance or the space beyond arm's length.

Box 3: Obtain the date of 1st USN assessment from the chart, which is the date when the client was first assessed for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results of the clinical evaluation are documented by a health professional will be an acceptable estimate.

Box 4: Indicate whether the results of the assessment concluded the presence of USN (1 for yes and 0 for no).

Box 5: Indicate the type of health professional involved in the assessment of USN through clinical evaluation (occupational therapist, neurologist, nurse, physiotherapist, etc.).

Box 6: Indicate whether the client was reassessed with the **same** clinical evaluation process (1 for yes and 0 for no). If the client was reassessed, continue to fill the next two boxes along the same row. If the client was not reassessed, you may stop filling the boxes along the same row.

Box 7: If the client was reassessed with the same clinical evaluation process, obtain the date of 2nd USN assessment from the chart, which is the date when the client was reassessed for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results of the clinical evaluation are documented by a health professional will be an acceptable estimate. If this was performed by another health professional, describe this in the additional comments section of the first box.

Box 8: Indicate whether the results of the reassessment concluded the presence of USN (1 for yes and 0 for no).

Box 9: Indicate the type of health professional involved in the reassessment of USN through clinical evaluation (occupational therapist, neurologist, nurse, physiotherapist, etc.).

Box 10:If the client was reassessed for a third time with the same clinical evaluation process, obtain the date of 3rd USN assessment from the chart, which is the date when the client was assessed again for USN by a health professional as indicated on their consultation report. If this information is not available, time at which the results of the clinical evaluation are documented by a health professional will be an acceptable estimate. If this was performed by another health professional, describe this in the additional comments section of the first box.

Box 11: Indicate whether the results of the assessment concluded the presence of USN (1 for yes and 0 for no).

Box 12: Indicate the type of health professional involved in the assessment of USN through clinical evaluation (occupational therapist, neurologist, nurse, physiotherapist, etc.).

IF THE CLIENT WAS ASSESSED AGAIN WITH THE SAME CLINICAL EVALUATION PROCESS, PLEASE USE THE BACK OF THIS FORM TO DESCRIBE THE DATE OF ASSESSMENT AND PRESENCE OF USN (Additional copies of the form will be provided if necessary)

Data Analysis (page 4)

For all the standardized and non-standardized tools, or the clinical evaluation processes used to assess USN in general, indicate the following:

Box 1: Indicate whether the client assessed for USN (yes is 1 and no is 0)

Box 2: Indicate whether the results of the assessment(s) concluded the presence of USN (1 for yes and 0 for no).

Box 3: Indicate whether the client was reassessed with these assessment tools/evaluation processes (1 for yes and 0 for no).

Box 4: Indicate the **Date of 1st USN assessment** with the use of standardized and non-standardized tools, or various clinical evaluation processes *(from page 2 through 5)* and **Date when first assessable** *(from page 1).*

Box 5: Indicate the hemispace assessed by the assessment tools/clinical evaluations by reviewing the list of tools classified according to their hemispace evaluated at the end of the booklet (Personal space is PS, Near extrapersonal space is NES, and Far extrapersonal space is FES).

Box 6: Indicate the type of health professional that was most often involved in assessment of USN for this client (occupational therapist, neurologist, nurse, physiotherapist, etc.).

Additional Comments: This section is reserved for any additional comments that need to be made regarding the chart abstraction, information documented on the form, any difficulties that arose, or information that may be pertinent for data analysis etc.

Checklist: **This section must be completed by the abstractor once the form is completed.** Check off the pages of the form that are completed and make sure that all these pages are stapled and submitted to the primary investigator. Include your signature and the date that the form was completed.

TOOLS FOR UNILATERAL SPATIAL NEGLECT	Standardized	Non-Standardized	Hemispace		
			PS	NES	FES
ADL Checklist for Neglect		X	X	X	X
Albert's Test	X			X	
Baking Tray Task	X			X	
Ball and Hole test		X		X	
Bell's Test	X			X	
Bilateral Scanning Task (BST)		X		X	
Catherine Bergego Scale (CBS)	X		X	X	X
Circle Cancellation		X		X	
Comb and Razor/Compact Test	X		X	X	
Computerized key taps		X		X	
Computerized Test for Visual Neglect		X		X	
Double Letter Cancellation Test (DLCT)	X			X	
Indented Paragraph Reading Test		X		X	
Làdavas's Tests		X		X	
Landscape Scenery		X		X	
Lateral Asymmetry in Visual Spatial Attention Test	X			X	
Line Bisection	X			X	
Meaningful Pictures		X		X	
Neglect Questionnaire		X	X	X	X
Number Cancellation		X		X	
Questionnaire for detecting everyday problems in stroke patients with USN		X	X	X	X
Random Letter Cancellation		X		X	
RBIT- short version	X			X	
Reading Test		X		X	
Rivermead Behavioral Inattention Test (RBIT)	X			X	

Scene-recall task for testing spatial attention		X		X	
Search-A-Word (SAW)	X			X	
Semi-Structured Scale for the Functional Evaluation of Hemi-Inattention in Personal Space	X		X		
Semi-Structured Scale for the Functional Evaluation of Hemi-Inattention in Extrapersonal Space	X			X	X
Sentence Reading Test		X		X	
Single Letter Cancellation Test (SLCT)	X			X	
Speeded Reading of Word Lists (SRWL)	X			X	
Star Cancellation	X			X	
Test of Everyday Attention (TEA)		X	X	X	
Unilateral Inattention Battery		X		X	X
Unilateral Inattention Functional Rating Scale		X	X	X	
Visual Scanning Test (VST)		X		X	

TOOLS FOR VISUAL PERCEPTION	Standardized	Non-Standardized	Hemispace		
			PS	NES	FES
Brain Injury Visual Assessment Battery for Adults (biVABA) subtests		X		X	X
Chessington Occupational Therapy Neurological Assessment Battery (COTNAB)	X			X	
Copy a house		X		X	
Copying a Cube		X		X	
Copying a Greek cross		X		X	
Clock Drawing Test (CDT)	X			X	
Dotting a target circle		X		X	
Draw-a-Man Test	X			X	
Drawing a Wagon wheel with spokes		X		X	
Flower Drawing		X		X	
Graham-Kendall Memory-for-Designs Test	X			X	
Halstead-Reitan Neuropsychology Battery	X			X	
Hemispheric Stroke Scale	X		X	X	
Làdavas's Tests	X			X	
Motor-Free Visual Perception Test (MVPT)	X			X	
National Institutes of Health Stroke Scale (NIHSS)	X		X	X	X
Ontario Society for Occupational Therapists (OSOT) Perceptual Evaluation	X			X	
Picture Matrix Memory task	X			X	
Raven Colored Progressive Matrices	X			X	
Rey-Osterreith Complex Figure Drawing	X			X	
Rivermead Perceptual Assessment Battery (RPAB)	X			X	
RPAB- short version	X			X	
Screening Instrument for Neurobehavioral impairments in Stroke (SINS)	X			X	
WAIS-R Block Design	X			X	
Wundt-Jastrow Illusion Test	X			X	

APPENDIX H

Health Professionals Involved in Assessment of USN

While the evidence strongly suggests that the prevalence of USN is high in the early post-stroke period and that it should be assessed, there seems to be some disparity when identifying the discipline most typically responsible for the assessment and treatment of USN. In designing this study, we hypothesized that occupational therapists were the professional group most likely to be involved in the detection of USN once the patient was admitted to an acute care bed, but there was no clear evidence in the literature to support this impression. Thus in October 2002, we conducted a survey of a convenience sample of 21 teaching and university–affiliated acute care hospitals across Canada. A brief questionnaire was designed to elicit information from various clinicians (coordinators of stroke units or stroke care teams, neurologists, nurses and therapists), regarding the health professional group most likely to assess USN. Table 1 presents the findings of this brief survey:

Table 1: Assessment of USN across Canadian Hospitals

Province	N	***Professionals Assessing USN***					
		Neurologist	Ophthalmologist	OT*	SLP**	PT***	Vision Specialist
Quebec	9	3	0	9	1	1	0
Ontario	5	3	1	1	0	0	1
British Columbia	6	3	0	4	2	1	0
Nova Scotia	1	1	0	1	0	0	0
TOTAL	**21**	**10**	**1**	**15**	**3**	**2**	**1**

*Occupational Therapist **Speech Language Pathologist ***Physical Therapist

From the findings it appears that neurologists commonly conduct a brief screen for USN during their neurological examination either in the emergency room or once a patient is admitted to the medical unit. Another finding of this survey was that once patients are admitted to a hospital unit, the occupational therapist is the health professional typically responsibility for the assessment of USN

APPENDIX I: GLOSSARY

- USN: Unilateral Spatial Neglect
- SAT: Standardized Assessment Tool
- NSAT: Non-standardized Assessment Tool
- ICD-9: International Classification of Diseases -9th revision
- RHD: Right Hemisphere Damage
- LHD: Left Hemisphere Damage
- PET: Positron Emission Tomographic
- RBIT: Rivermead Behavioral Inattention Test
- RPAB: Rivermead Perceptual Assessment Battery
- ADL: Activities of Daily Living
- IADL: Instrumental Activities of Daily Living
- OSOT Ontario Society of Occupational Therapists
- SD: Standard deviation