CHAPTER 3
METHODOLOGY

3.1 RESEARCH DESIGN

A descriptive study using a cross sectional design was used to establish norms on the JHFT for an ethnically diverse South African population between the ages of 20 and 59 years old. Subjects were only assessed on one occasion. This allowed for quicker data collection on a relatively large number of participants, at little cost. It also eliminated a drop out of participants and was therefore suitable for this study where association between age and hand function needed to be identified, but not cause and effect [80].

An analytical element was introduced into the descriptive study by considering factors of gender and culture. The factors have been cited in the literature as possible influencers on hand function [77, 72, 74, 75, and 81].

3.2 SUBJECT SELECTION

To qualify for the original Jebsen et al [1] study individuals had to present with normal upper extremity structures. This included a full range of movement in all upper limb joints, adequate strength in the upper limbs, unimpaired sensation and intact co-ordination. Jebsen et al [1] then worked out the means, standard deviation and analysis of variance (ANOVA) for age and gender. Norms were divided into two primary age groups, 20-59 and 60-94 year old individuals.

Since Jebsen et al [1] had found significant differences in the age groups outlined above and between males and females; it was decided to retain these variables for this study. Therefore, equal numbers of male and female subjects between the ages of 20 and 59 years were included. The other variable added to this study was ethnicity. Normal ethnically diverse South Africans were recruited at a general practitioner's (GP) practice over a two-week period. Males and females in each of the four official racial groups (Black, Coloured, Indian and White) were recruited to participate in the study. Due to the need to consider the aforementioned

demographics, a quota sampling method was used. Cluster sampling was not used to represent the number of each population group as a percentage of their representation in the population as that would have resulted in one or two Coloured and Indian subjects. It would thus have been impossible to meet the objective of this study that was to find a norm for each population group. Subjects were selected based on convenience. If they agreed to participate and were found to have no upper limb impairment; they were included in the study until the quota for the ethnic group they belonged to, was met.

3.2.1 Inclusion criteria

Individuals selected for the study were usually the relatives and friends who accompanied ill patients to the surgery. They were approached in the waiting room and seen whilst the doctor attended to their ill family or friends. Some individuals approached were medical representatives from drug companies. Individuals recruited to the study were assessed to ensure that they did not have a medical problem that may affect upper limb function. They were measured against the criteria documented in the original study by Jebsen et al [(1)]. i.e. they had to present with:-

- normal upper extremity structures,
- full range of movement in all upper limb joints,
- adequate strength in the upper limbs,
- unimpaired sensation and intact co-ordination,
- coherence and ablility to answer questions asked

All subjects were between the ages of 20 to 59 years old.
All subjects were able to write and read an entire sentence in English, which was determined by interviewing each potential subject.

3.2.2 Exclusion criteria

Individuals

- with any form of previous injury to the upper limbs,
- not between the ages of 20 to 59 years old,

- not able to read and write an entire sentence in English.

3.2.3 Sample Size

By using a sample size of 120, 60 males and 60 females was set in consultation with the statistician. This sample size in conjunction with a simple t-test, would achieve a 95% confidence interval with a precision of two units in the dominant hand and three units in the non-dominant hand.

3.3. MEASUREMENT INSTRUMENT

The JHFT was used. The seven sub tests of the JHFT were administered according to the original Jebsen et al [1] protocol. A commercially produced JHFT was used. Although tests items could have be collected or constructed by the researcher, it was decided that to ensure standardisation for this study. Thus the coins, cans and draughts were all bought, to make sure they matched exactly to Jebsen et al's [1] original specifications.

The standardised instructions were read out to the subject once the equipment for each subtest had been set out in front of them according to Jebsen et al's [1] specifications (Appendix A). Each subtest was timed using a stop watch from the time the tester said "go" according to the set criterion describe by Jebsen et al[1] for each sub test (Appendix A). If an item was fumbled or dropped during a subtest the timing was completed irrespective, as per the instructions.

3.3.1 Pilot study to establish inter tester reliability

Another occupational therapist, experienced in administration of standardised tests, was recruited as a research assistant to assist with the collection of the data. Prior to data collection, the inter-rater reliability on the JHFT was established between the principal researcher and the research assistant. This was done by the principal researcher and the research assistant assessing the same five subjects on a different day using the JHFT. The testing of the five subjects was conducted over two days.

The five subjects were not included in the study but met inclusion criteria for the study. Subjects for this pilot study were conveniently selected from within the researcher's workplace. These subjects had diagnoses similar to the patients included in the test retest reliability aspect of Jebsen et al's [1] study. These diagnoses included stroke, hand trauma and rheumatoid arthritis.

The testing of the subjects was alternated, so that three were tested on the first day by the principal researcher and the other two were tested on the first day by the research assistant. The researcher and research assistant then tested the subjects they had not tested on day one, on day two. This was done to eliminate the effect of practice on the test.

A mean and standard deviation was then calculated for each of the scores recorded by the researcher and research assistant, for each of the subtests. Though differences in recorded times were noted, all correlations were statistically significant at the $p = 0.03$ and 0.01 level, indicating high levels of inter-rater reliability. Refer to Appendix B for further details.

3.4 RESEARCH PROCEDURE

One hundred and twenty subjects were recruited from a busy GP practice in an urban area in Durban. The GP granted permission to use the practice premises, as well as recruit visitors attending the practice. Subjects were approached as they waited in the waiting room. Some subjects were medical representatives from drug companies waiting to see the doctor and others were people who had accompanied patients to the doctor's rooms. The information sheet was given to them to provide an explanation of the study and signed consent to participate was obtained.

Individuals recruited to the study were screened to ensure that they did not have a medical problem that affected upper limb function. Individuals were asked whether they currently or previously had experienced trauma or a medical condition that affected hand and upper limb function. Individuals were specifically asked if there

were any difficulties with perceived strength, sensation, co-ordination or restrictions in range of movement in their arms.

The subjects were further screened to ensure they met the criteria documented in the study by Jebsen et al [1] which included the following:

- normal upper extremity structures (based on general observation of the upper limbs - no amputees, missing digits, etc),
- full range of movement in all upper limb joints (assessed by asking the patient to complete all expected range of movements of the upper limb joints as part of the screening),
- adequate strength in the upper limbs (based on self rating by subject – subject were asked if strength was a restriction in any current activity of daily living),
- unimpaired sensation (subjects were asked to close their eyes, stimulus presented to upper limb, subjects were asked to accurately locate the stimulus whilst eyes remained closed),
- intact co-ordination (non-standardised screening as defined by clients being able to complete finger to nose test rhythmically and accurately),
- coherent and able to answer questions asked,
- ability to read and write a sentence in English (subjects were asked if they had attended school and could write cursive writing and read English).

If the subjects did not meet any of the inclusion criteria the principal researcher explained the reason for their exclusion emphasising that the study required replication as per Jebsen et al's [1] original criteria. If during the screening, a deficit in the upper extremity was noted, the subject was thanked for offering to participate, and if appropriate, advice was provided on where assistance may be sought.

Some possible subjects were excluded since they did not match all the criteria for inclusion, e.g. not able to write or read English, although they did fall within the normal limits of upper extremity function. The writing subtest required that the

subjects who normally wear spectacles do so during this subtest. This was confirmed with the subjects before they started the subtest and all subjects complied.
Thirty subjects from each population group were recruited with an equal number of male and female subjects in each group.

The test was completed in a quiet side room in the practice that was free from noise and other distractions, with adequate space to complete the test. To complete the test, each subject sat in a chair at a 76cm high desk in a well-lit area. After the initial instructions were given to the subject, questions from the subject were answered to promote understanding.

The subtests were administered according to the original Jebsen et al [1] protocol. Subtests were presented in the same sequence and the non-dominant hand was tested first. Each sub test has a specific procedure and instructions were strictly followed. (Appendix A). The design of the test allowed each subject to perform the test in a standardised manner and the results were timed using a stopwatch.

3.5 DATA COLLECTION

The sample was selected by asking subjects standard questions about age and ethnicity, before further screening was completed. Individuals were approached depending on the ethnic group and gender needed to fill the group requirements for the research, listed on the checklist.

A checklist was used to code subjects into the appropriate groups using coded numbers. Biographical data and other assessment data were recorded on the data collection form created by the principal researcher, to aid with data collection and later analysis (Appendix C). The 120 subjects were all assessed over a two-week period between 10.00 in the morning and 18.00 in the evening by the principal researcher and the research assistant. Each researcher assessed between five and seven subjects a day. Subjects were recruited by either the principal researcher or

the research assistant, who then assessed their hand function on the JHFT in the room allocated for the purpose.

The test was scored on a standard record sheet (Appendix C) with the time taken for each sub test for the non-dominant and dominant hand being recorded.

3.6 ETHICAL CONSIDERATIONS

Written permission from the GP was obtained before assessments commenced. Ethical clearance was applied for and obtained from the Committee for Research on Human Subjects at the University of the Witwatersrand. (Appendix D). Subjects were invited to attend, presented with an information sheet and signed informed consent was obtained from each subject before the assessment began. (Appendix E) The purpose of the assessment and an explanation of how the data would be collated and used were explained to each subject. Subjects were informed that they could refuse to participate or withdraw at any time and that data partially collected would be destroyed. Confidentiality was assured by not recording the names of subjects on the assessment forms and each subject was allocated a coded number to ensure that assessment findings were not confused with the assessment findings of another subject. Feedback on test performance was provided for all subjects who enquired about their results.

3.7 DATA ANALYSIS

Descriptive statistics were used with means and standard deviations being calculated for age, sex, handedness and population group. Norms for the subtests and test were established by calculating the mean and standard deviation for the entire sample.

The means for the dominant and non dominant hand of the sample in this study were compared to those found by Jebsen et al[(1)] for both males and females using confidence intervals, as no details of their raw data were available to establish

whether a significant difference between the means existed. A 95% confidence interval for the difference between the group means was used to establish a true difference between populations means [82].

The student t test was used to establish whether there were any significant differences between the four subject groups in terms of their performance on the subtests and to compare the characteristics of the groups.

Differences between the population groups were established to determine significance using an analysis of variance. A Bonferroni calculation was then completed. This is important in a study such as this, where the data has been subject to more than one test. The purpose is to eliminate a type one error, which is defined by incorrectly declaring a difference to be true due to chance rather than true effect/relationship. When the p level is set at 0.05, one in twenty statistical tests will show a chance finding when in fact there is no relationship. The Bonferroni correction adjusts for chance capitalisation by adjusting the p level downwards to ensure that the overall risk remains at 0.05[83].

The drawback in using the Bonferroni correction is that it may increase the chance of making a type two error. A type two error is when no effect or difference is declared when a true effect is in fact present. Though increasing the chance of a type two error, a Bonferroni correction is recommended in research such as this where a one-way analysis of variance has been completed. It is further indicated as a number of single tests have been completed when examining the individual variables of age, hand dominance and gender on hand function [83]. Scores were then calculated across all ages (20 – 59 years) and population groups to establish norms for the South African sample used.