UNIVERSITI PUTRA MALAYSIA

NORMATIVE DATA ON TRAIL MAKING TEST FOR GENERAL MALAYSIAN ADULT POPULATION ABOVE 40 YEARS OLD IN KLINIK KESIHATAN SALAK ON 2013

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NUR SYUHADA BINTI HINDU

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NORMATIVE DATA ON TRAIL MAKING TEST FOR GENERAL MALAYSIAN ADULT POPULATION ABOVE 40 YEARS OLD IN KLINIK KESIHATAN SALAK ON 2013

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ABSTRACT

Background: Trail Making Test (TMT) is one of the most popular, economical and easily administered instruments used in the clinical setting to measure general brain functions. It has been used in the diagnosis and evaluation of cognitive dysfunction for over 50 years. TMT assesses the psychomotor speed, attention, sequencing, mental flexibility and visual scanning. There were two parts: Trail A and Trail B, Trail A tests the attention while arranging numbers while Trail B tests executive function while arranging numbers and alphabets.

Objective: The general objective for this study was to determine normative data of TMT performance in the general Malaysian adult population above 40 years old. The specific objective was to determine the relationship between the sociodemographic factors which were age, gender, education level and race to the TMT performance.

Methods: The study design was a cross sectional observational community study with convenience sampling method. The subjects were all the adults above the age of 40 years old that visited the Klinik Kesihatan Salak between the periods of 15 July-1 August 2013 with their medical record. Adults who visited the Klinik Kesihatan Salak with medical history of neurological diseases, illnesses that affecting brain function, head trauma, significant psychiatric disturbance, do not understand the instruction given and also having vision or hearing problem were excluded from this study.

Result: There were 160 respondents. The minimum score of TMT A and TMT B are 20.00 seconds and 28.00 second respectively. While the maximum score of TMT A and TMT B are 188.00 seconds and 480.00 seconds respectively. Non-parametric method was used to identify the relationship between sociodemographic factors to the TMT performance. There was a significant fair direct correlation between age and TMT score, TMT A (r_s=0.48, $p < 0.05$), TMT B (r_s=0.42, $p < 0.05$). While for gender, there was no significant association between gender and TMT score (TMT A, $p > 0.05$), TMT B ($p > 0.05$). For race, there was no significant association between race and TMT score (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Lastly for educational level, there was significant association between education level and TMT score (TMT A, $p < 0.05$), TMT B ($p < 0.05$).

Conclusion: This study reveals that these four sociodemographic factors (age, gender, race and educational level) were closely related to the TMT performance. Based on our finding, there were statistically significance difference between the age and educational level with the TMT performance which showed alternative hypothesis. Besides, there were no statistically significant difference between gender and race with the TMT performance which showed null hypothesis.

Keyword: *Trail Making Test (TMT), age, gender, education level, culture*

UJIAN NORMATIF DATA MEMBUAT JEJAK BAGI GENERAL MALAYSIA PENDUDUK DEWASA BERUMUR LEBIH 40 TAHUN DI KLINIK KESIHATAN SALAK PADA 2013

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ABSTRAK

Latar belakang: Trail Membuat Ujian (TMT) adalah salah satu alat yang paling popular, ekonomi dan mudah digunakan dalam persekitaran klinikal untuk mengukur fungsi otak umum. Ia telah digunakan dalam diagnosis dan penilaian masalah kognitif selama lebih 50 tahun. TMT bertujuan untuk menilai kelajuan psikomotor, perhatian, urutan, fleksibiliti mental dan imbasan visual. Terdapat dua bahagian: Trail A dan B, ujian Trail A menguji perhatian mengatur nombor manakala ujian Trail B menguji fungsi eksekutif dalam menyusun nombor dan huruf.

Objektif: Objektif umum kajian ini adalah untuk menentukan data normatif berdasarkan prestasi TMT penduduk am dewasa Malaysia berumur lebih 40 tahun. Objektif spesifik adalah untuk menentukan hubungan antara faktor-faktor sosiodemografi seperti umur, jantina, tahap pendidikan dan bangsa dengan prestasi TMT.

Kaedah: Reka bentuk kajian adalah kajian keratan lintas masyarakat pemerhatian silang dengan kaedah persampelan konvinien. Populasi sampel adalah semua orang dewasa yang berumur lebih daripada 40 tahun yang melawat Klinik Kesihatan Salak antara tempoh 15 Julai - 1 Ogos 2013 yang mempunyai rekod perubatan. Orang dewasa yang melawat Klinik Kesihatan Salak dengan rekod perubatan seperti penyakit saraf, penyakit-penyakit yang menjejaskan fungsi otak, trauma kepala, gangguan psikiatri yang ketara, tidak memahami arahan yang diberikan dan juga penglihatan atau masalah pendengaran telah dikecualikan daripada kajian ini.

Keputusan: Terdapat sejumlah 160 responden. Skor minimum TMT A dan B TMT adalah 20.00 saat dan 28.00 saat. Manakala skor maksimum TMT A dan TMT B adalah 188.00 saat dan 480.00 saat. Kaedah bukan parametrik digunakan untuk mengenal pasti hubungan antara factor-faktor sosiodemografi dengan prestatsi TMT. Terdapat hubungan yang signifikan langsung antara umur dan skor TMT, TMT A ($r_s = 0.48$, $p < 0.001$), TMT B ($r_s = 0.42$, $p < 0.001$). Manakala bagi jantina, tidak ada hubungan yang signifikan antara jantina dan TMT skor (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Untuk bangsa, tidak ada hubungan yang signifikan di antara bangsa dan skor TMT (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Akhir sekali untuk tahap pendidikan, terdapat hubungan yang signifikan antara tahap pendidikan dan skor TMT (TMT A, $p < 0.05$), TMT B ($p < 0.05$).

Kesimpulan: Daripada kajian kami, keempat-empat faktor sosiodemografi seperti umur, jantina, bangsa dan tahap pendidikan berkait rapat dengan prestasi TMT. Berdasarkan hasil kajian kami, terdapat perbezaan yang signifikan secara statistik di antara umur dan tahap pendidikan dengan prestasi TMT yang menunjukkan hipotesis alternatif. Selain itu, tidak terdapat perbezaan statistik yang signifikan antara jantina dan bangsa dengan prestasi TMT yang menunjukkan hipotesis null.

Kata Kunci: *Jejak Membuat Ujian (TMT), umur, jantina, tahap pendidikan, budaya*

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TABLE OF CONTENTS

TITLE	PAGE
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
APPROVAL SHEETS	iv
DECLARATION FORM	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	xi
LIST OF FIGURES	xii
LIST OF ABBREVIATIONS	xii
LIST OF APPENDICES	xiv
CHAPTER 1: INTRODUCTION	
1.1 Background	1
1.2 Problem Statement and Significance of Problem	2
1.3 Objectives	3
1.3.1 General Objective	3
1.3.2 Specific Objective	3
1.4 Research Hypothesis	3
CHAPTER 2: LITERATURE REVIEW	
2.1 Race	4
2.2 Educational Level	6

2.3 Age 9

2.4 Gender 9

2.5 Conceptual framework 11

CHAPTER 3: METHODOLOGY

3.1 Study Location 12

3.2 Study Design 12

3.3 Study Duration 12

3.4 Sampling 12

3.4.1 Study Population 12

3.4.2 Sampling Population 13

3.4.2.1 Inclusion Criteria 13

3.4.2.2 Exclusion Criteria 13

3.4.3 Sampling Frame 13

3.4.4 Sampling Unit 13

3.4.5 Sample Size 14

3.4.6 Sampling Method 15

3.5 Instruments and Data Collection 15

3.5.1 Data Collection Techniques 15

3.6 Study Ethics 16

3.7 Data and Statistical Analysis 16

3.7.1 Dependant Variables 16

3.7.2 Independant Variables 16

CHAPTER 4: RESULTS

4.1 Response Rate 18

4.2 Descriptive Analysis 18

4.2.1 Age 18

4.2.2 Gender 19

4.2.3 Race 20

4.2.4 Educational Level 21

4.2.5 Median, Range, Maximum and Minimum for Continuous Variables 23

4.3 Inferential Analysis 26

4.3.1 Relationship between Age and TMT Score (Spearman's Correlation) 26

4.3.2 Relationship between Gender and TMT Score (Man Whitney U Test) 28

4.3.3 Relationship between Race and TMT Score (Independent Samples Kruskal Wallis Test) 29

4.3.4 Relationship between Educational Level and TMT score (Independent Samples Kruskal Wallis Test) 30

CHAPTER 5: DISCUSSION

5.1 Discussion 31

5.2 Limitations of Study 34

5.3 Conclusion 35

5.4 Recommendation 35

REFERENCES 36

APPENDICES 38

Gantt Chart 39

Research Team 40

Budget Planning 40

Trail Making Test Part A and Part B Instruction 41

Borang Persetujuan Responden 42

Consent Form 44

Trail Making Test Part A 46

Trail Making Test Part A-Sample 47

Trail Making Test Part B 48

Trail Making Test Part B-Sample 49

Trail Making Test Part B Jawi 50

Trail Making Test Part B Jawi-Sample 51

Approval Letter from NIH 52

LIST OF TABLES

Table 1: Research Finding on Relationship between Socio Demographic Factor and TMT performance.

Table 2: Statistical Analysis

Table 3: Distribution of Respondents by Age Categories

Table 4: Distribution of Respondents by Gender

Table 5: Distribution of Respondents by Race

Table 6: Distribution of Respondents by Educational Level

Table 7: Median, Range, Maximum and Minimum for Continuous Variables

Table 8: Comparison of TMT Score by Age

Table 8.1: TMT A Score Stratified by Age

Table 8.2: TMT B Score Stratified by Age

Table 9: Comparison of TMT Score by Gender

Table 10: Comparison of TMT Score by Race

Table 11: Comparison of TMT Score by Educational Level

LIST OF FIGURES

Figure 1: Conceptual Framework of Trail Making Test

Figure 2: Distribution of Respondents by Age Categories

Figure 3: Distribution of Respondents by Gender

Figure 4: Distribution of Respondents by Gender

Figure 5: Distribution of Respondents by Educational Level

LIST OF ABBREVIATIONS

TMT A – Trail Making Test Part A

TMT B – Trail Making Test Part B

LIST OF APPENDICES

Appendix 1: Gantt Chart

Appendix 2: Research Team

Appendix 3: Budget Planning

Appendix 4: Trail Making Test Part A and Part B Instruction

Appendix 5: Consent Form

Appendix 6: Standard Form of Trail Making Test

Appendix 7: Approval Letter from NIH

CHAPTER 1

INTRODUCTION

1.1 Background

Trail Making Test (TMT) is one of the most popular, economical and easily administered instruments used in the clinical setting to measure general brain functions. It has been used in the diagnosis and evaluation of cognitive dysfunction for over 50 years (Soukup et al., 1998).TMT assesses the psychomotor speed, attention, sequencing, mental flexibility and visual scanning (Seo et al., 2006). There are two parts: Trail A and Trail B, Trail A tests the attention by arranging numbers while Trail B tests executive function by arranging numbers and alphabets(Seo et al., 2006).This test is a time paper-and-pencil task where in Trail A participants require to connect the 25 randomly scattered number following the sequence without the line intersecting each other (Soukup et al., 1998). Trail B required the participants to connect the 25 randomly scattered numbers and letters, alternating between the two in progressive sequence (Soukup et al., 1998). The target score for both Trail A and Trail B are the total time in seconds required to complete the task (Soukup et al., 1998). Besides, the B-A difference score, the B:A ratio and B-A/A proportional score have been used for clinical setting as indicator of certain cognitive operations or marker of brain damage (Perianez et al., 2007).

1.2 Problem Statements and Significance of Problems

Although several TMT norms have been reported, most of them are basically for population from the other countries like US and Canada (Seo et al., 2006) but not specifically for Malaysia country. Therefore there is a need for having norms as parameters of normal cognitive performance of TMT of a general Malaysian adult to guide the screening, diagnosis and evaluation procedure of cognitive impairment. According to the reported study, the TMT performance is influenced by the demographic factors such as age, gender, education level and culture (Seo et al., 2006). Initially, TMT proposed that absolute cutoff score could be used to identify organic impairment but research clearly revealed that age, education and intelligence affected TMT performance (Royan et al., 2004). Therefore, the issues of the screening, diagnosis and evaluation procedure of cognitive impairment remained unresolved in our population. Therefore, further study is needed to provide the normative data for the Malaysian population and clarify the influence of the sociodemographic factors which are age, gender, education level and race to the TMT performance.

1.3Objective

1.3.1 General Objective

To determinethe normative data of TMT performance in the general Malaysian adult population above 40 years old.

1.3.2 Specific Objectives

1. To determine the relationship between the age and TMT performance.
2. To determine the relationship between the gender and TMT performance.
3. To determine the relationship between the education level and TMT performance.
4. To determine the relationship between the race and TMT performance.

1.4Research Hypothesis

1. There is a statistically significance difference between the age and TMT performance.
2. There is nostatistically significance difference between gender and TMT performance.
3. There is a statistically significance difference between educational level and TMT performance.
4. There is a statistically significance difference between race and TMT performance.

CHAPTER 2

LITERATURE REVIEW

According to the reported studieslast two decades among Asian population, the TMT performance was influenced by the sociodemographic factors such as age, gender, education level and culture (Seo et al., 2006; Perianez et al., 2007;Soukup et al., 1998). Initially, TMT proposed that absolute cutoff score could be used to identify organic impairment but other research clearly revealed that age, education and intelligence affected TMT performance (Lu et al., 2002).

2.1 Race

Culture is related to the ideas, customs, and social behavior of a society and also related to the arts and to intellectual achievements of certain population (Oxford Dictionary, 2013). Culture has different linguistic group such as English, Malay, Chinese, Korean and others (Lu et al., 2002;Seo et al., 2006).

Race, ethnicity and native language significantly influence neuropsychological test performance (O'Bryant, O'Jile, &MaCaffrey, 2004). While attention to race and ethnicity are receiving more attention by neuropsychologists (Echemendia, 2004; Ivnik, 2005), neurocognitive research for specific linguistic groups remains relatively rare.

Other research shows that deficits in attention are one of the most prevalent results in almost any disease that compromises brain functioning, including traumatic brain injury, Alzheimer's disease, Parkinson's disease, and epilepsy, among others (Rankin, Adams & Jones, 1996; Sohlberg&Mateer, 1989; Soukup& Adams, 1996; Williamson, Scott & Adams, 1996; Zec, 1993). Since the TMT measures attention, it might be assumed that its measurement is not influenced by cultural factors. Therefore, the use and results of this test should be unaffected by different culture base. The clinician practicing outside the US, for example, might feel that using North American norms could be legitimate since they would be unaffected by cultural differences. However, research has shown that cultural variables affect cognitive test performance (Ardila& Moreno, 2001; Greenfield, 1997; Rogoff&Chavajay, 1995).

The interpretation of TMT performance is based on those normative variables that affect performance, which are stratified by age, education, intellectual ability, and ethnicity (Abe et al., 2004; Bornstein &Suga, 1988; Drane et al., 2002; Hester, Kinsella, Ong, & McGregor, 2005; Rasmusson et al., 1998; Soukup, Ingram, Grady, &Schiess, 1998; Tombaugh, 2004; Zalonis et al., 2008).Consequently, normative data across different countries are not equivalent. Therefore, the basis of normative comparisons for different populations should be derived from the culture in which they were obtained (Ferna´ndez&Marcopulos, 2008). Creating normative data for the TMT Czech version could help establish cultural-specific data thereby minimizing the interpretive impact of misapplying non-cultural-specific normative information (Manly, 2008; van de Vijver&Tanzer, 2004).

Norms reported relatively comprehensive normative data, but their subjects were mainly from English speaking countries such as US or Canada (Ivnik et al., 1996; Tambaugh, 2004; Lucas et al., 2005; Steinberg et al., 2005; Seo et al., 2006). There has been a call for an "anthropological neuropsychology" based on the development of new cross-cultural normative databases stratified by socio-demographic factors (Ferraro & McDonald, 2005; Ardila, 2005).

Malaysian culture is different from the other countries culture. Therefore Malaysian needs its own norms of TMT. The Malaysian population comprises of Bumiputra (67.4%), Chinese (24.6%), Indian (7.3%) and others (0.7%) (Department of Statistic Malaysia. 2010). There has been no norm for Malaysian population to ensure accuracy in interpretation of cognitive impairments test. Although Malaysia has different races that are Malay, Chinese, Indian and others, but they are sharing mutual culture that is Malay language (Department of Statistic Malaysia. 2010). However there are minority of the population that practices the different types of knowledge such as Jawi (Muhammad BukhariLubis et al., 2006). Therefore the score of the TMT performance among Jawi and Roman alphabet in BahasaMelayu is not known.

2.2 Educational Level

In Malaysia education can be divided into two. There is formal and informal education. Malaysia has primary, secondary, and tertiary education (KementerianPelajaran Malaysia, 2013). According to the previous study, higher level of education is associated with better performance on TMT (Perianez et al., 2007).

Some studies have shown that educational level affects both parts of the TMT, with the time necessary to complete the TMT-A that require participants to arranging numbers and TMT-B that require participants to arranging numbers and alphabets being shorter for persons with a higher educational level (Periáñez et al., 2007; Giovagnoli et al. 1996; Stuss, Stethem, & Poirier, 1987). Whereas, other studies have found that educational level affects only the TMT-B (Tombaugh, 2004; Hashimoto et al., 2006; Ivnik, Malec, Smith, Tanglos, & Petersen, 1996).

Adults with less than 12 years education were significantly poorer on neuropsychological test performance than older adults with higher levels of completed education. A recent large study done by Tombaugh (2004) reported that performance on TMT-A and TMT-B is affected by both age and education; impact of education is especially significant for adults over 54 years of age (Hester et al., 2005).

The strong effects of age and educational level probably reflect the heterogeneity of the normative sample, which is representative of the Portuguese population. Noteworthy, the number of years of education was significantly related to all direct and derived TMT scores, even after adjusting for sex and age (Pinto et al 2013).

The influence of demographic characteristics noted here also raises the issue of interpreting TMT performance and, more generally, executive function, in the context of a patient's intellectual history. Years of education was utilized as a relatively crude index of premorbid

intellectualfunction in the present study. However, it would appear important for future studies providing normative data on executive tests to also administer other clinical measures to provide a more discrete measurement of premorbid functioning and to clarify the role of intellectual capacity in influencing a client's performance on widely used clinical neuropsychological measures of executive function.

Most studies only included participants with a relatively high education level. However, the effects in a population with a relatively low education level have not been clearly investigated. In contrast, conclusions regarding the influence of educational level on TMT performance have been inconsistent. Table 1 below shows the finding of several researchs:

Table 1: Research finding on relationship of sociodemographic factors and TMT performance

Authors	Research findings
Giovagnoliet al (1996).	The influence of age, education and general intelligence was always significant with TMT performance.
Cavaco et al (2008).	Both age and education were significantly correlated with direct scores.
Zalonis et al (2008)	Years of education were found to play an important role on TMT (A&B) performance.
Bezdicek et al (2012).	Education was correlated with TMT scores.
Robert et al (2005)	Education continues to be a significant factor when interpreting test performance.
Tombaugh (2004)	The stratification of the norms was based on findings that clearly showed that performance on Trails A and B was affected by age and education, but not by gender.

2.3 Age

Age is significantly related to neuropsychological performance (Tori et al., 2007).Both of the TMT performances are brief and sensitive to generalized mental slowing in advancing age (Lu et al., 2002). Age is critical in the TMT performance especially in individuals older than 50 years old because they will take longer time to complete the TMT (Soukup et al., 1998). Other study also suggested,performance on the TMT decreased with increasing age (Tombaugh et al., 2004). Advancing age is associated with slower response time to complete the test even among highly educated and healthy samples (Soukup et al., 1998).Hence, this demographic factor is significantly associated with the score on both Trails A and B (Lu et al., 2002).

2.4 Gender

There was no gender effect found on both of the TMT test scores (Lu et al., 2002).The stratification of the norms was based on findings that clearly showed that performance on Trails A and B was affected by age and education, but not by gender (Tombaugh et al., 2004). But, some of the studies suggested that men performed better than women on Trail A, while there was no gender effect found for Trail B (Seo et al 2006).

However, the significant gender effect wasexplained by a greater proportion of the poorly educated among the subjects with different social roles between man and woman (Seo et al 2006). Gender, however, was a moderating variable only for the elderly group (Tori et al., 2007). Although statistically significant gender effects are reported in large samples, consistent

gender differences within specific age groups have not emerged. Nevertheless, some of the more recent studies provide separate norms for men and women (Soukup et al., 1998).Hence, the gender effect is controversial.

2.5 Conceptual Framework

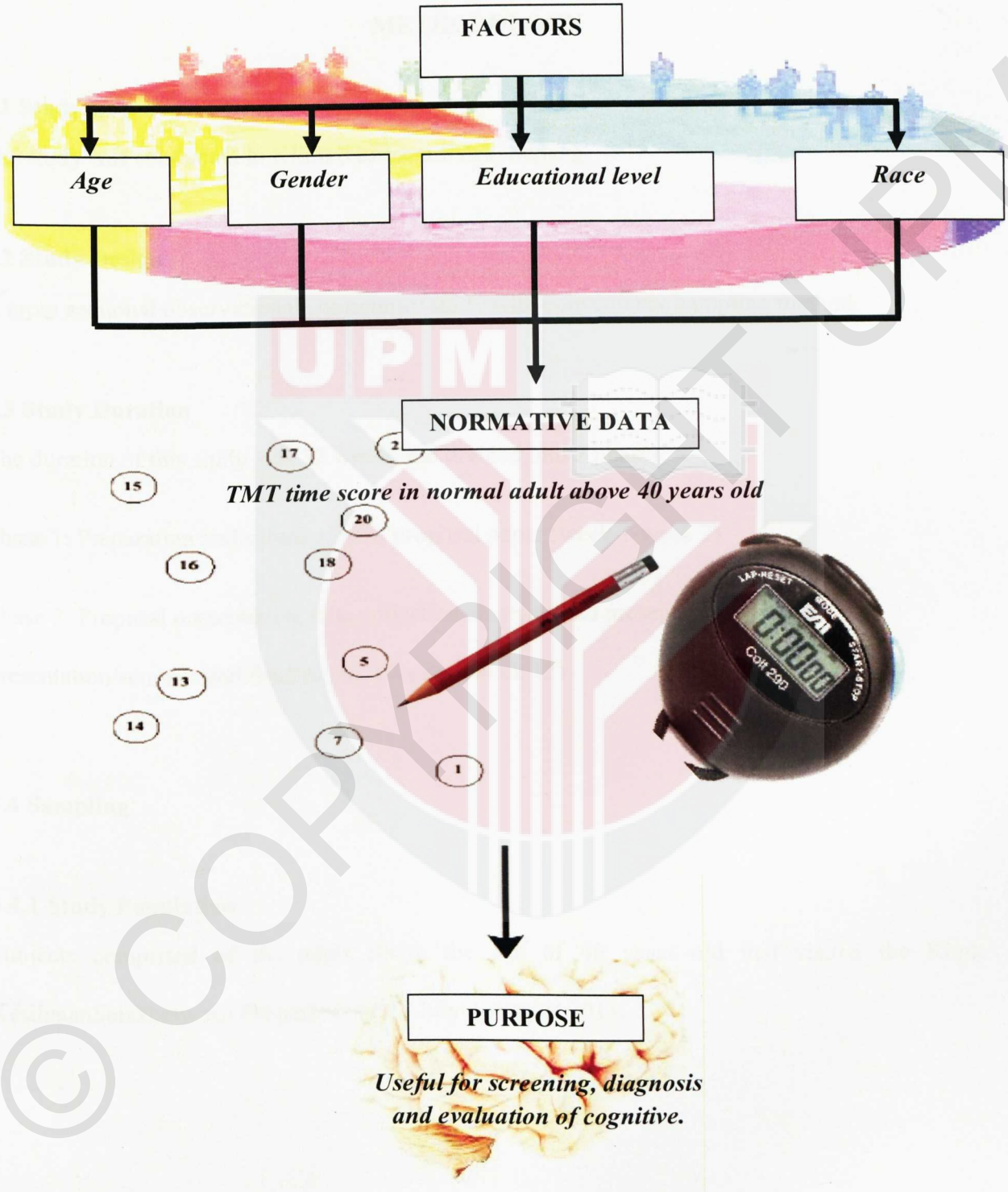

Figure 1: Conceptual framework of Trail Making Test

CHAPTER 3

METHODOLOGY

3.1 Study Location

The study was conducted in KlinikKesihatanSalak, Sepang.

3.2 Study Design

A cross sectional observational community study with convenience sampling method.

3.3 Study Duration

The duration of this study was 12 weeks and divided into 2 phases:

Phase 1: Preparation and submission of proposal paper (week 1-week 2)

Phase 2: Proposal presentation, data collection, analysis and presentation, final presentation/seminar and final report. (Week 3-week 12)

3.4 Sampling

3.4.1 Study Population

Subjects comprised of the adult above the age of 40 years old that visited the Klink KesihatanSalakbetween the periods of 15 July-1 August 2013.

3.4.2 Sampling Population

In our study, we recruited both male and female adult above 40 years old in KlinikKesihatanSalak.

3.4.2.1 Inclusion Criteria

All the adult that visited the KlinikKesihatanSalak above the age of 40 years old without exclusion criteria and must have their medical record in KlinikKesihatanSalak.

3.4.2.2 Exclusion Criteria

Adult that visited the KlinikKesihatanSalak who had the medical history of neurological diseases, illnesses that affecting brain function, head traumas, significant psychiatric disturbance, do not understand the instruction given and also havingvision and hearing problem as well.

3.4.3 Sampling Frame

A list of all the adult above 40 years old that visited the KlinikKesihatanSalak between 15 July-1 August 2013.

3.4.4 Sampling Unit

A normal adult above the age 40 years old that visited the KlinikKesihatanSalak without any neurologicalproblem in their medical record. The subject has the knowledge either in Jawi or Roman alphabets in Malay language.

3.4.5 Sample Size

Sample size estimation was determined by using cross-sectional (one group) proportion formula (Aday, 2005).

$$n = \frac{z^2_{1-\alpha/2}\, P(1-P)}{d^2}$$

Where:

n= sample size of the study population,

$z^2_{1-\alpha/2}$= number of standard error away from the mean(1.96)

P = estimated proportion (50%)

d= margin of error(7%)

$$n = \frac{1.96^2\ 0.5(1-0.5)}{0.07^2}$$

$$= 196$$

We get 160 respondents that is 80.2 % from our sample size.

We set the p-value less than 0.05 as the level of significance.

3.4.6 Sampling Method

In our study we used convenience sampling method to select our sample. The method of the sampling are stated below:

1. First, we have to ask the participant if they know eitherJawi and Roman alphabet
2. Then, all the participant that know either Jawi and Roman are selected either to answer the TMT test in Jawi or Roman alphabet based on their knowledge either in Jawi or Roman.

Outcome: The primary outcome was time score of the TMT performance.

3.5 Instrument and Data Collection

Consent form of participant standard form that comprises of important information which are the demographic factors (name, age, gender, education level and race) and the TMT test form.

3.5.1 Data Collection Technique

Step 1, we explained to the adult over 50 years old in KlinikKesihatanSalak about the TMT as well as providing them the information page at the front pages (Appendix 4). Then, we asked their written consent by using consent form at the next pages (Appendix 5). Next, we showed them the steps in performing the TMT.The participant was given a copy of the TMT Part A worksheet (Appendix 6) and a pen or pencil. Step 2 was demonstrating the test to the participant using the sample sheet (Trail Making Part A-Sample). The step 3 was time the participant as he or she follows the "trail" made by the numbers on the test. Then recorded the time and repeated the procedure for TMT Part B. We used stopwatch to time the TMT performance.

3.6Study Ethics

Ethical forms will be submitted to the following individuals/institutions:

1. The Ethical Committee of Universiti Putra Malaysia
2. The National Institute of Health (NIH)
3. PejabatKesihatanSepang and JabatanKesihatanNegeri Selangor.
4. Ministry of Health (MOH)

3.7Data and Statistical Analysis

In our study the dependent and independent variables were:

3.7.1 Dependent Variable:TMT time score in seconds

3.7.2 Independent Variables: Age, gender, education level and culture.

This variable comprises of continuous and categorical variables:

1. Continuous variables: TMT time score in seconds and age.
2. Categorical variables: Gender(nominal), education level(ordinal) and race(nominal).

Statistical analysis: Median and range was used to describe continuous data (data was not normally distributed). Data was analyzed by using Social Package for Social Science Version 21.0 (SPSS). In order to determine the association between the variables we used statistical analysis tests as shown in Table 2:

Table 2: Statistical analysis tests

Analysis Type	**Example**	**(Non-parametric)**
Compare two quantitative measurements	TMT time score and age	**Spearmans rank correlation**
Compare between one quantitative measurement and one categorical measurements (More than 2 categories)	TMT time score and education level & TMT time score and race	**Independent sample Kruskal-wallis test**
Compare between one quantitative measurement and one categorical measurements	TMT time score and gender	**Man Whitney U test**

We used *p*-value less than 0.05 for the level of significance association between the variables.

CHAPTER 4

RESULTS

4.1 Response Rate

In our study, out of the 196 of sample, we managed to get 160 respondents that we selected based on the inclusion criteria. The respond rate was of 80.2%. Data of 160 respondents was collected by using the TMT standard form.

4.2 Descriptive Analysis

4.2.1 Age

Table 3: Distribution of respondents by age categories

Age categories (years)	Frequency	Percentage (%)
41-45	16	10.0
46-50	16	10.0
51-55	33	20.6
56-60	37	23.1
61-65	31	19.4
66-70	16	10.0
71-75	10	6.3
76-80	1	0.6
Total	160	100.0

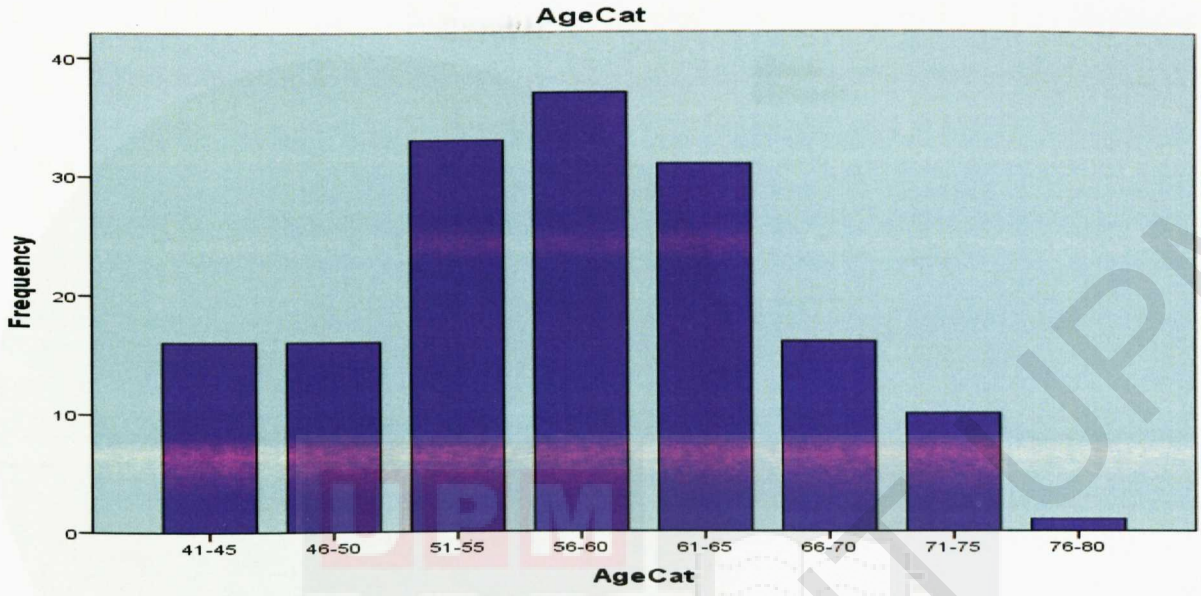

Figure 2: Distribution of respondents by age categories

Table 3 and Figure 2 show the distribution of respondents by age. The age category of 56-60 has highest percentage and frequency (23.1%, 37) as compared to age category of 76-80 that has the lowest percentage and frequency (0.6%, 1).

4.2.2 Gender

Table 4: Distribution of respondents by gender

Gender	Frequency	Percentage (%)
Male	88	55
Female	72	45
Total	160	100

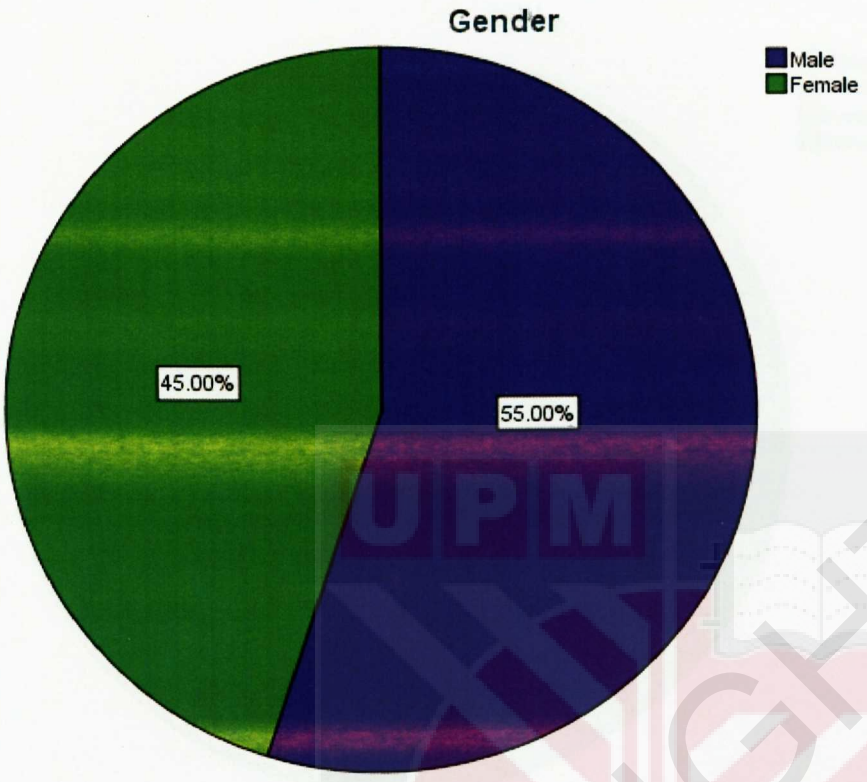

Figure 3: Distribution of respondents by gender

Table 4 and Figure 3 show the distribution of respondents by gender. Majority of the respondents are male with percentage and frequency of (55%, 88) as compared to female (45%, 72).

4.2.3 Race

Table 5: Distribution of respondents by race

Race	Frequency	Percentage (%)
Malay	131	81.9
Chinese	8	5.0
Indian	18	11.3
Others	3	1.9
Total	160	100.0

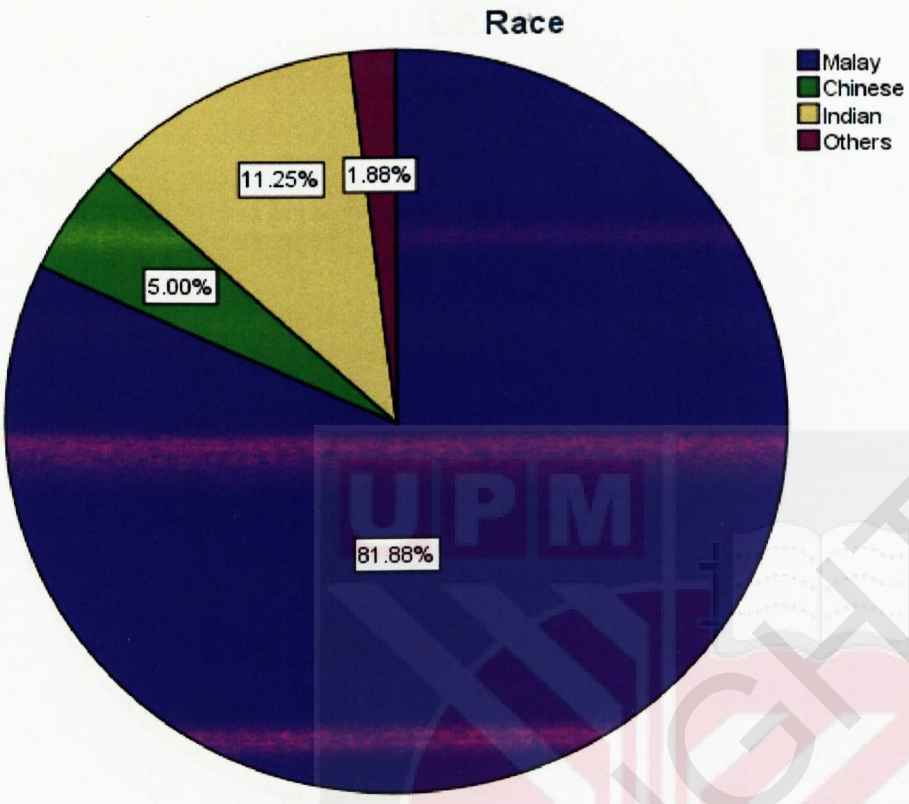

Figure 4: Distribution of respondents by race

Table 5 and Figure 4 show the distribution of respondents by race. Malay is the highest respondents with percentage and frequency of (81.9%, 131) followed by Indian (11.3%, 18), Chinese (5%, 8) and others (1.9%, 3).

4.2.4 Educational Level

Table 6: Distribution of respondents by educational level

Educational level	Frequency	Percentage (%)
No	4	2.5
Primary	32	20.0
Secondary	97	60.6
Tertiary	27	16.9
Total	160	100.0

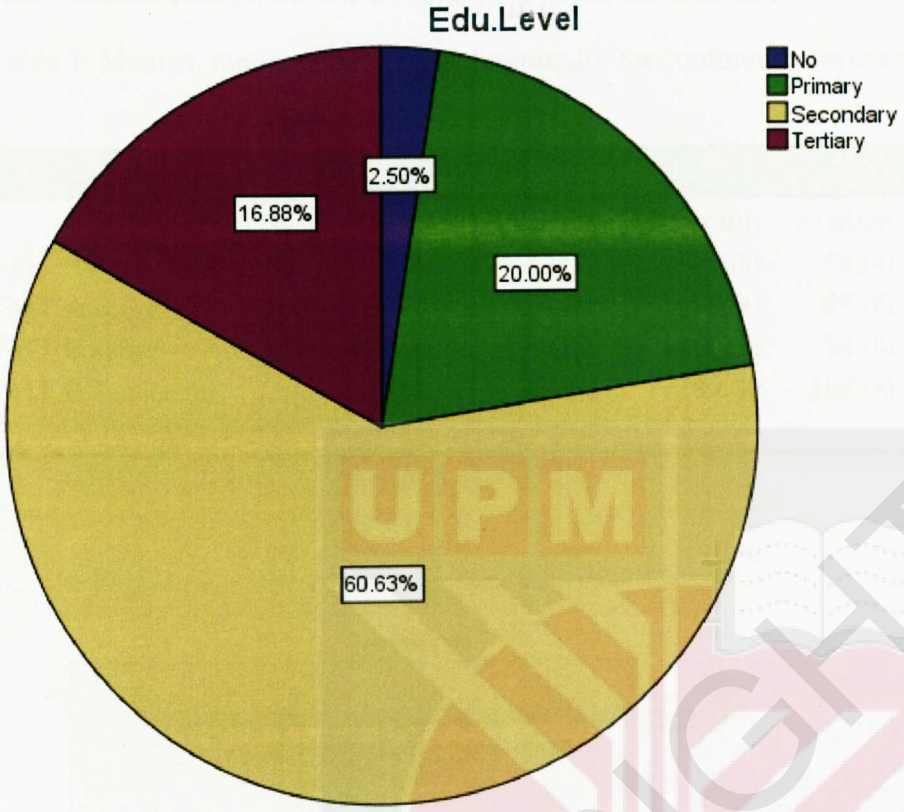

Figure 5: Distribution of respondents by educational level

Table 6 and Figure 5 show the distribution of respondents by educational level. The secondary education level is the highest with percentage and frequency of (60.0%, 97) as compared to no education level (2.5%, 4).

4.2.5Median, Range, Maximum and Minimum for Continuous Variables

Table 7: Median, range, maximum and minimum for continuous variables

Descriptive Statistics					
	N	Range	Minimum	Maximum	Median
Age	160	40.00	41.00	81.00	58.00
TMT A score	160	168.00	20.00	188.00	53.00
TMT B score	151	452.00	28.00	480.00	84.00
TMT B Jawi score	9	246.00	43.00	289.00	108.00

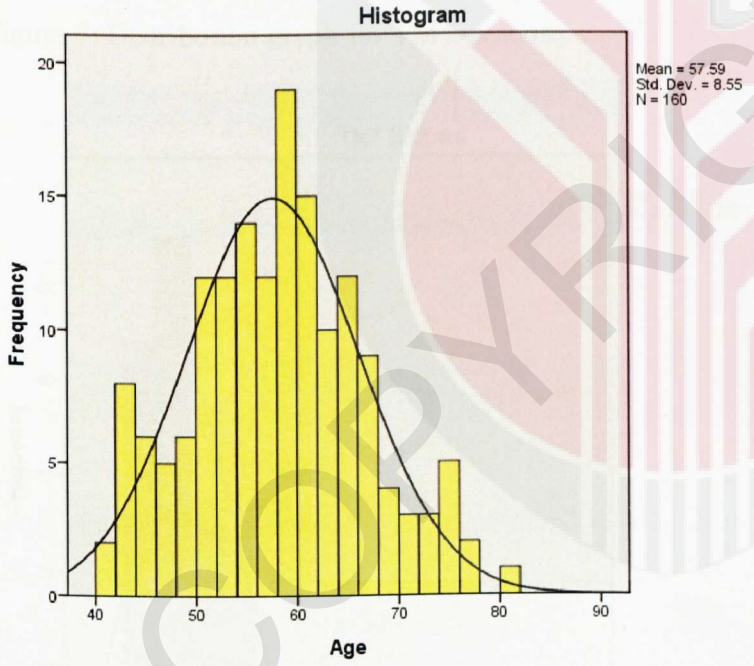

Figure 6: Distribution graph for age

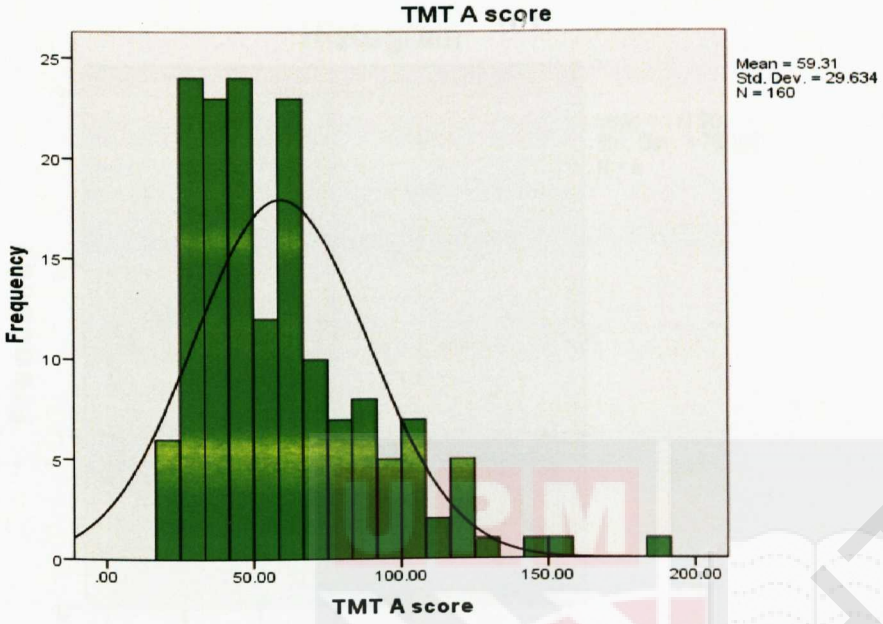

Figure 7: Distribution graph for TMT A score

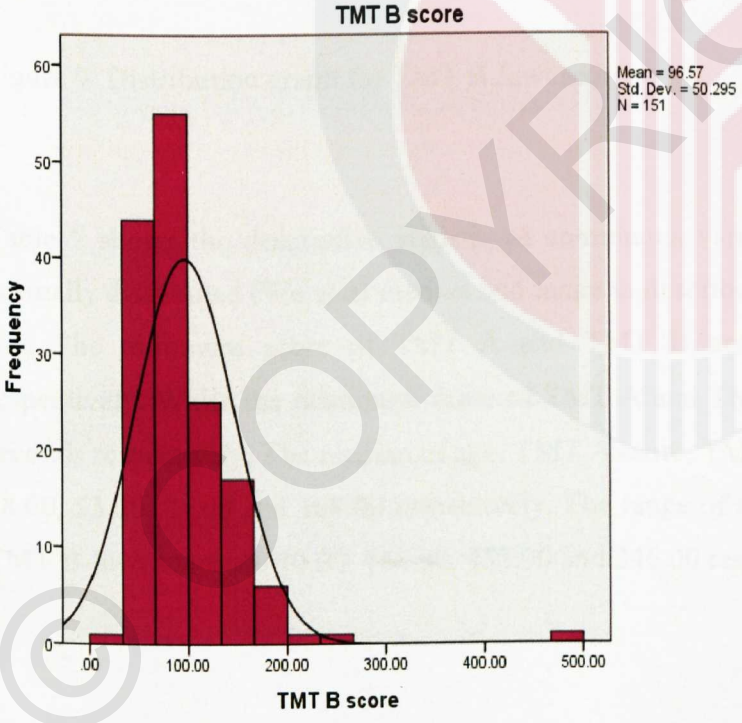

Figure 8: Distribution graph for TMT B score

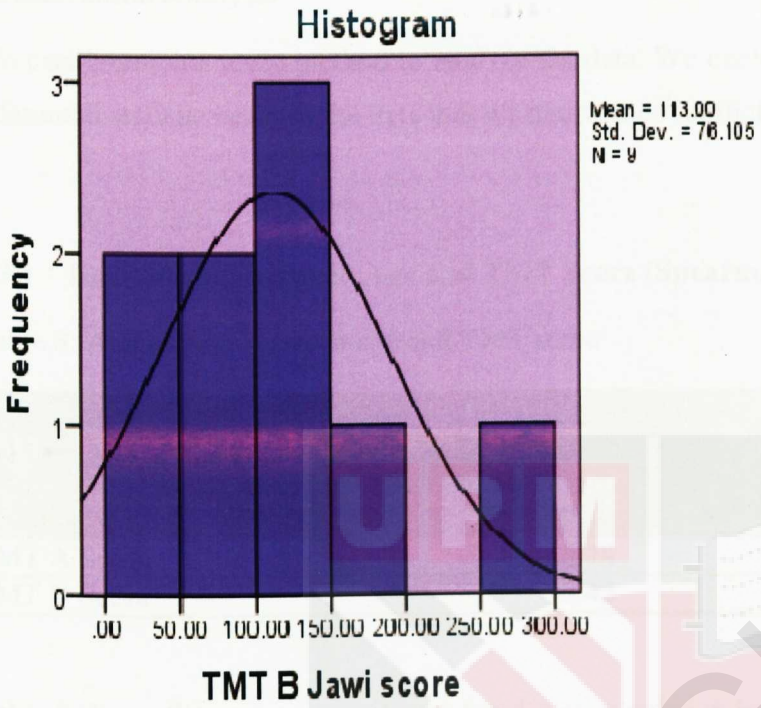

Figure 9: Distribution graph for TMT B Jawi score

Table 7 shows the descriptive statistic of continuous variables. The continuous data was not normally distributed (We used median and range to describe continuous data) as shown in Figure 6-8. The minimum score of TMT A and TMT B are 20.00 seconds and 28.00 second respectively. While the maximum score of TMT A and TMT B are 188.00 seconds and 480.00 seconds respectively. The median of age, TMT A score, TMT B score and TMT B Jawi score are 58.00, 53.00, 84.00 and 108.00 respectively. The range of age, TMT A score, TMT B score and TMT B Jawi score are 40.00, 168.00, 452.00 and 246.00 respectively.

4.3Inferential Analysis

We used non-parametric method to analyze the data. We excluded the TMT B Jawi score in the inferential statistic because the data that we had was not sufficient and it may lead to the biases.

4.3.1 Relationship between Age and TMT Score (Spearman's Correlation)

Table 8: Association between age and TMT score

TMT	Age p-value r_s	
TMT A Score	0.48	< 0.001
TMT B Score	0.42	< 0.001

Table 8 shows there was a significant fair direct correlation between age and TMT score,TMT A (r_s=0.48, p < 0.001), TMT B (r_s=0.42, p < 0.001). Therefore the null hypothesis was rejected.

Table 8.1: TMT A score stratified by age

TMT A / Age		0.00-20.00	20.01-40.00	40.01-60.00	60.01-80.00	80.01-100.00	100.01-120.00	120.01-140.00	140.01-160.00	180.01-200.00	Total
41-45	n	0	9	6	0	1	0	0	0	0	16
	%	0.0	56.2	37.5	0.0	6.2	0.0	0.0	0.0	0.0	100.0
46-50	n	1	9	2	2	1	0	1	0	0	16
	%	6.2	56.2	12.5	12.5	6.2	0.0	6.2	0.0	0.0	100.00
51-55	n	0	14	12	4	2	0	0	1	0	33
	%	0.0	42.4	36.4	12.1	6.1	0.0	0.0	3.0	0.0	100.0
56-60	n	0	10	10	7	7	3	0	0	0	37
	%	0.0	27.0	27.0	18.9	18.9	8.1	0.0	0.0	0.0	100.0
61-65	n	0	5	7	13	0	5	0	0	1	31
	%	0.0	16.1	22.6	41.9	0.0	16.1	0.0	0.0	3.2	100.0
66-70	n	0	3	6	0	5	2	0	0	0	16
	%	0.0	18.8	37.5	0.0	31.2	12.5	0.0	0.0	0.0	100.0
71-75	n	0	0	3	1	2	2	1	1	0	10
	%	0.0	0.0	30.0	10.0	20.0	20.0	10.0	10.0	0.0	100.0
76-80	n	0	0	0	0	0	1	0	0	0	1
	%	0.0	0.0	0.0	0.0	0.0	100.00	0.0	0.0	0.0	100.0
Total	n	1	50	46	27	18	13	2	2	0	160
	%	0.6	31.2	28.8	16.9	11.2	8.1	1.2	1.2	0.0	100.0

Table 8.2: TMT B score stratified by age

Age \ TMT B		0.00-50.00	50.01-100.00	100.01-150.00	150.01-200.00	200.01-250.00	450.01-500.00	Total
41-45	n	3	11	1	1	1	0	16
	%	11.0	68.8	6.2	6.2	6.2	0.0	100.0
46-50	n	2	11	2	0	1	0	16
	%	12.5	68.8	12.5	0.0	6.2	0.0	100.00
51-55	n	4	21	5	1	0	0	31
	%	2.1	67.7	16.1	3.2	0.0	0.0	100.0
56-60	n	1	22	8	4	0	0	35
	%	2.9	62.9	22.9	11.4	0.0	0.0	100.0
61-65	n	0	13	10	4	0	1	28
	%	0.0	46.4	35.7	14.3	0.0	3.6	100.0
66-70	n	0	9	5	2	0	0	16
	%	0.0	56.2	31.2	12.5	0.0	0.0	100.0
71-75	n	0	3	4	1	0	0	8
	%	0.0	37.5	50.0	12.5	0.0	0.0	100.0
76-80	n	0	0	0	0	1	0	1
	%	0.0	0.0	0.0	0.0	100.0	0.0	100.0
Total	n	10	90	35	13	18	2	151
	%	6.6	59.6	23.2	8.6	11.2	1.3	100.0

Table 8.1 and Table 8.2 show that 56.2% of age category between 41-45 has the TMT A score of 20.01-40 seconds. While 68.8% of age categories between 41-50 has the TMT B score of 50.01-100 seconds. As a conclusion age category between 41-45 years old have better performance in TMT A and TMT B as compared to other age categories above 50 years old.

4.3.2 Relationship between Gender and TMT Score (Man Whitney U Test)

Table 9: Association between gender and TMT score

Gender	TMT A score N(Mean rank)	TMT B score N(Mean rank)	TMT	Mann-Whitney U Test		
Male	88(74.81)	84(72.46)		***Mann-Whitney U***	***Standardized test statistic***	***p-value***
Female	72(87.45)	67(80.43)	TMT A score	3 668.50	1.717	**0.086**
Total	160	151	TMT B score	3 111.00	1.113	**0.266**

Based on Table 9, male showed better performance in TMT A and TMT B score as compared to female. Where the mean rank of TMT A score for male and female were 74.81 seconds and 87.45 seconds respectively, while mean rank of TMT B score for male and female were 72.46 seconds and 80.43 seconds respectively. The p-value were 0.086 (TMT A score) and 0.266 (TMT B score). Since the p-value for both TMT A score and TMT B score were greater than 0.05, both TMT score showed there was no statistically significant association between gender and TMT score (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Null hypothesis was not rejected. The results showed that there was no association between gender and TMT score.

4.3.3 Relationship between Race and TMT Score (Independent Samples Kruskal Wallis Test)

Table 10: Association between race and TMT score

Race	TMT A score N(Mean rank)	TMT B score N(Mean rank)	TMT	Independent-Samples Kruskal Wallis Test		
Malay	131(3)	122(3)		***Test statistic***	***df***	***p-value***
Chinese	8(1)	8(2)	TMT A score	7.124	3	**0.068**
Indian	18(4)	18(4)				
Others	3(2)	3(1)				
Total	160	151	TMT B score	7.213	3	**0.065**

Based on Table 10, Chinese showed better performance in TMT A while others showed better performance in TMT B. The first mean rank of TMT A score was Chinese followed by others, Malay and Indian. For TMT B score the first mean rank was others followed by Chinese, Malay and Indian. The p-value were 0.068 (TMT A score) and 0.065 (TMT B score). Since the p-value for both TMT A score and TMT B score were greater than 0.05, both TMT score show there was no statistically significant association between race and TMT score (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Null hypothesis was not rejected. The results showed that there was no association between race and TMT score.

4.3.4 Relationship between Educational Level and TMT Score (Independent Samples Kruskal Wallis Test)

Table 11: Association between educational level and TMT score

Educational level	TMT A score N(Mean rank)	TMT B score N(Mean rank)	TMT	Independent-Samples Kruskal Wallis Test		
No	4(3)	4(2)		*Test statistic*	*df*	*p-value*
Primary	32(4)	32(4)	TMT A score	43.84	3	**0.0001**
Secondary	97(2)	94(3)				
Tertiary	27(1)	24(1)				
Total	160	151	TMT B score	22.72	3	**0.0001**

Based on Table 11, tertiary educational level showed better performance in both TMT A and TMT B as compared other educational level. For TMT A score, the first mean rank was tertiary educational level followed by secondary, primary and no educational level. Then for TMT B score, the first mean rank was tertiary educational level followed by no, secondary and tertiary educational level. Therefore this result showed that the higher the educational level the better the TMT (A and TMT B) performance. The p-value were 0.001 (TMT A score) and 0.001 (TMT B score). Since the p-value for both TMT A score and TMT B score were smaller than 0.05, both TMT score showed there was a statistically significant association between educational level and TMT score (TMT A, $p < 0.05$), TMT B ($p < 0.05$). Null hypothesis was rejected. The results showed that there was association between educational level and TMT score.

CHAPTER 5

DISCUSSION

5.1 Discussion

The distribution of all the measures was skewed to the left (Figure 6-9). All of the measures are not normally distributed. Therefore we used non parametric tests to analyze the data as shown in Table 2. The frequency and percentage of sociodemographic factors are shown in Table 3-Table 6. The minimum score of TMT A and TMT B are 20.00 seconds and 28.00 second respectively. While the maximum score of TMT A and TMT B are 188.00 seconds and 480.00 seconds respectively. The median of age, TMT A score, TMT B score and TMT B Jawi score are 58.00, 53.00, 84.00 and 108.00 respectively. The range of age, TMT A score, TMT B score and TMT B Jawi score are 40.00, 168.00, 452.00 and 246.00 respectively (Table 7).

The influence of age and education was always significant; only for part A did females show a significantly longer time, but the level of significance was low and did no justify including gender among the adjusting variables (Bezdicek et al (2012). As expected age was significantly associated with TMT performance, performance on the TMT decreased with increasing age (Tombaugh et al., 2004). Advancing age is associated with slower response time to complete the test even among highly educated and healthy samples (Soukup et al., 1998). Hence, this demographic factor was significantly associated with the score on both Trails A and B (Lu et al., 2002). Table 8 shows there was a significant fair direct correlation between age and TMT score, TMT A (r_s=0.48, $p < 0.001$), TMT B (r_s=0.42, $p < 0.001$). Null hypothesis was rejected. Table 8.1 and Table 8.2 show that 56.2% of age category between 41-45 has the TMT A score of

20.01-40 seconds. While 68.8% of age categories between 41-50 has the TMT B score of 50.01-100 seconds. As a conclusion age category between 41-50 years old have better performance in TMT A and TMT B as compared to other age categories above 50 years old.

There was no gender effect found on both of the TMT test scores (Lu et al., 2002). The stratification of the norms was based on findings that clearly showed that performance on Trails A and B was affected by age and education, but not by gender (Tombaugh et al., 2004). But, some of the studies suggested that men performed better than women on Trail A, while there was no gender effect found for Trail B (Seo et al 2006). Based on Table 9, male showed better performance in TMT A and TMT B score as compared to female. Where the mean rank of TMT A score for male and female were 74.81 seconds and 87.45 seconds respectively, while mean rank of TMT B score for male and female were 72.46 seconds and 80.43 seconds respectively. The p-value were 0.086 (TMT A score) and 0.266 (TMT B score). Since the p-value for both TMT A score and TMT B score were greater than 0.05, both TMT score showed there was no statistically significant association between gender and TMT score (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Null hypothesis was not rejected. The results showed that there was no association between gender and TMT score.

Race, ethnicity and native language significantly influence neuropsychological test performance (O'Bryant, O'Jile, &MaCaffrey, 2004). Normative data across different countries are not equivalent. Therefore, the basis of normative comparisons for different populations should be derived from the culture in which they were obtained (Ferna´ndez&Marcopulos, 2008). Creating

normative data for the TMT Czech version could help establish cultural-specific data thereby minimizing the interpretive impact of misapplying non-cultural-specific normative information (Manly, 2008; van de Vijver&Tanzer, 2004).

The Malaysian population comprises of Bumiputra (67.4%), Chinese (24.6%), Indian (7.3%) and others (0.7%) (Department of Statistic Malaysia, 2010). Although Malaysia has different races which are Malay, Chinese, Indian and others, but they are sharing mutual culture that is Malay language (Department of Statistic Malaysia, 2010). Therefore in Malaysian population the race was not significantly associated with race.Based on Table 10, Chinese showed better performance in TMT A while others showed better performance in TMT B. The first mean rank of TMT A score was Chinese followed by others, Malay and Indian. For TMT B score the first mean rank was others followed by Chinese, Malay and Indian. The p-value were 0.068 (TMT A score) and 0.065 (TMT B score). Since the p-value for both TMT A score and TMT B score were greater than 0.05, both TMT score show there was no statistically significant association between race and TMT score (TMT A, $p > 0.05$), TMT B ($p > 0.05$). Null hypothesis was not rejected. The results showed that there was no association between race and TMT score.

In Malaysia education can be divided into two. There is formal and informal education. Malaysia has primary, secondary, and tertiary education (KementerianPelajaran Malaysia, 2013). According to the previous study, higher level of education is associated with better performance on TMT (Perianez et al., 2007) or in other word the higher the educational level the better the TMT performance.Based on Table 11, tertiary educational level showed better performance in

both TMT A and TMT B as compared other educational level. For TMT A score, the first mean rank was tertiary educational level followed by secondary, primary and no educational level. Then for TMT B score, the first mean rank was tertiary educational level followed by no, secondary and tertiary educational level. Therefore this result showed that the higher the educational level the better the TMT (A and TMT B) performance. The p-value were 0.001 (TMT A score) and 0.001 (TMT B score). Since the p-value for both TMT A score and TMT B score were smaller than 0.05, both TMT score showed there was a statistically significant association between educational level and TMT score (TMT A, $p < 0.05$), TMT B ($p < 0.05$). Null hypothesis was rejected. The results showed that there was association between educational level and TMT score.

5.2Limitations of Study

There are a few limitations in this study. Bias aroused in this study when the subject cannot understand the instruction of the TMT performance. The subjects with vision and hearing problem were unable to participate in this study. Furthermore, participants who are severely cognitive impaired also add to the bias. (We want to include the general population in order to make the subject representative for the Malaysian population).

5.3 Conclusion

From our study that had been conducted in KlinikKesihatanSalak, we found that these four socio demographic factor which were age, gender, culture and educational level were closely related to the TMT performance. Based on our finding, there were statistically significance difference between the age and educational level with the TMT performance which showed alternative hypothesis. Besides, there were no statistically significant difference between gender and race with the TMT performance which showed null hypothesis.

5.4 Recommendations

Based on our study, in order to representative for the general Malaysian adult population we suggest that it need to be done at the study location that can represent more bigger population for the further study. It was important to have more sample size to get better findings. In addition, we recommend that for those who were diagnose low cognitive function based on their TMT performance, they need to have intervention with the foods and drugs which can prevent cognitive impairment and improve their memory as well. Besides, we suggest that Malaysian adult population should be done some activities that can improve their cognitive function as their increasing age.

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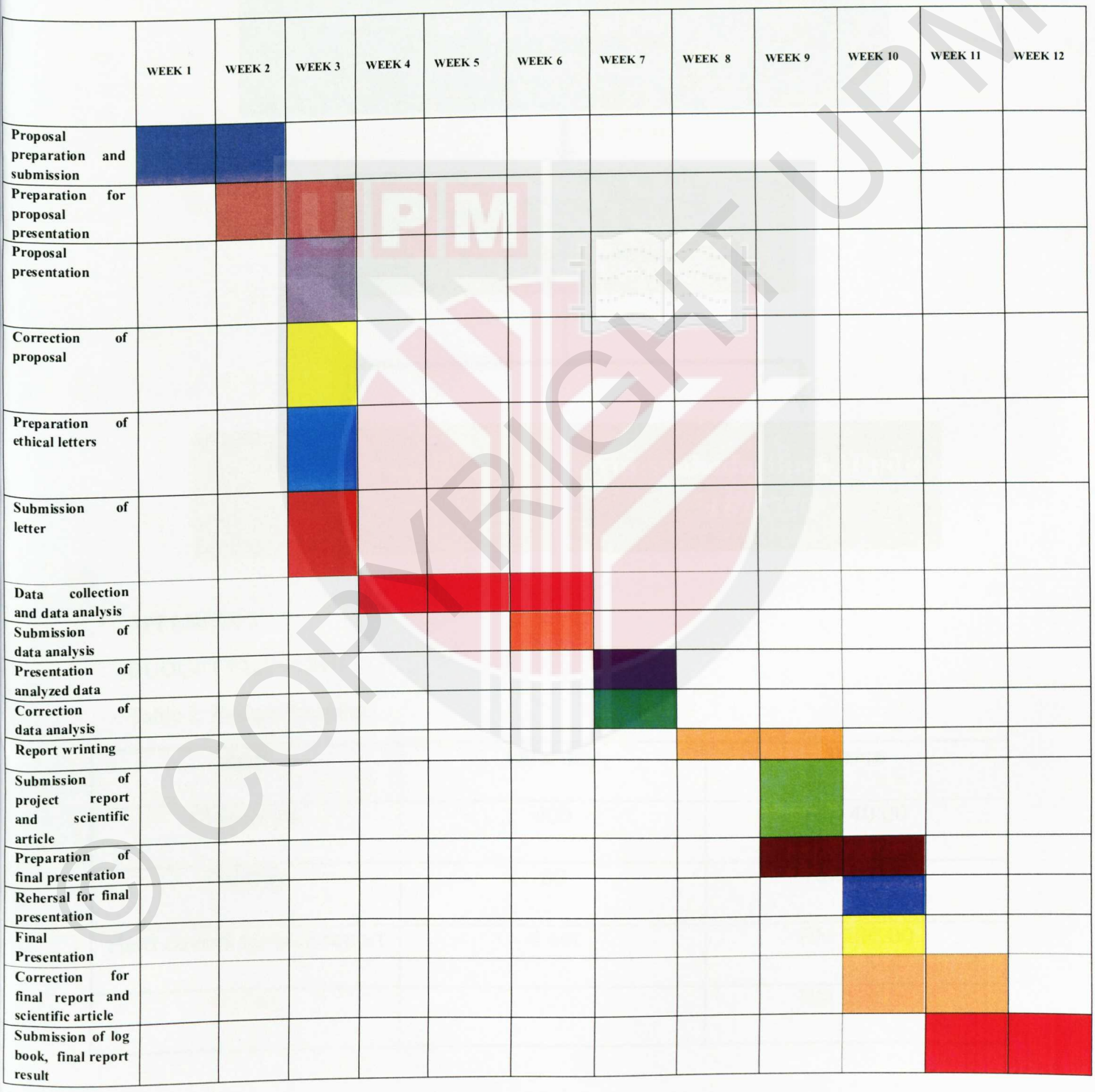
APPENDICES

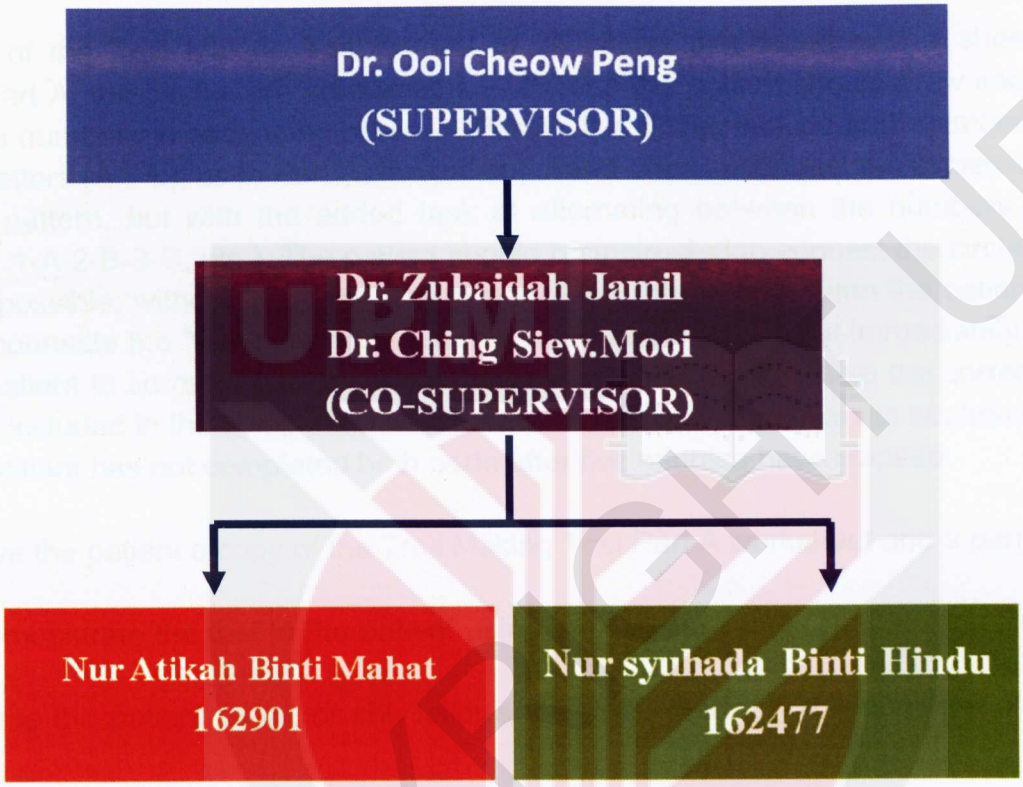
APPENDIX 1

WORK PLAN (Gantt chart)



APPENDIX 2

RESEARCH TEAM



APPENDIX 3

BUDGET PLANNING

Table 2: Budget Planning

Item	Quantity	Price
Photostate	400	RM 40.00
Printing	50	RM 50.00
Hard covers for final report	4 set	RM 200.00
TOTAL		**RM 290.00**

APPENDIX 4

Trail Making Test (TMT) Parts A & B

Instructions:

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The patient should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the patient as he or she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes have elapsed.

Step 1: Give the patient a copy of the Trail Making Test Part A worksheet and a pen or pencil.
Step 2: Demonstrate the test to the patient using the sample sheet (Trail Making Part A –*SAMPLE*).
Step 3: Time the patient as he or she follows the "trail" made by the numbers on the test.
Step 4: Record the time.
Step 5: Repeat the procedure for Trail Making Test Part B.

Table 3: Scoring of TMT (Lezak et al., 2004)

	Average	**Deficient**	**Rule of Thumb**
Trail A	29 seconds	> 78 seconds	Most in 90 seconds
Trail B	75 seconds	> 273 seconds	Most in 3 minutes

APPENDIX 5

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)

UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

BORANG PERSETUJUAN RESPONDEN

TAJUK PENYELIDIKAN :

DATA NORMATIF PADA UJIAN MEMBUAT TRAIL UNTUKPENDUDUKDEWASAAMMALAYSIADIKLINIK KESIHATANSALAKPADA2013

PENYELIDIK :

NUR ATIKAH BINTI MAHAT & NUR SYUHADA BINTI HINDU (PELAJARPENYELIDIK)

DR. OOI CHEOW PENG (KETUA PENYELIA)

DR. ZUBAIDAH BINTI JAMIL (PENOLONG PENYELIA)

DR. CHING SIEW MOOI (PENOLONG PENYELIA)

Saya..... No KadPengenalan. .....
beralamat.....
.....dengan
inibersetujuuntukmengambilbahagiansecarasukareladalammenyertaipenyelidikanklinikal
*(pengajianklinikal/ pengajiansoalselidik/ percubaanubat-ubatan) seperti yang disebut di atas.

Saya telah diberi penjelasan secara menyeluruh mengenai dasar penyelidikan klinikal dari segi metodologi, risiko dan komplikasi (seperti tertulis pada Helaian Penerangan Responden). Saya memahami bahawa saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan.Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya* berminat /tidakberminatuntukmengetahuikeputusankajian yang dijalankankeatassampel yang diambildarisaya.

*potong yang tidakberkenaan

Tandatangan ……..…… Tandatangan ……..……

(*Responden*) (*Saksi*)

Tarikh :…….. Nama :……

No. K/P: ……

Sayamengesahkanbahawasayatelahmenerangkankepadarespondensifatdantujuanpenyelidikanklinikalter sebut di atas.

Tarikh ……..…… Tandatangan ……..……

(*Penyelidik*)

UPM/FPSK/PADS/JKEUPM/CFR01

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM

UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

CONSENT FORM (RESPONDENT)

RESEARCH TITLE :

NORMATIVE DATA ON TRAIL MAKING TEST FOR GENERAL MALAYSIAN ADULTPOPULATION IN KLINIK KESIHATAN SALAK ON 2013

RESEARCHER :

NUR ATIKAH BINTI MAHAT & NUR SYUHADA BINTI HINDU (STUDENTS RESEARCHER)

DR. OOI CHEOW PENG (MAIN SUPERVISOR)

DR. ZUBAIDAH BINTI JAMIL (CO-SUPERVISOR)

DR. CHING SIEW MOOI (CO-SUPERVISOR)

I ..... Identity Card No. .....

address.....

.....hereby voluntarily agree to take part in the clinical research *(clinical study, questionnaire study/ drug trial) specified above.

I have been informed about the nature of the clinical research in terms of methodology, possible adverse effects and complications (as written in the Respondent Information Sheet). I understand that I have the right to withdraw from this clinical research at any time without assigning any reason whatsoever. I also understand that this study is confidential and all information provided with regards to my identity will remain private and confidential.

I* wish / do not wish to know the results of the tests performed on any samples taken from me.

* delete where necessary

Signature ……..…… Signature ……..……

(*Respondent*) (*Witness*)

Date :…….. Name :……..

I/C No. :…….

I confirm that I have explained to the respondent the nature and purpose of the above –mentioned clinical research.

Date ……..…… Signature ……..……

(Researcher)

APPENDIX 6

Trail Making Test Part A

Patient's ID:_____

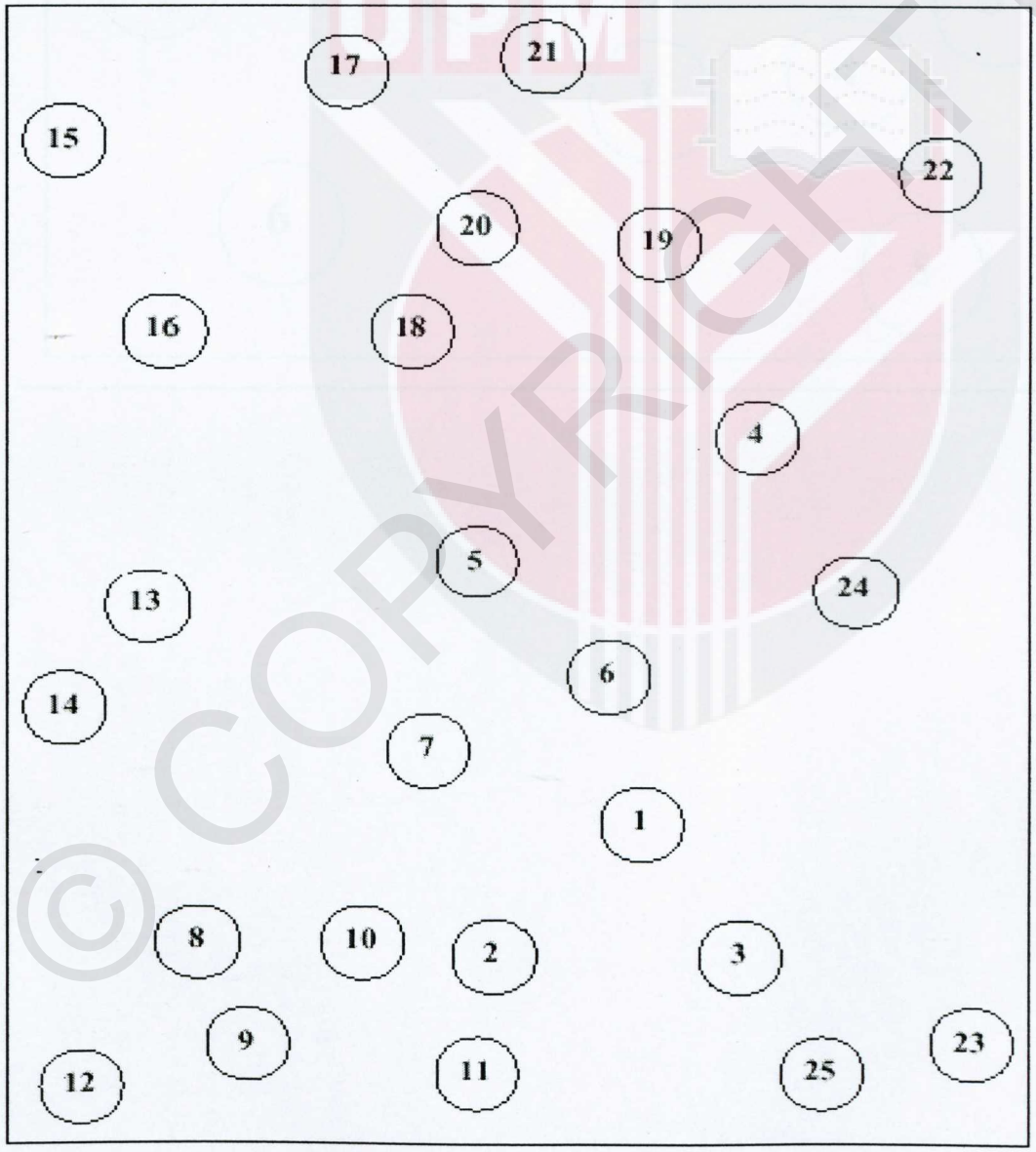
Age : _____

Gender : _____

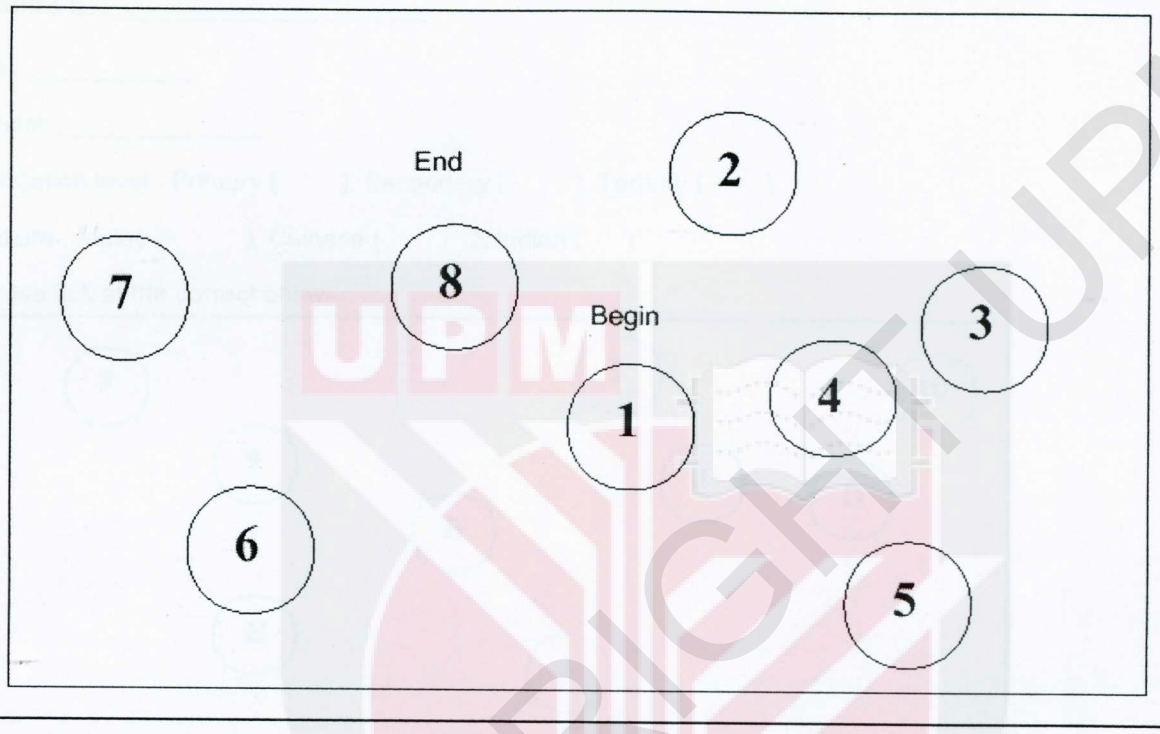
*Education level : Primary ( ), Secondary ( ), Tertiary ( )

*Culture : Malay ( ), Chinese ( ), Indian ( )

*please tick at the correct answer.



Trail Making Test Part A – SAMPLE



Trail Making Test Part B

Patient's ID :_____

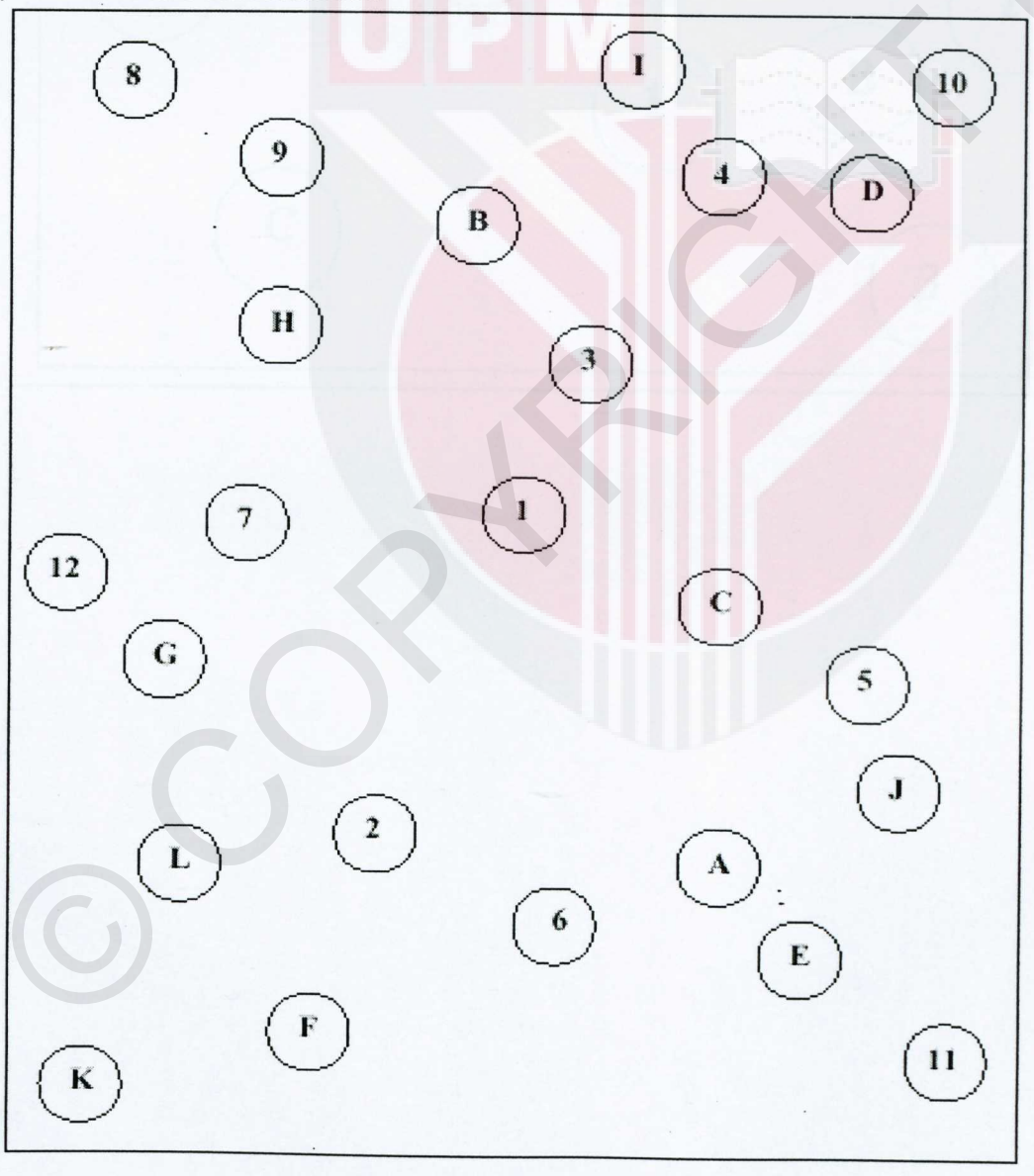
Age : _____

Gender : _____

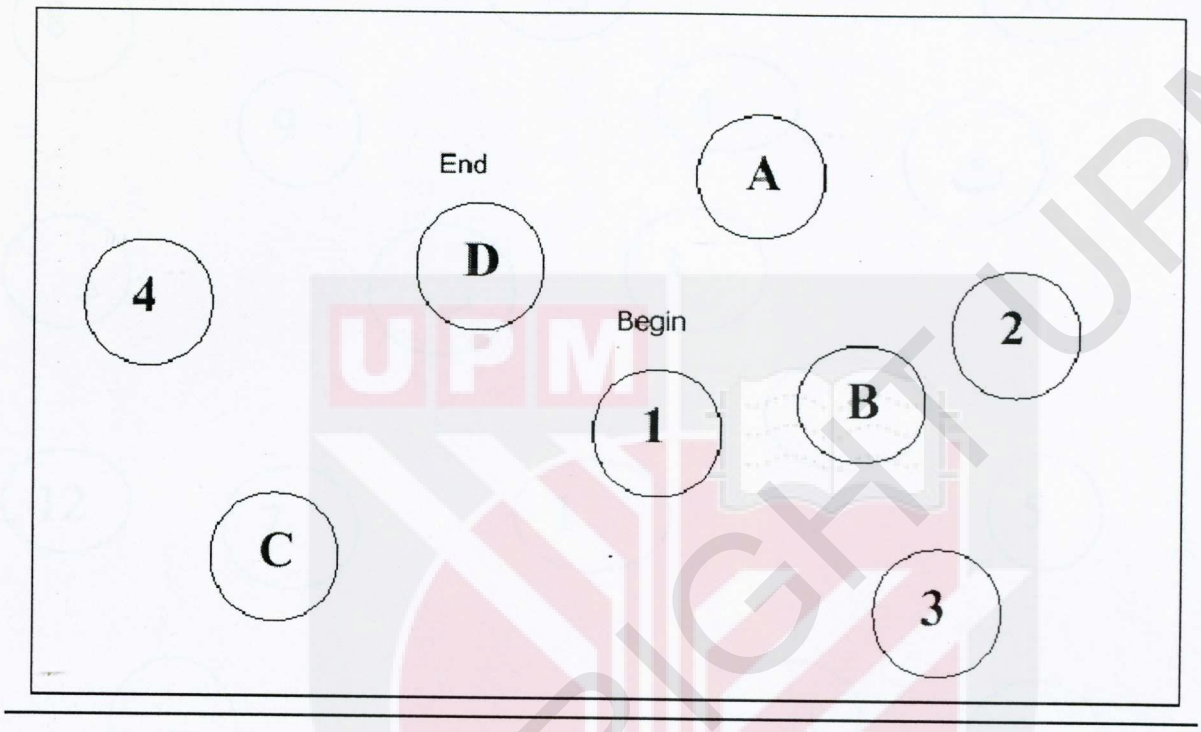
*Education level : Primary ( ), Secondary ( ), Tertiary ( )

*Culture : Malay ( ), Chinese ( ), Indian ( )

*please tick at the correct answer.

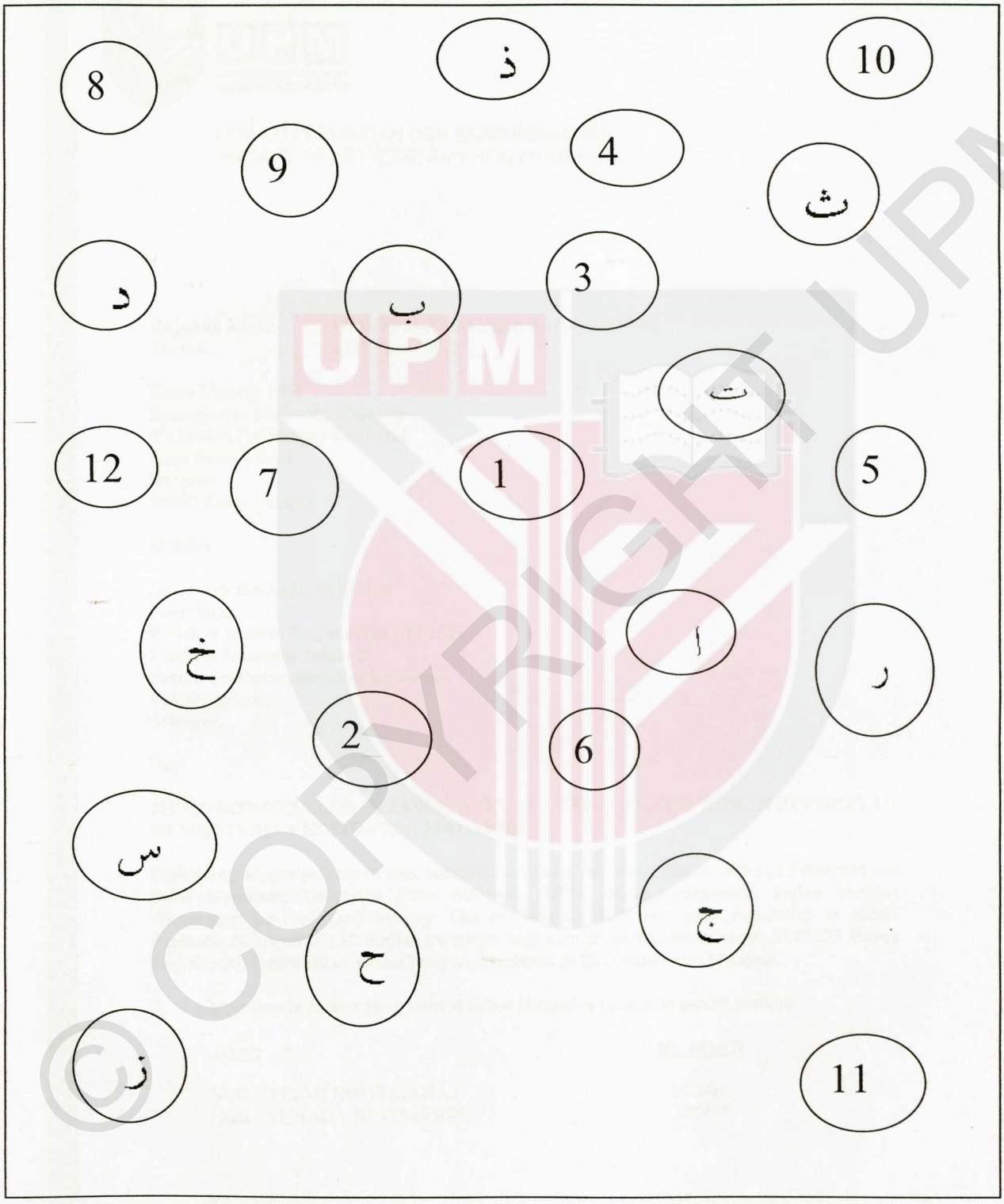


Trail Making Test Part B – SAMPLE



Trail Making Test Part B (JAWI)

Trail Making Test Part B (JAWI)- SAMPLE



UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES

Rujukan Kami : UPM/FPSK/(TDAP)600-3/1/3-(SPP3621)
Tarikh : 22hb April 2013

Ketua Uresetia NIH
Kementerian Kesihatan Malaysia
d/a Institut Pengurusan Kesihatan
Jalan Rumah Sakit
Bangsar
59000 Kuala Lumpur

Melalui:

Dr Hayati Bte Kadir @ Shahar
Penyelaras
Projek & Kaedah Penyelidikan SPP3621
Program Perubatan Tahun 2
Fakulti Perubatan dan Sains Kesihatan
43400 Serdang
Selangor.

Dr,

MEMOHON KELULUSAN JAWATANKUASA ETIKA PENYELIDIKAN PERUBATAN KEMENTERIAN KESIHATAN MALAYSIA

Berhubung dengan perkara di atas, sekumpulan pelajar perubatan Tahun 2 Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia (UPM) ingin menjalankan kajian bertajuk "Normative Data of Trail Making Test of General Malaysian Adult Population at Klinik Kesihatan Salak on 2013". Kajian ini adalah bagi memenuhi keperluan kursus SPP3621 Projek Dan Kaedah Penyelidikan dalam Program Perubatan di Universiti Putra Malaysia.

2. Nama-nama pelajar yang terlibat dalam kumpulan ini adalah seperti berikut:

Nama	No. Matrik
NUR ATIKAH BINTI MAHAT	162901
NUR SYUHADA BINTI HINDU	162477

Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan.
603-8947 2300 603-8947 2585 http://www.medic.upm.edu.my.
Fakulti Perubatan dan Sains Kesihatan, Aras 9 & 10B, Grand Seasons Avenue, 72, Jalan Pahang, 53000 Kuala Lumpur.
603-2050 1000 603-2050 1001

JKEUPM Ref No. : FPSK_Mei (13) 59 (UNDERGRADUATE)

Members of the JKEUPM who reviewed the documents:

Prof. Dr. Patimah Ismail

Date of approval: 17/6/2013

Endorsed at JKEUPM Meeting on 5/7/2013, attended by:

NAME	DESIGNATION	GENDER	TICK IF PRESENT
Prof. Dr. Norlijah Othman	Paediatrics& Dean, Faculty of Medicine and Health Sciences	Female	
Prof. Dr Zamberi Sekawi	Medical Microbiologist & Deputy Dean of Research and Internationalization, Faculty of Medicine and Health Sciences	Male	√
Prof. Dato' Dr. Lye Munn Sann	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Tengku Aizan Abd Hamid	Gerontologist & Director, Institute of Gerontology	Female	
Prof. Dr. Lekhraj Rampal	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	
Prof. Dr. Elizabeth George	Pathologist, Dept of Pathology, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Lim Thiam Aun	Anesthesiologist, Dept of Surgery, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Wan Omar Abdullah	Medical Parasitologist, Dept of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Patimah Ismail	Professor of Biomedicine, Dept of Biomedical Sciences, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Azali Mohamed	Professor of Macroeconomics, Dept of Economics, Faculty of Economics and Management	Female	
Assoc. Prof. Dr. Johnson Stanslas	Pharmacologist, Dept of Medicine, Faculty of Medicine and Health Sciences	Male	√
Assoc. Prof Dr. Mansor Abu Talib	Assoc. Professor of Guidance and Counselling, Dept of Human Development and Family Studies, Faculty of Human Ecology	Male	
Assoc. Prof. Dr. Noritah Omar (Lay Person)	Assoc. Professor of English Language, Dept of English Language, Faculty of Communication and Modern Languages	Female	√
Dr. Rojanah Kahar (Lay Person)	Lecturer of Dept of Human Development and Family Studies, Faculty of Human Ecology	Female	
Tan Sri Dato' Napsiah Omar (Lay Person)	Chairman, National Population and Family Development Board	Female	