



THE UNIVERSITY OF  
**SYDNEY**

## **COPYRIGHT AND USE OF THIS THESIS**

This thesis must be used in accordance with the provisions of the Copyright Act 1968.

Reproduction of material protected by copyright may be an infringement of copyright and copyright owners may be entitled to take legal action against persons who infringe their copyright.

Section 51 (2) of the Copyright Act permits an authorized officer of a university library or archives to provide a copy (by communication or otherwise) of an unpublished thesis kept in the library or archives, to a person who satisfies the authorized officer that he or she requires the reproduction for the purposes of research or study.

The Copyright Act grants the creator of a work a number of moral rights, specifically the right of attribution, the right against false attribution and the right of integrity.

You may infringe the author's moral rights if you:

- fail to acknowledge the author of this thesis if you quote sections from the work
- attribute this thesis to another author
- subject this thesis to derogatory treatment which may prejudice the author's reputation

For further information contact the University's Director of Copyright Services

**[sydney.edu.au/copyright](http://sydney.edu.au/copyright)**

**A NEUROPSYCHOLOGICAL STUDY OF FIRST-TIME SEX OFFENDERS  
OVER THE AGE OF 50: THE POSSIBLE CONTRIBUTION OF  
COGNITIVE DEFICITS TO SEXUAL OFFENDING**

**Marcelo Rodriguez  
BSc (Psychology), MAPS**

A thesis submitted in fulfilment of the requirements  
for the degree of Doctor of Philosophy

Discipline of Psychological Medicine  
University of Sydney

**2014**

## **ACKNOWLEDGEMENTS**

I owe an immense gratitude to a number of people, who have assisted me throughout this study and thesis. Without their knowledge, training, patience and goodwill, I would not have been able to produce this new body of knowledge.

Firstly, I would like to thank the Clinical Director of the NSW Community Forensic Mental Health Service, Dr. Stephen Allnutt, who encouraged me to undertake such a journey into the neuropsychological study of sex offenders and assisted me with the methodology of this study. I have valued his advice concerning this clinical population for many years.

I would like to thank my Supervisor Professor Philip Boyce who provided a map to help me grow as a researcher. I am sure I have been a great challenge to him.

I would like to thank my secondary supervisor Professor John Snowden, who I value immensely as a mentor and friend.

I would like to thank Professor John Hodges, Dr. Michael Hornberger, Dr. Olivier Piguet and the rest of the team at Neuroscience Research Australia with their recommendations of the neuropsychological tools used in frontotemporal dementia. I will be eternally grateful to Professor Hodges for his recommendations related to frontotemporal dementia. I have learned a great deal from him on the way.

I would like to thank my colleagues, especially Ms. Kath Jones and Dr. Andrew Ellis, who served as “guinea pigs” for the many neuropsychological tools, which I had to learn and master. Their support, collegiality and friendship have made my long road easier.

I would like to express my gratitude to Professor David Greenberg, who has offered his expertise in sex offender research.

I would like to thank my mother, who sadly passed away on 6 June 2013, for her love and support throughout my life. I would like to thank my father for his assistance, love and support. His professional help was paramount in submitting this body of research.

I would like to thank my wife, Dr. Jackie Canessa, who has shared this “journey”, as well as juggled work and our beautiful daughter, Bethany.

I would like to thank Justice Health and the Forensic Mental Health Network, for allowing me the time to complete this study.

Lastly, I would like to thank a participant of this study, EK. The inspiration to conduct a study on older first-time offenders was borne out of my experience in assessing EK. May he rest in peace.

## **DECLARATION**

I, hereby, declare that this submission is my own work and that, to the best of my knowledge, it contains no material previously published or written by another person, which to a substantial extent has been accepted for the award of any other degree or other qualification, except where due reference is made in the text of this thesis.

All data were collected, processed and interpreted by the author. The author performed data preparation and statistical analysis with the assistance of Professor Mick O'Neill and Dr. Peter Geelan-Small.

### **Statement of Ethics**

All participants who participated in this study provided consent freely and willingly. Approval was obtained from the ethics committees of the Department of Corrective Services, Justice Health and the Forensic Mental Health Network, and the University of Sydney.

## **ABBREVIATIONS AND ACRONYMS**

ACE-R      The Addenbrooke's Cognitive Examination Test

AD          Alzheimer's disease

ARCD      Age-Related Cognitive Decline

bvFTD      Behavioural variant frontotemporal dementia

COWAT     Controlled Oral Word Association Test

CUBIT      Custody Based Intensive Therapy

DASS       Depression, Anxiety and Stress Scales

DCS        Department of Corrective Services

DLPFC     Dorsolateral Prefrontal Cortex

EF          Executive Function

FEEST      Facial Expression of Emotion: Stimuli and Tests

FSIQ       Full Scale Intellectual Quotient

|       |                                   |
|-------|-----------------------------------|
| FT    | First-time sex offender           |
| FTD   | Frontotemporal Dementia           |
| HT    | Historical sex offender           |
| IGT   | The Iowa Gambling Task            |
| NSOC  | Non-sex offender controls         |
| OFC   | Orbitofrontal Prefrontal Cortex   |
| PIQ   | Performance Intelligence Quotient |
| PFC   | Prefrontal Cortex                 |
| RAVLT | Rey Auditory Verbal Learning Test |
| RCF   | Rey Complex Figure                |
| TMT   | The Trail-Making Test             |
| VIQ   | Verbal Intellectual Quotient      |

VMPFC Ventromedial Prefrontal Cortex

WASI Wechsler Abbreviated Scale of Intelligence

WCST Wisconsin Card Sorting Test



## **ABSTRACT**

The literature suggests an association between frontal-executive dysfunction and sexual offending. Specifically, deficits in executive function may result in poor decision-making, disinhibited behaviour, lack of empathy and emotional dysregulation. In addition, an association between temporal lobe dysfunction and new sexual practices, characterised by hypersexuality, a sudden interest in sexual fetishes or late onset paedophilic interest, has been reported.

The main aim of this study was to investigate the neuropsychological function of elderly first-time sex offenders (FT), who were charged with sexual offences after the age of 50.

As sex offenders and frontotemporal dementia (FTD) patients share clinical and psychometric similarities, another aim of this study was to investigate whether the psychometric results of FT sex offenders resembled those patients with FTD.

Elderly FT sex offenders have not been previously studied; therefore, this study contributes to the limited research on elderly sex offenders.

### **Method**

One hundred offenders, aged 50 years or older (range 50-85, mean = 61.2, SD = 7.1) years with a median age of 60 years, 80% of which were incarcerated at the time of this study, were administered a battery of neuropsychological measures,

which have been validated in the assessment of FTD. Of particular interest to this study was executive function, including decision-making, using the Iowa Gambling Task (IGT); memory, vocabulary, language skills; and a proxy measure of social cognition, assessing facial emotion recognition.

The sample consisted of 32 FT sex offenders, 36 historical sex offenders (HT), i.e., individuals who had committed sexual offences prior to the age of 50; and 32 non-sexual offender controls (NSOC). The non-sex offenders did not have a history of pervasive aggression or violence.

This study's hypotheses were threefold; (a) FT sex offenders would demonstrate greater neuropsychological deficits than HT sex offenders and NSOC offenders; (b) the two sex offender groups would demonstrate greater neuropsychological deficits than NSOC offenders; and (c) FT sex offenders would demonstrate poorer function in social cognition.

## **Results**

FT sex offenders were less likely to offend against males and extrafamilial children. More than 30% of FT sex offenders committed child pornography offences. Only one FT sex offender committed a violent sexual offence. Despite the lower self-reported rate of paedophilic interest, more than 84% of sexual offences committed by FT sex offenders were against children.

Approximately one third of FT sex offenders had a history of alcohol problems; 41% had a history of depression; 66% had a history of head injury; and 72% had a history of hypertension. However, the groups only differed significantly in the rate of hypertension, with FT sex offenders having a significantly higher rate of hypertension than non- sex offenders.

FT sex offenders had a significantly higher positive screening rate of dementia compared to non-sex offenders. The two sex offender groups had similar screening results for dementia.

As has been reported in previous neuropsychological studies of sex offenders, the neuropsychological performance of FT sex offenders was variable. FT sex offenders demonstrated similar performance to HT sex offenders; however, NSOC offenders outperformed FT sex offenders on a number of executive and temporal lobe function measures. Specifically, non-sex offenders outperformed FT sex offenders on three out of four executive function measures. Overall, sex offenders demonstrated greater deficits in executive function than controls. Both groups of sex offenders also demonstrated inferior performance on measures of temporal function compared to controls.

Although the three groups did not significantly differ, a high proportion of offenders (56.6% for the sample) were impaired on a proxy measure of social cognition, a measure of facial emotion recognition, the Facial Expression of Emotion: Stimuli and Tests (FEEST), compared to normative data. Significantly, 61% of FT sex offenders were impaired on the FEEST.

## **Conclusions**

The current results provide partial support for the first hypothesis, i.e., FT sex offenders demonstrate greater neuropsychological deficits, weaknesses or impairment relative to controls. There was stronger support for the second hypothesis, proposing that sex offenders, as a group, demonstrate poorer neuropsychological function than non-sex offenders. As the groups did not differ in a measure of social cognition, the third hypothesis was not supported.

In light of these results, it seems that deficits in executive function play an important role in sexual offending early in life due to possible neurodevelopmental anomalies. Furthermore, it is proposed that executive function deficits later in life, due to many possible factors such as cardiovascular disease, drug and alcohol abuse, depression or brain trauma, equally plays an important role in sexual offending. The current results suggest that HT sex offenders experience neurodevelopmental anomalies in executive function early in life; and FT sex offenders develop executive dysfunction much later in life.

In addition, performance on measures of temporal lobe function suggest that sex offenders demonstrate deficits in visuospatial function possibly due to planning and organization deficits, as well as weaknesses in memory span, new learning, and recognition memory compared to controls. It is proposed that the poor executive function by sex offenders played a major part in working memory deficits, which further affected temporal function.

On a measure of social cognition, the poor performance by FT sex offenders, relative to normative data, can be interpreted as being similar to patients with behavioural frontotemporal dementia (bvFTD), who also demonstrate significant difficulties identifying the emotions of others, lack empathy, have difficulties in understanding social cues and show marked behavioural difficulties in social situations.

The current data suggests that, as a group, offenders demonstrate high rates of ventromedial prefrontal cortex (VMPFC) damage, irrespective of offender type. Individuals with poor facial emotion recognition have been found to have discrete damage to the VMPFC. An alternative hypothesis for the deficits shown by FT sex offenders in recognition of facial emotion can be attributed to impaired temporal lobe function, as individuals who demonstrate deficits in social cognition present with damage to the temporal lobes.

As the rate of head injury in elderly FT sex offenders was high in this study, the deficits in facial emotion recognition can be attributed to the long-term effects of traumatic brain injury (TBI).

The current results suggest a need for further neurocognitive and neurological assessment in elderly first-time sex offenders. Given the clinical and psychometric similarities of elderly first-time sex offenders with the “acquired sociopathy” in FTD, further investigation into FTD is necessary.

The implications of neuropsychological and clinically relevant deficits in this group of elderly FT sex offenders suggest that greater supervision, monitoring and placement are required, rather than investing in cognitive behavioural treatments and victim empathy enhancement, as, in most cases, such therapeutic interventions are unlikely to be effective.

## **TABLE OF CONTENTS**

|   |             |
|---|-------------|
| <b>ACKNOWLEDGEMENTS</b>   | <b>I</b>    |
| <b>DECLARATION</b>  | <b>III</b>  |
| STATEMENT OF ETHICS   | III         |
| <b>ABBREVIATIONS AND ACRONYMS</b>   | <b>IV</b>   |
| <b>ABSTRACT</b>   | <b>VII</b>  |
| <b>LIST OF APPENDICES</b>   | <b>XIX</b>  |
| <b>LIST OF TABLES</b>   | <b>XX</b>   |
| <b>LIST OF FIGURES</b>  | <b>XXII</b> |
| <b>1 INTRODUCTION</b>   | <b>1</b>    |
| 1.1 INTRODUCTION TO THIS STUDY  | 1           |
| 1.2 SECTION 1   | 2           |
| 1.2.1 SEXUAL OFFENDING AND VICTIMS  | 2           |
| 1.2.2 PREVALENCE RATE OF SEX OFFENCES IN AUSTRALIA                          | 3           |
| 1.2.2.1 Underreporting of sexual offences                                   | 4           |
| 1.2.3 IDENTIFIED LONG-TERM PROBLEMS OF SEXUAL ABUSE                         | 5           |
| 1.3 SECTION 2   | 6           |
| 1.3.1 OFFENDER AGE AND SEXUAL OFFENDING                                     | 6           |
| 1.3.2 SEXUAL OFFENCE HISTORIES AND CHARACTERISTICS OF ELDERLY SEX OFFENDERS | 8           |
| 1.4 SECTION 3   | 9           |
| 1.4.1 WHY RESEARCH FIRST-TIME SEX OFFENDERS OVER THE AGE OF 50?             | 9           |
| 1.4.2 THE PRESENT STUDY   | 10          |
| 1.4.3 OVERVIEW OF THIS THESIS   | 10          |
| <b>2 NORMAL COGNITIVE AGEING</b>  | <b>13</b>   |
| 2.1 INTRODUCTION  | 13          |
| 2.1.1 CROSS-SECTIONAL AND LONGITUDINAL STUDIES                              | 13          |
| 2.2 SECTION 1   | 15          |
| 2.2.1 PROCESSING SPEED IN THE OLDER PERSON                                  | 15          |
| 2.2.2 MEMORY IN THE OLDER PERSON  | 15          |
| 2.2.2.1 Working memory in the older person                                  | 16          |
| 2.2.3 TERMS   | 17          |
| 2.2.3.1 Executive function  | 17          |
| 2.2.3.2 Executive dysfunction   | 18          |
| 2.2.4 THE LIMITATIONS OF EXECUTIVE FUNCTION TESTS                           | 18          |

|            |  |           |
|------------|--|-----------|
| 2.2.4.1    | Unreliability of executive function tests  | 19        |
| 2.2.4.2    | Lack of specificity of executive function tests  | 19        |
| 2.2.5      | EXECUTIVE FUNCTION IN THE OLDER PERSON   | 20        |
| 2.2.6      | ANATOMICAL CORRELATES ASSOCIATED WITH EXECUTIVE FUNCTION IN THE OLDER PERSON               | 22        |
| 2.2.7      | SOCIAL COGNITION DEFICITS IN OLDER PEOPLE  | 22        |
| <b>2.3</b> | <b>SECTION 2</b>   | <b>23</b> |
| 2.3.1      | LIMITATIONS IN THE COGNITIVE ASSESSMENT OF OLDER POPULATIONS                               | 23        |
| <b>2.4</b> | <b>SUMMARY</b>   | <b>24</b> |
| <b>2.5</b> | <b>COMMENT</b>   | <b>26</b> |
| <b>3</b>   | <b><u>STRUCTURAL BRAIN IMPAIRMENT AND NEUROPSYCHOLOGICAL DEFICITS IN SEX OFFENDERS</u></b> | <b>27</b> |
| <b>3.1</b> | <b>INTRODUCTION</b>  | <b>27</b> |
| <b>3.2</b> | <b>SECTION 1 - STRUCTURAL AND NEUROLOGICAL IMPAIRMENT IN SEX OFFENDERS</b>                 | <b>28</b> |
| 3.2.1      | THE NEUROBIOLOGY OF SEXUAL FUNCTION  | 28        |
| 3.2.2      | NEURO-ANATOMICAL STUDIES OF SEX OFFENDERS  | 30        |
| 3.2.3      | NEURODEVELOPMENTAL STUDIES OF PAEDOPHILIA  | 31        |
| 3.2.4      | SEXUAL OFFENDING FOLLOWING ACQUIRED BRAIN DAMAGE OR TRAUMATIC BRAIN INJURY                 | 32        |
| 3.2.5      | ABNORMAL BRAIN FUNCTION AND NEW CASES OF PARAPHILIA  | 34        |
| 3.2.6      | RATES OF DEMENTIA IN ELDERLY SEX OFFENDERS   | 36        |
| 3.2.7      | DEMENTIA PATIENTS AND SEXUAL OFFENDING   | 37        |
| 3.2.8      | HYPERSEXUALITY IN THE ELDERLY  | 38        |
| <b>3.3</b> | <b>CONCLUSIONS</b>   | <b>38</b> |
| <b>3.4</b> | <b>SECTION 2 - NEUROPSYCHOLOGICAL STUDIES OF SEX OFFENDERS</b>                             | <b>41</b> |
| <b>3.5</b> | <b>INTRODUCTION</b>  | <b>41</b> |
| 3.5.1      | NEUROCOGNITIVE DEFICITS IN OFFENDER POPULATIONS  | 41        |
| 3.5.2      | GLOBAL COGNITIVE DEFICITS IN SEX OFFENDERS   | 43        |
| 3.5.3      | EXECUTIVE FUNCTION DEFICITS IN SEX OFFENDERS   | 43        |
| 3.5.4      | LOW IQ AND OTHER COGNITIVE DEFICITS IN CHILD SEX OFFENDERS/PAEDOPHILES                     | 44        |
| 3.5.5      | INCONSISTENT FINDINGS IN NEUROPSYCHOLOGICAL STUDIES OF SEX OFFENDERS                       | 46        |
| 3.5.6      | METHODOLOGICAL PROBLEMS IN SEX OFFENDER BRAIN FUNCTION RESEARCH                            | 47        |
| 3.5.6.1    | Heterogeneity of sex offenders   | 49        |
| 3.5.6.2    | Problems associated with control groups  | 50        |
| 3.5.7      | CONFOUNDING FACTORS IN NEUROPSYCHOLOGICAL RESEARCH OF SEX OFFENDERS                        | 51        |
| 3.5.8      | THE NEW WAVE OF NEUROPSYCHOLOGICAL RESEARCH OF SEX OFFENDERS                               | 51        |
| <b>3.6</b> | <b>CONCLUSIONS</b>   | <b>52</b> |
| <b>3.7</b> | <b>COMMENT</b>   | <b>53</b> |
| <b>4</b>   | <b><u>FRONTOTEMPORAL DEMENTIA</u></b>  | <b>55</b> |
| <b>4.1</b> | <b>INTRODUCTION</b>  | <b>55</b> |



|             |   |           |
|-------------|---|-----------|
| <b>4.2</b>  | <b>BRAIN AREAS AFFECTED BY FTD</b>                      | <b>55</b> |
| <b>4.3</b>  | <b>FTD AND BEHAVIOUR CHANGES</b>                        | <b>56</b> |
| <b>4.4</b>  | <b>BEHAVIOURAL FTD (bvFTD)</b>                          | <b>58</b> |
| <b>4.5</b>  | <b>COMMENT</b>  | <b>59</b> |
| <b>5</b>    | <b>PRESENT STUDY</b>                                    | <b>61</b> |
| <b>5.1</b>  | <b>AIMS</b>   | <b>61</b> |
| <b>5.2</b>  | <b>SPECIFIC HYPOTHESES</b>                              | <b>62</b> |
| <b>5.3</b>  | <b>ETHICS APPROVAL</b>                                  | <b>65</b> |
| <b>5.4</b>  | <b>RECRUITMENT</b>                                      | <b>66</b> |
| 5.4.1       | IDENTIFICATION OF PARTICIPANTS                          | 66        |
| 5.4.2       | METHOD OF RECRUITMENT                                   | 67        |
| <b>5.5</b>  | <b>INFORMATION AND CONSENT</b>                          | <b>67</b> |
| <b>5.6</b>  | <b>REFUSERS</b>   | <b>67</b> |
| <b>5.7</b>  | <b>PARTICIPANTS</b>                                     | <b>68</b> |
| 5.7.1       | FIRST-TIME SEX OFFENDERS (FT)                           | 69        |
| 5.7.2       | HISTORICAL SEX OFFENDERS (HT)                           | 69        |
| 5.7.3       | NON-SEXUAL OFFENDER CONTROLS (NSOC)                     | 70        |
| <b>5.8</b>  | <b>INCLUSION CRITERIA</b>                               | <b>70</b> |
| <b>5.9</b>  | <b>EXCLUSION CRITERIA</b>                               | <b>71</b> |
| <b>5.10</b> | <b>PROCEDURE</b>  | <b>72</b> |
| 5.10.1      | DURATION OF ASSESSMENTS                                 | 72        |
| 5.10.2      | ASSESSMENTS IN PRISON                                   | 73        |
| 5.10.2.1    | Long Bay Prison, MSPC and CUBIT                         | 73        |
| 5.10.2.2    | Special permission for laptop                           | 74        |
| 5.10.3      | ASSESSMENTS IN THE COMMUNITY                            | 74        |
| 5.10.3.1    | Forensic Psychology Services (FPS)                      | 74        |
| 5.10.4      | EXPERIENCE OF DATA COLLECTION IN PRISON                 | 75        |
| <b>5.11</b> | <b>MATERIALS</b>  | <b>75</b> |
| 5.11.1      | DEMOGRAPHIC MEASURES                                    | 75        |
| 5.11.2      | SCREENING MEASURES                                      | 76        |
| 5.11.2.1    | The Addenbrooke's Cognitive Examination-Revised (ACE-R) | 76        |
| 5.11.2.2    | Depression, Anxiety, and Stress Scales (DASS)           | 77        |
| 5.11.3      | NEUROPSYCHOLOGICAL MEASURES                             | 78        |
| 5.11.3.1    | Rationale for this study's neuropsychological battery   | 78        |
| 5.11.3.2    | Wechsler Abbreviated Scale of Intelligence (WASI)       | 79        |

|             |   |            |
|-------------|---|------------|
| 5.11.3.3    | The Hayling Test  | 80         |
| 5.11.3.4    | The Iowa Gambling Task (IGT)  | 82         |
| 5.11.3.5    | The Trail-Making Test (TMT)   | 85         |
| 5.11.3.6    | Verbal Fluency - The FAS test   | 86         |
| 5.11.3.7    | The Rey Complex Figure Test (RCF)   | 87         |
| 5.11.3.8    | Rey Auditory Verbal Learning Test (RAVLT)   | 88         |
| 5.11.4      | SOCIAL COGNITION MEASURE  | 89         |
| 5.11.4.1    | Facial Expression of Emotion: Stimuli and Tests (FEEST)   | 89         |
| <b>5.12</b> | <b>STATISTICAL ANALYSES</b>   | <b>91</b>  |
| 5.12.1      | POWER ANALYSIS  | 91         |
| 5.12.2      | STATISTICAL ANALYSIS  | 92         |
| 5.12.2.1    | Multivariate analysis of variance (MANOVA)  | 94         |
| 5.12.2.2    | Canonical variates analysis (CVA)   | 95         |
| 5.12.2.3    | Residual maximum likelihood (REML)  | 97         |
| 5.12.2.4    | Logistic regression   | 97         |
| <b>6</b>    | <b>RESULTS</b>  | <b>98</b>  |
| <b>6.1</b>  | <b>EXCLUSION AND REFUSAL DATA</b>   | <b>98</b>  |
| <b>6.2</b>  | <b>DEMOGRAPHICS OF PARTICIPANTS</b>   | <b>99</b>  |
| 6.2.1       | AGE OF OFFENDER AND YEARS OF EDUCATION  | 99         |
| 6.2.2       | TOTAL TIME IN PRISON  | 100        |
| 6.2.3       | OCCUPATION  | 100        |
| 6.2.4       | MARITAL STATUS  | 101        |
| 6.2.5       | SEXUAL ORIENTATION  | 101        |
| 6.2.6       | HANDEDNESS  | 101        |
| 6.2.7       | DRUG AND ALCOHOL, PSYCHIATRIC HISTORY, AND HEAD INJURY  | 102        |
| 6.2.8       | HYPERTENSION AND DIABETES   | 102        |
| 6.2.9       | AGE AT FIRST SEXUAL OFFENCE   | 103        |
| 6.2.10      | TIME INTERVAL BETWEEN FIRST SEXUAL OFFENCE AND NEUROPSYCHOLOGICAL TESTING   | 104        |
| 6.2.11      | SEXUAL OFFENCES AGAINST CHILDREN  | 104        |
| 6.2.12      | MALE VICTIMS  | 105        |
| 6.2.13      | EXTRAFAMILIAL SEXUAL OFFENCES   | 105        |
| 6.2.14      | INCEST, HETEROSEXUAL RAPE, HOMOSEXUAL INDECENT SEXUAL ASSAULT, CHILD PORNOGRAPHY, AND<br>MULTIPLE SEXUAL OFFENCES | 105        |
| 6.2.15      | SEXUAL VIOLENCE   | 106        |
| 6.2.16      | PAEDOPHILIC DISORDER AND OTHER PARAPHILIC DISORDERS   | 107        |
| 6.2.17      | NON-SEXUAL CRIMINAL HISTORY   | 108        |
| <b>6.3</b>  | <b>SCREENING MEASURES RESULTS</b>   | <b>109</b> |
| 6.3.1       | DEMENTIA SCREENING RESULTS  | 109        |
| 6.3.1.1     | Addenbrooke's Cognitive Examination-Revised (ACE-R)   | 109        |
| 6.3.1.1.1   | ACE-R impairment  | 110        |
| 6.3.2       | SELF-REPORTED SYMPTOMS OF CLINICAL IMPAIRMENT   | 111        |
| 6.3.2.1     | Depression, Anxiety and Stress Scale (DASS)   | 111        |
| <b>6.4</b>  | <b>NEUROPSYCHOLOGICAL MEASURES RESULTS</b>  | <b>113</b> |
| 6.4.1       | LEVEL OF INTELLIGENCE   | 113        |

|            |   |            |
|------------|---|------------|
| 6.4.1.1    | WASI FSIQ, VIQ and PIQ                                      | 113        |
| 6.4.1.1.1  | WASI Subtests   | 114        |
| 6.4.2      | EXECUTIVE FUNCTION MEASURES RESULTS                         | 115        |
| 6.4.2.1    | The Hayling Test  | 115        |
| 6.4.2.1.1  | Hayling Total Score   | 116        |
| 6.4.2.1.2  | Hayling category A and B errors                             | 117        |
| 6.4.2.1.3  | Hayling Impairment  | 118        |
| 6.4.2.2    | Verbal fluency - The FAS                                    | 120        |
| 6.4.2.2.1  | FAS total   | 120        |
| 6.4.2.2.2  | FAS Impairment  | 121        |
| 6.4.2.3    | The Iowa Gambling Task (IGT)                                | 122        |
| 6.4.2.3.1  | IGT Total Money and IGT impairment                          | 124        |
| 6.4.2.4    | The Trail-Making Test                                       | 124        |
| 6.4.2.4.1  | Part B Impairment   | 125        |
| 6.4.3      | TEMPORAL LOBE MEASURES RESULTS                              | 127        |
| 6.4.3.1    | The Rey Complex Figure (RCF)                                | 127        |
| 6.4.3.1.1  | RCF copy and immediate recall impairment                    | 128        |
| 6.4.3.2    | The Rey Auditory Verbal Learning Test (RAVLT)               | 130        |
| 6.4.4      | SOCIAL COGNITION RESULTS                                    | 132        |
| 6.4.4.1    | The Facial Expression of Emotion: Stimuli and Tests (FEEST) | 133        |
| 6.4.4.1.1  | FEEST Impairment  | 134        |
| <b>7</b>   | <b>DISCUSSION</b>   | <b>138</b> |
| <b>7.1</b> | <b>REVIEW OF AIMS</b>                                       | <b>138</b> |
| <b>7.2</b> | <b>SYNOPSIS OF DEMOGRAPHIC FINDINGS</b>                     | <b>138</b> |
| 7.2.1      | ALCOHOL PROBLEMS  | 139        |
| 7.2.2      | DEPRESSION  | 140        |
| 7.2.3      | HEAD INJURY   | 140        |
| 7.2.4      | HYPERTENSION  | 141        |
| <b>7.3</b> | <b>SEX OFFENCES COMMITTED BY FT AND HT SEX OFFENDERS</b>    | <b>141</b> |
| <b>7.4</b> | <b>REVIEW OF HYPOTHESES</b>                                 | <b>142</b> |
| 7.4.1      | HYPOTHESES 1 AND 2  | 143        |
| 7.4.1.1    | Dementia screening  | 143        |
| 7.4.1.2    | Level of Intelligence                                       | 143        |
| 7.4.1.3    | Executive function results                                  | 144        |
| 7.4.1.4    | Conclusions of executive function in FT sex offenders       | 147        |
| 7.4.1.5    | Conclusions of executive function in sex offenders          | 148        |

|            |   |            |
|------------|---|------------|
| 7.4.1.6    | Temporal lobe function tests                                  | 149        |
| 7.4.1.7    | Conclusions of temporal lobe function in FT sex offenders     | 149        |
| 7.4.1.8    | Conclusions of temporal lobe function in sex offenders        | 150        |
| 7.4.2      | HYPOTHESIS 3  | 150        |
| 7.4.2.1    | Social cognition results                                      | 150        |
| 7.4.2.2    | Conclusions of social cognition in FT sex offenders           | 151        |
| <b>7.5</b> | <b>LIMITATIONS OF THIS STUDY</b>                              | <b>153</b> |
| <b>7.6</b> | <b>RECOMMENDATIONS FOR FUTURE RESEARCH</b>                    | <b>157</b> |
| 7.6.1      | ASSESSMENT OF PREMORBID IQ                                    | 157        |
| 7.6.2      | CONTROL GROUPS  | 158        |
| 7.6.3      | REDUCE HETEROGENEITY IN SEX OFFENDER SAMPLES                  | 158        |
| 7.6.4      | DEVELOPMENT OF BETTER EXECUTIVE FUNCTION TESTS                | 158        |
| 7.6.5      | USE MORE THAN ONE SOCIAL COGNITION MEASURE                    | 159        |
| 7.6.6      | CONFOUNDING VARIABLES   | 160        |
| <b>7.7</b> | <b>RECOMMENDATIONS FOR CLINICIANS</b>                         | <b>161</b> |
| 7.7.1      | IMPLICATIONS OF THIS STUDY ON SEX OFFENDER TREATMENT/PROGRAMS | 161        |
| 7.7.2      | OBTAIN A HISTORY OF HEAD INJURY                               | 163        |
| 7.7.3      | ASSESSMENT OF EXECUTIVE FUNCTION                              | 163        |
| 7.7.4      | NEUROIMAGING  | 164        |
| 7.7.5      | FRONTOTEMPORAL DEMENTIA                                       | 164        |
| 7.7.6      | RISK ASSESSMENT   | 165        |
| <b>7.8</b> | <b>CONCLUSIONS</b>  | <b>165</b> |
| <b>7.9</b> | <b>FINAL COMMENTS</b>   | <b>168</b> |
|            | <b>REFERENCES</b>   | <b>169</b> |

## LIST OF APPENDICES

|  |     |
|--|-----|
| Appendix 1 - Information Sheet.....                | 235 |
| Appendix 2 - Consent Form .....                    | 236 |
| Appendix 3 - Hayling Sentence Completion Test..... | 237 |
| Appendix 4 - Test instructions and scoring .....   | 240 |
| Appendix 5 - PhD PowerPoint Presentation.....      | 245 |

## LIST OF TABLES

|   |     |
|---|-----|
| Table 3-1 Studies and overall effect sizes included in the meta-analysis by Joyal et al. (2014) ..... | 48  |
| Table 6-1 Sample Demographics .....   | 99  |
| Table 6-2 Types of sex offences committed by the sex offender groups .....                            | 105 |
| Table 6-3 Rate of paedophilic and paraphilic disorders .....  | 107 |
| Table 6-4 Types of non-sexual offences committed by group .....                                       | 108 |
| Table 6-5 ACE-R score results .....   | 110 |
| Table 6-6 DASS results .....  | 112 |
| Table 6-7 Intellectual function results by group .....  | 114 |
| Table 6-8 Hayling results by group .....  | 116 |
| Table 6-9 Hayling results (combined) .....  | 117 |
| Table 6-10 FAS results by group .....   | 120 |
| Table 6-11 FAS p values (group contrasts) .....   | 121 |
| Table 6-12 IGT results by group .....   | 123 |
| Table 6-13 Predicted means on the trail-making test .....   | 125 |
| Table 6-14 Trail-making test results by group .....   | 125 |
| Table 6-15 Rey Complex Figure results .....   | 128 |

Table 6-16 RAVLT Total and Recognition results by group ..... 130

Table 6-17 FEEST results by group ..... 134

Table 6-18 Summary table of neuropsychological results ..... 136

## LIST OF FIGURES

|   |     |
|---|-----|
| Figure 3-1 A Patient who developed paedophilic fantasies following a right orbitofrontal tumour ..... | 35  |
| Figure 6-1 Mean age at first sexual offence by the sex offender groups .....                          | 103 |
| Figure 6-2 Mean Hayling Total score and mean Category A and B errors .....                            | 118 |
| Figure 6-3 Hayling impairment results.....  | 119 |
| Figure 6-4 FAS Total and Individual F, A, S words .....   | 122 |
| Figure 6-5 Trail-making test results .....  | 126 |
| Figure 6-6 Copy and Immediate Recall results .....  | 129 |
| Figure 6-7 RAVLT and Total Recognition scores .....   | 132 |



# 1 INTRODUCTION

## 1.1 Introduction to this study

Few studies have adopted a rigorous methodology in the investigation of neurocognitive function of elderly sex offenders. This study attempted to draw inferences from the neurocognitive investigation of sex offenders, who commit their first sexual offence after the age of 50 years. This thesis, which I believe addresses the most important issues in the investigation of an association between brain function and sexual offending in elderly first-time sex offenders, is divided into several parts.

Section 1 of this chapter covers the myriad of societal problems that arise from sexual offending, followed by the prevalence of sexual offending in Australia, the problems of underreporting, and the long-term effects of sexual abuse.

Section 2 of this chapter provides an introduction of the characteristics of the elderly sex offender, their risk of re-offending, and, of concern, the limited research available.

Section 3 presents a rationale for researching elderly first-time sex offenders, the aims of the study, and an overview of this thesis.

## 1.2 SECTION 1

### 1.2.1 Sexual offending and victims

Society remains outraged about the risk that sex offenders pose to their victims, usually children and women. Sex offenders often evoke fear and other negative reactions (Shackley et al., 2013). More recently, the serious sex offender legislation in New South Wales, other states in Australia, and internationally has led to heightened media attention and further societal concern.

Contrary to society's perception, victims usually know their perpetrators. Approximately 60% of boys and 80% of girls are abused by someone known to the child or the child's family (Lieb et al., 1998). In a study of 3,000 women randomly selected from electoral rolls, only 15% involved strangers, more than 38% of the abusers were relatives, and more than 46% were family acquaintances (Anderson et al., 1993).

Sexual re-offending is also a significant problem in the lives of sex offenders. Some studies suggest that sex offenders, when followed up for long periods, have high rates of sexual re-offending (Langevin and Curnoe, 2012; Langevin et al., 2004). For example, a study of more than 2,000 sex offenders in Canada found that between 47% and 81% of sex offenders re-offended (Langevin and Curnoe, 2012).

Significantly, the treatment of sex offenders remains controversial and misunderstood even among mental health professionals. The bleakness of this

situation and the concerns by society regarding sexual offending are unfortunately not assisted by studies that report poor efficacy of sex offender treatment (Dennis et al., 2012; Hanson et al., 2002; Marques et al., 2005). However, not all agree that sexual offender treatment is ineffective, with some studies concluding that treatment can reduce sexual recidivism (Bradford et al., 2013; Harenski et al., 2012; Losel and Schmucker, 2005; Olver et al., 2013; Schmucker and Losel, 2008), with psychological and pharmacologic treatment being effective in reducing re-offending (Garcia et al., 2013).

### **1.2.2 Prevalence rate of sex offences in Australia**

Prevalence figures can differ substantially depending on the definition of sexual abuse used. For example, a broad definition of sexual abuse, one that includes exposure to pornographic material or exhibitionism, will produce a much higher prevalence estimate than a definition that includes only the most severe and intrusive forms of sexual abuse, such as rape.

The collective statistics of recorded crime in Australia highlight the problem of sexual abuse. The prevalence estimates range from 1% of all children for abuse by a parent (Rosenman and Rodgers, 2004) to 45% of females when a broad definition of abuse is used, such as sexual exhibitionism, or "flashing", by a stranger (Australian Institute of Family Studies) (AIFS, 2010).

In 2003, a report by the Australian Institute of Health and Welfare (2009) estimated that 187 per 100,000 children aged 0-14 years were victims of sexual abuse. In the

*Personal Safety Survey of 2005*, approximately 30% of women aged between 18 and 24 years reported sexual violence in the last 12 months (ABS, 2005). In 2007, there were 19,781 sexual assaults recorded in Australia, with 94 victims per 100,000 (AIC, 2007). The 2010-11 Crime Victimization Survey estimated that 54,900 (0.3%) of Australians aged 18 years and over had been victims of at least one sexual assault in the previous 12 months (ABS, 2012).

#### **1.2.2.1 Underreporting of sexual offences**

The true prevalence of sexual offending is contentious. Sexual offending accounts for only 1% of crimes recorded in England and Wales (Eastman et al., 2012). In the US, 9.7% of prisoners have a history of sexual offending (Greenfeld, 1997) and Australian data report a figure as high as 13.3% (Gelb, 2007). However, these figures represent significant underestimates of the extent of the problem as many sexual offences are not reported (ABS, 1996; ABS, 2002; ABS, 2010), or, if they are reported, the allegations are often withdrawn.

Of the cases that do enter the criminal justice system, few reach trial, which means that only a fraction of all reported sex offences result in convictions (Lievore, 2003). In 2007, the Australian Institute of Criminology (AIC) estimated that less than 30% of sexual assaults were reported to the police (AIC, 2007).

Victims do not disclose or report sexual violence for a range of reasons (Mouzos and Makkai, 2004). These reasons include: they do not identify the act as sexual violence, let alone as a criminal offence, they do not consider the incident serious

enough to warrant reporting, they are ashamed, may be fearful of the perpetrator, they do not think that they will be believed, and/or they may be genuinely fearful of how they will be treated by the criminal justice system (Fuller, 1989).

### **1.2.3 Identified long-term problems of sexual abuse**

Difficulties associated with child sexual abuse can continue for many years following the abuse (Swanston et al., 1997; Tebbutt et al., 1997). Sexually abused children report a higher rate of psychiatric morbidity than their non-abused peers during childhood, adolescence and adulthood. These include depression and low self-esteem (Lanktree et al., 1991; Mellott and Wagner, 1993; Stern et al., 1995), anxiety and sadness (Mannarino and Cohen, 1986), school and behavioural problems, such as running away from home (Gomes-Schwartz et al., 1990), powerlessness (Finkelhor, 1984), and hopelessness (Mellott and Wagner, 1993). The long-term consequences of child sexual abuse have been identified as: depression (Mullen et al., 1994; Mullen et al., 1988), low self-esteem (Finkelhor, 1984), and increased risk of further victimisation, such as sexual re-victimisation involving rape or other types of sexual abuse (Beitchman et al., 1991; Ogloff et al., 2012). Other problems such as eating disorders (Bulik et al., 1989), suicidal behaviour (Cutajar et al., 2010; Plunkett et al., 2001), relationship and sexual difficulties (Mullen et al., 1994), drug and alcohol abuse (Cutajar et al., 2010; Strine et al., 2012), and engagement in criminal activity may manifest in late adolescence and adulthood (Ogloff et al., 2012; Rivera and Widom, 1990). In addition, the effects of sexual abuse can continue into adulthood and old age, with a similar prevalence of psychiatric problems as those

found in younger people, such as mixed anxiety and depression, generalized anxiety disorder, eating disorders, PTSD, and suicidal ideation (Chou, 2012).

## **1.3 SECTION 2**

### **1.3.1 Offender age and sexual offending**

Non-violent, violent, and sexual crimes are inversely related to age (Bonta et al., 1998). Generally, older people commit fewer crimes than young people. For example, violent crimes are mostly committed by young males between the ages of 15 and 25 (Krug, 2002).

However, not all offenders are young or begin to offend at a young age (Barak et al., 1995; Fazel and Grann, 2002; Kunz, 2011; O'Sullivan and Chesterman, 2007; Overshott et al., 2012; Yorston, 2004). For example, in the UK people over the age of 60 commit about 11 homicides and over 300 sex offences each year (Yorston, 2004).

Sexual offences are consistently over-represented in the UK, Canada and the United States (Uzoaba, 1998). Elderly sex offenders account for 1.7% of rapes and 3.8% of all reported "other sex offences" for a total of 5.5% of sex crimes (Johnson, 1995). Other studies report that between 2% and 14% of sex offenders are over the age of 60 (Abel et al., 1988; Mezey et al., 1991).

Age is an important factor to consider in the prediction of sexual offending risk and there is a body of research that suggest that in some types of sex offenders age can predict a reduction in sexual recidivism (Barbaree et al., 2003; Blanchard et al., 1999; Dickey et al., 2002; Fazel et al., 2006; Hanson, 2006; Prentky and Lee, 2007; Thornton, 2006). For example, the incidence of rape peaks in late adolescence and early adulthood (Greenfeld, 1997). Rapists tend to be younger than child sex offenders and the recidivism risk of “non-paraphilic” rapists decreases dramatically as a function of age (Dickey et al., 2002; Hanson, 2002).

It is possible that the lower rate of sexual offending by older men can be attributed to a reduction in sexual drive (Barbaree et al., 2003). This decline has been supported by a study comparing more than 2,000 paedophiles, hebephiles (those attracted to adolescents) and teleiophiles (those most attracted to physically mature partners) in phallometric assessment<sup>1</sup> for erotic age-preference (Blanchard and Barbaree, 2005). The results suggested that sexual arousal was inversely correlated with age, and there was no difference between paedophiles, hebephiles, and teleiophiles in the rate at which arousability declined.

Some studies are more conservative when viewing age as a “protective factor” for sexual re-offending (Harris and Rice, 2007; Langevin et al., 2004). The reality is that a group of sex offenders are at an increased risk for sexually reoffending irrespective of age. Those with high psychopathy scores, for example, exhibit no significant age-

---

<sup>1</sup> Phallometry is a physiological technique in which an individual's penile blood volume is monitored while presented with a standardized set of laboratory stimuli depicting male and female pubescent children and adults.

related reduction in offending (Hare et al., 1992; Harris et al., 2003; Woodworth et al., 2013). Another group of sex offenders that show no age-related attenuation in sexual recidivism are extra-familial child sex offenders. A meta-analysis examined the relationship of age and sexual recidivism using data from 10 follow-up studies of more than 4,000 adult male sex offenders and found that recidivism rates of extra-familial paedophiles showed little reduction in sexual re-offending patterns until after the age of 50 (Hanson, 2002).

### **1.3.2 Sexual offence histories and characteristics of elderly sex offenders**

There is limited research on elderly sex offenders, although elderly sex offenders have been found to account for 5% of sex crimes, including 1.7% of all reported rapes (Johnson, 1995). Elderly sex offenders are more likely to have multiple victims, commit non-violent offences, offend in their homes, and are less likely to sexually assault strangers (Curtice et al., 2003; Fazel et al., 2002). Previous studies of elderly sex offenders identify fathers, stepfathers, grandfathers or an acquaintance of the victim as perpetrators and females as victims (Fazel et al., 2002; Goodwin et al., 1983; Margolin and Craft, 1989).

Many elderly sex offenders are “first time offenders” with no prior criminal record of any sexual or other offence (Hucker and Ben-Aron, 1985). Older offenders are more likely to commit “non-violent” sexual offences such as exhibitionism as opposed to “violent” sex offences (Alston, 1986). However, there is some evidence from small case studies that elderly men commit violent offences, such as rape, following the death of a spouse (Carabellese et al., 2012).



The research on elderly sex offenders suggests that they can be a high risk for sexual offending against young children. A study by Poortinga et al. (2007) comparing offenders whose victims were under 6 years of age to those whose victims were 12 or more years of age, found that 23.3% offended against very young victims (less than 6 years of age). Of those individuals, elderly offenders (60 years old or greater) were three times more likely to offend against this young victim group.

## **1.4 SECTION 3**

### **1.4.1 Why research first-time sex offenders over the age of 50?**

Efforts to control sexual offending often focus on the prevention of sexual re-offending of men who have a history of sexual offending and are generally well-known to authorities, including the police and the courts. Sex offenders are required to register as a sex offender<sup>2</sup>, reveal where they live, and are not allowed to live near child congregation places, schools, or churches. In addition, there are penalties for repeat offenders and for non-compliance of registration.

In contrast to known sex offenders, much less is known about first-time sex offenders and even less is known about elderly first-time sex offenders, especially in

---

<sup>2</sup> The Australian National Child Offender Register (ANCOR) is a web-based system used in all jurisdictions. Authorized police use ANCOR to monitor persons convicted of child sex offences and other specified offences once they have served their sentence. Offenders are monitored for eight years, 15 years or the remainder of their life (4 years or 7½ years for juvenile offenders). On 1 March 2011, there were 12,596 registered offenders across Australia.

respect to their risk. Much of the research so far has been on much older sex offenders while this study investigated sex offenders as young as 50 years old.

#### **1.4.2 The present study**

This case-control study investigates the neuropsychological function of a group of elderly first-time sex offenders. This is an important group of sex offenders to research because there is a need to identify the risks relevant to “first-time” sex offenders, whose historical factors are unknown. Otherwise, clinicians will increasingly be faced with the challenge of estimating sexual recidivism risk in the absence of a known sexual offence history. Current actuarial instruments, such as the Static-99R (Hanson et al., 2012) and the Sex Offender Risk Appraisal Guide (SORAG) (Quinsey et al., 1998), which rely on historical risk factors, such as previous sexual offending, will not assist clinicians in these cases.

This study aims to increase our knowledge of the neuropsychological function of first-time offenders, who commit their first sexual offence much later in their lives, and attempts to investigate whether they demonstrate further risk of sexual offending as a function of neurocognitive impairment.

#### **1.4.3 Overview of this thesis**

To achieve a thorough investigation and understanding of the cognitive function of this population of elderly sex offenders, an introduction to relevant topics and empirical studies was necessary.

Chapter 2 covers the research of normal cognitive ageing, outlining the delineation between normal and pathological ageing. The cognitive functions, such as processing speed, memory, and executive function, which are susceptible to the effects of ageing, are discussed. This chapter would have been incomplete without a discussion of the limitations associated with the assessment of older adults. Therefore, a short summary of the neural substrates of the older adult, as well as the limitations of existing so-called “frontal tests” are discussed.

Chapter 3 outlines the association between structural, neuropsychological function and sexual offending, in the process, critically evaluating the research in this field. This chapter covers various topics, introducing the reader to the complexity of attributing sexual offending to morphological and cognitive changes. The chapter highlights the contribution of frontal and temporal lobe dysfunction in sexual offending, as well as the contribution of deficits in social cognition, which can contribute to the risk of sexual offending in the elderly. Chapter 3 concludes with a summary of the methodological problems endemic in neuropsychological research of sex offenders.

Chapter 4 introduces the research on frontotemporal dementia (FTD) emphasising the possibility of a link between frontal and temporal deficits observed in sex offenders and those of FTD patients, who can also commit sexual offences.

Chapter 5 outlines the methodology of this study, re-iterating its aims, including the hypotheses to be tested, definition of participant groups, and the battery of neuropsychological tests used.

Chapter 6 provides the results of the statistical models used to analyse the data.

Chapter 7 discusses the results, the possible implications, along with many limitations of extrapolating conclusions from the results, and recommendations for future researchers and clinicians in this field.

## 2 NORMAL COGNITIVE AGEING

### 2.1 Introduction

Cognitive ageing refers to decline in cognitive functions as people age (Deary et al., 2009; Starr et al., 1997). The research in normal human cognitive ageing is divided. It is unclear whether cognitive decline is disease-specific or simply part of the so-called “normal ageing process”.

The purpose of this chapter is to outline the changes in cognition that inevitably occur in normal human ageing. In section 1, the cognitive functions susceptible to ageing are discussed in detail given their relevance to the current study. The limitations of existing so called “frontal” or executive function tests are also discussed. This section concludes with a short summary of the neural substrates affected in cognitive ageing.

In section 2, the limitations in the assessment of older adults are discussed, as well as the steps taken to avoid biases in the assessment of executive function of the older adult.

#### 2.1.1 Cross-sectional and longitudinal studies

Studies of older adults are typically cross-sectional, which results in different conclusions regarding cognitive decline in the aged. Cross-sectional studies, which compare cohorts of different ages and make inferences about cognitive decline, are

limited in scope because they only test the person at a particular juncture and, therefore, ignore previous functioning or factors that are better covered over intermittent periods. On the other hand, longitudinal studies provide useful information about a person's decline over time, using the same tests; however, these studies are expensive and, given the medical problems associated with ageing, they suffer from dropout rates.

Just as age-related changes in brain structure are not uniform across the entire brain or across individuals, age-related changes in cognition are not uniform across all cognitive domains or across all older individuals. Notwithstanding, healthy older adults experience a steady decline in cognitive ability whether measured longitudinally (Park et al., 1996), or cross-sectionally (Small et al., 1999).

Crystallized abilities, such as language, verbal ability and breadth of knowledge, as well as autobiographical and emotional memory, remain stable until later in life (Schum and Sivan, 1997; Willis et al., 1992). Expertise-based on over-learned skills show some attenuated or no age-related change, particularly with continued practice (Krampe and Ericsson, 1996; Morrow et al., 2001). In contrast, processing speed, working memory, problem solving and new learning decline (Anstey and Low, 2004; Ballesteros et al., 2009; Kramer et al., 2007; Small, 2001).

The following sections outline the cognitive changes generally found in older populations:

## **2.2 SECTION 1**

### **2.2.1 Processing speed in the older person**

Processing speed has been consistently shown to slow with age (Eckert et al., 2010; Fozard et al., 1994; Hedden et al., 2005; Levitt et al., 2006; Salthouse, 1995; Salthouse, 1996; Willis et al., 1992). Older people show a reduction in the amount of information they can process at a single point in time. It has been proposed that slowing in the aged can account for much of the changes in performance that decline with age (Fisk and Warr, 1996; Nettelbeck and Burns, 2010). Many tests are timed and tap into fluid intelligence, raising the possibility that processing speed has an important effect on other cognitive functions (Lezak et al., 2004).

Structurally, a frontal pattern of grey matter and white matter variation related to cerebral small vessel disease, as well as a cerebellar pattern of grey matter and white matter variation, has been associated with age-related declines in processing speed (Eckert et al., 2010).

### **2.2.2 Memory in the older person**

Memory complaints are common among older adults and are more prevalent among the very old and those with low levels of education (Fournet et al., 2012; Jonker et al., 2000). Furthermore, subjective memory deficits have been correlated with performance, as individuals who report problems with memory generally perform

poorly on standardized memory tests, such as the California Verbal Learning Test (Hohman et al., 2011).

However, it is not clear whether memory problems are permanent or can be modulated as there is some evidence that memory in older people can improve with lifestyle changes, such as exercise (Nagamatsu et al., 2013).

Not all aspects of memory show age-related decline (Henry et al., 2004). Semantic memory remains relatively intact in healthy older adults, while episodic memory, i.e., the conscious recollection of a personal experience that contains information on what has happened and also where and when it happened, shows age-related decline (Chen and Naveh-Benjamin, 2012; Kinugawa et al., 2013; Naveh-Benjamin et al., 2005; Nyberg et al., 2012; Salthouse, 2009; Shing et al., 2010).

#### **2.2.2.1 Working memory in the older person**

Working memory refers to a limited capacity system that is responsible for the temporary storage and processing of information while cognitive tasks are performed (Lezak et al., 2004). Memory capacity and attentional control are two essential elements of working memory, which are further subdivided into several more specific components (Baddeley, 2000; Miyake et al., 2000).

Working memory is assessed by a variety of tasks. The unifying feature of all these tasks are twofold; (1) to hold the relevant material intact, and (2) to perform a mental



operation so that attentional control, defined as the ability to effectively preserve and retrieve items from memory in the presence of interference, is maintained.

Working memory declines incrementally with age (Bender and Raz, 2012; Fakhri et al., 2012; Holtzer et al., 2009; Meguro et al., 2001; Remick et al., 2012; Sander et al., 2012). Specifically, older adults demonstrate deficits in attention because they allow irrelevant information to enter working memory and occupy working memory resources, which are required for efficient processing (Scullin et al., 2011).

### **2.2.3 Terms**

Before addressing the issues of executive function in the older person, it is important to revisit some terms, i.e., executive function, executive dysfunction and the problems encountered in the measurement of executive function.

#### **2.2.3.1 Executive function**

Executive function (EF) can be defined as higher-order cognitive processes that orchestrate simple ideas, movements and actions into complex goal-directed behaviours that are multidimensional (Alvarez and Emory, 2006; Jurado and Rosselli, 2007; Stuss and Alexander, 2000; Zelazo et al., 2004). EF has been proposed to have three primary components: attention, working memory, and inhibition/switching (Baldo et al., 2001; Fuster, 2002; McCabe et al., 2010; Miyake et al., 2000). These higher order processes include cognitive flexibility, monitoring one's own behaviour, self-control, delay of gratification, drive inhibition, and the

anticipation of future consequences (Luria, 1980; Malloy and Richardson, 1994; Raz et al., 1997).

#### **2.2.3.2 Executive dysfunction**

Executive dysfunction may manifest in a constellation of problems in everyday life. Behavioural disinhibition, concrete thinking, perseveration, lack of initiative, poor planning and goal-setting, apathy and loss of cognitive flexibility are all characteristics of executive dysfunction (Lezak et al., 2004). Impairments in set shifting ability is a notable feature of executive dysfunction (Avila et al., 2003).

#### **2.2.4 The limitations of executive function tests**

Research on EF has historical roots in neuropsychological studies of patients with frontal lobe damage; however, the use of certain tests may not necessarily index damage to these areas (Alvarez and Emory, 2006; Miyake et al., 2000). These findings can therefore be confusing and provide uncertainty as to which neuropsychological functions EF tests actually measure (Collette and Van der Linden, 2002).

Tests of abstract reasoning and verbal fluency are commonly referred to as “frontal lobe” tests because patients with severe frontal lesions perform poorly on them. Eventually it became standard practice to conclude that individuals who perform poorly on EF tests had a “frontal lobe deficit”.

As not all frontal lobe damage patients perform poorly on EF tests, Alvarez and Emory (2006) argue that frontal lobe damage (anatomy) should not be synonymous with executive dysfunction.

#### **2.2.4.1 Unreliability of executive function tests**

EF tests can be unreliable. Some studies have found that patients with frontal lesions perform within normal limits on EF tests (Baddeley et al., 1997; Eslinger and Damasio, 1985; Shallice and Burgess, 1991) while others have found that those with non-frontal or diffuse lesions perform as poorly as those with frontal lesions on these tests (Anderson et al., 1991; Axelrod et al., 1996). Even in the presence of obvious executive dysfunction, patients can perform well on a variety of EF tests; however, the decision-making impairment is obvious in the real lives of patients (Bechara et al., 2005).

#### **2.2.4.2 Lack of specificity of executive function tests**

“Executive function tests” can be multi-factorial or suffer from lack of specificity; and poor performance can be inferred for reasons other than dysfunction in the frontal lobes (Stuss et al., 1995).

The Wisconsin Card Sorting Test (WCST), the Tower of Hanoi (TOH) task, and its variant, the Tower of London task, are so routinely used that they have become the primary research tools in assessing the “many” executive functions brain-damaged

patients, as well as in individual differences in normal populations. Although poor performance on these tests may suggest damage, there could also be other explanations for poor EF.

Piguet et al. (2005) argue that because of the heavy reliance on other cognitive systems, pure measures of EF probably do not exist. Demakis (2004) argues that given the complexity of frontal lobe functioning and multiple cognitive abilities mediated by these brain regions, it is unreasonable to expect that one test can serve to investigate for anomalies and that it is equally unreasonable to expect that one single test can serve as a 'gold standard'.

#### **2.2.5 Executive function in the older person**

Older people cope less well when asked to solve unfamiliar reasoning problems, which require the person to distinguish relevant from irrelevant or redundant elements. For example, older adults experience problems in switching tasks, which implies that older adults must engage in more task-set reconfigurations or switch recourse demands during task-switching tests (Themanson et al., 2006; Wasylshyn et al., 2011).

In addition to the effects of ageing, the medical problems of the elderly, such as those brought about by cardiovascular risk factors, have been found to contribute to deficits in EF (Dregan et al., 2013; Knopman et al., 2001; Leritz et al., 2011; Reis et al., 2013).

A number of studies, using a variety of EF tasks, have documented important age-related decrements in EF relative to young adults (Bisiacchi et al., 2008; Brennan et al., 1997; Clarys et al., 2009; Fisk and Sharp, 2004; Gunstad et al., 2006; Head et al., 2009; Parkin and Java, 1999; Zelazo et al., 2004; Zhou et al., 2011). In the Stroop test, older people perform inferiorly to young people (Boone et al., 1990; Bugg et al., 2007; Salthouse, 2000; West, 2000). Older adults commit more perseverative errors and complete fewer categories on the WCST than young adults (Isingrini and Vazou, 1997). Older people demonstrate poorer set shifting and set maintenance on the WCST, consistent with reduced efficiency of feedback use (Ashendorf and McCaffrey, 2008). Verbal fluency has been found to steadily decline with increasing age (Ylikoski et al., 1999), with older adults producing fewer words on tests of verbal and semantic fluency (Troyer et al., 1997).

The pattern suggests an accelerated EF decline after the age of 60 (Treitz et al., 2007). Some studies, however, have suggested that such declines occur much later, when people reach their 70s and 80s (Lin et al., 2007; Mack et al., 2005), while some studies have reported a decline in EF in middle-aged individuals (Zhou et al., 2011), as young as age 50 (De Luca et al., 2003).

Some studies propose selective ageing deficits in normal EF rather than a general decline (Goh et al., 2012; Rodriguez-Aranda and Sundet, 2006).

In contrast to the above studies, other researchers have provided an alternative view that EF performance declines in older people. Some researchers have not found age differences in verbal fluency tasks (Bryan et al., 1997; Davis et al., 1990; Mejia et al.,

1998), and have not replicated poor performance on the WCST by older people (Boone et al., 1990; Mejia et al., 1998).

### **2.2.6 Anatomical correlates associated with executive function in the older person**

The brain undergoes pronounced age-associated structural changes in old age. The most obvious change is a steady decrease in brain size, with an increase in ventricular spaces and cerebrospinal fluid (Deary et al., 2009; Keller, 2006; Raz et al., 2005).

Specifically, ageing leads to structural and functional declines in the frontal lobes (Bartzokis et al., 2001) with cortical thinning and volumetric reduction in the prefrontal cortex (Moscovitch and Winocur, 1995; Rajah et al., 2010; Raz et al., 1997; Raz and Rodrigue, 2006; Stuss et al., 1996; West, 1996), specifically in the orbitofrontal, dorsolateral, and ventromedial prefrontal cortices (Fjell et al., 2009; Kramer et al., 2007; Walhovd et al., 2011; Zimmerman et al., 2006). In addition, functional neuroimaging studies have reported reduced prefrontal cortex activation in older adults compared to younger adults (Logan et al., 2002), as well as decreased cerebral glucose metabolism (Hsieh et al., 2012).

### **2.2.7 Social cognition deficits in older people**

In addition to deterioration or slowness in cognitive function, older people can also demonstrate deficits in emotional/cognitive integration (Baena et al., 2010). In recent

years these behavioural aspects have been included under the umbrella of “social cognition”, which has been shown to dissociate from conventional EF.

Among the age-related social deficits found, older people have deficits in facial emotion recognition (Suzuki and Akiyama, 2013); and Theory of Mind (ToM) tasks, which require understanding of other people’s beliefs and intentions (Bailey and Henry, 2008; Charlton et al., 2009; German and Hehman, 2006; Keightley et al., 2006a; Maylor et al., 2002; Phillips et al., 2002; Slessor et al., 2007; Sullivan and Ruffman, 2004; Uekermann et al., 2006). ToM tasks used in ageing studies have required judgments in relation to the affective states of others, including the understanding of cues to sarcasm, deception, white lies and social faux pas.

## **2.3 SECTION 2**

### **2.3.1 Limitations in the cognitive assessment of older populations**

There are potentially three major limitations encountered in the field of geriatric neuropsychology.

Firstly, the assessment of age-related cognitive decline (ARCD) is complicated by low educational achievement, as many psychometric measures can be difficult to interpret in lower educational populations. Education is therefore an important factor in determining the level of impairment on screening tests for dementia (Bravo and Hebert, 1997) and performance on neuropsychological measures (Lezak et al., 2004; Mitrushina et al., 2005).

The second limitation in cognitive gerontology is that the brain changes in normal, healthy older people are varied and diffuse rather than localized and specific; and it is unclear whether they affect all cognitive abilities to the same extent (Rabbitt et al., 2007). For example, within samples of healthy older people without dementia, a marker for diffuse neurophysiological changes, incidence of white matter lesions is associated with poorer performance on a wide variety of cognitive abilities (van Swieten et al., 1996; Ylikoski et al., 1995).

The third limitation in cognitive gerontology is that neuropsychological measures often fall short of achieving an accurate prediction of everyday functioning within the complexity of the real world, outside the testing context (Marson and Hebert, 2006).

## 2.4 Summary

In summary, an extensive research base has shown age-related cognitive decline in memory, including working memory and episodic memory, processing speed and EF using a variety of measures. In addition, elderly individuals can demonstrate deficits in social cognition. The research suggests that cognitive functions are interdependent and can detrimentally impact on each other in the presence of impairment or deficit.

Of particular interest to this study, there are three explanations that can account for the inconsistency in age-related EF decline.



Firstly, executive function measures may be too difficult for healthy older people due to their multifactorial nature and therefore any “deficits” or “impairment” may not reflect actual changes in EF in healthy ageing. There is probably no better example than the WCST, which requires adequate visual processing, basic numerical ability, some rule induction abilities, the ability to process feedback, working memory, the ability to shift mental set, and adequate motivation (Strauss et al., 2006). This means that there are a number of ways in which performance can be compromised. As a result, it is difficult to interpret whether WCST failure is due to EF or other components of brain function. Thus, an EF task failure does not necessarily demonstrate the presence of executive impairment.

Secondly, executive dysfunction in the aged can be related to other cognitive functions, other than EF. The EF decline can be related to loss of fluid intelligence (Bielak et al., 2006), or slower processing speed rather than changes in executive constructs (Fisk and Sharp, 2004; Salthouse et al., 2003), as processing speed and executive functions have been postulated to not be mutually exclusive (Albinet et al., 2012). In addition, memory and EF deficits have been found to be highly correlated, indicating that lower performance in tasks in one domain (episodic memory) is associated with the other (executive function) (Goh et al., 2012).

Thirdly, executive processes are not a unitary construct, which can be explained by a single factor (Elliott, 2003; Goh et al., 2012; Huizinga et al., 2006; Hull et al., 2008). EF does not sum to a constellation of distinct sub-functions or sub-components, as it involves several discrete cognitive processes that can be traced to particular neural substrates (Stuss and Alexander, 2000).

Neuroimaging studies support the multi-faceted nature of EF by showing that different components of EF can be attributed to different parts of the prefrontal cortex. For example, the ability to maintain information in working memory has been found to mostly recruit lateral prefrontal cortex (Narayanan et al., 2005); switching between tasks has been found to be the domain of the medial prefrontal cortex (Crone et al., 2006); and the ability for inhibition has been attributed to the orbitofrontal prefrontal cortex (Aron et al., 2004).

## 2.5 Comment

The present study attempted to address the limitations of EF assessment in the elderly by using EF measures that are not multifactorial or “beyond the capacity” of an older population.

Secondly, this study attempted to use measures that tap into as many EF functions (i.e., inhibition, planning, decision-making, and working memory) to investigate for discrete EF functions.

In addition, social cognition was assessed with the Facial Expression of Emotion: Stimuli and Tests (FEEST), described in Chapter 5.

## **3 STRUCTURAL BRAIN IMPAIRMENT AND NEUROPSYCHOLOGICAL DEFICITS IN SEX OFFENDERS**

### **3.1 Introduction**

The last chapter provided an introduction to the cognitive assessment of the older adult. This was an important chapter in providing a background to the neuropsychological assessment of older populations. There were two reasons for the inclusion of the last chapter. Firstly, it was an introduction to the problems encountered in interpreting measures of neurocognitive function in the elderly. Secondly, it attempted to outline the limitations of cognitive assessment in providing an explanation for sexual offending.

This chapter covers the association between cognitive function, neural substrates, and sexual offending.

This chapter is divided into two parts: Section 1 covers the anatomical areas that have been known to contribute to sexual offending, and Section 2 critically evaluates the body of neuropsychological research in sex offenders. Obviously, the sections overlap as anatomy and function are correlated.

## 3.2 SECTION 1 - Structural and neurological impairment in sex offenders

### 3.2.1 The neurobiology of sexual function

The neurobiology of sexual function is inferred from three principal research methods: (1) animal studies; (2) human studies involving laboratory manipulations of sexual responding; and (3) clinical reports of sexual dysfunction secondary to drug treatment or disease (Meston and Frohlich, 2000).

Before the advent of neuroimaging, neurological studies of sexual behaviour relied on animal models (Elwers and Critchlow, 1960; Fernandez-Guasti et al., 1992; Green et al., 1957; Stark, 2005). For example, rhesus monkeys that undergo removal of the temporal lobes demonstrate the Klüver-Bucy syndrome (Klüver and Bucy, 1997; Snell, 1992). They become docile and show little evidence of anger, are unable to appreciate objects visually, develop an increased appetite and hyperorality (a tendency to examine objects by mouth); as well as demonstrate an indiscriminate increase in sexual activity with either sex.

Recent studies on the neurobiology of sex have been facilitated using fMRI and photon emission computed tomography (PET) (Georgiadis and Kringelbach, 2012). The neuroanatomical areas that control sexual behaviour, including libido, initiation of sexual contact, and sexual preference comprise a complex neural network of structures in the central nervous system (Stoleru et al., 2012). These include subcortical and cortical regions, with the mesial temporal lobe and the amygdala in

particular being a crucial structure in human sexual drive (Baird et al., 2007; Beauregard et al., 2001; Fisher et al., 2005; Hamann et al., 2004), as well as the frontal lobes (Stoleru et al., 2003). Using PET, an increase in blood flow in the right prefrontal cortex has been found during orgasm (Tiihonen et al., 1994), as well as on the left side of the temporal lobe and ventral prefrontal cortex (Holstege and Huynh, 2011).

The amygdala has been found to be important in sexual function in mammals. Amygdala stimulation can elicit sexual arousal in the rat (Stark, 2005) when dopamine is increased in the medial preoptic area (Dominguez and Hull, 2001) and functional imaging reveals amygdala activation during sexual arousal in humans (Hamann et al., 2004; Karama et al., 2002).

The other source of studying sexual arousal and behaviour has derived from the study of neurological patients, for example, those with epilepsy or focalized or disseminated lesions (Rees et al., 2007). Studies of patients with brain lesions or neurologic disorders are unique in enabling us to examine specific brain-behaviour relationships. For example, changes in sexual practices have been observed in patients with temporal lobectomy. However, studying patients with brain injury or disease can be limiting because the changes in sexual behaviour may be primary or secondary to the neurological condition (Georgiadis and Kringelbach, 2012).

The following section is an introduction of the contribution of cerebral lesions or neurological changes and sexual offending.

### **3.2.2 Neuro-anatomical studies of sex offenders**

The association between brain damage and sexual offending has been documented since the 1880s when the Austro-German psychiatrist and author of the seminal work *Psychopathia Sexualis*, Richard von Krafft-Ebing, observed that the autopsy of a homicidal paedophile's brain showed, "morbid changes of the frontal lobes of the first and second temporal convolutions, and part of the occipital convolutions" (Krafft-Ebing and King, 1999)(p. 86).

Since Krafft-Ebing's observations, brain imaging studies have reported generalized brain dysfunction in sex offenders (Hendricks et al., 1988), particularly abnormalities in frontal and temporal lobe regions (Cohen et al., 2002b; Hucker et al., 1988; Hucker et al., 1986; Langevin et al., 1989a; Langevin et al., 1989b; Mendez et al., 2000; Schiffer et al., 2008; Spinella et al., 2006; Wright et al., 1990).

In addition to the possible association between sexual offending and frontal and temporal lobe damage, a few studies have reported relatively smaller brains in sex offenders, particularly in the left hemisphere, compared to non-sexual, non-violent controls (Wright et al., 1990); smaller right amygdala (Schiltz et al., 2007); diminished blood flow in frontal and temporal areas compared to non-sexual offenders (Graber et al., 1982; Hendricks et al., 1988; Hucker et al., 1986); and decreased glucose metabolism in the temporal and frontal cortices (Cohen et al., 2002b).

### **3.2.3 Neurodevelopmental studies of paedophilia**

The aetiology of paraphilic sexual preferences in men remains unclear; however, there is a growing body of research that paraphilic preferences, particularly in paedophilia, might be due to prenatal neurodevelopment (Blanchard et al., 2002; Blanchard et al., 1999; Cantor et al., 2004; Quinsey, 2003). This neurodevelopmental hypothesis suggests that some pre-, peri-, or post-natal event disrupts normal brain development, thereby “causing” or “increasing” the risk of paedophilia.

Some studies suggest that paedophiles have a greater incidence of head injury (Blanchard et al., 2002; Blanchard et al., 2003). Functional neuroimaging techniques suggest that brain regions are more activated in response to non-pornographic images representing children in paedophiles compared to healthy controls. These regions include the cerebellum, the right orbital gyrus, the right inferior frontal gyrus, the left fusiform gyrus, the left anterior cingulate gyrus, and the right and left insulae (Stoléru et al., 2013). Other studies using fMRI have found that paedophiles show altered neural activity in the amygdala, hypothalamus, dorsolateral and orbitofrontal prefrontal cortices (Poepl et al., 2011; Poepl et al., 2013; Sartorius et al., 2008; Schiffer et al., 2008; Schiltz et al., 2007; Walter et al., 2007). In addition, paedophiles who molest very young victims have gray matter reductions in the orbitofrontal cortex and angular gyri bilaterally (Poepl et al., 2013).

In addition, an association between non-right handedness (NRH) and late fraternal birth order (FBO) has been found in sex offenders. For example, a study of more

than 8,000 offenders, including paedophiles, had a higher rate of NRH compared to non-offenders (Bogaert, 2001). Similarly, Cantor et al. (2005b) found that the rate of NRH was nearly triple in paedophilic men compared to those who sexually offend adults. Some studies, however, provide limited support for a relationship between NRH and sexual offending (Blanchard et al., 2007; Nachschon and Deno, 1987).

The evidence supporting a neurodevelopmental explanation has gained popularity; however, these studies are few to generalize to all paedophiles or to all sex offenders.

#### **3.2.4 Sexual offending following acquired brain damage or traumatic brain injury**

Acquired brain injury (ABI) has been defined as an injury to the brain that can occur as a result of trauma, hypoxia, infection, tumour, substance abuse, degenerative neurological disorders or stroke (Fortune and Wen, 1999). Traumatic brain injury (TBI) often results in long-lasting disability with cognitive, physical, behavioural and psychiatric dimensions (Jacobsson et al., 2009; Masel and DeWitt, 2010; O'Connor et al., 2005; Ponsford et al., 1995a; Ponsford et al., 1995b; Wood and Rutterford, 2006). Neuropsychological impairment can include a combination of cognitive deficits in memory, verbal fluency, executive function, processing speed, as well as changes in personality and behaviour (Anderson et al., 2001; Gross et al., 1996).

As a group, TBI patients demonstrate poor inhibitory control, which results in poor behavioural self-regulation and impaired social cognition (Christ et al., 2003;



Babbage et al., 2011). As a result, TBI patients can demonstrate high levels of irritability, impulsivity and aggression, lack inhibition and decision-making skills (Rao et al., 2009; Wood and McHugh, 2013), and are at high risk of involvement in the legal system, as there is a link between irritability, aggression and violent offending (Baguley et al., 2006; Brower and Price, 2001; Fazel et al., 2011; Leon-Carrion and Ramos, 2003; Luiselli et al., 2000b; Sarapata et al., 1998; Schofield et al., 2006; Timonen et al., 2002). Prisoners are more likely to report persisting cognitive problems associated with TBI and are much more likely to screen positive for impulsivity and personality disorder (Perkes et al., 2011).

Studies have consistently found high levels of TBI among prisoner populations (range 22-100%) leading to speculation of causation between TBI and offending (Langevin et al., 2000; Schofield et al., 2006; Shiroma et al., 2010; Shiroma et al., 2012; Slaughter et al., 2003; Williams et al., 2010). These estimates demonstrate that TBI appears to be more frequent in offender populations than in the general population, where community-based surveys suggest a lifetime TBI prevalence of between 5-10% (Butterworth et al., 2004; Silver et al., 2001), or 1 in 45 (432,700 people) in 2003 according to the survey of Disability, Ageing and Carers study (ABS, 2004).

Sexual offending following TBI is under-reported and the prevalence of such offences has been limited to those individuals who have been charged or convicted. Nevertheless paedophiles report a significant history of head injury/TBI before age 13, when the brain is still developing, compared to non-paedophilic men (Blanchard et al., 2002; Blanchard et al., 2003). Langevin (2006) for example, found that in a

sample of 476 more than 49% of sex offenders had sustained serious head injuries and 22.5% sustained significant neurological insults.

Behaviours secondary to TBI range from serious sex offences, such as child molestation, rape, and exhibitionism to less serious offences, such as inappropriate touching (Mendez and Shapira, 2011b; Mendez et al., 2000). One study found that out of 445 TBI patients, 6.5% committed a form of sexual offence following brain injury (Simpson et al., 1999). Of these, 64.8% were “touching” offences (i.e., frotteurism and toucherism), followed by exhibitionism (22.7%), and overt sexual aggression comprising of 9.4% of all offences. In the absence of a prior sexual offence history, Simpson et al. (1999) concluded that TBI can be a contributing factor in sexual offending. Langevin (2006) found that his TBI group was convicted for a wide range of sexual offences and tended to offend against adults rather than against children.

### **3.2.5 Abnormal brain function and new cases of paraphilia**

The definition of a paraphilia, provided by the American Psychiatric Association (APA) of the *Diagnostic and Statistical Manual of Mental Disorders- Fifth Edition (DSM-5)*, is any intense and persistent sexual interest other than sexual interest in genital stimulation or preparatory fondling with phenotypically normal, physically mature, consenting human partners (American-Psychiatric-Association, 2013).

An inappropriate sexual interest in children may result from brain disease as well as from the sexual dysfunction disorder of paedophilia. Many child sex offenders have

the condition known as paedophilia, which is, predominantly, a sexual attraction to prepubescent children, often present since adolescence. Paedophilic behaviour can be manifested by non-paedophiles whose predominant sexual attraction is to adults but who, nevertheless, manifest inappropriate sexual behaviour toward children. Some of these non-paedophiles develop a sexual attraction to children in association with a brain disorder.

New onset of paedophilic and incestuous behaviour has been reported following the development of cognitive impairment caused by organic disorders (Mendez et al., 2000; Regestein and Reich, 1978), including epilepsy (Silva et al., 1999).

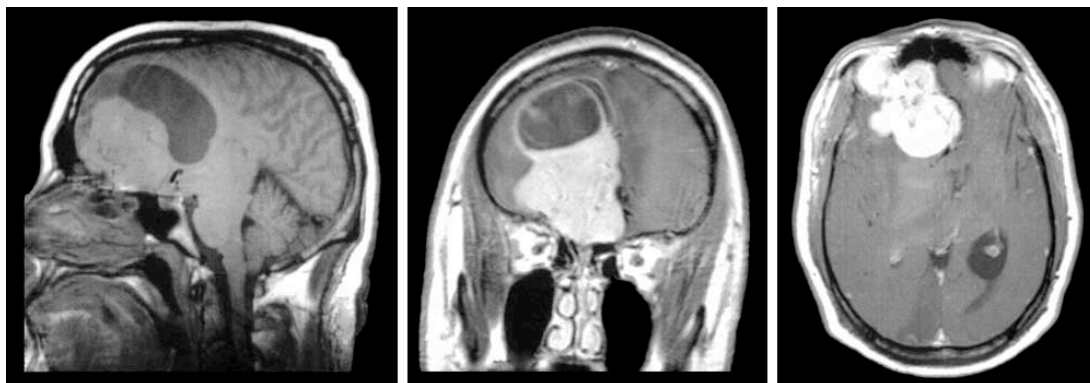


Figure 3-1 A Patient who developed paedophilic fantasies following a right orbitofrontal tumour<sup>3</sup>

Patients with orbitofrontal prefrontal cortex damage, for example, can develop sexually inappropriate behaviour toward children (Burns and Swerdlow, 2003) [see Figure 3-1].

---

<sup>3</sup> Magnetic resonance imaging scans at the time of initial neurologic evaluation: T1 sagittal (A), contrast-enhanced coronal (B), and contrast-enhanced axial (C) views. In A and B, the tumour mass extends superiorly from the olfactory groove, displacing the right orbitofrontal cortex and distorting the dorsolateral prefrontal cortex. With permission by Burns & Swerdlow.

Older studies have reported that patients with temporal lobe seizures can develop fetishism and transvestism (Epstein, 1961; Hoenig and Kenna, 1979; Kolarsky et al., 1967). A small group of individuals with damage to parts of the temporal lobe, particularly in the right hemisphere, have developed late-life paedophilia (Anson and Kuhlman, 1993; Mendez et al., 2000). Eight patients that developed sexual behaviour toward prepubescent children in mid-to-late-life were found to have frontal, temporal, subcortical, hypothalamic, and septal nuclei disease (Mendez and Shapira, 2011b).

Brain disorders can result in a predisposition for sexual attraction to children through disinhibition with frontal disease, sexual preoccupation with right temporal disease, or hypersexuality with subcortical disease in non-motor basal ganglia, hypothalamus, or septal nuclei (Mendez and Shapira, 2011a).

### **3.2.6 Rates of dementia in elderly sex offenders**

Although some studies have found a high prevalence of psychiatric morbidity in sex offenders, including psychosis, substance abuse, mood and personality disorders (Cohen et al., 2002a; Dunsieith et al., 2004; Fazel et al., 2007b; Fazel et al., 2002; Kafka and Hennen, 2002; Koch et al., 2011; McElroy et al., 1999; Wallace et al., 1998), a surprisingly low prevalence of brain changes have been found in elderly sex offenders (Clark and Mezey, 1997; Fazel et al., 2002; Fazel et al., 2007a; Hucker and Ben-Aron, 1985).

Clark and Mezey (1997) found little evidence of an organic disorder in their small sample of 13 child sex offenders over the age of 65. Fazel et al. (2002) found less than 1% had a clinical diagnosis of dementia in their study of 101 sex offenders aged over 59. Curtice et al. (2003) found that only 3 out of 18 sex offenders between the ages of 65-84 were diagnosed with dementia.

### **3.2.7 Dementia patients and sexual offending**

The prevalence of sexually disinhibited behaviour in dementia patients has been found to be between 2-25% (Alagiakrishnan et al., 2005; Burns et al., 1990; Drachman et al., 1992; Duffy, 1995; Szasz, 1983).

Many older individuals who commit rape, molest children, engage in public masturbation, and sexual exposure, are eventually diagnosed with dementia (Cooper, 1987). For example, a 5-year cohort study of geriatric patients with cognitive impairment and sexual disinhibition concluded that inappropriate sexual behaviour in the elderly was related to the onset subcortical dementia, multi-infarct dementia, traumatic brain injury, frontal lobe syndrome or temporal lobe syndrome (Lothstein et al., 1997).

Dementia patients can manifest antisocial behaviour of late onset, or acquired sociopathy, and commit sexual offences (Mendez et al., 2011; Mendez et al., 2000; Rainero et al., 2011). Patients with right-sided temporal variants of frontotemporal dementia have been found to be particularly sexually aggressive (Edwards-Lee et

al., 1997; Mendez, 2010). However, in contrast to antisocial individuals, dementia patients manifest disinhibited antisocial acts without premeditation or foresight.

### **3.2.8 Hypersexuality in the elderly**

Hypersexuality is the tendency to seek out sexual activity with appropriate and/or inappropriate partners and sometimes objects at appropriate or inappropriate times.

Dementia patients can sometimes manifest hypersexuality (Cross et al., 2013; Hashimoto et al., 2004; Higgins et al., 2004; Robinson, 2003; Wiseman et al., 2000). Case series suggest that hypersexuality in elderly men account for many sexual offences against elderly women in nursing care facilities (Rosen et al., 2010).

Hypersexuality can occur as a result of strokes, surgical resection, or other lesions of the temporal lobe (Baird et al., 2002; Blumer, 1970; Braun et al., 2003; Devinsky et al., 2010; Miller et al., 1986). Similarly, patients with frontal lobe lesions can manifest hypersexuality, with temporo-limbic damage possibly leading to disturbances in sexual drive, including change in the direction of sexual drive (Miller et al., 1986; Stein et al., 2000).

## **3.3 Conclusions**

The main conclusions that emerge from studies of sexual offending as a result of cerebral lesions are:

- a) There are few studies of elderly sex offenders and conclusions are usually restricted by case studies or small sample sizes
- b) Frontal and temporal lobe impairments have been the most cited in its contribution to sexual offending in offenders of all age groups
- c) An association between neurodevelopmental anomalies and paedophilic disorder have been reported in a few studies
- d) There is an association between TBI and sexual offending, ranging from serious sex offences such as rape to less serious sex offences such as exhibitionism
- e) New cases of paraphilia following brain injury are relatively rare
- f) The notion that dementia rates are high in elderly sex offenders have not been supported
- g) The prevalence of sexually disinhibited behaviour in dementia has been found to be between 2-25%
- h) Hypersexuality in dementia patients has been reported as a factor in sexual offending

- i) Finally, there is no definitive conclusion from studies of elderly sex offenders that brain impairment is entirely responsible for sexual offending



## 3.4 SECTION 2 - Neuropsychological studies of sex offenders

### 3.5 Introduction

Surprisingly, there is relatively limited brain function research on sex offenders. A meta-analysis conducted by Joyal et al. (2014), which included 23 neuropsychological studies consisting of more than 1,700 participants could not ascertain whether sex offenders present with *specific* or *broad* cognitive deficits. They concluded that neuropsychological data on sex offenders are relatively scarce to confirm any specific trends.

Despite limited brain function research, the neuropsychological assessment of sex offenders represents the most common source of information about the possible contribution of brain dysfunction in sex offenders (Joyal et al., 2007).

This section provides a critical appraisal of the literature of the association of neuropsychological impairment and sexual offending. The section concludes with a review of the inconsistent findings of neuropsychological deficits in sex offenders and the methodological problems encountered in this field.

#### 3.5.1 Neurocognitive deficits in offender populations

A number of neuropsychological studies have demonstrated a pattern of left hemisphere dysfunction in many violent males, psychopaths, and children with conduct disorders (Flor-Henry, 1976; Moffitt and Silva, 1988; Raine, 1993; Suchy

and Kosson, 2005). For example, deficits have been found in motor dexterity, visuospatial/construction skills, verbal comprehension, verbal and visual memory and attention shift, executive function, as well as verbal IQ being more impaired than performance IQ in many offenders (Hancock et al., 2010; Muscatello et al., 2013; Syngelaki et al., 2009; Tuominen et al., 2013).

However, neuropsychological studies of antisocial behaviour, especially those focusing on executive functions, have yielded mixed results. Morgan and Lilienfeld (2000) found a significant relationship between antisocial behaviour and deficits in executive function. Dolan and Park (2002) found deficits in planning ability, set shifting, Go/No-go tasks and visual memory to be associated with antisocial personality disorder. Among the studies of different offence categories, one study found that violent offenders were impaired in shifting attention, but had good working memory and planning abilities. Other studies found impairments in a broad range of executive and memory functions among violent offenders (Dolan, 1994; Hancock et al., 2010; Hoaken et al., 2007; Miura, 2009; Morgan and Lilienfeld, 2000; Zou et al., 2013), but when comparing violent, arson and sex offenders, Dolan and Park (2002) found no difference between them except for a higher rate of perseverative errors among arsonists.

Therefore left hemisphere impairment and inconsistent and varied findings found in clinical and forensic populations are not unique to sex offenders.

### **3.5.2 Global cognitive deficits in sex offenders**

A number of studies have reported neuropsychological impairment in sex offenders of all ages (Cantor et al., 2004; Eastvold et al., 2011; Flor-Henry, 1987; Hucker et al., 1988; Kelly et al., 2002; Langevin et al., 1989b; Langevin et al., 1989a; Langevin and Curnoe, 2008a; Stone and Thompson, 2001; Suchy et al., 2009a; Young et al., 2010), particularly deficits in tasks sensitive to frontal and/or temporal lobes (Flor-Henry, 1987; Joyal et al., 2007; Lang, 1993).

Flor-Henry (1987) concluded that in a heterogeneous sample, including homicidal rapists, violent sex offenders, paedophiles, incest offenders, fetishists, and exhibitionists, verbal ability and executive function were significantly impaired compared to non-criminal controls. Gillespie and McKenzie (2000) also found that sex offenders as a group obtained lower scores than non-sex offenders on most measures assessing left frontotemporal dysfunction, including verbal ability.

### **3.5.3 Executive function deficits in sex offenders**

The literature suggests that some sex offenders perform poorly on executive function measures (Flor-Henry, 1987; Kelly et al., 2002; Veneziano et al., 2004). Recent studies have investigated the association between sexual deviance and executive dysfunction (Cohen et al., 2010; Eastvold et al., 2011; Schiffer and Vonlaufen, 2011). The literature suggests that child sex offenders, compared to sex offenders who offend against adults, demonstrate significant deficits on higher order executive function measures compared to sex offenders against adults (Joyal et al., 2014).

Contrary to long-held beliefs that sexual offending in older men is associated with executive dysfunction, there was little evidence of executive dysfunction in a sample of 50 elderly sex offenders compared to non-sexual offender controls (Fazel et al., 2007a). However, Fazel et al. (2007a) used only four screening executive tests therefore the authors did not rule out the possibility of frontal lobe deficits, concluding that the use of sensitive brain scanning techniques could be more advantageous in detecting frontal lobe abnormalities.

However, executive function refers to a broad range of cognitive functions and therefore this may explain the lack of convergence and specificity across studies. The distinction between *lower order* executive functions such as behavioural inhibition, control of interference, and selective attention and *higher order* ones (e.g., reasoning, deduction, planning, and cognitive flexibility) has rarely been made (Joyal et al., 2014).

#### **3.5.4 Low IQ and other cognitive deficits in child sex offenders/paedophiles**

The association between low IQ, especially verbal IQ, and criminality has been well established (Ellis and Walsh, 2003; Farrington and Welsh, 2007; Lynam et al., 1993; Moffitt and Lynam, 1994) and it is not necessarily unique to sex offending.

Although it is not clear how low intellectual function contributes to child sexual abuse, a number of studies have reported that child sex offenders perform poorer on measures of intellectual function compared to adult sex offenders (Blanchard et al.,

1999; Cantor et al., 2005a); and other offenders (Cantor et al., 2004; Cantor et al., 2005a; Langevin et al., 1989b). For example, incest offenders obtained significantly lower IQ scores than property offenders (Langevin et al., 1988).

In addition to lower IQ, some studies have reported that paedophiles perform worse than adult rapists on processing speed, academic functioning, and the Luria-Nebraska battery (Blanchard et al., 1999; Cantor et al., 2005a; Cantor et al., 2006; Graber et al., 1982; Hucker et al., 1986; Martin, 1999; Scott et al., 1984; Suchy et al., 2009a).

However, studies that have found an association of poorer cognitive function in child sex offenders are fraught with ascertainment bias, as many subjects available for research are incarcerated, while the more “intelligent” child sex offenders are less likely to be arrested. However, one study found that the low intelligence hypothesis in child sex offenders held strong when multiple referral sources were investigated (Blanchard et al., 2007).

In contrast, one study found that child sex offenders yielded higher IQs than non-sex offenders (Eastvold et al., 2011). Furthermore, some studies have reported better performance than the general population in a subgroup of paedophiles, clerics, on measures of IQ (Langevin et al., 2000; Plante and Aldridge, 2005). However, it can be argued that paedophilic priests are demographically different from other paedophiles. Clerics have higher levels of education compared to child sex offenders in custody, who have lower educational levels (Blanchard et al., 2007; Blanchard et al., 1999).

### **3.5.5 Inconsistent findings in neuropsychological studies of sex offenders**

Many neuropsychological studies of sex offenders have generated mixed and inconsistent results, with no significant differences from controls (Dolan et al., 2002; Gillespie and McKenzie, 2000; Hucker et al., 1988; Kelly et al., 2002; Langevin et al., 1989b; O'Carroll, 1989; Stone and Thompson, 2001; Veneziano et al., 2004). For example, an early study reported that when age, education, and alcohol history were controlled, neuropsychological function differences were not observed between child sex offenders and non-sex offenders (Abracen et al., 1991). Another study found that although 13% of incest offenders were impaired on the Halstead-Reitan Neuropsychological Battery, they did not differ from non-sex offenders (Langevin et al., 1988).

Similarly when age, education and IQ were controlled, no differences were found on tasks known to assess frontotemporal function (i.e., the Stroop, verbal fluency, the trail-making part B, and the Wechsler Memory Scale) between homicide, arson, and sex offenders (Dolan et al., 2002). Veneziano et al. (2004) found no significant differences between juvenile sex offenders and non-sex offenders on the trail-making test, COWAT, the Tower of London and the WCST.

In keeping with these findings, Langevin and Curnoe (2008b) found that although sex offenders were impaired on the Halstead-Reitan Neuropsychological Battery, they did not significantly differ from non-sexual offenders.

### **3.5.6 Methodological problems in sex offender brain function research**

Neuropsychological studies have been few and limited by mixed sex offender populations using different test batteries. Many of these studies consist of clinical reports or small research projects involving few participants and no comparison groups (Bowden, 1989; Burns and Swerdlow, 2003; Graber et al., 1982; Mendez et al., 2000; Tost et al., 2004). One study (Gillespie and McKenzie, 2000) for example, compared 8 male mentally disordered sex offenders (with a mean age of 41.38 years) to 8 male mentally disordered non-sex offenders on nine measures of left frontotemporal function. Table 3-1 summarises some of the studies reviewed by Joyal et al. (2014) in their meta-analyses of 23 neuropsychological studies reporting data on 1,756 participants, of these 1,063 were sex offenders (i.e., average N=46 sex offenders per study). A total of 147 effect sizes were calculated by Joyal et al. (2014) of which all but eight were based on means and standard deviations.

Table 3-1 Studies and overall effect sizes included in the meta-analysis by Joyal et al. (2014)

| Study                       | Comparison (N)                         | Measure               | EF      | Z       | Q               |
|-----------------------------|--|-----------------------|---------|---------|-----------------|
| Abracen (1991)              | SOC (12) VS.<br>Ctrl (13)              | All                   | 0.92*   | 2.2     | 0.05            |
|                             |  | Raven                 | 0.98*   | 2.3     |                 |
|                             |  | Trail-B               | 0.85*   | 0.07    |                 |
| Cohen et al. (2002)         | SOC (22) vs.<br>Ctrl (24)              | All                   | 0.02    | 0.07    | 2.59            |
|                             |  | Trail-B               | -0.21   | -0.7    |                 |
|                             |  | WCST-Cat              | 0.0     | 0.0     |                 |
|                             |  | COWAT                 | 0.01    | 0.9     |                 |
|                             |  | Stroop                | 0.25    | 0.8     |                 |
| Cohen et al. (2010)         | SOC (22-50) vs.<br>Ctrl (20-87)        | All                   | 0.15    | 0.6     | <b>10.97*</b>   |
|                             |  | Trail-B               | -0.27   | -0.7    |                 |
|                             |  | WCST-Cat              | 0.0     | 0.0     |                 |
|                             |  | COWAT                 | 0.01    | 0.9     |                 |
|                             |  | Stroop                | 0.25    | 0.8     |                 |
| Dolan et al. (2002)         | SO (20) vs. HO<br>(27)                 | All                   | 0.31    | 1.0     | 5.02            |
|                             |  | Trail-B               | -0.17   | -0.57   |                 |
|                             |  | WCST<br>perseveration | 0.54*   | 1.8     |                 |
|                             |  | COWAT                 | 0.13    | 0.49    |                 |
|                             |  | Logical memory        | 0.38    | 1.26    |                 |
|                             |  | Visual memory         | 0.67*   | 2.2     |                 |
| Eastvold et al. (2011)      | Pedo (30) & CM<br>(30) vs. NSO<br>(29) | All                   | 0.2     | 1.1     | <b>14.43**</b>  |
| Gillespie & McKenzie (2000) | SO (8) vs. NSO<br>(8)                  | All                   | 0.32    | 0.6     | 2.7             |
| Joyal et al. (2007)         | SOC (12) & SO<br>(8)                   | All                   | 0.64**  | 2.3     | <b>49.39***</b> |
|                             |  | COWAT                 | 1.98*** | 4.8     |                 |
|                             |  | Stroop                |         | 1.67*** |                 |
| Langevin et al. (1985)      | Pedo (32) vs.<br>Ctrl (54)             | Raven                 | 0.58**  |         |                 |
| Langevin et al. (1989a)     | Exhibitionists<br>(13) vs. NSO<br>(14) | Trail-B               | 0.5     |         |                 |
| O'Carroll (1989)            | SO (11) vs. Ctrl<br>(11)               | All                   | 0.28    | 1.4     | 2.34            |
|                             |  | Trail-B               | 0.37    | 0.86    |                 |



|                        |  |     | Raven   | 0.52 | 1.21 |               |
|------------------------|--|-----|---------|------|------|---------------|
| Schiffer<br>Vonlaufen  | & Pedo (15), SOC<br>(15) vs. Ctrl (17) | All | 0.92*** | 3.4  |      | <b>13.11*</b> |
| Suchy et al.<br>(2009) | Pedo (20), SOC<br>(20) vs. Ctrl (20)   | All | 0.43*   | 1.9  | 7.1  |               |

---

As a result of these questionable methodologies, the results have been highly divergent and non-specific. The following factors affect the generalizability of results.

### 3.5.6.1 Heterogeneity of sex offenders

Several typologies have been proposed, indicating that sex offenders are a heterogeneous group (Marshall et al., 1990). Some sex offenders exclusively offend against children, while others offend against adults. Some sex offenders are paedophilic, that is, they primarily have a sexual interest in children, while others, who sexually offend children are not necessarily paedophilic. That is, not all sex offenders have a paraphilic disorder. Some sex offenders commit only non-contact offences, for example, exhibitionists, while others commit many kinds of contact sexual offences. Some sex offenders exclusively commit sex offences while others are more criminally versatile.

Despite this, the main methodological problem in this field has been that sex offenders have been treated as a homogeneous group in many studies (Flor-Henry, 1987; Langevin and Curnoe, 2008a; Langevin et al., 1988; Spinella et al., 2006; Young et al., 2010). Neuropsychological studies have commonly grouped child sex offenders together with rapists, despite limited evidence that they possess similar cognitive profiles (Beauregard et al., 2001). An example of the treatment of sex

offenders as a homogeneous group was exemplified by a study that compared rapists, paedophiles and exhibitionists (Galski et al., 1990).

### **3.5.6.2 Problems associated with control groups**

The literature suggests that highly divergent conclusions have resulted from inappropriate control groups. The neuropsychological function of sex offenders has been compared to non-sex offenders or non-criminals (Joyal et al., 2014) or to individual test norms (Stone and Thompson, 2001). The biggest problem with non-sex offender controls is that the lack of group differences can be attributed to the high rates of brain dysfunction in non-sex offenders (Mills and Raine, 1994). On the other hand, non-offender populations are usually not matched for drug and alcohol use, head injury, or neurodevelopmental problems, which affect the interpretation of neuropsychological function.

In addition, violent sex offenders have been routinely compared to non-violent sex offenders. For example, Langevin and Curnoe (2008b) used a forensic psychiatric patient control group, consisting of mostly violent offenders. A serious methodological flaw emerges with this practice as violent sex offenders have been found to have damage to specific brain areas. For example, one group of violent sex offenders, sexual sadists, have demonstrated greater brain abnormalities on MRI (Aigner et al., 2000), with greater amygdala activation when viewing pain pictures, such as a person slamming a door on another person's hand, compared to non-sexual sadists (Harenski et al., 2012).

Violent offenders have abnormal frontal/parietal cortex, medial temporal structures, and third ventricles (Schiltz et al., 2013), a reduction in blood flow in prefrontal areas (Soderstrom et al., 2000), as well as hypo-activity in frontotemporal areas (Anckarsater et al., 2007). Therefore violent offenders demonstrate executive dysfunction. For these reasons, it has been recommended that future neuropsychological studies of sex offenders should recruit non-violent controls (Joyal et al., 2007).

### **3.5.7 Confounding factors in neuropsychological research of sex offenders**

Confounding factors, which have rarely been taken into account in many neuropsychological studies of sex offenders, are also problematic. Age, education, IQ, and substance abuse can present competing explanations for observed neuropsychological impairment. A history of brain injury, neurodevelopmental abnormalities, learning disorders, substance abuse, and endocrine disorders are common among sex offenders, making it difficult to interpret neuropsychological results (Langevin and Curnoe, 2008b; Langevin and Watson, 1996; Langevin et al., 2008).

### **3.5.8 The new wave of neuropsychological research of sex offenders**

Recent studies have attempted to address the problems of heterogeneity and control groups (for e.g., Suchy et al., 2009a). This new approach demonstrates a change in scope in identifying meaningful brain abnormalities on discrete types of affective and cognitive dysfunction among different types of sex offenders.

Recent studies have found that non-paedophilic child sex offenders perform worse on cognitive measures than paedophilic child sex offenders (Eastvold et al., 2011; Schiffer and Vonlaufen, 2011; Suchy et al., 2009a). In addition, non-paedophilic offenders demonstrate more difficulty than paedophilic child sex offenders in the recognition of facial and prosodic (auditory) affect (Suchy et al., 2009b). Paedophiles outperform non-paedophilic offenders on executive tasks and generally display greater self-monitoring, which suggests that paedophiles are more likely to plan their offences while the latter are more impulsive (Eastvold et al., 2011).

These studies suggest that child sex offenders can be cognitively differentiated, one group being paedophilic and the other non-paedophilic.

### **3.6 Conclusions**

The main conclusions that emerge from neuropsychological studies of sex offenders are:

- a) The research is limited to a less than 30 studies with small sample sizes
- b) The findings are varied, divergent and non-specific due to small and heterogeneous samples of sex offenders
- c) When neuropsychological deficits are found, frontotemporal dysfunction is observed

- d) In some studies, paedophiles demonstrate lower IQ than matched controls, although much of this research has been conducted on incarcerated paedophiles or individuals available for research, which may not be generalizable to other paedophiles. In contrast a subgroup of paedophiles, clerics, have been found to have higher IQs compared to the general population.
- e) Many neuropsychological studies to date are fraught with significant methodological problems
- f) Recent studies indicate that non-paedophilic child sex offenders demonstrate greater cognitive deficits than paedophilic offenders

### 3.7 Comment

Structural and functional brain deficits are present in sex offenders, particularly in paedophiles, which appear to be correlated with their sexual behaviour. There is little research in the neuropsychological function of elderly sex offenders. Many of the cited studies in these sections have been on young and adult sex offenders. There are no neuropsychological studies of men who commit their first sexual offence after the age of 50 years, who often do not have a criminal record. Therefore an important gap in the literature has been identified.

Chapter 4 introduces the research on frontotemporal dementia (FTD). The reason for this chapter emerges from the remarkably similar neuropsychological profiles and behavioural changes found in FTD patients and sex offenders.

A research design that aims to address this gap in knowledge in elderly first-time sex offenders is outlined in Chapter 5.

## 4 FRONTOTEMPORAL DEMENTIA

### 4.1 Introduction

Frontotemporal dementia (FTD) is one of the most common dementias of early onset, occurring in individuals under 65 years (Snowden et al., 2002) and accounts for 30%-50% of all cases of dementia (Hodges et al., 2003; Ratnavalli et al., 2002). Symptoms can begin to appear between the ages of 45 to 65 years.

FTD is characterized by significant changes in social behaviour and personality, as well as a general blunting of emotions (Kumfor et al., 2013; Kumfor and Piguet, 2012; Miller et al., 2012).

FTD is heterogeneous, with some patients presenting with changes in social behaviour and personality while others have progressive loss of language ability, aphasia. The underlying brain pathology is also heterogeneous. FTD is commonly misdiagnosed with psychiatric illnesses such as schizophrenia, depression, hypochondriasis, obsessive-compulsive disorder, and sociopathy (Miller et al., 1997b), as well as Alzheimer's disease (Bozeat et al., 2000).

### 4.2 Brain areas affected by FTD

FTD is associated with discrete atrophy of the orbito-medial frontal and plus or minus the anterior temporal lobes (Neary et al., 1998; Piguet et al., 2011; Rosen et al., 2002a); with progressive deterioration of the frontal lobes, particularly the

ventromedial prefrontal cortex (VMPFC) and the orbitofrontal prefrontal cortex (OFC) (Mendez et al., 2008).

VMPFC patients often make decisions, which are viewed as irresponsible and risky (Boes et al., 2011). Equally, OFC patients display severe impairments in real-life decision-making; are deprived of appropriate emotional regulation and the control of basic drives, despite remaining unimpaired intellectually and having the ability to make correct choices at other times (Clark and Manes, 2004; Manes et al., 2002; Zald and Andreotti, 2010).

Case histories indicate that those with right temporal FTD retain the capacity to tell right from wrong; however, demonstrate a slow and insidious loss in capacity for moral rationality (Tost et al., 2004), and socially desirable behaviour (Mychack et al., 2001).

### **4.3 FTD and behaviour changes**

The behavioural changes most commonly emerge in the 50s (Johnson et al., 2005), although the age of onset for FTD can range from the third to the ninth decade (Mendez and Cummings, 2003).

The clinical course of FTD can be divided into three stages and begins with noticeable personality and behavioural changes, lack of awareness, and poor judgment (Liu et al., 2004). The second stage is characterized by increasing cognitive problems with language deficits being the most prominent (Mesulam et al.,



2003; Mesulam, 2001). In the third stage, patients become aphasic and progress to complete muteness (Leyton et al., 2011)

Disinhibition and a reduction in the ability to inhibit impulses are prominent early symptoms of FTD (Welsh-Bohmer and Warren, 2006; Werner et al., 2007). FTD patients present with disturbed social and moral behaviour, which contrasts with premorbid functioning (Mendez et al., 2008). They appear unconcerned for the emotional consequences of their actions and are impaired in the ability to infer the mental states and feelings of others, otherwise known as “Theory of Mind” (ToM) (Baron-Cohen et al., 2001; Gregory et al., 2002; Torralva et al., 2007; Wellman et al., 2001).

A study reviewed 192 articles and grouped ten behavioural categories consistent with FTD (Mendez et al., 2008). These categories included apathy-abulia, disinhibition-impulsivity, loss of insight and self-referential behaviour, decreased emotion and empathy, violation of social and moral norms, changes in dietary and eating behaviour, and repetitive behaviours.

Sociopathic acts, or acquired sociopathy, are more prominent in FTD than other dementias (Mendez et al., 2000; Mendez et al., 2005; Nakano et al., 2006). FTD patients have been known to commit violent and sexual offences (Mendez et al., 2011; Mendez, 2010; Mendez et al., 2005; Miller et al., 1997a). The sexual offences by FTD patients include inappropriate touching and fondling of adults and children, indecent exposure and, often, an increase in paedophilic fantasy and arousal (Mendez, 2010).

#### 4.4 Behavioural FTD (bvFTD)

The behavioural variant of FTD (bvFTD) is characterized by deterioration in social function and personality and predominantly associated with atrophy of the frontal lobes (Rascovsky et al., 2011). Compromise to a number of social abilities may alter an individual's perception or engagement in social interactions, producing behaviour that is regarded as abnormal, eccentric, inappropriate, or offensive (Harciarek and Cosentino, 2013).

Individuals diagnosed with bvFTD demonstrate significant changes in behaviour and personality, including reduced empathy, apathy and disinhibition, perseveration, problems depicting the facial emotions of others, and lack of insight (Lavenex et al., 1999; Lough et al., 2006; Neary et al., 1998; Mendez and Lim, 2004; Mendez and Perryman, 2002; Piguet et al., 2011; Rosen et al., 2004; Torralva et al., 2007). For example, bvFTD patients have difficulty depicting the facial emotion of disgust (Eckart et al., 2012) and demonstrate difficulties depicting sarcasm (Shany-Ur et al., 2012). Therefore ToM is significantly affected in bvFTD (Adenzato et al., 2010; Lough et al., 2006), with individuals experiencing greater ToM difficulties than Alzheimer's sufferers (Henry et al., 2014).

Bedside cognitive assessments and standard neuropsychological assessments can be normal in bvFTD (Gregory and Hodges, 1996; Mendez, 2010), including in measures of executive function (Hornberger et al., 2008; Lough et al., 2001; Roca et al., 2013). However, executive function deficits are often present in bvFTD (Harciarek and Cosentino, 2013; Strenziok et al., 2011), depending on the extent of

the disease progression (Roca et al., 2013). These deficits are found across working memory, inhibitory control, planning, verbal fluency, and generative behaviours (Huey et al., 2009; Johns et al., 2009). This reflects the early compromise of OFC and VMPFC damage and anterior temporal lobe areas (Seeley et al., 2008).

#### 4.5 Comment

Given the association between frontotemporal dysfunction and sexual offending, and the profound changes found in FTD patients, also as a result of frontotemporal pathology, it is possible that elderly first-time sex offenders could be suffering from FTD.

It is possible that men who sexually assault children and/or adults for the first time after the age of 50 or who develop new sexual practices, such as changes in sexual orientation or the development of new fetishes could have developed bvFTD.

To investigate this possible link, a battery of neuropsychological tests routinely used in the assessment of FTD was used in this study. The rationale for using these tests, i.e., their sensitivity and specificity in the assessment of decision-making, initiation and suppression, cognitive flexibility, verbal fluency, memory and recognition of facial expression are discussed at length in Chapter 5.

The diagnosis of FTD is complex, as it involves taking a thorough clinical history, obtaining family reports, neuropsychological assessment and neuroimaging.

Therefore the diagnosis of FTD in FT sex offenders was beyond the scope of this study.

Notwithstanding, one of the aims of this study was to investigate whether the neuropsychological results of FT sex offenders resembled those found in patients with FTD

## 5 PRESENT STUDY

There is no published study that has systematically investigated the neuropsychological function of men who commit their first sexual offence after the age of 50.

The decision to include adults as young as 50 years old was twofold: (a) It was a pragmatic decision, as first-time sex offenders older than 50 years (for e.g., over 65) would have resulted in an even smaller sample size, and (b) it reflected the scientific literature of cognitive decline in some individuals in the 50-60 age group. For example, some studies have reported a decline in executive function in individuals as young as 50 (De Luca et al., 2003; Zhou et al., 2011). In addition, some researchers have adopted a functional definition of 'older prisoners' as being those who are 50 years of age and over (Kerbs and Jolley, 2009; Stojkovic, 2007).

### 5.1 Aims

The aim of this study was to investigate whether first-time sex offenders over the age of 50 demonstrate deficits, weakness or impairment on a number of neuropsychological measures compared to historical sex offenders and non-sexual non-violent offenders.

Another aim was to analyse a number of confounding variables, which are known to influence brain function, such as age, cardiovascular function, head injury, endocrine disorders, substance abuse, and depression.

## 5.2 Specific Hypotheses

This study had three hypotheses:

1. First-time sex offenders would demonstrate greater neuropsychological deficits or impairment than historical sex offenders and non-sexual offender controls
2. The two sex offender groups would demonstrate greater neuropsychological deficits or impairment compared to non-sexual offender controls
3. First-time sex offenders would demonstrate significantly greater rates of impairment in social cognition compared to the other offender groups

In order to test these hypotheses, I had a series of specific hypotheses<sup>4</sup>:

- 1) I predicted that FT sex offenders would produce significantly lower ACE-R scores compared to HT and NSOC offenders; and the two sex offender groups would produce lower ACE-R scores than NSOC offenders. If supported by the data, these results would suggest higher rates of dementia among sex offenders.
- 2) It was hypothesized that the three groups would not differ significantly in

---

<sup>4</sup> A full description of all measures are described in the *MATERIALS section*

scores of depression, anxiety or stress.

- 3) It was hypothesized that FT sex offenders would produce significantly lower Full-Scale IQ (FSIQ), particularly Verbal IQ, than NSOC offenders on the Wechsler Abbreviated Scale of Intelligence (WASI). In addition, the two sex offender groups would demonstrate a similar pattern of results when compared to NSOC offenders.

These hypotheses took into consideration the literature that a group of sex offenders, paedophiles, perform poorer than non-sex offenders on measures of intellectual function. It was hypothesized that the sex offender groups would not differ from each other on the vocabulary subtest.

- 4) On a range of executive function measures, I predicted that FT sex offenders would perform worse than HT and NSOC offenders and sex offenders would perform worse than non-sex offender controls. Specifically:
  - a) On the Hayling test, I predicted that FT sex offenders would commit a greater number of Category A and B errors than HT and NSOC offenders and the two sex offender groups would commit more Category A and B errors than NSOC offenders.
  - b) I hypothesized that FT sex offenders would produce significantly fewer words than NSOC offenders on the FAS; the FT and HT sex offenders would not significantly differ; and the sex offender groups would follow a

similar pattern compared to NSOC offenders. In addition, the offenders were categorized as impaired if they generated fewer words than normative data found in Tombaugh et al. (1999).

- c) On the Iowa Gambling Task (IGT), I predicted that FT sex offenders would select more disadvantageous cards than HT and NSOC offenders; and the two sex offender groups would select more disadvantageous cards than NSOC offenders.
  - d) On the Trail-Making Test, I predicted that the three groups would not differ on Part A. However, I predicted that FT sex offenders would be significantly slower on Part B compared to HT and NSOC offenders; and that the sex offender groups would be slower on Part B than NSOC offenders.
- 5) I predicted that FT sex offenders would perform worse than HT and NSOC offenders on measures of temporal lobe function.
- a) I predicted that on the Rey Complex Figure (RCF), FT sex offenders would produce lower scores on the RCF copy trial than HT and NSOC offenders. A similar pattern was expected between the two sex offender groups in comparison to NSOC offenders



- b) On the Rey Auditory Verbal Learning Test (RAVLT), I predicted that FT sex offenders would recall fewer words from a word list and recognize fewer words in a subsequent trial.
- 6) On a proxy measure of social cognition, the Facial Expression of Emotion: Stimuli and Tests (FEEST), I predicted that FT sex offenders would have greater difficulty recognizing facial expression of emotion than HT and NSOC offenders. FT sex offenders would provide lower scores on facial recognition of emotion, such as anger, disgust, surprise and fear; and the two sex offender groups would provide similar difficulties compared to NSOC offenders.

My hypotheses related to the FEEST attempted to replicate previous studies which found poorer emotional recognition in sex offenders compared to controls (Gery et al., 2009; Oliver et al., 2009; Suchy et al., 2009b), as well as similar poor facial emotional recognition by FTD patients (Eckart et al., 2012).

### **5.3 Ethics approval**

Prior to the commencement of this study, ethics approval was obtained from the NSW Department of Corrective Services (granted on 15 December 2008 Document 08/8806) and the Justice Health and the Forensic Mental Health Network Human Research Ethics and Committee (granted 24 September 2009 Document S532/09).

## 5.4 Recruitment

Psychologists employed by the Department of Corrective Services (DCS) in Long Bay Prison and in the community were approached and briefed about this research. The psychologists worked for either the sex offender program, Custody Based Intensive Therapy (CUBIT), at the Metropolitan Special Program Centres (MSPC Area 2), Malabar, or the community-based Forensic Psychology Services, Surry Hills, New South Wales.

Face-to-face lectures with PowerPoint presentations and written information were provided to psychologists (see Appendix 5). The methodology, hypotheses, inclusion and exclusion criteria were all explained.

### 5.4.1 Identification of participants

There were two methods of identifying participants:

1. Sex offenders were identified by DCS psychologists from CUBIT and the Forensic Psychology Services and referred to me
2. Offenders were identified from Justice Health and the Forensic Mental Health Network files in prison clinics. This involved searching files by hand and ascertaining the following:

- 1) Date of birth

- 2) Age at offence
- 3) Type of offence - sexual, non-sexual, non-violent
- 4) Whether participants met inclusion criteria

#### **5.4.2 Method of recruitment**

The participants were recruited in person or by telephone. A verbal and written overview of the study and its methodology were provided to all participants. Participation was voluntary. No incentives or inducements of any kind were offered.

#### **5.5 Information and consent**

Confidentiality and anonymity were assured. Identifiable information was removed from all files after the data was collected to ensure privacy.

Prior to the administration of neuropsychological measures, all participants were provided with an information sheet detailing the purpose of the study (Appendix 1). They were also provided with further verbal explanation if required.

The participants signed a consent form (Appendix 2), which indicated they had understood the basis for the study and agreed to participate.

#### **5.6 Refusers**

Overall 13 potential participants declined to participate in the study, including:

- 5 FT sex offenders
- 3 HT sex offenders
- 5 NSOC offenders

The reasons provided by FT sex offenders for their non-participation included:

- 2 (40%) denied having committed a sexual offence
- 2 (40%) were *not interested* in participating
- 1 (20%) did not provide a reason

## 5.7 Participants

One hundred male offenders ranging in age between 50 and 85 (Mean = 61.2, SD = 7.1) years with a median age of 60 years participated in this study. The mode was 57 years and therefore the age spread was problematic in identifying certain participants as being “elderly”<sup>5</sup>. However, there was only one 85 year-old and only two 50 year-olds in this sample, with most offenders ranging between 55 and 69 years. At the time of this study, 88% of the sample was incarcerated, including: 25 (78%) first-time sex offenders, 31 (86%) historical sex offenders, and 32 (100%) non-sex offender controls.

---

<sup>5</sup> Most countries have accepted the chronological age of 65 years as a definition of 'elderly' or older person (World Health Organization).

### **5.7.1 First-time sex offenders (FT)**

Thirty-two FT sex offenders, with a mean age of 63.9 (range 53-78, S.D. = 7.1) years with a median age of 63 years were recruited. The FT sex offenders were recruited on the basis of having committed their *first* sexual offence after the age of 50. The participants were consecutively recruited provided they met inclusion criteria.

The official criminal records of FT sex offenders were verified and supplemented by other information provided by the offender, including, information related to additional sexual offences before the age cut-off of 50 years.

To reduce a serious methodological problem, FT sex offenders were directly asked whether they had committed previous sexual offences before the age of 50. In order to reduce the erroneous inclusion in the FT sex offender group and the interpretation of that data, the researcher asked each sex offender, "*Have you ever committed a sexual offence in the past, prior to this sexual offence/alleged offence?*"

NB: FT sex offenders who reported previous sexual offences were either excluded from the study or recruited into the historical sex offender group.

### **5.7.2 Historical sex offenders (HT)**

Thirty-six sex offenders with a history of sexual offending before the age of 50, with a mean age of 62.3 (range 51-85, S.D. = 6.4) years with a median age of 62 years

were recruited. These offenders were selected on the basis that they had committed a sexual offence before the age of 50.

Fifty-three per cent of the HT sex offender sample was enrolled in a sex offender program at the time of assessment.

### **5.7.3 Non-sexual offender controls (NSOC)**

As suggested by other researchers (Joyal et al., 2007; Langevin and Curnoe, 2008a), the non-sexual control group consisted of offenders without a history of pervasively using violence. Thirty-two NSOC offenders, with no history of sexual offences, with a mean age of 57.3 (range 50-75, S.D. = 6.5) years with a median age of 55.5 years were recruited.

The official offence history of NSOC offenders was verified to rule out previous sexual and violent offences.

## **5.8 Inclusion Criteria**

Sexual offence: those offences that were against children or non-consenting adults. Child pornography offences were included.

First-time sex offenders (FT): all consecutive admissions to prison, who were over the age of 50 when they first committed a sexual offence.

Historical sex offenders (HT): those charged and convicted of sex offences, 50 years or older, who had committed at least one sexual offence before the age of 50. These offenders were subject to exclusion criteria.

Non-sex offenders (NSOC): offenders who had never been charged or convicted of a sexual offence and were 50 years or older. These offenders were subject to exclusion criteria.

## 5.9 Exclusion criteria

Offenders were excluded from the study if they were:

- Non-English speaking
- Unable to complete questionnaires
- Were illiterate
- From a cultural background that would have impeded reliable interpretation of neuropsychological tests
- Suffering from medical conditions (see below), that could impair neuropsychological performance

HT and NSOC offenders were excluded for the following reasons:

- Had a history of major mental illness (e.g., schizophrenia, schizoaffective disorder, or bipolar disorder)

- Had a history of neurodegenerative disease (e.g., dementia, Parkinson's disease)
- A history of stroke or associated neurological signs or symptoms
- A history of neurological illnesses (e.g., epilepsy, a history of seizures)

## 5.10 Procedure

FT sex offenders were compared on various neuropsychological measures to HT sex offenders and NSOC offenders (see *Materials* section).

In addition, the neuropsychological results of offenders were compared to normative data. This comparison of scores was used to assess for impairment using age and years of education norms from individual measures.

Recruitment occurred from December 2008 to September 2011. The author of this thesis conducted all the neuropsychological assessments over this three-year period.

### 5.10.1 Duration of assessments

The duration of each neuropsychological assessment ranged from two to three hours. Some assessments were conducted over two and sometimes three sessions depending on the participant's processing speed, fatigue, prison operation and time constraints.



### **5.10.2 Assessments in prison**

The prison assessments were conducted at Sydney's Long Bay Prison. There were several assessment sites, including the Sex Offender program, CUBIT, and the Metropolitan Special Program Centre (MSPC) areas 1, 2, and 3.

#### **5.10.2.1 Long Bay Prison, MSPC and CUBIT**

The Long Bay Correctional Complex is an Australian maximum to minimum-security prison for male offenders located in Sydney, Australia. The complex is located approximately 14 kilometres south of Sydney's central business district. The facility is operated by the Department of Corrective Services, an agency of the Department of the Attorney General and Justice, of the government of New South Wales.

The MSPC is a maximum through to minimum secure facility, which houses many different types of inmates. It is the second largest prison (in terms of inmate population) in the state of New South Wales, with a current inmate population of around 1200. The programs' areas of the prison comprises the Violent Offenders Therapeutic Program, Developmentally Delayed Program, the Kevin Waller Unit for elderly males, ACMU for active suicidal prisoners, Multi Purpose Unit (high risk inmates on segregation orders and inmates requiring non association for safety) and CUBIT sex offenders program.

CUBIT is a purposeful built residential sex offender program for 40 men, who have sexually abused adults and/or children. Offenders admitted to the program are

accommodated in a special, self-contained therapeutic unit in the MSPC. The CUBIT program is staffed with a multi-disciplinary team including psychologists and custodial staff. Treatment is delivered within a group format with 10 offenders and two psychologists per group. The emphasis of therapy requires the participant to examine the issues of offending, exploring the impact of offending on victims, identifying offence pathways, and developing a detailed self-management plan (Ware and Bright, 2008).

#### **5.10.2.2 Special permission for laptop**

The author required special permission from the area Prison Governor to bring a computer laptop into the prison. The laptop contained the software programs for the Iowa Gambling Task (IGT) and the Facial Expression of Emotion: Stimuli and Tests (FEEST).

#### **5.10.3 Assessments in the community**

The community assessments were conducted at the offices of the Forensic Psychology Services in Surry Hills, Sydney.

##### **5.10.3.1 Forensic Psychology Services (FPS)**

FPS offers group treatment to lower risk sex offenders on probation or parole. The program runs for one session per week for approximately one year. In addition,

community maintenance programs are provided, which designed to maintain treatment gains made in treatment programs in custody or community, as well as assisting sex offenders to implement relapse prevention strategies in a community context. Attendance is normally a condition of parole.

#### **5.10.4 Experience of data collection in prison**

I experienced several difficulties in the collection of data in the prison system, including:

- Unexpected and frequent prison lock-downs
- Inmates being unexpectedly transferred to other prisons in NSW
- Unexplained refusal of entry by Department of Corrective Services officers
- Instructed to terminate interviews prematurely due to operational time constraints
- Absence/lack or inadequate office space to conduct assessments
- Occasional noise problems

### **5.11 Materials**

#### **5.11.1 DEMOGRAPHIC MEASURES**

The following demographic data were collected from prison files: age; marital status; education; handedness; occupation; location at the time of assessment (i.e., prison or community); type of offence; time of admission to prison; time in prison for index

offence; total time in prison over lifetime; age at index offence; victim type; criminal history; age at testing; and sexual orientation. The medical, drug and alcohol, and psychiatric histories were ascertained from offenders during interview.

The medical histories of each participant were collected from the participant and corroborated from prison files to ascertain the possible association of medical illness/condition and neuropsychological function. For example, the contribution of traumatic brain injury (Bohnen et al., 1992; Ponsford and Kinsella, 1992; Schretlen and Shapiro, 2003), particularly when the head injury is severe (West et al., 2011), hypertension (Elias et al., 2004; Matoso et al., 2013; Raz et al., 2003; Waldstein, 1995), and diabetes (Fischer et al., 2009; Yeung et al., 2009; Yeung and Thornton, 2011), can all contribute to poorer cognitive function.

### **5.11.2 SCREENING MEASURES**

The participants were administered a screening measure for dementia and a clinical functioning measure for depression, anxiety and stress.

#### **5.11.2.1 The Addenbrooke's Cognitive Examination-Revised (ACE-R)**

Dementia screening forms a routine part of the clinical diagnosis of dementia, therefore, the ACE-R was chosen to assess dementia in this study.

The most popular brief dementia screening test is the Mini Mental State Examination (MMSE) (Folstein et al., 1975); however, it is heavily reliant on language skills, does

not evaluate executive and visuospatial function, and its memory component is inadequate (Bak and Mioshi, 2007). As a result, some patients, such as FTD patients, often perform well on the MMSE despite obvious clinical difficulties (Mendez, 2010; Slachevsky et al., 2004).

Similarly to the MMSE, one of the limitations of the original ACE was its poor capability for the detection of executive dysfunction. The weaknesses identified in the ACE, prompted the development of the Addenbrooke's Cognitive Examination-Revised (ACE-R) (Mioshi et al., 2006). The ACE-R has been reported to have excellent sensitivity and specificity (alpha coefficient > 0.8) for the diagnosis of dementia (Larner, 2013), especially in Alzheimer's disease (Crawford et al., 2012; Larner, 2007; Mathuranath et al., 2000; Yoshida et al., 2011), at cut-off scores of 88/100 and 82/100 in a university hospital clinic (Mioshi et al., 2006).

The total (and maximum) ACE-R score is 100 with higher scores reflecting better ability. A cut-off score has been determined to assess for dementia. For example, a cut-off score of 86 has been set for individuals in the 50-59 age bands with an education of 12 years (Mioshi et al., 2006).

#### **5.11.2.2 Depression, Anxiety, and Stress Scales (DASS)**

The DASS is a 42-item self-report instrument designed to measure the three related negative emotional states of depression, anxiety and tension/stress (Lovibond and Lovibond, 1995).

Each of the three DASS scales contains 14 items, divided into subscales of 2-5 items with similar content. The Depression scale assesses dysphoria; hopelessness; self-deprecation; lack of interest/involvement; anhedonia and inertia. The Anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The Stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient.

### **5.11.3 NEUROPSYCHOLOGICAL MEASURES**

#### **5.11.3.1 Rationale for this study's neuropsychological battery**

Given the literature review on the possible contribution of frontotemporal dysfunction and sex offending, a battery of neuropsychological tests was chosen to investigate the possible contributions of frontotemporal deficits in this sample of sex offenders.

The neuropsychological battery of tests was selected to balance verbal and nonverbal skills, using both time and untimed tasks. This battery of tests was also selected on the basis that they simulate real life situations, as well as being practical to use in custodial settings.

Furthermore, this study avoided the use of "global composite scores" used in many neuropsychological studies, as they have generated non-specific and divergent results (Joyal et al., 2014). Measures of executive functions have been particularly

researched in its association between sexual deviance and executive dysfunction (Eastvold et al., 2011; Schiffer and Vonlaufen, 2011). However, the distinction between *lower* order executive functions such as behavioural inhibition, control of interference, and selective attention, and *higher* order ones, such as reasoning, deduction, planning and cognitive flexibility, has rarely been made. Well-validated and specific measures to assess specific neuropsychological hypotheses were used in this study and “composite” scores to analyse the data were avoided.

#### **5.11.3.2 Wechsler Abbreviated Scale of Intelligence (WASI)**

The Wechsler Abbreviated Scale of Intelligence (WASI) was chosen as an estimate measure of global intelligence. The WASI consists of four subtests: Vocabulary, Block Design, Similarities, and Matrix Reasoning. The WASI is a valid measure of intellectual ability in clinical, educational and research settings for ages 6 to 89 years. This assessment yields traditional verbal, performance and full-scale IQ scores and is linked to the Wechsler Adult Intelligence Scale – third edition (WAIS-III). This linkage allows estimating a range of full-scale IQ scores on the comprehensive batteries and increases the WASI's clinical utility. The WASI is an excellent test for cognitive screening (Stano, 2004), which takes approximately 30 minutes to administer. It has been used in a number of studies measuring intellectual functioning in adult and youth offenders (Colwell et al., 2005; Fougere et al., 2013; Sondena et al., 2008).

Neuropsychological test performance is known to be associated with intellectual ability (Diaz-Asper et al., 2004). In persons with disease or brain injury, assessment of cognition typically considers a person's original intellectual endowment or their premorbid intellect (Watt and O'Carroll, 1999).

It was anticipated that participants who performed in the low IQ range on the WASI were more likely to also perform poorly on other tests due to premorbid low intelligence. Participants, who perform well on the WASI, can nevertheless show impairment on other cognitive measures. For example, a participant, who falls in the average range in intellectual functioning, can demonstrate impairment on executive function. This phenomenon has been shown in FTD patients.

### **Executive Function Measures**

The following measures attempt to cover some of the core functions of executive function such as inhibition, decision-making, working memory and verbal fluency.

#### **5.11.3.3 The Hayling Test**

The Hayling consists of two sets of 15 sentences, each having the last word missing (see Appendix 3). In the first part, Section 1, the examiner reads each sentence aloud and the participant has to complete the sentence as quickly as possible. For example, "The old house will be torn... (participant says) down." This section yields a simple measure of response speed. In the second part, Section 2, the participant is faced with the more novel task of completing the sentence with a word that is



unconnected to the sentence in every way. For example, “The captain wanted to stay with the sinking... (participant says) light bulb.” In this instance the participant has to inhibit a strongly activated (automatic) response before generating a new response. This section yields two scores, an error score and response speed.

Responses in section 2 are scored according to the directions of Burgess and Shallice (1997). Category A errors are responses which plausibly completes the sentence. Category B errors are responses connected to the sentence in some way, but not direct completions of the sentence. Sentence completions that are unconnected to the sentence are considered correct responses. Participants were not permitted to repeat the same word for each sentence and participants were discouraged after their first repeated response. Long time response intervals were also interpreted as signifying executive dysfunction.

The Hayling test was designed to be sensitive to executive function disturbance (Odhuba et al., 2005). Patients with damage in prefrontal areas have been found to be slower in the two sections of the test and make more errors on the second section compared to controls (Burgess and Shallice, 1997). The Hayling is associated with left prefrontal lobe function, as it requires response initiation and suppression (Collette et al., 2001; Nathaniel-James et al., 1997).

Advancing age has been associated with poorer performance on the Hayling Test, especially on Section 2 (Andres and Van der Linden, 2000; Bielak et al., 2006; Burgess and Shallice, 1997). However, the deficits on the Hayling by normal aged

participants have been modest compared to patients with pathologic ageing (Belleville et al., 2006). For further instructions and scoring see Appendix 4.

#### **5.11.3.4 The Iowa Gambling Task (IGT)**

In decision-making research of individuals with brain dysfunction, gambling tasks are frequently used in order to simulate real-life decision-making situations. These laboratory decision-making tasks have improved the knowledge of fundamental mechanisms of decision-making, as well as factors that can diminish the ability to make advantageous decisions (Bechara, 2005).

The IGT has been used in studies examining decision-making capacity in a variety of clinical populations that show a propensity for selecting disadvantageous cards. These include substance addiction (Barry and Petry, 2008), recidivists charged with driving under the influence of alcohol (Bouchard et al., 2012; Kasar et al., 2010), alcoholics that have been long-term abstinent (Fein et al., 2004), pathological gambling (Cavedini et al., 2002), obsessive-compulsive disorder patients with hoarding problems (Lawrence et al., 2006), anorexia nervosa (Cavedini et al., 2004), impulsive aggressive disorders (Best et al., 2002), psychopathic individuals (Mitchell et al., 2002; Suchy et al., 2009a), and various offenders, including sex offenders (Arata, 1998).

The IGT attempts to mimic real world decision-making, where the outcomes of strategies and choices have an element of immediate and long-term uncertain consequences (Bechara, 2007). The IGT is a gambling task that involves selecting cards. Each card selection results in the participant winning an amount of money;

however, some choices also result in the loss of money. Decks A and B are characterized by large wins (\$100 per choice) but occasional large punishments (e.g., \$1250 on deck B), resulting in net loss with repeated selection. Decks C and D are associated with smaller wins (e.g., \$50 per choice) but also small losses, resulting in the gradual accumulation of profit over repeated selection. Higher short-term rewards are associated with larger punishments, making the choice of lower short-term rewards more advantageous in the long-term.

Participants are free to switch from any deck to another at any time. The 100 selections are divided into five blocks of 20 consecutive selections to examine learning on the task. A net score is measured by calculating the number of cards picked from advantageous decks (C and D) minus the number of cards picked from the disadvantageous ones (A and B) in each block of 20 cards. Thus, positive net scores indicate a preference for the advantageous decks and negative net scores suggest a preference for the disadvantageous ones.

The IGT was originally developed for the detection of decision making impairment in patients with ventromedial prefrontal cortex (VMPFC) and dorsolateral prefrontal cortex damage, who exhibited real-world decision making deficits; however, performed normally on lab-based measures of cognitive functioning (Bechara, 2007). Individuals with known VMPFC lesions show poorer decision-making on the IGT relative to controls (Bechara et al., 2000), as do patients with right frontal lesions (Clark et al., 2003), orbitofrontal prefrontal cortex (OFC) (Bechara et al., 1994), bvFTD (Poletti et al., 2013) and early/mild FTD (Torrvalva et al., 2007). The amygdala has also been implicated in poor decision-making strategies on the IGT due to the

lack of emotional response to negative outcomes, particularly fear (Gupta et al., 2011).

VMPFC patients perform poorly on the IGT because they are insensitive to future consequences; and are guided by immediate prospects rather than the accumulation of long-term positive outcomes.

Normal and brain-damaged controls (patients with damage other than the VMPFC) are initially drawn into the riskier cards (A and B) as a function of the larger payoffs; however, eventually shift to the safer, low payoff, decks (C and D). Patients with VMPFC damage on the other hand, continue to select cards from the risky decks and fail to respond to losses (Bechara et al., 2000).

Most healthy participants sample cards from each deck, and after about 40 or 50 selections are fairly proficient at selecting the advantageous decks. Patients with executive dysfunction, however, continue to persevere with the disadvantageous decks, although they are aware they are losing money (Manes et al., 2002).

IGT impairment by older adults has received mixed results with some studies concluding that there is an age-effect in IGT performance (Bertoux et al., 2012; Carvalho et al., 2012; MacPherson et al., 2002; Wood et al., 2005; Zamarian et al., 2008). For example, Carvalho et al. (2012) found that when the total IGT results were compared, there were no differences in scores between young people and elderly adults; however, older adults significantly chose more Deck A cards. In two comparison studies of adults ages 26-55 to adults ages 56-85, a large proportion of

the older adults showed impairment on the IGT (Denburg et al., 2005). However, in another comparison study of adults ages 18–35 to 65–88 no age-effects were noted on the IGT (Wood et al., 2005).

Zamarian et al. (2008) supported the hypothesis that executive function deficits in older adults contribute to decision-making impairments on the IGT. Decision-making in older adults may be affected by the complexity and the ambiguous nature of the IGT (Brand and Markowitsch, 2010).

Joyal et al. (2014) recommended the IGT as a measure of risk taking in sex offenders. I therefore explored decision-making in sex offenders using this decision-making measure. For further instructions and scoring see Appendix 4.

#### **5.11.3.5 The Trail-Making Test (TMT)**

The TMT is a standardized visual search and sequencing tasks that is heavily influenced by attention, concentration, resistance to distraction, and cognitive flexibility (or set-shifting) (Strauss et al., 2006). More specific purposes include the detection of frontal lobe deficits, problems with psychomotor speed, visual search and sequencing, attention, and impairments in set shifting (Demakis, 2004; Reitan and Wolfson, 1994). Part A of the TMT requires visual scanning, numeric sequencing and visuomotor speed. This portion of the test is not a good indicator of brain impairment since there is not a significant amount of time difference between normal subjects and brain-damaged patients (Bradford, 1992). However, the time performance of Part B has been found to be sensitive to frontal lobe pathology and is

an index of executive function (Arbuthnott and Frank, 2000; Davidson et al., 2008; Gouveia et al., 2007; Misdraji and Gass, 2010; Sanchez-Cubillo et al., 2009; Terada et al., 2013). In fMRI and functional near-infrared spectroscopy (fNIRS) studies of the TMT, left-sided dorsolateral prefrontal cortex as well as bilateral ventro and dorsolateral prefrontal cortex activation have been found in TMT Part B (Muller et al., 2014; Zakzanis et al., 2005).

Age, education, and intelligence are known to affect TMT performance (Spren and Strauss, 1998). For example, IQ is significantly correlated with performance on scores on Part B (Oosterman et al., 2010). Studies have reported declining performance with increasing age, particularly in greater time for completion rather than error rates (Ashendorf et al., 2008; Coubard et al., 2011; May and Hasher, 1998; Oosterman et al., 2010; Rasmusson et al., 1998). For further instructions and scoring see Appendix 4.

#### **5.11.3.6 Verbal Fluency - The FAS test**

Letter fluency is most commonly assessed by forms of the Controlled Oral Word Association Test (COWAT) (Benton and Hamsher, 1989), which requires participants to produce words beginning with a certain letter of the alphabet, usually “F”, “A”, and “S”.

Impaired verbal fluency has been reliably associated with frontal lobe damage (Davidson et al., 2008; Henry and Crawford, 2004; Robinson et al., 2012a; Schwartz and Baldo, 2001; Stuss et al., 1998), particularly if the lesion is in the left frontal lobe

(Baldo et al., 2001; Gouveia et al., 2007). Voluntary generation is widely thought to be a frontal lobe process and prefrontal damage is known to result in a lack of initiation (Fuster, 2009). Most studies report a positive association between number of years of formal education and performance on tasks of letter and category verbal fluency (Loonstra et al., 2001; Tombaugh et al., 1999).

A decline in verbal fluency performance with age has been found in the healthy elderly (Brickman et al., 2005; Loonstra et al., 2001), particularly after age 60 (Rodriguez-Aranda and Martinussen, 2006). For further instructions and scoring see Appendix 4.

### **Temporal Lobe Measures**

The following tests attempt to cover some of the more important functions associated with temporal lobe function such as visuospatial function, memory span, new learning, and recognition memory.

#### **5.11.3.7 The Rey Complex Figure Test (RCF)**

The RCF is a copying task that has been documented to load on executive function and memory (Smith and Zahka, 2006). In clinical studies, it has been observed that patients that use disorganized strategies to copy the RCF have difficulty recalling the figure after a delay and perform poorly (Newman and Krikorian, 2001).

The RCF is commonly used to assess visuospatial and executive function in older adults, who have planning and organization deficits (Gasparini et al., 2008; Robinson

et al., 2007). Education has not been strongly associated with complex figure performance (Hubley and Jassal, 2006); however, intelligence has been found to affect performance on the RCF (Schwarz et al., 2009). Age effects have been reported by a number of researchers, with deteriorating performance as age increases (Fastenau et al., 1999; Gallagher and Burke, 2007); others indicate that scores remain relatively constant and a sudden sharp drop in scores only emerge in much older samples (Ostrosky-Solis et al., 1998).

Impulsivity has been found to affect organizational ability in offenders, that is, individuals that are more impulsive tend to take less time to analyse the drawing and sort out major from minor elements of the drawing to copy the RCF (Cornell et al., 1997). For further instructions and scoring see Appendix 4.

#### **5.11.3.8 Rey Auditory Verbal Learning Test (RAVLT)**

The RAVLT is a brief measure that assesses immediate memory span, new learning, susceptibility to interference, and recognition memory (Strauss et al., 2006). The RAVLT has been shown to be sensitive to brain disease and to discriminate well between normal and neurological patients (Redoblado et al., 2003; Vakil et al., 1998). Better RAVLT performance has been associated with higher IQ levels (Schmidt, 2004); and is affected by age and gender (Lehmann et al., 2013; Vakil and Blachstein, 1997; Vakil et al., 1998; Vakil et al., 2010; Van der Elst et al., 2005).

Total learning on the RAVLT has been found to be deficient in many clinical populations, including traumatic brain injury (Atchison et al., 2004), Alzheimer's



disease (Ricci et al., 2012), bvFTD (Hornberger et al., 2010a), and mild cognitive impairment (Nordlund et al., 2007).

The RAVLT consists of five presentations of a 15-word list (List A), followed by a free recall of a second word list (List B), and a sixth recall trial of list A. Delayed recall may be examined with a seventh recall trial after a 20-30 minute delay. The recognition trial is tested by asking the respondent to indicate which of 30 words read aloud were from List A (15) and which were not (15). For further instructions and scoring see Appendix 4.

#### **5.11.4 SOCIAL COGNITION MEASURE**

##### **5.11.4.1 Facial Expression of Emotion: Stimuli and Tests (FEEST)**

Facial expressions have important functions and the ability to read them is considered a prerequisite for understanding other people's thoughts, feelings and adequate social interaction (Bornhofen and McDonald, 2008b). For example, aggressive behaviour may result from a deficit in adequately recognizing and responding to distress-related social cues (Blair, 2001; Seidel et al., 2013).

Impairments in the ability to recognize facial affect can be demonstrated with neuropsychological, performance-based tests requiring patients to label or match images of facial expressions. The FEEST or The Ekman 60 Faces Test uses a range of photographs from the Ekman and Friesen series of Pictures of Facial Affect (Ekman and Friesen, 1976), which has been the most widely used and validated

series of photographs in facial expression research. From this series, the faces of 10 actors (6 female, 4 male) are chosen, each displaying six basic emotions (happiness, sadness, disgust, fear, surprise and anger). The maximum test score indicating best performance is 60 for all six emotions and 10 for each basic emotion.

The FEEST has been shown to be a reliable and valid measure of emotion recognition in various clinical populations, including FTD patients, who are significantly impaired on facial recognition tasks, showing deficits in ability to identify happiness, sadness, disgust, fear, surprise and anger (Diehl-Schmid et al., 2007; Keane et al., 2002; Lough et al., 2006; Miller et al., 2012; Rosen et al., 2004). TBI patients have also demonstrated difficulty in the FEEST with particular difficulty in depicting sadness and anger, which were correlated with behavioral problems and impaired self-awareness (Spikman et al., 2013).

Patients with OFC (Lidaka et al., 2001; Willis et al., 2010) and amygdala damage (Adolphs, 2002; Adolphs and Tranel, 2003) demonstrate difficulty in processing negative expression of emotion. This suggests that damage to these areas affects an individual's ability to respond appropriately to negative emotion in others.

Older individuals have been found to be less adept than younger people in identifying facial recognition of emotion (Keightley et al., 2007; Keightley et al., 2006b; Ruffman et al., 2008; Suzuki et al., 2007). A recent study found that older adults demonstrate impairments in their ability to identify expressions of fear, sadness, and happiness; however, can recognize anger, disgust, and surprise (Horning et al., 2012).

Two studies have reported that sex offenders, including child sex offenders, are less accurate than controls in recognizing facial expressions of anger, disgust, surprise and fear, confusing fear with surprise, and disgust with anger (Gery et al., 2009; Oliver et al., 2009). For further instructions and scoring see Appendix 4.

## 5.12 Statistical analyses

### 5.12.1 Power analysis

At the beginning of this study, it was expected that a medium to large effect sizes (ES) between groups (Cohen, 1992) setting alpha at 0.05 (significance criterion) and power of 0.80, the estimated number per group (assuming equal sample sizes) would be 21 for large ( $f=0.40$ ) and 52 for a medium effect size ( $f=0.25$ ). For analyses using chi-square tests (e.g., offender type), the required sample size for a 3 X 2 contingency table with 2 degrees of freedom would be 36 per group for a medium ES with alpha set at 0.05. However, due to the difficulty of recruiting participants and having to exclude some cases due to missing values the obtained sample size was smaller than anticipated. First-time sex offenders over the age of 50 years were more difficult to find than expected, as were non-violent, non-sexual offenders over the age of 50.

The sample size in this study is relatively small and this has a direct impact on the power of statistical tests performed. If differences between means are small relative to the variation in the data, small samples may make it impossible to detect those

differences. The remedy would have been a larger sample size; however, that was not possible in this study. All the results therefore need to be read bearing in mind the limitations imposed by the relatively small samples available. An example of calculating power following an analysis of variance is provided below with the variable Full Scale IQ (FSIQ):

FSIQ Means:

| FT    | HT    | NSOC  |
|-------|-------|-------|
| 106.7 | 101.8 | 108.5 |

|          |      |         |       |      |       |
|----------|------|---------|-------|------|-------|
| Change   | d.f. | s.s.    | m.s.  | v.r. | F pr. |
| + group  | 2    | 740.8   | 370.4 | 1.51 | 0.227 |
| Residual | 91   | 22384.3 | 246.0 |      |       |
| Total    | 93   | 23125.1 | 248.7 |      |       |

These means are not very different given the standard deviation in the data (about 15.6, viz square root of 246.0). The power of this test to detect a real difference was only 13%, obtained using the Excel file *Power and sample size* from <http://www.stats.net.au/resources.htm> (O'Neill and Thomson, 1998).

### 5.12.2 Statistical analysis

Statistical analyses were performed using GenStat version 15 (2012. VSN International Ltd, Hemel Hempstead, United Kingdom) and exploratory statistical

analyses using the Statistical Package for the Social Sciences (SPSS) version 20. A 5% ( $p < 0.05$ ) significance level was adopted.

The data were subjected to data checking techniques before and during statistical analyses. There were missing data (in brackets) for some variables: FSIQ (n=6), PIQ (n=12), VIQ (n=14); ACE-R (n=2); Hayling (n=2); IGT (n=2); RCF (n=4); RAVLT (n=4); FEEST (n=17); FAS (n=3); Trail-making test (n=8); and DASS (n=6).

Descriptive analyses were performed to examine baseline characteristics of study participants. Maximum likelihood chi-square tests were used for categorical variables. Chi-Square was used to compare frequencies of categorical variables between the two sex offender groups related to sexual offences. Therefore the non-sexual group was excluded from this analysis, as they had not been convicted for a sexual offence.

Bonferroni correction was applied to control the overall Type I error when multiple t-tests were carried out to compare continuous variables between the sex offender groups. As suggested by the Bonferroni correction, each of the  $\alpha$ -level (i.e., 0.05) was divided by the number of tests conducted. T-tests to compare test performance between the sex offenders were appropriate as no age difference existed between them,  $t_{(66)} = .963$ ,  $p > 0.05$ .

Analyses of variance (ANOVA) were used to evaluate group differences in some continuous measures, such as age. Multivariate analysis of variance (MANOVA) was used to compare all the individual neuropsychological tests among the three groups.

The reason for using MANOVA instead of multiple ANOVAs was to reduce the family-wise error rate, which occurs when individual tests are carried out on the same data (Field, 2009).

Neuropsychological results were also compared to normative data for all the tests to investigate significant differences in function with the general population with similar age and education attainment.

The relationship between three or more discrete variables were analysed through the multi-way frequency analysis, log-linear analysis.

#### **5.12.2.1 Multivariate analysis of variance (MANOVA)**

Univariate ANOVA is a statistical technique in which responses measured on subjects (or experimental units) from more than two groups can be judged as likely to come from the same population or different populations. This result provides statistical evidence, allowing conclusion to be made about whether any of the groups differ in the variable measured. The ANOVA technique is based on a least-squares procedure and requires assumptions of normality and constant variance to be met. It is therefore usually restricted to measurements of continuous variables. Multivariate ANOVA, or MANOVA, is an extension of univariate ANOVA when there are several dependent variables (Tabachnick and Fidell, 2013).

MANOVA takes scores from the multiple dependent variable and creates a single dependent variable giving the ability to test for the above effects. Statistical reports

however will provide individual p-values for each dependent variable, indicating whether differences and interactions are statistically significant.

Where measurements of more than one continuous variable are taken on each subject and where, again, there are more than two groups of subjects, MANOVA allows a decision to be made about whether the groups come from the same or different population(s), the population(s) in this case being multivariate normal population(s).

The same assumptions and provisos apply to MANOVA as to univariate ANOVA but in a multivariate sense. A number of test statistics have been developed for MANOVA. The statistic used in this study was Wilk's lambda, with Rao's  $F$  statistic providing the  $P$  value for hypothesis tests.

MANOVA has greater power than ANOVA to detect effects because it takes into account the correlations between dependent variables. MANOVA incorporates information about several outcome measures and, therefore, informs whether groups of participants can be distinguished by a combination of scores on several dependent measures.

#### **5.12.2.2 Canonical variates analysis (CVA)**

Canonical variates analysis is a multivariate statistical method providing a means to determine where group differences detected by a MANOVA, for example, might lie. In other words, CVA allows the groups of subjects to be separated in terms of the

measured variates. This separation is done, first, by constructing linear combinations of the measured variates. The linear combinations are constructed in such a way that the first linear combination is that which determines the weighting of the variates which maximises the differences among the groups. The second linear combination weights the variates to obtain the next greatest differentiation among the groups. Denoting measured variates by  $X_i$ ,  $i = 1, \dots, p$ , coefficients of those variates by  $a_i$  and the linear combinations (viz. the canonical variates) by  $Z_i$ , we can write

$$Z_1 = a_{11}X_1 + a_{12}X_2 + \dots + a_{1p}X_p$$

$$Z_2 = a_{21}X_1 + a_{22}X_2 + \dots + a_{2p}X_p, \text{ and so on.}$$

Usually, the maximum number of such linear combinations is the smaller of  $p$  (i.e., the number of measured variates) and the number of groups. The maximisation of the differences among the groups for each canonical variate,  $Z_i$ , is achieved by maximising the  $F$  statistic for a univariate ANOVA performed on the particular  $Z_i$  values. The particular relationship among the coefficients in each  $Z_i$  is the basis for describing the nature of the differences among the groups displayed by that canonical variate. So, for example, with three variates that are measured on the same scale, if the first linear function produces weights or “factor loadings” of (0.4, 0.5, 0.3), then the first linear function of the three variates ( $X_1, X_2, X_3$ ) that most successfully separates the groups is  $Z_1 = 0.4 \times X_1 + 0.5 \times X_2 + 0.3 \times X_3$ . This could be interpreted as showing that the three variates all contribute approximately equally to differentiating the subject groups, with variate,  $X_2$  (with the largest coefficient or loading) perhaps somewhat more important than variates  $X_1$  and  $X_3$  (with smaller coefficients or loadings).



### **5.12.2.3 Residual maximum likelihood (REML)**

Residual maximum likelihood is a technique for fitting statistical models, which are broadly similar to ANOVA models (Tabachnick and Fidell, 2013). For linear mixed models, REML is more general than ANOVA in that it allows for changing variances across groups and possible correlations among the data. REML is better in the presence of missing data, which is an issue with the current study, in that it provides less biased parameter estimates than ANOVA. Linear mixed models fitted by REML belong to the likelihood-based class of models.

In analyses where REML was used and the presence of a significant difference was indicated by a p value of less than 0.05, the significant differences were identified by comparing group means pairwise using least significant differences (LSDs).

### **5.12.2.4 Logistic regression**

Logistic regression was used where the response variable was binary, for example, data with measured responses present/absent. Such models are based on the binomial distribution and are fitted by maximum likelihood. Logistic regression models provide predictions of the probability of the responses for each subject (or treatment) group for the particular binary response variate in question (Tabachnick and Fidell, 2013).

## 6 RESULTS

### 6.1 Exclusion and refusal data

A total of 17 participants were excluded from this study. The reasons were:

- 9 FT sex offenders reported having committed their first sexual offence before the age of 50
- 1 HT sex offender was excluded due to having a stroke in between testing sessions
- 7 NSOC offenders were excluded for a mixture of reasons, these were:
  - a) 2 due to epilepsy
  - b) 2 due to severe brain damage
  - c) 1 due to a stroke
  - d) 1 due to experiencing psychosis
  - e) 1 due to the revelation that he pervasively used violence

A total of 13 offenders refused to participate in this study.

- 5 FT
- 3 HT
- 5 NSOC

## 6.2 DEMOGRAPHICS OF PARTICIPANTS

The mean age of the participants was 61.2 (SD = 7.1) years, 33% were married, they had, on average, 9.9 years of education, 39% had been employed in unskilled work, and 77% were Australian born. Characteristics of the sample are found in Table 6-1.

Table 6-1 Sample Demographics

|                         | FT<br>n=32              | HT<br>n=36              | NSOC<br>n=32            | F     | $\chi^2$ | p          |
|-------------------------|-------------------------|-------------------------|-------------------------|-------|----------|------------|
| Age                     | 63.9 <sup>a</sup> (7.1) | 62.3 <sup>a</sup> (6.4) | 57.3 <sup>b</sup> (6.5) | 8.761 |          | < 0.001*** |
| Education               | 9.6 <sup>a</sup> (3.9)  | 9.4 <sup>a</sup> (3.4)  | 10.8 <sup>a</sup> (3.0) | 1.489 |          |            |
| Time in prison          | 2.8 <sup>a</sup> (2.9)  | 7.1 <sup>b</sup> (7.2)  | 6.3 <sup>b</sup> (6.5)  |       |          | 0.001**    |
| Married                 | 13 (41%)                | 7 (19%)                 | 13 (41%)                |       | 4.675    |            |
| Never married           | 8 (25%)                 | 9 (25%)                 | 3 (9%)                  |       | 3.320    |            |
| Divorced                | 6 (19%)                 | 13 (36%)                | 10 (31%)                |       | 2.596    |            |
| Professional/Managerial | 8 (25%)                 | 5 (14%)                 | 4 (13%)                 |       | 2.158    |            |
| Skilled/semi-skilled    | 17 <sup>a</sup> (53%)   | 7 <sup>b</sup> (19%)    | 16 <sup>a</sup> (50%)   |       | 9.968    | 0.007**    |
| Unskilled               | 7 <sup>a</sup> (22%)    | 22 <sup>b</sup> (61%)   | 10 <sup>a</sup> (31%)   |       | 12.151   | 0.002**    |
| Homosexual              | 1 (3%)                  | 14 (39%)                | 1 (3%)                  |       | N/A      |            |
| Heterosexual            | 31 <sup>a</sup> (97%)   | 14 <sup>b</sup> (61%)   | 31 <sup>a</sup> (97%)   |       | 21.927   | < 0.001*** |
| Non-right handedness    | 2 (6%)                  | 6 (17%)                 | 1 (3%)                  |       | N/A      |            |
| Drug & Alcohol          | 11 (34%)                | 15 (42%)                | 20 (63%)                |       | 5.520    |            |
| Alcohol                 | 11 (34%)                | 15 (42%)                | 13 (41%)                |       | .431     |            |
| Drugs                   | 1 (3%)                  | 3 (8%)                  | 15 (47%)                |       | N/A      |            |
| Psychiatric History     | 16 (50%)                | 13 (36%)                | 12 (38%)                |       | 1.589    |            |
| Depression              | 13 (41%)                | 11 (31%)                | 12 (38%)                |       | .791     |            |
| Head Injury             | 21 (66%)                | 20 (56%)                | 20 (63%)                |       | .767     |            |
| Hypertension            | 23 <sup>a</sup> (72%)   | 20 <sup>a</sup> (56%)   | 12 <sup>b</sup> (38%)   |       | 7.800    | 0.020*     |
| Diabetes                | 4 (13%)                 | 3 (8%)                  | 6 (19%)                 |       | N/A      |            |

\*p < 0.05 \*\*p < 0.01 \*\*\*p < 0.001

### 6.2.1 Age of offender and years of education

A series of one-way analyses of variance (ANOVA) identified whether the groups differed significantly in their mean age and years of education. There were significant

differences in age across offender type ( $p < 0.001$ ). NSOC offenders were significantly younger than FT and HT sex offenders. There was no significant difference in age between FT and HT sex offenders. (Note: means were marked “a” and “b” to show this in Table 6-1). The groups did not differ in years of education ( $p = 0.254$ ).

### **6.2.2 Total time in prison**

FT sex offenders served a mean of 2.8 years ( $SD = 2.9$ ) in prison, which was significantly shorter than HT and NSOC offenders, Kruskal-Wallis test ( $p = 0.001$ ), while the latter two groups did not differ. This result was expected, as 66% of FT sex offenders did not have a previous criminal history, many had been incarcerated for the first time, whilst many of the HT and NSOC offenders had long criminal histories.

### **6.2.3 Occupation**

Seventeen per cent of the total sample was employed in professional, managerial, or intermediate occupations, 40% were employed in skilled occupations, and 39% were unskilled. The groups did not significantly differ in professional/managerial/intermediate occupations ( $p = 0.340$ ). FT and NSOC offenders were significantly more likely to be employed in skilled occupations compared to HT sex offenders ( $\chi^2 = 9.968$ ,  $p = 0.007$ ). Therefore HT sex offenders were, overall, more unskilled than the two groups ( $\chi^2 = 12.151$ ,  $p = 0.002$ ). (Note: 2 HT offenders and 2 NSOC offenders did not provide their occupation).

#### **6.2.4 Marital status**

Using five marital status categories in a chi-square test of homogeneity, 6 out of the 15 expected values were less than 5 therefore separated or widow categories were combined in further analysis, as they each indicate a subject who had been married. There were no significant differences among the four marital status categories (married, divorced, never married, and widowed-separated) in relation to offender group ( $p = 0.198$ ).

#### **6.2.5 Sexual Orientation**

While the majority of offenders reported a heterosexual orientation, the HT sex offenders reported a significantly lower rate of heterosexuality than FT and NSOC offenders ( $\chi^2 = 21.927, p < 0.001$ ).

#### **6.2.6 Handedness**

The chi-square analysis of non-right handedness provided expected values of less than 5 in two groups and so cannot be relied on. However, only 8 (11.8%) of the combined sex offender groups were left-handed, therefore there was little support in this study for left-handedness in sex offenders found in other studies (Blanchard et al., 2007; Bogaert, 2001; Cantor et al., 2004).

### **6.2.7 Drug and alcohol, psychiatric history, and head injury**

The groups did not significantly differ in the rate of drug and alcohol problems. The rate of alcohol abuse/history was 39% for the sample. The chi-square analysis provided expected values of less than 5 in two groups in the category “drugs” and so cannot be relied on.

As offenders with a known history of major mental illness (e.g., schizophrenia, schizoaffective disorder, or bipolar disorder) were excluded from this study, and none of the FT sex offenders had a major mental illness, the current data encapsulated less serious psychiatric problems such as depression, anxiety, and adjustment difficulties. The groups did not significantly differ in reported history of psychiatric problems; nevertheless, the sample’s rate of psychiatric problems, i.e., 41%, was consistent with previous studies of offenders (Butler et al., 2011; Fazel and Danesh, 2002). Depression was the most common psychiatric complaint in FT sex offenders, although they did not significantly differ from the other two offender groups.

The rate of reported head injury was 61% for the total sample; however, the groups did not significantly differ in the rate of head injury.

### **6.2.8 Hypertension and diabetes**

The overall rate of hypertension for the total sample was 55%, with the FT sex offenders significantly showing the highest rate, i.e., 72%. FT sex offenders

demonstrated a significantly higher rate of hypertension than NSOC offenders ( $\chi^2 = 7.80$ , d.f. = 2,  $p = 0.020$ ). There were no other group differences.

The overall incidence of diabetes was 13% for the total sample; however, the chi-square analysis provided expected values of less than 5 in two groups and therefore cannot be relied on.

### 6.2.9 Age at First Sexual Offence

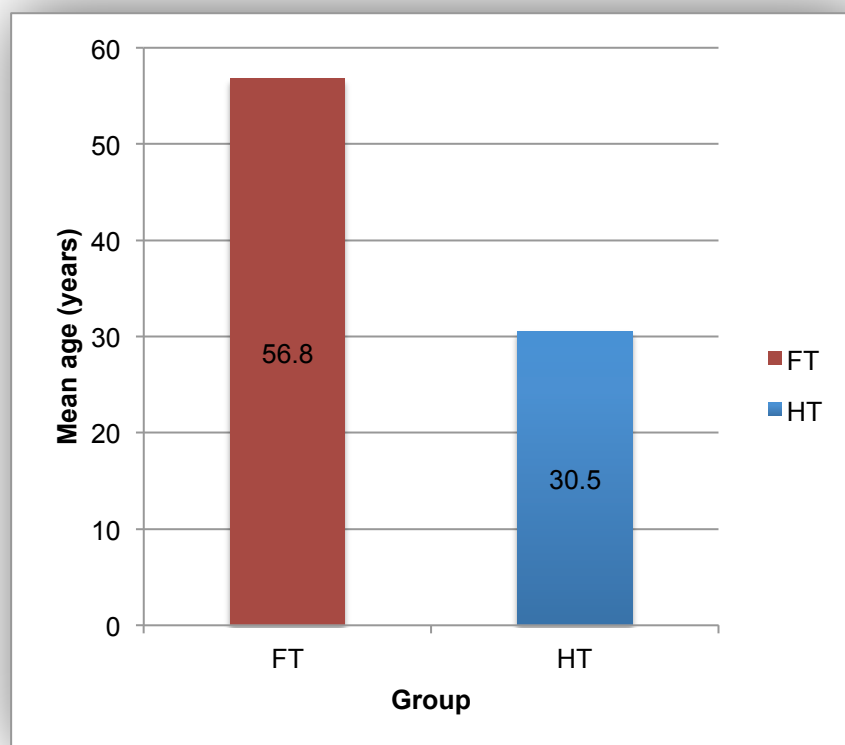


Figure 6-1 Mean age at first sexual offence by the sex offender groups

HT sex offenders committed their first sexual offence much earlier than FT sex offenders, ( $t_{(66)} = 9.034$ ,  $p < 0.001$ ) (above). The mean age at first sexual offence for

the FT sex offenders was 56.8 (SD 12.7) years compared to the HT sex offenders, 30.5 (SD 11.3) years.

#### **6.2.10 Time interval between first sexual offence and neuropsychological testing**

HT sex offenders were assessed at a much later time from their first sexual offence. FT sex offenders were tested on average within 4.8 (SD = 4.4) years from their first sexual offence while HT sex offenders were tested on average within 31.8 (SD = 12.7) years. They did not differ in mean age at testing, FT (M = 61.6, SD 13.2) years, and HT (M = 62.6, SD 6.5) years. However, the time difference, between when the sexual offence was committed and testing, was significant, ( $t_{(43)} = 11.9, p < 0.001$ ).

#### **6.2.11 Sexual offences against children**

The combined groups of offenders convicted of offences against children involving direct physical contact, “contact offences”, and offenders convicted of child pornography offences are referred to as sexual offenders against children. Although there were high rates of sexual offences against children, with 84% and 94% of FT and HT sex offenders, respectively, committing sexual offences against children, the groups did not significantly differ in child victim type.



Table 6-2 Types of sex offences committed by the sex offender groups

|                               | FT<br>N (%) | HT<br>N (%) | $\chi^2$ | <i>p</i> |
|-------------------------------|-------------|-------------|----------|----------|
| Offences against children     | 27 (84%)    | 34 (94%)    | 1.860    |          |
| Male victims                  | 8 (25%)     | 19 (53%)    | 5.460    | 0.018*   |
| Extrafamilial child molesters | 15 (47%)    | 28 (78%)    | 6.959    | 0.008**  |
| Incest offenders              | 4 (13%)     | 7 (19%)     | N/A      |          |
| Rapist (adult) heterosexual   | 4 (13%)     | 5 (14%)     | N/A      |          |
| Child pornography offences    | 10 (31%)    | 1 (3%)      | N/A      |          |
| Multiple sexual offences      | 2 (6%)      | 5 (14%)     | N/A      |          |
| Sexual violence               | 1 (3%)      | 6 (17%)     | N/A      |          |

\**p* < 0.05 \*\**p* < 0.01

### 6.2.12 Male victims

HT sex offenders committed significantly more sex offences against males (*p* = 0.018), which was consistent with their self-reported lower rate of heterosexuality.

### 6.2.13 Extrafamilial sexual offences

HT sex offenders committed significantly more extrafamilial sexual offences (*p* = 0.008).

### 6.2.14 Incest, heterosexual rape, homosexual indecent sexual assault, child pornography, and multiple sexual offences

The sex offender groups did not differ in incidence of incest offences. Chi-square provided expected values of less than 5 for one and, at times, both groups in the

following categorical variables: heterosexual rape, indecent sexual assault, child pornography, and multiple sexual offences, and therefore cannot be relied on. The categories of three and four offences were combined to address this problem. There were significant differences between the two groups in the number of offences committed ( $p < 0.001$ ). The analysis suggests the incidence of a single offence is lower among HT sex offenders. A further analysis, contrasting numbers of offenders committing a single offence with those committing more than one offence across the two groups confirmed this ( $p < 0.001$ ). The percentage of HT sex offenders committing only a single offence (3%) was much lower than that of FT sex offenders (38%).

#### **6.2.15 Sexual violence**

Sexual violence in this study was defined as physical violence during a sexual assault<sup>6</sup>. Violence was defined as any kind of force, which any reasonable person would object to, such as being held/restrained, punched, scratched, bitten, choked, slapped, burnt, or any kind of physical force where the person was injured. The rate of sexual violence of the combined sample of sex offenders was low (10%) therefore chi-square analysis cannot be relied on. Sexual violence was relatively rare in FT sex offenders. Only one (3%) FT sex offender was sexually violent compared to six (17%) HT sex offenders. Although there were four cases of rape perpetrated by FT sex offenders, which could be regarded as meeting this study's criteria for sexual violence, there was a paucity of information about the nature of the violence and

---

<sup>6</sup> Psychological injury to the victim was unable to be quantified either by the documentation reviewed or the self-report provided by perpetrator/participant.

therefore it was not possible to reliably categorize these offences as being examples of “sexual violence”.

### 6.2.16 Paedophilic disorder and other paraphilic disorders

Table 6-3 Rate of paedophilic and paraphilic disorders

|                            | FT<br>n=27 | HT<br>n=34 | $\chi^2$ | p          |
|----------------------------|------------|------------|----------|------------|
| Paedophilic disorder       | 8 (29%)    | 28 (82%)   | 18.941   | < 0.001*** |
| Other paraphilic disorders | 2 (6%)     | 5 (14%)    | N/A      |            |

Paedophilic disorder was assessed using the *Diagnostic and Statistical Manual of Mental Disorders - fifth edition* (DSM-5) criteria (American-Psychiatric-Association, 2013)<sup>7</sup>. HT sex offenders self-reported a significantly higher rate of paedophilic disorder compared to FT sex offenders ( $\chi^2 = 18.941$ ,  $p < 0.001$ ). As Table 6-3 shows, the variable “other paraphilic disorders” cannot be relied on, as expected values were less than 5 in the FT sex offender group.

<sup>7</sup> DSM-5 defines paedophilic disorder as a paraphilic disorder in which adults or adolescents 16 years of age or older have intense and recurrent sexual urges and fantasies about prepubescent children that they have either acted on or which cause them distress or interpersonal difficulty. Individuals can still be diagnosed with paedophilic disorder despite the absence of self-reported distress, provided that there is evidence of recurrent behaviours persisting for six months.

## 6.2.17 Non-sexual criminal history

Table 6-4 Types of non-sexual offences committed by group

|                             | FT<br>n=32 | HT<br>n=36 | NSOC<br>n=32 | $\chi^2$ | <i>p</i>   |
|-----------------------------|------------|------------|--------------|----------|------------|
| Break & Enter               | 2 (6%)     | 4 (11%)    | 3 (9%)       | N/A      |            |
| Stealing/Theft              | 2 (6%)     | 3 (8%)     | 5 (16%)      | N/A      |            |
| Common assault              | 5 (16%)    | 3 (8%)     | 0 (0%)       | N/A      |            |
| Aggravated assault          | 1 (3%)     | 1 (3%)     | 0 (0%)       | N/A      |            |
| Attempted murder            | 0 (0%)     | 1 (3%)     | 0 (0%)       | N/A      |            |
| Fraud                       | 0 (0%)     | 0 (0%)     | 4 (13%)      | N/A      |            |
| Driving offences            | 1 (3%)     | 2 (6%)     | 6 (19%)      | N/A      |            |
| Car theft                   | 1 (3%)     | 0 (0%)     | 1 (3%)       | N/A      |            |
| Property offences           | 1 (3%)     | 0 (0%)     | 1 (3%)       | N/A      |            |
| Possession of firearm       | 1 (3%)     | 1 (3%)     | 3 (9%)       | N/A      |            |
| Drug offences               | 1 (3%)     | 0 (0%)     | 16 (50%)     | N/A      |            |
| Other offences <sup>8</sup> | 1 (3%)     | 3 (8%)     | 4 (13%)      | N/A      |            |
| <i>Overall non-sexual</i>   | 11 (34%)   | 14 (39%)   | 27 (84%)     | 19.900   | < 0.001*** |

There was a large statistical difference in the non-sexual criminal history between the sex offenders and NSOC offenders ( $\chi^2 = 19.900$ ,  $p < 0.001$ ), with 84% of NSOC offenders having a previous non-sexual criminal history (i.e., 16% of NSOC offenders were first-time non-sex offenders, see above).

<sup>8</sup>The “other offences category” included larceny, perverting the course of justice, and receiving/possession of stolen goods.

## **6.3 SCREENING MEASURES RESULTS**

### **6.3.1 Dementia screening results**

The Addenbrooke's Cognitive Examination-Revised (ACE-R) was used to screen for dementia. The total (and maximum) ACE-R score is 100 with higher scores reflecting better ability. The ACE-R provides cut-off scores for dementia. For example, a cut-off score of 86 has been set for individuals in the 50-59 age bands with an education of 12 years (Mioshi et al., 2006). Based upon my literature review I predicted that there would be a higher rate of dementia among first time sex offenders, with FT sex offenders producing significantly lower scores than to the other two groups on the ACE-R.

#### **6.3.1.1 Addenbrooke's Cognitive Examination-Revised (ACE-R)**

The five components of the ACE-R (i.e., attention, memory, verbal fluency, language, and visuospatial) were analysed by MANOVA. There was a significant difference in the three sets of five component means ( $p = 0.012$ ) (see Table 6-5). NSOC offenders provided significantly higher ACE-R scores than FT and HT sex offenders ( $p < 0.001$ ). The FT and HT sex offenders did not significantly differ ( $p = 0.996$ ).

Table 6-5 ACE-R score results

|                  | FT<br>M (SD), %<br>n=32  | HT<br>M (SD), %<br>n=34 | NSOC<br>M (SD), %<br>n=32 | p      |
|------------------|--------------------------|-------------------------|---------------------------|--------|
| ACE-R total      | 87.7 <sup>a</sup> (10.4) | 86.9 <sup>a</sup> (6.4) | 92.5 <sup>b</sup> (4.1)   | 0.012* |
| Attention        | 17.2 (2.1)               | 17.1 (1.5)              | 17.9 (0.4)                |        |
| Memory           | 22.4 (3.4)               | 21.2 (3.4)              | 23.6 (2.2)                |        |
| Verbal fluency   | 10.5 (2.5)               | 10.7 (2.3)              | 11.9 (1.8)                |        |
| Language         | 22.8 (3.1)               | 22.7 (1.7)              | 23.3 (1.9)                |        |
| Visuospatial     | 14.9 (1.8)               | 15.2 (1.2)              | 15.8 (0.5)                |        |
| ACE-R Impairment | 8 (25%)                  | 10 (29%)                | 2 (6%)                    |        |

\*p < 0.05

A canonical variates analysis (CVA) of these component variates showed that a single latent score was adequate for discriminating among the group means. The coefficients for the latent score (rounded to one decimal point) suggest a contrast between language and the other four components: Latent score 1 = 0.2×attention + 0.1×memory + 0.3×verbal fluency - 0.3×language + 0.4×visual-spatial.

A linear model based on residual maximum likelihood (REML) was used in the analysis of the single latent scores.<sup>9</sup> There was a highly significant difference between NSOC offenders and the two sex offender groups (p < 0.001). FT and HT sex offenders did not significantly differ (p = 0.996).

#### 6.3.1.1.1 ACE-R impairment

The ACE-R cut-off age norms were used to determine impairment. ACE-R impairment was determined by categorizing offenders into dichotomous 0/1 data,

<sup>9</sup> The REML method is particularly suited to data with missing values, such as the current data set.

where a score of 1 was used to indicate impairment and 0 for non-impairment. Logistic regression found that this difference was not significant ( $p = 0.077$ ).

As can be observed by the results, my hypothesis that FT sex offenders would produce significantly lower ACE-R scores compared to the two groups was partially supported. The FT sex offenders produced significantly lower ACE-R scores than NSOC offenders; however, FT sex offenders did not differ from HT sex offenders in ACE-R scores.

### **6.3.2 Self-reported symptoms of clinical impairment**

The DASS was used to assess self-reported symptoms of clinical impairment, such as depression, which has been found to be a contributing factor in cases of poor neuropsychological function (Douglas and Porter, 2009), due to slow processing speed (Bielak et al., 2011). The DASS has been shown to be a reliable and valid measure of the constructs it was intended to assess in non-clinical populations (Crawford and Henry, 2003) and depressed clinical populations (Page et al., 2007).

#### **6.3.2.1 Depression, Anxiety and Stress Scale (DASS)**

On reviewing the literature, some studies have found a high prevalence of psychiatric morbidity, including depression, anxiety and stress, in sex offenders. Using the DASS I, therefore, predicted that FT and HT sex offenders would provide higher DASS scores than NSOC offenders. I also predicted that the two sex offender groups would not significantly differ from each other.

A one-way ANOVA of DASS scores did not detect a significant differences between the three groups ( $F_{2, 91} = 0.03, p = 0.974$ ) (see Table 6-6). In addition, each subscale revealed no significant differences between the groups. Thus, my hypothesis that sex offenders would provide higher DASS scores compared to NSOC offenders was not supported.

The lack of group differences in mean DASS scores does not suggest that clinical symptoms significantly contributed adversely to the neuropsychological function of any group.

Table 6-6 DASS results

|            | <b>FT</b><br><b>M (SD)</b><br><b>n=30</b> | <b>HT</b><br><b>M (SD)</b><br><b>n=32</b> | <b>NSOC</b><br><b>M (SD)</b><br><b>n=32</b> | <b>F</b> | <b>p</b> |
|------------|---|---|---|----------|----------|
| DASS Total | 26.6 (24.5)                               | 28.0 (28.9)                               | 25.8 (19.1)                                 | 0.03     | 0.974    |
| Depression | 10.3 (9.9)                                | 9.4 (10.7)                                | 8.6 (8.3)                                   | 0.234    | 0.792    |
| Anxiety    | 7.2 (7.4)                                 | 8.4 (9.4)                                 | 7.2 (5.3)                                   | 0.295    | 0.745    |
| Stress     | 9.2 (9.2)                                 | 10.6 (9.3)                                | 10.1 (6.9)                                  | 0.217    | 0.805    |



## 6.4 NEUROPSYCHOLOGICAL MEASURES RESULTS

### 6.4.1 LEVEL OF INTELLIGENCE

Some studies have found that a group of sex offenders, namely, paedophiles, demonstrate lower intellectual performance than non-sex offenders (Cantor et al., 2004; Cantor et al., 2005a; Langevin et al., 1989b). Using the Wechsler Abbreviated Scale of Intelligence (WASI), my hypotheses were:

1. FT and HT sex offenders would provide lower WASI scores than NSOC offenders
2. FT and HT sex offenders would not differ

#### 6.4.1.1 WASI FSIQ, VIQ and PIQ

A MANOVA of the sets of means from the three offender groups for the three variables, FSIQ, PIQ and VIQ (see Table 6-7), together with the covariate, Age<sup>10</sup>, found that the effect of Age was not significant ( $F_{(3, 80)} = 0.73, p = 0.535$ ). The covariate, Age, was therefore removed from the model. A subsequent MANOVA of the sets of means from the three offender groups for the three variables, FSIQ, PIQ and VIQ found no significant differences among the means ( $F_{(6, 162)} = 1.610, p = 0.147$ ).

---

<sup>10</sup> Note that the NSOC offenders were significantly younger than FT and HT sex offenders

Table 6-7 Intellectual function results by group

|              | <b>FT</b><br><b>M (SD)</b><br><b>n=31</b> | <b>HT</b><br><b>M (SD)</b><br><b>n=33</b> | <b>NSOC</b><br><b>M (SD)</b><br><b>n=30</b> | <b>F</b> | <b>p</b> |
|--------------|---|---|---|----------|----------|
| FSIQ         | 106.7 (18.3)                              | 101.8 (14.1)                              | 108.5 (14.9)                                | 1.610    | 0.147    |
| VIQ          | 107.5 (16.8)                              | 102.8 (16.3)                              | 109.2 (16.1)                                |          |          |
| PIQ          | 105.6 (17.5)                              | 99.6 (12.2)                               | 104.3 (13.1)                                |          |          |
| Vocabulary   | 58.4 (12.6)                               | 54.7 (11.2)                               | 58.3 (10.5)                                 | 0.91     | 0.511    |
| Block design | 53.6 (10.1)                               | 51.4 (7.2)                                | 53.2 (7.5)                                  |          |          |
| Similarities | 51.1 (11.7)                               | 48.1 (10.0)                               | 54.2 (8.9)                                  |          |          |
| Matrix R.    | 50.0 (13.6)                               | 49.4 (10.5)                               | 53.9 (9.4)                                  |          |          |

My prediction of lower intellectual level in sex offenders compared to non-sex offenders was therefore not supported. However, my prediction that the two sex offender groups would not differ in intellectual function was supported.

#### 6.4.1.1.1 WASI Subtests

Some of the research, for example, Gillespie and McKenzie (2000), have found that sex offenders perform more poorly on most measures assessing left frontotemporal dysfunction than non-sex offenders. I therefore hypothesised that the sex offender groups would provide lower scores on a measure of vocabulary, the WASI Vocabulary subtest, compared to NSOC offenders.

My hypothesis predicting lower vocabulary scores in sex offenders, (i.e., measures of verbal ability), compared to NSOC offenders was not supported. A MANOVA of the subtest scores for Vocabulary, Block Design, Similarities and Matrix Reasoning showed no significant differences among offender group means ( $F = 0.910$ ,  $p =$

0.511). Subsequently a canonical variates analysis was performed; however, the weighted variable accounting for the greatest variation among subtest score means could only account for 63% of that variation.

A REML-based linear model analysis found no significant differences among the first canonical variate scores ( $p = 0.140$ ). These three analyses suggested that there were no significant differences in WASI subtest scores among the groups.

## **6.4.2 EXECUTIVE FUNCTION MEASURES RESULTS**

### **6.4.2.1 The Hayling Test**

The Hayling test is sensitive to executive function and is associated with left prefrontal lobe function, as it requires response initiation and suppression. Patients with prefrontal cortex damage have been found to be slower in the two sections of the Hayling and on section 2 make more errors compared to controls. Based on this literature review, I had two hypotheses:

1. FT sex offenders would commit more category A and B errors than HT and NSOC offenders
2. The two sex offender groups would commit more category A and B errors than NSOC offenders

#### 6.4.2.1.1 Hayling Total Score

The Hayling Total score defines whether an individual is impaired on the Hayling. The lower the Hayling Total score, the more likelihood the individual is impaired. Therefore if the *Overall Scaled Score* of an individual was less than 10, the individual was given a score of “1” and was regarded as falling in the “impaired range”. A score of 10 resulted in an Overall Scaled Score of “2” and was regarded as abnormal, a score of 11-12 resulted in an Overall Scaled Score of “3” or poor, a “4” low average, a “5” moderate average, a “6” average, a “7” high average – and all the way to an Overall Scaled Score of “10”, which is regarded as very superior.

Table 6-8 Hayling results by group

|                    | FT<br>M (SD), %<br>n=31 | HT<br>M (SD), %<br>n=36 | NSOC<br>M (SD), %<br>n=31 | $\chi^2$ | <i>p</i>   |
|--------------------|-------------------------|-------------------------|---------------------------|----------|------------|
| Hayling Total      | 3.1 (1.6) <sup>a</sup>  | 3.5 (1.9) <sup>a</sup>  | 5.2 (1.5) <sup>b</sup>    | 24.57    | < 0.001*** |
| Category A errors  | 4.5 (3.6) <sup>a</sup>  | 3.2 (2.7) <sup>a</sup>  | 1.1 (1.4) <sup>b</sup>    | 14.34    | < 0.001*** |
| Category B errors  | 5.1 (2.9) <sup>a</sup>  | 4.7 (2.5) <sup>a</sup>  | 2.9 (2.3) <sup>b</sup>    | 5.79     | 0.004**    |
| Hayling Impairment | 21 (68%) <sup>a</sup>   | 19 (53%) <sup>a</sup>   | 5 (16%) <sup>b</sup>      | 17.71    | < 0.001*** |

\*\*p < 0.01 \*\*\*p < 0.001

The Hayling total scores obtained by these offenders were problematic due to the spread of scores. Only four offenders scored a “2”, 3 scored a “5”, 3 a “7” and only 2 “8” (see Table 6-9). For the purpose of analysis, combining was necessary to avoid small cells: 1 and 2 together, and 5 or more.

Table 6-9 Hayling results (combined)

| Hayling Total<br>Row Labels | Score     |          |           |           |          |           |          |          | Grand Total |
|-----------------------------|-----------|----------|-----------|-----------|----------|-----------|----------|----------|-------------|
|                             | 1         | 2        | 3         | 4         | 5        | 6         | 7        | 8        |             |
| FT                          | 7         | 3        | 11        | 5         | 1        | 4         |          |          | 31          |
| HT                          | 9         | 1        | 9         | 8         |          | 8         |          | 1        | 36          |
| NSOC                        | 1         |          | 4         | 6         | 2        | 14        | 3        | 1        | 31          |
| <b>Grand Total</b>          | <b>17</b> | <b>4</b> | <b>24</b> | <b>19</b> | <b>3</b> | <b>26</b> | <b>3</b> | <b>2</b> | <b>98</b>   |

A chi-square test of homogeneity showed that the groups were significantly different on Hayling total score ( $\chi^2 = 24.57$ , d.f. = 6,  $p < 0.001$ ). Furthermore, NSOC offenders provided significantly different score patterns from the combined FT and HT sex offender groups ( $\chi^2 = 22.88$ , d.f. = 3,  $p < 0.001$ ). A subsequent chi-square test demonstrated that the score patterns of FT and HT sex offenders were not significantly different ( $\chi^2 = 1.69$ , d.f. = 3,  $p = 0.640$ ).

#### 6.4.2.1.2 Hayling category A and B errors

As illustrated in Figure 6-2, Log-linear modelling revealed that FT and HT sex offenders committed significantly more Category A errors than NSOC offenders ( $p < 0.001$ ). The sex offender groups did not significantly differ from each other in Category A errors ( $p = 0.078$ ). The same pattern was evident for Category B errors with the sex offenders committing significantly more Category B errors than NSOC offenders ( $p = 0.004$ ). The sex offender groups did not significantly differ from each other in Category B errors ( $p = 0.580$ ).

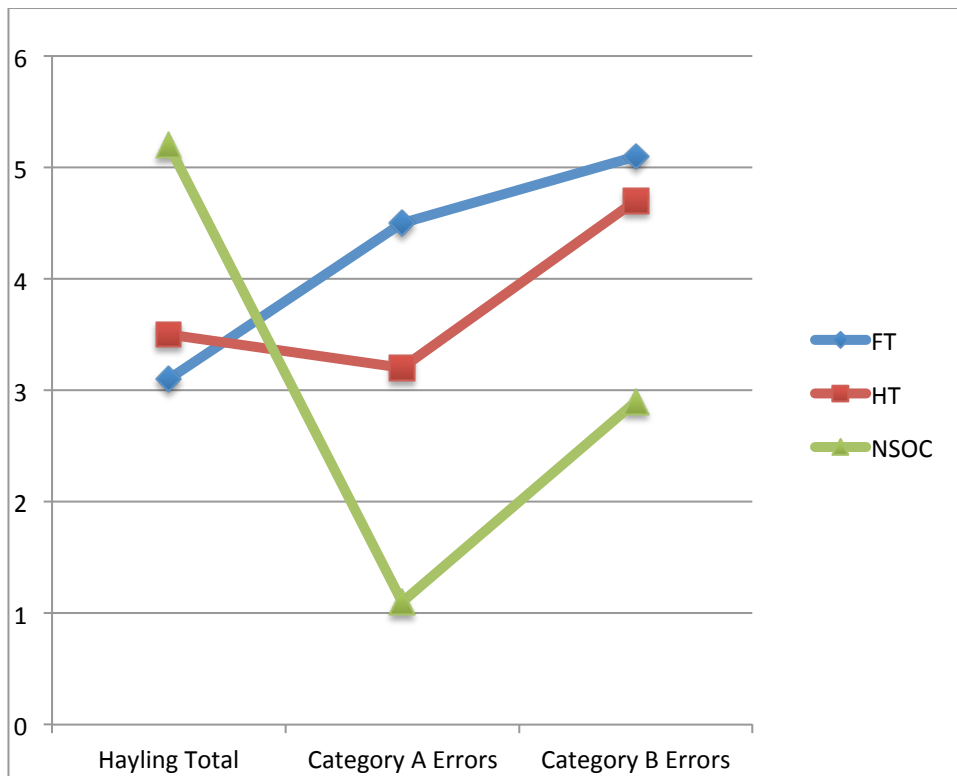


Figure 6-2 Mean Hayling Total score and mean Category A and B errors

#### 6.4.2.1.3 Hayling Impairment

The Hayling impairment score in this study was defined as a score of 3 or less. As Table 6-8 and Figure 6-3 show, 68% of FT sex offenders, more than half of HT sex offenders, and 16% of NSOC offenders were impaired on the Hayling. The sex offender groups demonstrated a significantly higher rate of Hayling impairment than NSOC offenders, FT ( $p = 0.016$ ) and HT ( $p = 0.002$ ) respectively. The sex offender groups did not significantly differ from each other ( $p = 0.254$ ).

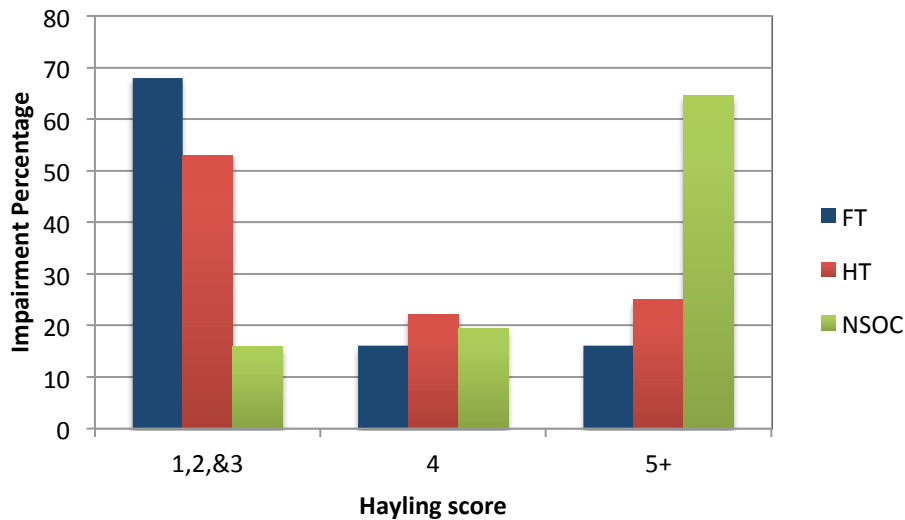


Figure 6-3 Hayling impairment results

As Figure 6-3 illustrates, 65% of NSOC offenders provided a Hayling Total score of 5 or more and therefore differentiated themselves from the two groups of sex offenders.

The results indicate a partial support for my first hypothesis. FT sex offenders committed significantly more category A and B errors than NSOC offenders; however, did not differ from HT sex offenders. However, there was statistical evidence for my second hypothesis (i.e., that sex offenders would commit significantly more category A and B errors than NSOC offenders).

The pattern of results on the Hayling suggests that, overall; sex offenders demonstrate deficits in response initiation and suppression, which are valid indices of poorer executive function or, in extreme cases, significant executive dysfunction.

#### 6.4.2.2 Verbal fluency - The FAS

Verbal fluency tests are routinely used to assess executive dysfunction in patients with frontal lobe damage. Based on the literature reviewed, sex offenders demonstrate difficulties in verbal learning and verbal fluency. I therefore predicted that:

1. FT sex offenders would produce significantly fewer words than NSOC offenders
2. The FT and HT sex offenders would not significantly differ in words produced
3. The sex offender groups would produce fewer words than NSOC offenders

##### 6.4.2.2.1 FAS total

Log-linear modelling was used to analyse group differences across groups. As Table 6-10 shows, NSOC offenders produced significantly more words than FT sex offenders ( $p < 0.001$ ).

Table 6-10 FAS results by group

|                 | <b>FT</b><br><b>M (SD), %</b><br><b>n=31</b> | <b>HT</b><br><b>M (SD), %</b><br><b>n=34</b> | <b>NSOC</b><br><b>M (SD), %</b><br><b>n=32</b> | <b>p</b>   |
|-----------------|--|--|--|------------|
| FAS Total score | 31.9 (13.2)                                  | 37.4 (12.3)                                  | 43.9 (10.5)                                    | < 0.001*** |
| FAS Impairment  | 6 (19%)                                      | 2 (6%)                                       | 4 (13%)  | 0.168      |

\*\*\* $p < 0.001$



As Table 6-11 illustrates, HT sex offenders also produced significantly more words than FT sex offenders across all words (i.e., F, A, and S words). HT and NSOC offenders did not differ in all word types (see also Figure 6-4).

Table 6-11 FAS p values (group contrasts)

|              | F words | A words | S words |
|--------------|---------|---------|---------|
| FT vs. HT    | 0.044   | 0.028   | 0.045   |
| FT vs. NSOC  | < 0.001 | < 0.001 | < 0.001 |
| HT vs. NSCOC | 0.120   | 0.056   | 0.063   |

#### 6.4.2.2.2 FAS Impairment

FAS impairment was assessed by comparing the scores of offenders with age and education normative data provided by Tombaugh et al. (1999). Impairment was analysed using logistic regression, as it is a binary variate. There were no significant differences among the groups in the probability of impairment ( $p = 0.168$ ).

The hypotheses were partially supported. The FT sex offenders produced significantly fewer words than NSOC offenders. However, the HT sex offenders unexpectedly produced significantly more words than FT sex offenders. In addition, the HT sex offenders did not differ from NSOC offenders in the amount of words produced and therefore the third hypothesis was not supported.

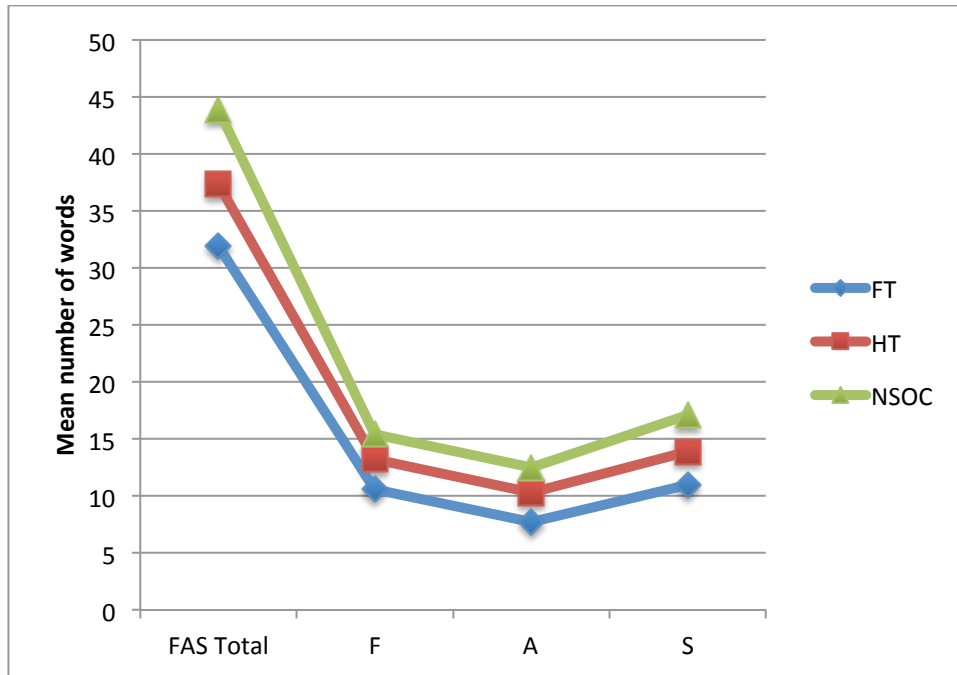


Figure 6-4 FAS Total and Individual F, A, S words

The performance of FT sex offenders in comparison to the other two groups suggests that they have difficulty generating words, which has been found to be a frontal lobe function (Davidson et al., 2008; Henry and Crawford, 2004; Robinson et al., 2012a; Schwartz and Baldo, 2001; Stuss et al., 1998), therefore, the performance of FT sex offenders is highly indicative of poor executive function and frontal lobe pathology.

#### 6.4.2.3 The Iowa Gambling Task (IGT)

This study investigated the decision-making skills of offenders by using the IGT. The IGT is used in the detection of decision making impairment in patients with damage

to the ventromedial prefrontal cortex (VMPFC) and dorsolateral prefrontal cortex who exhibit real-world decision making deficits (Bechara, 2007). Individuals with known VMPFC lesions show a preference for selecting more (disadvantageous) deck A and B cards (Bechara et al., 2000). My predictions for IGT performance were that:

1. FT sex offenders would select significantly more high-risk cards than HT and NSOC offenders, i.e. from decks A and B
2. The two sex offender groups would select significantly more cards than NSOC offenders from decks A and B

Log-linear modelling showed no significant difference among the groups in card choices ( $F_{6, 380} = 1.41, p = 0.210$ ). The three groups showed a similar pattern of advantageous or disadvantageous card selections (see Table 6-12).

Table 6-12 IGT results by group

|                 | <b>FT</b><br><b>M (SD), %</b><br><b>n=31</b> | <b>HT</b><br><b>M (SD), %</b><br><b>n=35</b> | <b>NSOC</b><br><b>M (SD), %</b><br><b>n=32</b> |
|-----------------|--|--|--|
| IGT Net Total   | 3.1 (22.6)                                   | 7.6 (20.9)                                   | 14.1 (25.5)                                    |
| Deck A          | 19.3 (6.4)                                   | 19.5 (5.4)                                   | 17.7 (6.9)                                     |
| Deck B          | 29.2 (8.3)                                   | 27.8 (9.0)                                   | 25.3 (8.9)                                     |
| Deck C          | 23.4 (9.2)                                   | 22.3 (7.9)                                   | 25.1 (10.8)                                    |
| Deck D          | 28.2 (6.9)                                   | 29.7 (11.9)                                  | 32.6 (13.6)                                    |
| IGT Total Money | -\$1091 (1001)                               | -\$999 (1031)                                | -\$734 (1275)                                  |
| IGT impairment  | 16 (52%)                                     | 13 (37%)                                     | 14 (44%)                                       |

#### **6.4.2.3.1 IGT Total Money and IGT impairment**

There were no group differences in total money won or lost ( $p = 0.452$ ) or impairment ( $p = 0.496$ ). As the groups did not differ on the IGT, my hypotheses were not supported. However, the groups demonstrated impairment rates of between 37% and 52% (43.9% for the sample) on the IGT. This finding indicates that some offenders demonstrate significant decision-making deficits.

#### **6.4.2.4 The Trail-Making Test**

The trail-making test has been used to detect frontal lobe deficits, problems with psychomotor speed, visual search and sequencing, attention, and impairments in set shifting. As stated earlier in the literature review, slower times on Part B has been found to be sensitive to frontal lobe pathology and is an index of executive function (Mitrushina et al., 2005). I therefore predicted:

1. On Part A, the groups would demonstrate no differences
2. On Part B, FT sex offenders would demonstrate significantly slower times than HT and NSOC offenders
3. On Part B, the sex offender groups would demonstrate significantly slower times than NSOC offenders

Analysis of trail-making parts A and B revealed heterogeneous variances across the three groups, thus violating the assumptions for ANOVA. A REML-based model was used to test for differences among group means for both parts A and B separately,

with group variances modelled heterogeneously. Table 6-13 shows the predicted means for the groups.

Table 6-13 Predicted means on the trail-making test

|        | FT                 | HT                 | NSOC              |
|--------|--------------------|--------------------|-------------------|
| Part A | 44.5 <sup>a</sup>  | 42.9 <sup>a</sup>  | 33.9 <sup>b</sup> |
| Part B | 122.9 <sup>a</sup> | 124.8 <sup>a</sup> | 86.8 <sup>b</sup> |

The three groups were significantly different for both part A ( $p = 0.009$ ) and part B ( $p < 0.001$ ). NSOC offenders provided significantly faster times in both Part A and B compared to the sex offender groups (the means are in seconds) (Table 6-14 and Figure 6-5). FT and HT sex offenders were not significantly different.

Table 6-14 Trail-making test results by group

|                   | FT                        | HT                        | NSOC                     | <i>p</i>   |
|-------------------|---------------------------|---------------------------|--------------------------|------------|
|                   | M (SD), %<br>n=30         | M (SD), %<br>n=31         | M (SD), %<br>n=31        |            |
| Part A            | 40.3 (22.1) <sup>a</sup>  | 42.9 (16.2) <sup>a</sup>  | 33.9 (10.0) <sup>b</sup> | 0.009**    |
| Part B            | 111.7 <sup>a</sup> (59.2) | 124.8 (45.9) <sup>a</sup> | 86.8 <sup>b</sup> (28.5) | < 0.001*** |
| Part B Impairment | 8 (27%) <sup>a</sup>      | 8 (26%) <sup>a</sup>      | 2 (6%) <sup>b</sup>      | 0.047*     |

\* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$

#### 6.4.2.4.1 Part B Impairment

Offenders that were impaired on the trail-making test Part B were scored 1, while offenders that were not impaired were scored 0; for example, there were 8 FT sex

offenders that scored 1 and therefore 8 (27%) FT sex offenders were regarded as being impaired (Table 6-14). The trail-making norms by Reynolds (2002) were used to determine whether a participant was impaired on Part B. A participant, for example, who takes more than 155 seconds to complete Part B falls below the 1<sup>st</sup> percentile and is therefore regarded as being impaired according to the norms from the Comprehensive Trail-making Test (CTMT) (Reynolds, 2002).

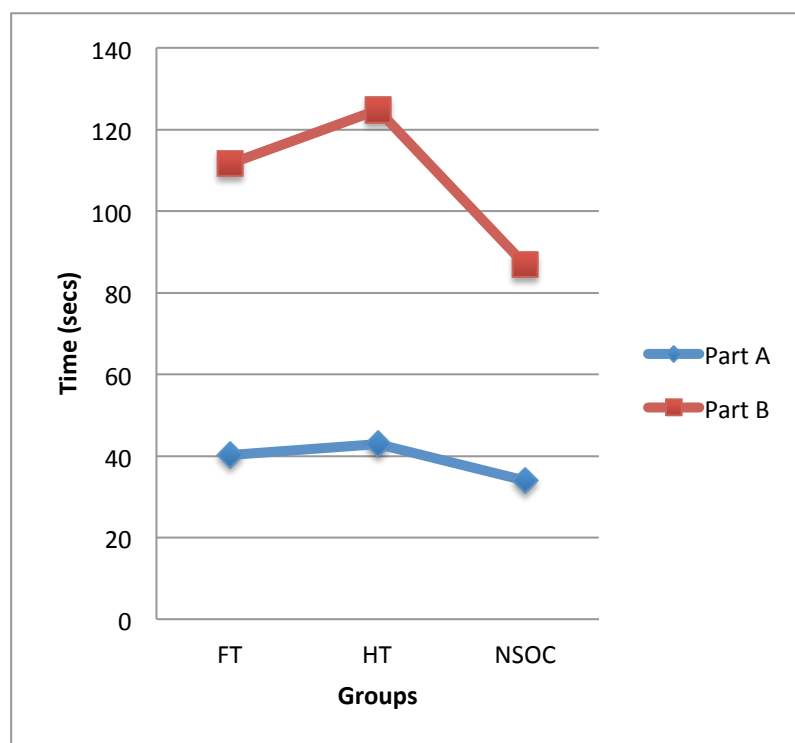


Figure 6-5 Trail-making test results

The groups did not differ in Part B Impairment using an overall chi-square logistic regression test ( $p = 0.052$ ). However, FT sex offenders were significantly more impaired than NSOC offenders ( $p = 0.047$ ), whereas FT and HT sex offenders were not significantly different ( $p = 0.939$ ). Specifically, the probability of Part B Impairment for an FT offender was estimated as 0.267 (the odds being 0.364). From the logistic

regression analysis, the odds ratio for the HT group was 0.965, resulting in an estimated probability of impairment of 0.258 (very similar to FT offenders). The effect for the NSOC offenders was quite different; the odds ratio for this group was 0.190, resulting in an estimated probability of Part B Impairment of only 0.065.

My hypotheses were partially supported. As NSOC offenders provided significantly faster times than FT and HT sex offenders on Part A, the first hypothesis that the groups would not significantly differ in Part A was not supported. The second hypothesis was partially supported as FT sex offenders provided slower times than NSOC offenders on Part B; however, not compared to HT sex offenders. There was support for the second hypothesis as the two sex offender groups demonstrated significantly slower times than NSOC offenders on Part B.

Overall the performance by sex offenders on Part B of the trail-making test provides evidence for poorer executive function compared to non-sex offender controls.

### **6.4.3 TEMPORAL LOBE MEASURES RESULTS**

#### **6.4.3.1 The Rey Complex Figure (RCF)**

The RCF has been shown to load on executive function and has been commonly used to assess executive function in older adults, who demonstrate planning and organizational deficits. Individuals that use disorganized strategies to copy the RCF have been shown to have difficulty recalling the figure after a delay. I therefore hypothesised that:

1. FT sex offenders would demonstrate poorer performance than HT and NSOC offenders on the RCF (i.e., producing lower scores on the RCF copy and immediate recall trials)
2. A similar pattern was expected between the two sex offender groups compared to the NSOC offenders

Table 6-15 Rey Complex Figure results

|                             | FT<br>M (SD)<br>n=31    | HT<br>M (SD)<br>n=33    | NSOC<br>M (SD)<br>n=32  | p      |
|-----------------------------|-------------------------|-------------------------|-------------------------|--------|
| Copy                        | 30.9 (7.6) <sup>a</sup> | 31.1 (4.4) <sup>a</sup> | 34.3 (2.5) <sup>b</sup> | 0.014* |
| Immediate Recall            | 16.1 (7.5) <sup>a</sup> | 13.9 (5.3) <sup>a</sup> | 18.5 (6.8) <sup>b</sup> | 0.014* |
| Copy Impairment             | 7 (23%)                 | 8 (24%)                 | 2 (6%)                  | 0.088  |
| Immediate recall Impairment | 5 (16%)                 | 4 (12%)                 | 3 (9%)                  | 0.715  |

\*p < 0.05

RCF copy and immediate recall were analysed by MANOVA and canonical variate analysis. As Table 6-15 demonstrates, the set of means across the groups showed significant differences (p = 0.014).

NSOC offenders performed significantly better on RCF Copy and Immediate Recall compared to FT and HT sex offenders (see Figure 6-6). FT and HT sex offenders did not differ.

#### 6.4.3.1.1 RCF copy and immediate recall impairment

RCF copy and immediate recall impairment was regarded as scores falling in the 1<sup>st</sup> percentile or lower according to the RCF norms by Meyers and Meyers (1995). The



groups did not differ on either copy ( $p = 0.088$ ) or immediate recall impairment ( $p = 0.715$ ).

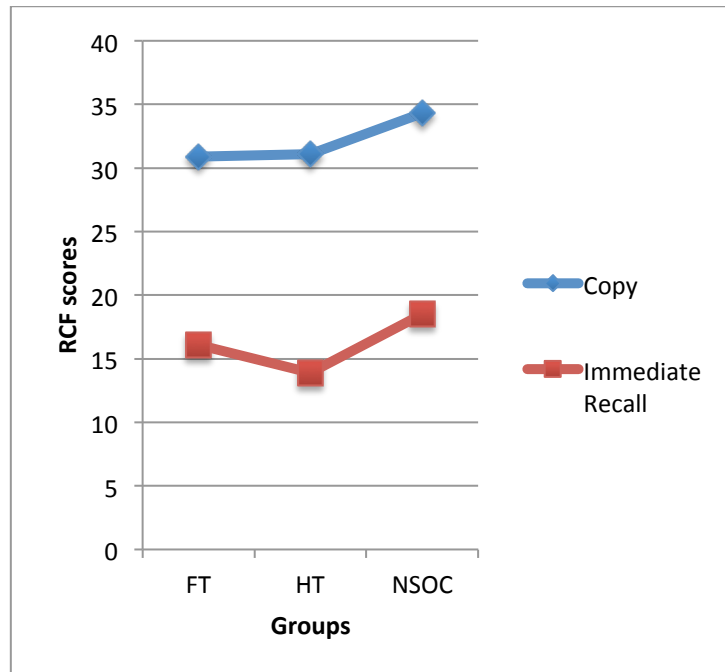


Figure 6-6 Copy and Immediate Recall results

The hypotheses were partially supported. There was partial support for my first hypothesis that FT sex offenders would produce lower copy and immediate recall RCF scores than HT and NSOC, as FT sex offenders produced significantly lower (RCF copy and immediate recall) scores than NSOC offenders; however, the FT and HT sex offenders did not differ. The second hypothesis was supported, as the sex offender groups produced significantly lower RCF copy and immediate recall scores compared to NSOC offenders.

### 6.4.3.2 The Rey Auditory Verbal Learning Test (RAVLT)

The RAVLT assesses immediate memory span, new learning, susceptibility to interference, and recognition memory. Total learning on the RAVLT has been found to be deficient in many clinical populations, including those with traumatic brain injury, Alzheimer's disease, bvFTD and mild cognitive impairment. Therefore I hypothesised that:

1. FT sex offenders would recall and recognize fewer words than HT and NSOC offenders
2. A similar pattern was expected between the two sex offender groups compared to NSOC offenders

A MANOVA of RAVLT Total and Recognition scores revealed that the difference in the set of means among the groups was significant ( $p = 0.023$ ) (see Table 6-16).

Table 6-16 RAVLT Total and Recognition results by group

|                   | <b>FT</b><br><b>M (SD)</b><br><b>n=32</b> | <b>HT</b><br><b>M (SD)</b><br><b>n=36</b> | <b>NSOC</b><br><b>M (SD)</b><br><b>n=32</b> | <b>p</b> |
|-------------------|---|---|---|----------|
| RAVLT Total       | 39.1 (11.3) <sup>a</sup>                  | 36.7 (7.4) <sup>a</sup>                   | 43.7 (8.6) <sup>b</sup>                     | 0.023*   |
| RAVLT Recognition | 12.8 (2.4) <sup>a</sup>                   | 12.7 (2.7) <sup>a</sup>                   | 14.1 (1.0) <sup>b</sup>                     | 0.023*   |

\* $p < 0.05$

A subsequent canonical variate analysis demonstrated that the first canonical variate was enough to discriminate between the groups; explaining 94% of the variation in

group means (noting a p value of  $p = 0.026$  for requiring only the first canonical variate versus one of  $p = 0.421$  for also requiring the second canonical variate, showing that the first canonical variate is sufficient).

A REML analysis of these scores; however, showed a high level of significance among group means ( $p = 0.005$ ), the group means being:

| <b>FT</b> | <b>HT</b> | <b>NSOC</b> |
|-----------|-----------|-------------|
| -0.1321   | -0.3286   | 0.4669      |

In conclusion, the NSOC offenders generated significantly more words (from the RAVLT) than FT and HT offenders (see Figure 6-7). The sex offender groups were not significantly different from each other. The differences are based on the canonical variate, which combines RAVLT total and recognition scores in a 3:1 ratio; that is, the groups differ on a variable that weighs RAVLT recognition scores substantially more than RAVLT total scores.

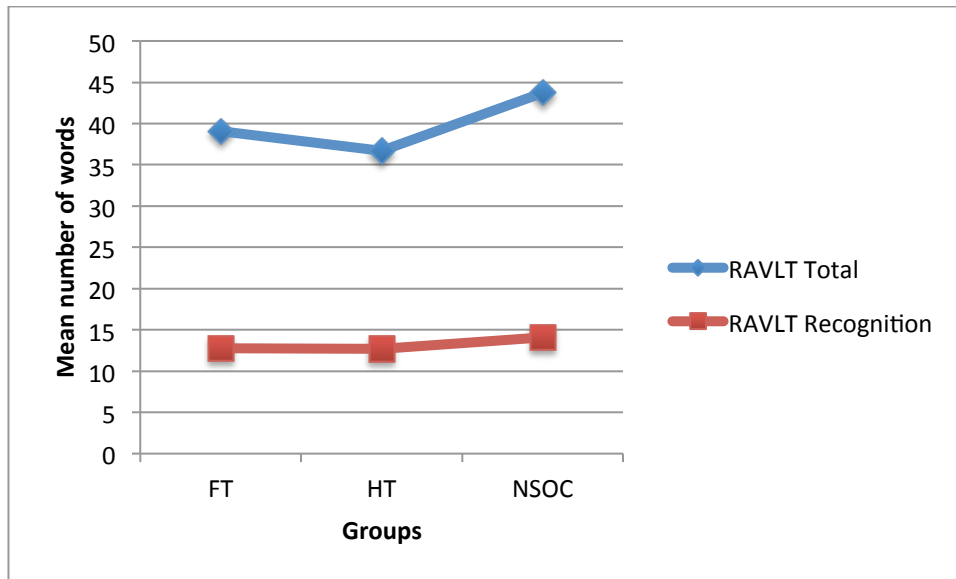


Figure 6-7 RAVLT and Total Recognition scores

FT sex offenders generated and recognized fewer words than NSOC offenders therefore partially confirming my prediction. However, FT and HT sex offenders did not differ. There was support for the second hypothesis as NSOC offenders generated significantly and recognised more words than both groups of sex offenders.

#### 6.4.4 SOCIAL COGNITION RESULTS

Three studies have found that sex offenders perform poorly on facial recognition of emotion (Gery et al., 2009; Oliver et al., 2009; Suchy et al., 2009b). Similarly FTD patients demonstrate impairment on facial recognition tasks, showing deficits in ability to identify facial expressions of happiness, sadness, disgust, fear, surprise

and anger. Patients with orbitofrontal prefrontal damage also demonstrate difficulty in processing negative expression of emotion.

Therefore, on a proxy measure of social cognition, the Facial Expression of Emotion: Stimuli and Tests (FEEST), I predicted that:

1. FT sex offenders would demonstrate greater deficits in the recognition of human emotion such as anger, disgust, surprise and fear, compared to HT and NSOC offenders
2. A similar pattern was expected between the two groups of sex offenders compared to NSOC offenders

#### **6.4.4.1 The Facial Expression of Emotion: Stimuli and Tests (FEEST)**

The emotion happiness was recognized more accurately than other expressions and was rarely confused with other expressions. However, on average, all three groups performed poorly on identification of negative emotions, including anger, disgust, fear and sadness (see Table 6-17).

Table 6-17 FEEST results by group

|                  | FT<br>M (SD)<br>n=28 | HT<br>M (SD)<br>n=24 | NSOC<br>M (SD)<br>n=31 | p     |
|------------------|----------------------|----------------------|------------------------|-------|
| FEEST Total      | 44.8 (6.7)           | 42.9 (5.7)           | 43.9 (6.3)             | 0.632 |
| Anger            | 6.9 (2.3)            | 6.7 (1.5)            | 6.5 (1.8)              |       |
| Disgust          | 7.1 (2.2)            | 6.6 (2.4)            | 7.3 (2.0)              |       |
| Fear             | 5.0 (2.3)            | 4.3 (2.2)            | 5.4 (2.7)              |       |
| Happiness        | 9.7 (0.8)            | 9.7 (0.7)            | 9.4 (1.1)              |       |
| Sadness          | 7.2 (2.2)            | 7.1 (1.8)            | 7.3 (1.9)              |       |
| Surprise         | 8.9 (1.3)            | 8.5 (1.2)            | 8.4 (1.6)              |       |
| FEEST Impairment | 17 (61%)             | 14 (58%)             | 16 (52%)               | 0.765 |

The six emotions (anger, disgust, fear, happiness, sadness and surprise) were rated on a scale from 1 to 10 and, strictly speaking, should not be analysed by MANOVA. However, a MANOVA and subsequent canonical variate analysis was deemed useful for exploring discrimination only. Any p value, therefore, should be taken as indicative only. MANOVA provided such a large p value ( $p = 0.632$ ) that it is safe to conclude that there appears to be little separation among the groups on facial recognition of emotion. In addition, while a canonical variate analysis indicated that the first canonical score explained 80% of the variation among group means, there was so little variation that no single component separated the groups.

#### 6.4.4.1.1 FEEST Impairment

Although the groups did not significantly differ ( $p = 0.765$ ), the three groups showed high FEEST impairment rates, between 52% and 61%, (56.6% for the sample), when compared to FEEST age-stratified norms.

The hypothesis that FT sex offenders would demonstrate greater deficits in the recognition of human emotion compared to HT and NSOC offenders by showing lower scores on facial recognition of emotion was therefore not supported. In addition, overall, sex offenders did not differ in facial recognition scores compared to NSOC offenders.

Table 6-18 shows a summary of the study's neuropsychological results.

Table 6-18 Summary table of neuropsychological results

| Test                        | Statistical difference | Comparisons                   | p       |
|-----------------------------|------------------------|-------------------------------|---------|
| ACE-R total                 | YES                    | NSOC > FT, HT                 | < 0.05  |
| DASS                        | NO                     | FT=HT=NSOC                    | ns      |
| FSIQ                        | NO                     | FT=HT=NSOC                    | ns      |
| VIQ                         | NO                     | FT=HT=NSOC                    | ns      |
| PIQ                         | NO                     | FT=HT=NSOC                    | ns      |
| Vocabulary                  | NO                     | FT=HT=NSOC                    | ns      |
| Block design                | NO                     | FT=HT=NSOC                    | ns      |
| Similarities                | NO                     | FT=HT=NSOC                    | ns      |
| Matrix Reasoning            | NO                     | FT=HT=NSOC                    | ns      |
| Hayling Total               | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.001 |
| Category A errors           | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.001 |
| Category B errors           | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.01  |
| Hayling Impairment          | YES                    | FT > NSOC<br>FT=HT<br>NSOC=HT | < 0.001 |
| FAS Total                   | YES                    | NSOC, HT > FT<br>NSOC=HT      | < 0.001 |
| FAS Total errors            | NO                     | FT=HT=NSOC                    | ns      |
| FAS Impairment              | NO                     | FT=HT=NSOC                    | ns      |
| Iowa Gambling Task          | NO                     | FT=HT=NSOC                    | ns      |
| IGT Net Total               |                        |                               |         |
| Deck A                      | NO                     | FT=HT=NSOC                    | ns      |
| Deck B                      | NO                     | FT=HT=NSOC                    | ns      |
| Deck C                      | NO                     | FT=HT=NSOC                    | ns      |
| Deck D                      | NO                     | FT=HT=NSOC                    | ns      |
| IGT Total Money             | NO                     | FT=HT=NSOC                    | ns      |
| IGT impairment              | NO                     | FT=HT=NSOC                    | ns      |
| TMT Part A                  | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.01  |
| TMT Part B                  | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.001 |
| TMT Part B impairment       | YES                    | FT > NSOC<br>FT=HT            | < 0.05  |
| RCF Copy                    | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.05  |
| RCF Immediate recall        | YES                    | NSOC > FT, HT<br>FT=HT        | < 0.05  |
| Copy impairment             | NO                     | FT=HT=NSOC                    | ns      |
| Immediate recall impairment | NO                     | FT=HT=NSOC                    | ns      |
| RAVLT total                 | YES                    | NSOC > FT, HT                 | < 0.05  |



|                   |     |               |        |
|-------------------|-----|---------------|--------|
|                   |     | FT=HT         |        |
| RAVLT recognition | YES | NSOC > FT, HT | < 0.05 |
|                   |     | FT=HT         |        |
| FEEST total       | NO  | FT=HT=NSOC    | ns     |
| Anger             | NO  | FT=HT=NSOC    | ns     |
| Disgust           | NO  | FT=HT=NSOC    | ns     |
| Fear              | NO  | FT=HT=NSOC    | ns     |
| Happiness         | NO  | FT=HT=NSOC    | ns     |
| Sadness           | NO  | FT=HT=NSOC    | ns     |
| Surprise          | NO  | FT=HT=NSOC    | ns     |
| FEEST impairment  | NO  | FT=HT=NSOC    | ns     |

## 7 DISCUSSION

### 7.1 Review of aims

The aim of this study was to investigate the neuropsychological function of elderly first-time (FT) sex offenders using a battery of neuropsychological tests, which has been validated in the assessment of frontotemporal dementia (FTD). This study focused on the distinct possibility that FT sex offenders could appear cognitively intact, even demonstrating normal performance on standard neuropsychological batteries, yet their behaviour was clinically inconsistent with prior functioning.

A secondary aim of this study was to investigate a number of socio-demographic variables, such as age, cardiovascular function, head injury, endocrine disorders, substance abuse, and depression; and their association with neurocognitive functioning and sexual offending.

Lastly, this study investigated whether the psychometric results of FT sex offenders resembled those found in patients with FTD.

### 7.2 Synopsis of demographic findings

The medical, psychiatric, and substance use problems of FT sex offenders were comparable to other studies of older offenders (Colsher et al., 1992; Fazel et al., 2001; Kakoullis et al., 2010).

### **7.2.1 Alcohol problems**

Thirty-nine per cent of offenders had a history of alcohol abuse. Moreover, alcohol was the drug of choice of sex offenders, including one third of FT sex offenders, which is consistent with the alcohol profiles of sex offenders in previous studies (for e.g., Langevin and Curnoe, 2008b). Alcohol abuse, dependence, or acute intoxication has been associated with sexual offending (Abracen et al., 2000; Hamdi and Knight, 2012; Johnson and Knight, 2000).

The association of chronic and excessive consumption of alcohol and brain damage has been established, with structural changes in the regions important to neurocognitive function (Matsumoto and Matsumoto, 2008). Neuroimaging, physiological, neuropathological, and neuropsychological studies of alcohol-dependent individuals show that the frontal lobes, limbic system, and cerebellum are vulnerable to damage and dysfunction (Oscar-Berman and Marinkovic, 2007). In addition, excessive alcohol use causes long-term disruption in executive function (Fernandez-Serrano et al., 2010; Hartley et al., 2004; Noel et al., 2001; Ratti et al., 2002). It is therefore plausible that FT sex offenders, who abuse alcohol and develop lower or higher-order executive dysfunction, are at an increased risk for sexual offending.

### **7.2.2 Depression**

Thirty-six per cent of the sample reported a history of depression, including more than 40% of FT sex offenders, which is consistent with the rate of depression in other offender studies (de Carvalho et al., 2013; Fazel and Danesh, 2002).

Given that depression is associated with poor neuropsychological function (Douglas and Porter, 2009; Shenal et al., 2003), including attention (Zakzanis et al., 1999), executive function (Harvey et al., 2004; Porter et al., 2003), memory (Fossati et al., 1999), and slow processing speed (Bielak et al., 2011), some of the poor cognitive results by FT sex offenders could be attributed to the effects of depression.

### **7.2.3 Head injury**

The rate of traumatic brain/head injury in FT sex offenders was 66%, which was comparable to other offender studies (Perkes et al., 2011; Schofield et al., 2006; Shiroma et al., 2012; Williams et al., 2010). Although the majority of individuals who sustain mild TBI, such as concussion, seemingly “recover” without neuroimaging signs or neuropsychological sequelae (Bigler, 2013), some individuals experience cognitive impairment for many years following the original injury (Hoofien et al., 2001; Senathi-Raja et al., 2010), with the common problems being residual deficits in cognitive speed, visuo-construction, attention, and memory (Millis et al., 2001).

Recent fMRI findings also demonstrate that although, neuropsychological tests may not detect deficits or abnormality on assessment, there is imaging evidence that memory/attentional networks are in fact damaged (Bigler, 2013).

It is therefore distinctly possible that, despite the absence of statistical significant differences between the offender groups, head injury may have played a prominent role in the cognitive results obtained by FT sex offenders.

#### **7.2.4 Hypertension**

The rate of hypertension in FT sex offenders was 72%, which was significantly higher than non-sex offenders. It is likely that the high rates of hypertension in FT sex offenders may have contributed to poorer cognitive function, as hypertension is a risk factor for cognitive decline (Raz et al., 2003; Seux et al., 1998; Wiederkehr et al., 2009).

### **7.3 Sex offences committed by FT and HT sex offenders**

FT sex offenders were less likely to commit sexual offences against males and extrafamilial children. Although more than 84% of sexual offences were perpetrated against children, only 29% of FT sex offenders admitted to a paedophilic interest.

A degree of denial is commonly observed in sex offenders ranging from absolute denial of the facts to minimization or justification of the offence, to distorted attributions of responsibility (Levenson, 2011; Levenson and Macgowan, 2004). It is

possible that a proportion of FT sex offenders continue to deny paedophilic interests for a number of reasons. These reasons include: embarrassment of their sexual interest in children, fear of attracting further criminal charges or more severe sentences, further rejection by family and friends, and/or placement with other paedophiles in sex offenders programs.

The other possibility for the denial of a paedophilic disorder is that FT sex offenders are not primarily sexually aroused to children. There could be three explanations: (a) FT sex offenders are not preferentially paedophilic but they commit child sexual offences when the opportunity arises; (b) FT sex offenders commit sexual offences due to neurocognitive and neuropathologic aetiologies; or (c) a combination of the two.

#### **7.4 Review of hypotheses**

This study had *three* main hypotheses:

- 1) First-time sex offenders would demonstrate greater neuropsychological deficits or impairment compared to historical sex offenders and non-sex offenders.
- 2) Compared to non-sex offenders, the two sex offender groups would demonstrate greater neuropsychological deficits or impairment.
- 3) First-time sex offenders would demonstrate higher rates of impairment in social cognition compared to historical sex offenders and non-sex offenders.

## **7.4.1 HYPOTHESES 1 AND 2**

### **7.4.1.1 Dementia screening**

The hypothesis that FT sex offenders would demonstrate higher rates of dementia, as evidenced by significantly lower ACE-R scores, was partially supported. FT sex offenders produced significantly lower ACE-R scores than NSOC offenders; but they did not differ from HT sex offenders. Both sex offender groups provided significantly lower ACE-R scores than non-sex offenders; therefore, there is some support for my second hypothesis of a possible higher rate of dementia among sex offenders.

Significantly, 25% of FT sex offenders provided below cut-off scores for dementia, which is a relatively high rate of dementia for such a small sample, in comparison to the 13% estimated rate of dementia in US prisons (Maschi et al., 2011). As a result of this dementia rate, it is plausible that the results in cognitive domains related to memory, new learning and executive function can be attributed to possible dementia in this group of FT sex offenders. Further conclusions about this study's rate of dementia, however, are limited by the required comprehensive assessment in the diagnosis of dementia.

### **7.4.1.2 Level of Intelligence**

Overall, the current study found no support for low IQ in sex offenders, previously reported (Blanchard et al., 1999; Cantor et al., 2004; Cantor et al., 2005a; Guay et

al., 2005; Langevin et al., 1988; Langevin et al., 1989b). Only 5 (16%) FT sex offenders provided IQ scores less than 90 points and only 2 (6%) had an IQ of less than 70. In addition the FSIQ mean was more than 106 IQ points (median FSIQ = 115) in FT sex offenders, with 13 (40%) obtaining an IQ higher than 115. Therefore, there was limited support for low IQ as being the driver for poor function in other cognitive domains. However, the Wechsler Abbreviated Scale of Intelligence (WASI) can over-estimate IQ by several points in comparison to the longer versions of the Wechsler scales (Axelrod, 2002). Notwithstanding, it is unlikely that the score overestimates of the WASI can entirely explain the non-significant results between groups, as the scores for all three groups would have been equally inflated.

#### **7.4.1.3 Executive function results**

I predicted that FT sex offenders would perform significantly worse than NSOC offenders on a range of executive function tests. This hypothesis took into consideration the number of studies reporting poor executive function in sex offenders (Cohen et al., 2010; Eastvold et al., 2011; Joyal et al., 2014; Schiffer and Vonlaufen, 2011; Suchy et al., 2009a; Veneziano et al., 2004).

I also hypothesized that FT sex offenders would demonstrate poorer performance in executive function due to possible prefrontal damage. As FT sex offenders reported much lower rates of paedophilic interest than HT sex offenders, I explored whether FT sex offenders demonstrate greater deficits in executive function than HT sex offenders, who reported a higher rate of paedophilic interest.



*The executive function results are individually reported and discussed below:*

The Hayling results of the present study suggest that sex offenders experience response initiation and suppression, suggestive of left prefrontal pathology (Collette et al., 2001; Nathaniel-James et al., 1997). Furthermore, the Hayling results in the present study resembled those patients with bvFTD (Hornberger et al., 2010b), which, perhaps, highlights the similarities of FT sex offenders and bvFTD patients in behaviour, executive function and decision-making.

Using a phonemic verbal fluency measure (the FAS); there was partial support for my hypotheses due to the inconsistent results provided by sex offenders. HT sex offenders, unexpectedly, performed better than FT sex offenders. Overall, the verbal fluency results of FT sex offenders is suggestive of prefrontal cortex damage (Baldo et al., 2001; Brannen et al., 2001; Davidson et al., 2008; Gouveia et al., 2007; Henry and Crawford, 2004; Robinson et al., 2012a; Schwartz and Baldo, 2001; Stuss et al., 1998). Therefore, the predicted verbal fluency results of FT sex offenders suggest a weakness in speed of processing, verbal skills, and word retrieval. This finding is in line with previous studies suggesting poorer verbal fluency in non-paedophilic offenders compared to paedophilic offenders (e.g., Schiffer and Vonlaufen, 2011).

Although there was little evidence supporting my hypothesis on a decision-making task, as the groups did not significantly differ on the Iowa Gambling Task (IGT), the three offender groups demonstrated high rates of IGT impairment in comparison to normative data. On this evidence, the association between poor decision-making and offending, whether it is sexual or non-sexual offending, appears strong. More

than 50% of FT sex offenders were impaired on the IGT, suggesting that poor decision-making could contribute to sexual offending in these IGT impaired individuals. The IGT results indicate a degree of risk taking in sex offenders, which may be generalizable to “real life” decision-making.

In addition, the IGT performance by FT sex offenders may suggest the presence of ventromedial prefrontal (VMPFC) pathology, as the IGT has been found to be sensitive to VMPFC lesions (Bechara et al., 1994; Bechara et al., 2000; Tranel et al., 2002). Alternatively, the IGT results of FT sex offenders are suggestive of prefrontal damage found in patients with orbitofrontal (OFC) damage, as these patients display real-life decision-making deficits, despite remaining unimpaired intellectually (Clark and Manes, 2004; Manes et al., 2002; Zald and Andreotti, 2010), which was the case in FT sex offenders. Furthermore, the possibility of OFC damage in FT sex offenders supports studies of OFC damage in sex offenders (Dressing et al., 2001; Schiffer et al., 2008; Schiffer and Vonlaufen, 2011; Spinella et al., 2006). Although definitive conclusions regarding structural damage are beyond this study, the data suggests the presence of prefrontal damage in some sex offenders.

My hypotheses related to the Trail-Making Test were partially supported. The unexpected better performance on Part A (TMT-A) by NSOC offenders in comparison to FT and HT sex offenders suggests that the poor performance by sex offenders can be attributed to slower psychomotor speed and poor attention. It is unlikely that age was a factor in performance, as TMT-A is not usually affected by age (Rasmusson et al., 1998). Predictably, FT sex offenders were slower on TMT-B compared to NSOC offenders, which indicates poorer executive function in sex offenders, as TMT-B is

sensitive to impulsivity and poor control of interference, indicative of poorer executive function (Lezak et al., 2004) and sensitive to frontal lobe pathology (Arbuthnott and Frank, 2000; Davidson et al., 2008; Gouveia et al., 2007; Misdraji and Gass, 2010; Sanchez-Cubillo et al., 2009; Terada et al., 2013).

Although, there is an association between slower TMT-B performance and age (Ashendorf et al., 2008; Coubard et al., 2011; May and Hasher, 1998; Oosterman et al., 2010; Rasmusson et al., 1998), this does not fully explain the poorer performance by sex offenders as the three groups consisted of older offenders. If an age effect alone were a factor, all three groups would have performed poorly on TMT-B.

Caution must be exercised in interpreting poor performance on TMT-B by sex offenders, as multiple cognitive functions are involved in TMT-B performance, i.e., attention, visual search, visual-spatial scanning, and speed (Crowe, 1998; Oosterman et al., 2010). Therefore decline in executive function by FT and HT sex offenders cannot be entirely inferred from poor TMT-B performance.

#### **7.4.1.4 Conclusions of executive function in FT sex offenders**

The results by FT sex offenders suggest either impairment or weaknesses in executive function, as they were outperformed on three (Hayling, FAS, and TMT-B) out of four executive function tests by non-sex offenders; and in one (FAS) by HT sex offenders. The executive function results, therefore, suggest that the deficits, weaknesses or perhaps impairment are widespread rather than discrete in FT sex offenders. In other words, the data demonstrates that if FT sex offenders are poor in

a specific executive function task, they are likely to be poor in another measure of executive function.

Given that FT sex offenders, as a group, reported much lower rates of paedophilic disorder, the better executive function results by HT sex offenders relative to FT sex offenders, on a measure of verbal fluency (FAS), supports the findings by Eastvold et al. (2011) where paedophilic offenders outperformed non-paedophilic offenders on executive function.

#### **7.4.1.5 Conclusions of executive function in sex offenders**

The NSOC offenders outperformed the two sex offender groups on three executive function tests (Hayling, FAS, and TMT-B), which suggest that sex offenders, relative to non-sex offenders, demonstrate impairment or weaknesses in a number of executive functions, suggesting that these deficits are multiple components of executive function.

As NSOC offenders outperformed the two sex offenders on most executive function tests, age was unlikely to be a major factor in poorer executive function performance of sex offenders. Therefore the decline in executive function in sex offenders was unlikely to be a product of age-related loss of fluid intelligence alone as suggested (e.g., Bielak et al., 2006), or slower processing speed (Fisk and Sharp, 2004; Salthouse et al., 2003). Nevertheless, it is possible that loss of fluid intelligence and slower processing speed might have influenced poorer executive function performance in some offenders.

#### **7.4.1.6 Temporal lobe function tests**

I predicted that FT sex offenders would demonstrate significant deficits on temporal function tests relative to HT and NSOC offenders; and a similar pattern was expected from the sex offender groups compared to NSOC offenders. There was partial support for my first hypothesis as FT sex offenders produced significantly lower scores on the Rey Complex Figure (RCF) copy and immediate recall trials compared to NSOC offenders; however, FT sex offenders did not differ from HT sex offenders.

My second prediction was supported as both sex offender groups performed poorly in comparison to NSOC offenders on both trials of the RCF. There was support for the hypotheses on the Rey Auditory Verbal Learning Test (RAVLT). The NSOC offenders outperformed FT sex offenders; however, FT and HT sex offenders did not differ. This RAVLT performance by sex offenders is in line with the findings by Deutsher (2004), who found that sex offenders outperformed non-offenders on the RAVLT.

#### **7.4.1.7 Conclusions of temporal lobe function in FT sex offenders**

FT sex offenders were outperformed by NSOC offenders on both tests of temporal lobe function, the RCF and RAVLT, suggesting that FT sex offenders demonstrate

deficits in visuo-spatial function, memory span, new learning, and recognition memory compared to non-sex offenders.

#### **7.4.1.8 Conclusions of temporal lobe function in sex offenders**

Overall, the results suggest that sex offenders demonstrate deficits in visuo-spatial function due to planning and organization deficits, as well as weaknesses in memory span, new learning, and recognition memory compared to non-sex offenders.

In addition, the RCF also elicits planning behaviour and has been regarded also as an index of executive function. This is primarily achieved by observing the participant's approach to copying the complex figure, with a haphazard, fragmented mode of response suggesting poor planning (Lezak et al., 2004). Therefore the results on the RCF also suggest greater impulsivity in sex offenders, thus affecting performance and suggesting that the executive function deficits of sex offenders are broad or multifactorial.

### **7.4.2 HYPOTHESIS 3**

#### **7.4.2.1 Social cognition results**

The groups did not significantly differ in the The Facial Expression of Emotion: Stimuli and Tests (FEEST), a proxy measure of social cognition. Therefore, my prediction that FT sex offenders would demonstrate significantly greater rates of

impairment in social cognition was not statistically supported.

Notwithstanding, the data indicates that the three groups demonstrated impairment rates between 52% and 61% on the FEEST when compared to normative data, with FT sex offenders producing the highest rate of FEEST impairment.

#### **7.4.2.2 Conclusions of social cognition in FT sex offenders**

As there were no significant differences between the groups in social cognition, the following conclusions relate to the overall impairment observed in sex offenders in comparison to FEEST normative data. These conclusions, therefore, are speculative and/or explorative.

The poor facial emotion recognition in offenders, at least in sex offenders, is likely to be explained by poor executive function. This interpretation is supportive of previous findings, which have concluded that deficits in facial emotion recognition is associated with poor executive function (MacPherson et al., 2002). Alternatively, the deficits shown in facial emotion recognition by FT sex offenders may be explained by poor temporal lobe function, as individuals who demonstrate deficits in social cognition demonstrate abnormal temporal lobe function (Bonora et al., 2011; Broicher et al., 2012). Therefore it is possible that FT sex offenders demonstrate damage to structures known to be associated with face processing or perception activated in occipitotemporal areas (Kanwisher et al., 1997; Pitcher et al., 2011; Rossion et al., 2003).

The current FEEST results suggest that a large proportion of FT sex offenders demonstrate deficits in facial emotion recognition, sharing a commonality with patients with behavioural FTD (bvFTD) (Diehl-Schmid et al., 2007; Fernandez-Duque and Black, 2005; Keane et al., 2002; Lough et al., 2006; Miller et al., 2012; Rascovsky et al., 2011; Rosen et al., 2004), and patients with VMPFC damage (Hornak et al., 1996; Mah et al., 2005).

In addition, the poor FEEST results by FT sex offenders are similar to those found in OFC patients, who demonstrate deficits in rapidly translating social information to alter behaviour (Rankin, 2007). However, the diagnosis of bvFTD or prefrontal cortex damage is beyond the scope of this study, as such diagnoses require further assessment and neuroimaging.

As the rate of head injury in FT sex offenders in this study was high, it is likely that TBI may explain the poor performance in facial emotion recognition, as TBI patients demonstrate poor facial emotion recognition performance (Bornhofen and McDonald, 2008a; Ietswaart et al., 2008), with particular difficulty in depicting sadness and anger (Green et al., 2004; Spikman et al., 2013).

A large proportion of sex offenders in this study committed sex offences against children. The present FEEST results by sex offenders is supportive of previous findings that child sex offenders have difficulty identifying facial signals of emotion (Gery et al., 2009; Oliver et al., 2009).



The FEEST results in the present study may also suggest, like previous studies, that sex offenders lack empathy. As sex offenders have been found to confuse fear and surprise (Gery et al., 2009; Hudson et al., 1993; Robinson et al., 2012b), it is possible that FT sex offenders experience deficits in the identification of distress in the “eyes” of their victims. It is possible that FT sex offenders make inaccurate assessment of reward or punishment, a key element in successful adherence to social norms. Moreover, these social deficits are also found in FTD patients (Neary et al., 1998; Rosen et al., 2002b; Snowden et al., 2002).

Another possible explanation for the deficits by the three offender groups in facial emotion recognition could be related to the effects of ageing, as older individuals have been found to be less adept than younger people in identifying facial emotion recognition (Horning et al., 2012; Keightley et al., 2007; Keightley et al., 2006b; Ruffman et al., 2008; Suzuki and Akiyama, 2013; Suzuki et al., 2007).

## **7.5 Limitations of this study**

The recruitment of elderly first-time sex offenders presents as the major limitation of this study. Those individuals not previously charged or convicted for a sexual offence, who continue to report that their first sexual offence occurred after the age of 50 but in reality were committed before that time, distort the data and its conclusions.

The present findings are limited by the veracity of information obtained from files from the Department of Corrective Services and Justice Health, which were partly

based on self-reports. Given the lack of confidentiality in custodial settings, many offenders may be fearful that the information provided may have negative social and legal repercussions. They are therefore likely to provide 'selective' information or none at all regarding other sexual offences committed.

Limited statistical power is an obvious limitation of this study. When non-significant differences were found, caution may be required because non-significance does not necessarily indicate an absence of group differences. The small sample size reduces the generalizability of the results. Also a larger sample of FT sex offenders could provide different cognitive results to those provided in this study.

Another limitation is the interpretation of results by historical sex offenders. The fact that historical sex offenders potentially committed their first sexual offence much earlier than the FT sex offenders is problematic. Interpreting current neuropsychological results and linking cognitive deficits to sexual offending can be unreliable. Therefore it is not possible to reliably conclude that historical sex offenders may have experienced cognitive deficits at the time of their first sexual offence. It is possible that these cognitive deficits were not present at the time of offending and they could have occurred much later due to a myriad of medical or psychological factors. In as much as possible, testing first-time sex offenders closer to the time of offence was attempted; however, this was not possible for the historical sex offenders.

The effect of time served in prison is an important factor due to the possible negative effects of incarceration on cognitive function, which has been previously reported

(Stojkovic, 2007; Yorston and Taylor, 2006). Apathy, physical and psychological trauma, stress and other psychological/psychiatric or emotional states caused by incarceration could have negatively affected performance.

The methodological design was another limitation of this study. A cross-sectional design can be limiting due to the effect of certain variables on performance. Fatigue, stress, and the effects of incarceration, can all affect neuropsychological performance. On the other hand, placement in the same environment for a long period and not having access to destabilizing factors, such as alcohol and drugs, can have a positive effect on cognitive performance.

As in some areas of neuropsychology, such as forensic and compensation cases, the validity of self-report is an obvious concern. Studies estimate that 19-66% of offenders malingering or exaggerate psychiatric symptoms (McDermott and Sokolov, 2009; Mittenberg et al., 2002). However, the majority of offenders in this study were post-sentence and therefore the “secondary gain” was not obvious. The reality is that this data was for research purposes and, therefore, assured confidentiality/anonymity may have reduced the risk of malingering; however, not totally ruled it out. Alternatively, the results could have been invalidated by poor effort from participants.

One of the many problems in neuropsychology, unlike medicine, is that, while a specific test may provide a definitive diagnosis (i.e., a positive biopsy that defines a specific type of cancer); given the nature of neurobehavioural disorders, neuropsychology simply does not have that specificity (Dodrill, 1997). Therefore the

deficits obtained by some offenders may mean that some individuals have experienced a degree of cognitive function or have weaknesses rather than a pathological disorder. This may be particularly pertinent in individuals over the age of 65.

The interpretation that poor neuropsychological function in older persons contributes to sexual offending has some limitations, especially as neuropsychological function is associated with age-related decline. As covered in Chapter 2, processing speed, working memory, problem solving and new learning decline (Anstey and Low, 2004; Ballesteros et al., 2009; Kramer et al., 2007; Small, 2001). Advancing age, for example, has been associated with poorer performance on the Hayling Test (Belleville et al., 2006; Bielak et al., 2006) and on tests of verbal and semantic fluency (Troyer et al., 1997) compared to younger participants. Therefore, some of the results obtained by FT sex offenders may cloud conclusions drawn from any association of cognitive deficits and sexual offending.

Although the current study suggest an association between poorer executive function and sex offending, current measures of “executive function” are limited by specificity, sensitivity, and construct validity, i.e., that a test actually measures what it purports to measure. The assessment of executive function in older adults has also received criticism, as executive function may be confounded from the effects of slower processing speed found in the elderly (Albinet et al., 2012).

The confounds generated by the medical problems of offenders make the interpretation of poor neurocognitive results as being causative of sexual offending

extremely difficult. Perhaps as Langevin and Curnoe (2008b) suggest, neuropsychological anomalies co-occur with sexual disorder rather than being causally related.

An obvious problem in sex offender studies is that participants are recruited from the judicial system, either through prison or community treatment programs. The neuropsychological function of those not charged or convicted will remain unknown, therefore, conclusions related to neuropsychological deficits are derived from those individuals that are charged and convicted.

## **7.6 Recommendations for future research**

### **7.6.1 Assessment of premorbid IQ**

This study did not use a measure of reading to estimate premorbid IQ, which, in retrospect, was an error in methodology. A measure of reading can provide useful information about premorbid intellectual function in individuals with suspected organic damage. Reading tests have been found to be a better indicator of premorbid ability based on the rationale that reading skills are resistant to brain insult and irregularly spelled words cannot be decoded phonologically; and therefore rely on previously acquired skills (Nelson and O'Connell, 1978). Future studies could rectify this by introducing a measure such as the National Reading Assessment Test (Nelson, 1991).

### **7.6.2 Control groups**

Non-sexual and non-violent offenders are more appropriate controls than those used in other studies. This study, therefore, supports the view by Joyal et al. (2007) that this group of offenders, NSOC, is more closely matched than antisocial, impulsive and violent men. It is therefore recommended in future studies that non-sexual, non-violent controls be used.

### **7.6.3 Reduce heterogeneity in sex offender samples**

The main methodological problem in sex offender studies has been the treatment of sex offenders as a homogeneous group (Flor-Henry, 1987; Langevin and Curnoe, 2008a; Langevin et al., 1988; Spinella et al., 2006; Young et al., 2010). Unfortunately, due to the small sample size available, this study analysed data from a heterogeneous group of FT sex offenders. Reducing the problem of heterogeneity in sex offender studies by grouping child sex offenders and adult offenders separately and comparing paedophilic child sex offenders with non-paedophilic child sex offenders, as suggested by Suchy et al., (2009a; 2009b), would improve future studies.

### **7.6.4 Development of better executive function tests**

The executive function measures remain problematic and more targeted and specific measures are needed. Specifically, reliable tests that approximate the real world can

be more useful in detecting higher-order executive impairment. Such tests will be clinically meaningful in the assessment of everyday impairment.

Given the multi-function and circuitry of the prefrontal cortex (see Rosenbloom et al., 2012), a single executive function measure is unlikely to provide specificity in isolation. Test development, when combined with advances in neuroimaging and neurophysiology, has the potential to dramatically increase our understanding of the orbitofrontal and ventromedial prefrontal cortices and its association with sexual offending.

#### **7.6.5 Use more than one social cognition measure**

This study used one proxy measure of social cognition, which, in retrospect, was limiting in finding a significant difference in social cognition between sex offenders and non-sex offenders. It is recommended that other social cognition instruments, such as the faux pas recognition test (Baron-Cohen et al., 1997; Stone et al., 1998), the Theory of Mind Task Battery, reading the mind in the eyes test (Baron-Cohen et al., 1997; Baron-Cohen et al., 2001); and/or the prosody perception task (Borod et al., 1992), be considered to assess social cognition in sex offenders.

It is also important to develop a larger array of psychometric measures to assess social cognition. Social cognition is a mixture of different processes and depends on the exchange of specific signals such as facial expression, body movement, and eye gaze (Frith and Frith, 2007). Historically, and too commonly, many clinical disorders lead to impairments in social perception that are not easily detected using standard

neuropsychological tests (McDonald, 2012).

Perhaps more research into Theory of Mind (ToM) may assist us to better understand the deficits in social cognition found in sex offenders, particularly since we are discovering the neuroanatomical and neurochemical bases of ToM (Abu-Akel and Shamay-Tsoory, 2011). Further research would clarify whether ToM deficits are significant predictors in sexual offending. So far the little research carried out has found that child sex offenders have deficits in ToM, specifically in respect to their ability to infer the mental states of children (Elsegood and Duff, 2010).

#### **7.6.6 Confounding variables**

Unfortunately research into older sex offenders will have the additional problems of confounding variables, which clouds the conclusions of any study. The association of age, sexual offending, and the many confounding medical variables in elderly populations provides any researcher with a complex task.

Nevertheless, the exploration of these variables on neurocognitive function is important and necessary. Cardiovascular, endocrine, head injury, psychiatric, neurologic, and drug and alcohol dependence/abuse are important factors that contribute to sexual offending. Some of these factors can be predictive of offending and the following decades will bring about a better understanding of their relationship to sexual offending.



## 7.7 Recommendations for clinicians

### 7.7.1 Implications of this study on sex offender treatment/programs

Cognitive behavioural therapy (CBT) has been the preferred mode of treatment for sex offenders (McGrath et al., 2010; Moster et al., 2008). The primary goals of CBT are to reduce the risk of reoffending by cognitive restructuring. This includes challenging cognitive distortions, justification and minimisation of offence behaviour. Other key goals are to improve social competence, for example, self-esteem, managing negative emotional states and problem solving (Lockmuller et al., 2008).

Another treatment goal is improving victim empathy and enabling the perpetrator to develop relapse-prevention skills (Hudson and West, 1996). Victim empathy is a component in the majority of sex offender treatment programs, despite both theory and research being underdeveloped (Mann and Barnett, 2013; Ward et al., 2006). Indeed, empathy for victims was found to be unrelated to recidivism in two large-scale meta-analyses (Hanson and Bussière, 1998; Hanson and Morton-Bourgon, 2005). Therefore the rationale for including an empathy component in practice appears to be based on intuition; specifically, the view that the experience of empathy will promote change in distorted attitudes and prevent re-offending (Marshall et al., 1999; Marshall et al., 1995).

Empathy has been defined as a four-stage process involving the ability to recognize emotional states in others, take the perspective of others, and vicariously replicate these emotional states; with the fourth stage being the decision to act or not on the

basis of those feelings (Marshall et al., 1995). Examples of treatment procedures include psychoeducation relating to victim impact in general, perspective-taking exercises such as role-plays relating to their specific victims or auto-biographical accounts written “as if” by their victim, and the construction of mock apology letters (Webster, 2002).

CBT is a complex treatment approach that is of limited benefit to individuals with cognitive deficits, particularly those with significant deficits in executive function. Patients with executive dysfunction are slow learners and therefore treatment tends to be lengthy and laborious (Boelen et al., 2011). Cognitive problems that potentially affect treatment include short attention span, distractibility, superficial processing, memory and new learning (Bezeau et al., 2004).

The results of this study suggest that many sex offenders selected into these programs will be unlikely to derive benefit from this kind of treatment due to the three core components of empathy required (i.e., emotion recognition, perspective taking, affective responsiveness). The reality is that offenders that have limited cognitive function or are impaired are enrolled in these programs despite the questionable benefit of treatment. When studies clearly demonstrates that individuals with prefrontal lesions are unable to show empathy, it seems counter-intuitive that sex offender programs should attempt to instil these virtues on sex offenders that do not have the capacity to develop empathy due to damage to these prefrontal areas.

The results of this study suggests that behavioural interventions, indefinite supervision and containment, aimed at providing the cognitively impaired offender

with control over their compulsive urges; and the use of antilibidinal medication, such as anti-androgens and selective serotonin re-uptake inhibitors, may be more helpful and less resource intensive. Appropriate placement is another necessary intervention to ensure high supervision or no access to potential victims.

Alternatively, some sex offenders with cognitive and social cognition deficits would benefit from specifically tailored treatment programs that take such limitations into account and do not simply apply the arsenal of CBT techniques that were originally developed for non-cognitive compromised subjects.

### **7.7.2 Obtain a history of head injury**

The literature strongly suggests that individuals who sustain a head injury are at a significant risk of committing a sexual offence (Luiselli et al., 2000a; Mendez and Shapira, 2011b; Mendez et al., 2000; Simpson et al., 1999) and head injury is a predictor for sexual re-offending (Langevin and Curnoe, 2011). It then follows that when assessing elderly individuals, who commit a sexual offence for the first time, it is important that clinicians obtain a thorough medical history, including a history of head trauma.

### **7.7.3 Assessment of executive function**

If executive dysfunction is prognostic of these clinically important functional and behavioural outcomes, then executive function should form a greater part of the routine clinical assessment of sex offenders than is the case currently. A greater

awareness of the significance of executive dysfunction in an individual's life if the sex offending was "out of character" may help clinicians to offer the courts accurate assessments, as well as identify individuals who will need more intensive supervision, monitoring and support.

#### **7.7.4 Neuroimaging**

Neuroimaging techniques such as structural and functional (fMRI) and positron emission tomography (PET) allow us to see how brain structure and function change with age. Clinicians referring individuals for neuroimaging and neurophysiological assessments, particularly those individuals who develop late-onset paedophilic interest, can improve future studies in finding an underlying brain mechanism for the disturbance in sexual behaviour.

#### **7.7.5 Frontotemporal dementia**

Given the behavioural similarities of elderly FT sex offenders and acquired sociopathy in FTD (Mendez et al., 2005; Mendez et al., 2008), further clinical investigation into FTD is necessary in this group of elderly men, who commit sex offences for the first time. FTD symptoms can begin to appear between the ages of 45 and 65 years; therefore, consideration of FTD in this group of sex offenders may assist in clarifying diagnosis, treatment, risk management, sentencing and placement.

Accurate assessment and diagnosis of FTD is likely to remain a challenge, as bedside cognitive and standard neuropsychological assessments, including assessment of executive function, can be normal in behavioural FTD (bvFTD) (Gregory and Hodges, 1996; Hodges, 2013; Hornberger et al., 2008; Lough et al., 2001; Mendez, 2010; Roca et al., 2013).

#### **7.7.6 Risk assessment**

The results of this study might assist in the development of static and dynamic risk assessment tools, which will assist clinicians in the evaluation of elderly sex offenders with cognitive deficits. Static factors would include a history of head injury and dynamic factors would include onset of changes in personality, sudden antisocial behaviour, and changes in sexual identification or practices.

The assessment of impairment at the time of the commission of a sexual offence should also be considered. It is likely that alternative treatment, placement, and risk management strategies will be required for individuals with cognitive deficits.

### **7.8 Conclusions**

The present study contributes to the neuropsychological literature on sex offenders, contributing to the knowledge of elderly first-time sex offenders, who commit sexual offences much later in their lives.

Highlighting this contribution, were that FT sex offenders produced similar neuropsychological results to HT sex offenders but showed greater cognitive weaknesses or impairment compared to non-sexual offender controls. In addition, sex offenders performed more poorly than non-sex offenders on most neuropsychological tests.

Therefore, there was partial support for the first hypothesis that FT sex offenders demonstrate greater impairment than HT sex offenders and NSOC offenders. There was greater support for the second hypothesis that sex offenders show greater neuropsychological impairment than non-sex offenders.

Although a significant proportion of offenders demonstrated deficits in social cognition, the groups did not differ in a proxy measure of social cognition. Therefore, the third hypothesis was not supported. Notwithstanding the high rates of impairment in a social cognition task in FT sex offenders is of concern given their perpetration of sexual offences at a much later time in their lives.

In conclusion, this study suggests that sex offenders, as a group, irrespective of when they offend (early or later in life), exhibit executive function deficits and possible damage to the prefrontal cortex. The neuropsychological results of FT sex offenders also resemble those of FTD patients. However, neuroimaging is required to confirm these findings, which is outside the scope of this study.

This study proposes that executive function deficits contributes to sexual offending early in life due to possible neurodevelopmental problems (i.e., intrauterine

pathology, lack of development, or trauma); and later in life due to disease, substance abuse, neurotoxicity or trauma.

I propose that HT sex offenders experience neurodevelopmental perturbations, demonstrated in abnormal executive function early in life, while FT sex offenders develop executive dysfunction much later in life.

Whilst there is unlikely to be one specific neurocognitive reason, which can fully explain sexual offending in elderly individuals, the current findings suggest that, in at least some individuals, significant neuropsychological impairment may contribute to sexual offending primarily in four ways:

1. FT sex offenders develop executive dysfunction as a result of frontotemporal damage
2. The combination of a lifelong underlying paedophilic interest and the insidious or sudden onset in executive dysfunction contributes significantly to sexual offending of children by FT sex offenders
3. FT sex offenders demonstrate greater impulsivity, poorer working memory, behavioural dyscontrol, and poorer affective regulation
4. A high proportion of FT sex offenders display impaired social cognition and possible deficits in Theory of Mind, which, in turn, result in poor appraisal of their environment and the emotional distress of their victims

## 7.9 Final comments

Executive function is a construct that cannot be explained by a single factor (Elliott, 2003; Goh et al., 2012; Huizinga et al., 2006; Hull et al., 2008) and is a difficult construct to define as executive function encompasses a wide array of abilities.

The causality of sexual offending by elderly first time sex offenders will remain difficult to understand as merely being an example of “executive dysfunction”. Many sex offences are not impulsive, in fact they involve careful planning and grooming as in many cases of child molestation; therefore mounting a defence of “impulsivity” and lack of volition as a result of executive dysfunction is unlikely to be accepted (see Fabian, 2012).

In addition, no simple explanation for anomalous sexual behaviour can be attributed to damage to prefrontal areas or temporal-limbic structures alone. The strength of this argument lies with the reality that not all men, who demonstrate either clinical or psychometrically measured executive dysfunction, or prefrontal damage, or temporal lobe dysfunction commit sexual offences.

Nevertheless, it is distinctly possible that some men with a premorbid propensity for sexual offending, such as an underlying paedophilic interest, who develop pathologic brain changes will be at a high risk for committing sexual offences.



## References

- Abel GG, Becker JV, Cunningham-Rathner J, et al. (1988) Multiple paraphilic diagnoses among sex offenders. *Bulletin of the American Academy of Psychiatry and the Law* 16: 153-168.
- Abracen J, Looman J and Anderson D. (2000) Alcohol and drug abuse in sexual and nonsexual violent offenders. *Sexual Abuse* 12: 263-274.
- Abracen J, O'Carroll R and Ladha N. (1991) Neuropsychological dysfunction in sex offenders? *The Journal of Forensic Psychiatry* 2: 167-177.
- ABS. (1996) Women's Safety Australia. Canberra: Australian Bureau of Statistics.
- ABS. (2002) National Crime and Safety Survey Canberra: Australian Bureau of Statistics.
- ABS. (2004) Disability, ageing and carers: summary of findings Australia, 2003. In: Statistics ABo (ed). Canberra: Australian Bureau of Statistics.
- ABS. (2005) Personal Safety Survey. Canberra: Australian Bureau of Statistics.
- ABS. (2010) Recorded Crime. Canberra: Australian Bureau of Statistics.
- ABS. (2012) Crime Victimization, Australia, 2010-2011 Canberra: Australian Bureau of Statistics.
- Abu-Akel A and Shamay-Tsoory S. (2011) Neuroanatomical and neurochemical bases of theory of mind. *Neuropsychologia* 49: 2971-2984.
- Adenzato M, Cavallo M and Enrici I. (2010) Theory of mind ability in the behavioural variant of frontotemporal dementia: an analysis of the neural, cognitive, and social levels. *Neuropsychologia* 48: 2-12.
- Adolphs R. (2002) Recognizing emotion from facial expressions: psychological and neurological mechanisms. *Behav Cogn Neurosci Rev* 1: 21-62.

- Adolphs R and Tranel D. (2003) Amygdala damage impairs emotion recognition from scenes only when they contain facial expressions. *Neuropsychologia* 41: 1281-1289.
- AIC. (2007) Guilty Outcomes in Reported Sexual Assault and Related Offence Incidents. Australian Institute of Criminology.
- AIFS. (2010) The prevalence of child abuse and neglect. Australian Institute of Family Studies.
- Aigner M, Eher R, Fruehwald S, et al. (2000) Brain abnormalities and violent behavior. *Journal of Psychology and Human Sexuality* 11: 57-64.
- Alagiakrishnan K, Lim D, Brahim A, et al. (2005) Sexually inappropriate behaviour in demented elderly people. *Postgraduate Medical Journal* 81: 463-466.
- Albinet CT, Boucard G, Bouquet CA, et al. (2012) Processing speed and executive functions in cognitive aging: how to disentangle their mutual relationship? *Brain and Cognition* 79: 1-11.
- Alston L. (1986) *Crime and older Americans*, Springfield Illinois: Charles C. Thomas Publisher.
- Alvarez JA and Emory E. (2006) Executive function and the frontal lobes: a meta-analytic review. *Neuropsychology Review* 16: 17-42.
- American-Psychiatric-Association. (2013) *Diagnostic and statistical manual of mental disorders - fifth edition DSM-5*, Arlington, VA: American Psychiatric Publishing.
- Anckarsater H, Piechnik S, Tullberg M, et al. (2007) Persistent regional frontotemporal hypoactivity in violent offenders at follow-up. *Psychiatry Research* 156: 87-90.
- Anderson J, Martin J, Mullen P, et al. (1993) Prevalence of childhood sexual abuse experiences in a community sample of women. *Journal of the American Academy of Child and Adolescent Psychiatry* 32: 911-919.

- Anderson SW, Damasio H, Jones RD, et al. (1991) Wisconsin Card Sorting Test performance as a measure of frontal lobe damage. *Journal of Clinical and Experimental Neuropsychology* 13: 909-922.
- Anderson V, Catroppa C, Morse S, et al. (2001) Outcome from mild head injury in young children: a prospective study. *Journal of Clinical and Experimental Neuropsychology* 23: 705-717.
- Andres P and Van der Linden M. (2000) Age-related differences in supervisory attentional system functions. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences* 55: P373-380.
- Anson JA and Kuhlman DT. (1993) Post-ictal Kluver-Bucy syndrome after temporal lobectomy. *Journal of Neurology, Neurosurgery and Psychiatry* 56: 311-313.
- Anstey KJ and Low LF. (2004) Normal cognitive changes in aging. *Australian Family Physician* 33: 783-787.
- Arata CM. (1998) To tell or not tell: current function of child sexual abuse survivors who disclosed their victimization. *Child Maltreatment* 3: 63-71.
- Arbuthnott K and Frank J. (2000) Trail making test, part B as a measure of executive control: validation using a set-switching paradigm. *Journal of Clinical and Experimental Neuropsychology* 22: 518-528.
- Aron AR, Robbins TW and Poldrack RA. (2004) Inhibition and the right inferior frontal cortex. *Trends Cogn Sci* 8: 170-177.
- Ashendorf L, Jefferson AL, O'Connor MK, et al. (2008) Trail Making Test errors in normal aging, mild cognitive impairment, and dementia. *Archive of Clinical Neuropsychology* 23: 129-137.
- Ashendorf L and McCaffrey RJ. (2008) Exploring age-related decline on the Wisconsin Card Sorting Test. *The Clinical Neuropsychologist* 22: 262-272.

- Atchison TB, Sander AM, Struchen MA, et al. (2004) Relationship between neuropsychological test performance and productivity at 1-year following traumatic brain injury. *The Clinical Neuropsychologist* 18: 249-265.
- Avila C, Barros A, Ortet G, et al. (2003) Set-shifting and sensitivity to reward: A possible dopamine mechanism for explaining disinhibitory disorders. *Cognition and Emotion* 17: 951-959.
- Axelrod BN. (2002) Validity of the Wechsler abbreviated scale of intelligence and other very short forms of estimating intellectual functioning. *Assessment* 9: 17-23.
- Axelrod BN, Goldman RS, Heaton RK, et al. (1996) Discriminability of the Wisconsin Card Sorting Test using the standardization sample. *Journal of Clinical and Experimental Neuropsychology* 18: 338-342.
- Babbage DR, Yim J, Zupan B, et al. (2011) Meta-analysis of facial affect recognition difficulties after traumatic brain injury. *Neuropsychology* 25: 277-285.
- Baddeley A. (2000) The episodic buffer: a new component of working memory? *Trends Cogn Sci* 4: 417-423.
- Baddeley A, Della Sala S, Papagno C, et al. (1997) Dual-task performance in dysexecutive and nondysexecutive patients with a frontal lesion. *Neuropsychology* 11: 187-194.
- Baena E, Allen PA, Kaut KP, et al. (2010) On age differences in prefrontal function: the importance of emotional/cognitive integration. *Neuropsychologia* 48: 319-333.
- Baguley IJ, Cooper J and Felmingham K. (2006) Aggressive behavior following traumatic brain injury: how common is common? *Journal of Head Trauma Rehabilitation* 21: 45-56.
- Bailey PE and Henry JD. (2008) Growing less empathic with age: disinhibition of the self-perspective. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences* 63: P219-P226.

- Baird AD, Wilson SJ, Bladin PF, et al. (2002) Hypersexuality after Temporal Lobe Resection. *Epilepsy Behav* 3: 173-181.
- Baird AD, Wilson SJ, Bladin PF, et al. (2007) Neurological control of human sexual behaviour: insights from lesion studies. *Journal of Neurology, Neurosurgery and Psychiatry* 78: 1042-1049.
- Bak TH and Mioshi E. (2007) A cognitive bedside assessment beyond the MMSE: the Addenbrooke's Cognitive Examination. *Practical neurology* 7: 245-249.
- Baldo JV, Shimamura AP, Delis DC, et al. (2001) Verbal and design fluency in patients with frontal lobe lesions. *Journal of the International Neuropsychological Society* 7: 586-596.
- Ballesteros S, Nilssonb L and Lemairec P. (2009) Ageing, cognition, and neuroscience: An introduction. *European Journal of Cognitive Psychology* 21: 161-175.
- Barak Y, Perry T and Elizur A. (1995) Elderly criminals: A study of the first criminal offence in old age. *International Journal of Geriatric Psychiatry* 10: 511-516.
- Barbaree HE, Blanchard R and Langton CM. (2003) The development of sexual aggression through the life span: the effect of age on sexual arousal and recidivism among sex offenders. *Annals of the New York Academy of Sciences* 989: 59-71.
- Baron-Cohen S, Jolliffe T, Mortimore C, et al. (1997) Another advanced test of theory of mind: evidence from very high functioning adults with autism or asperger syndrome. *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 38: 813-822.
- Baron-Cohen S, Wheelwright S, Hill J, et al. (2001) The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 42: 241-251.

- Barratt ES, Stanford MS, Kent TA, et al. (1997) Neuropsychological and cognitive psychophysiological substrates of impulsive aggression. *Biological Psychiatry* 41: 1045-1061.
- Barry D and Petry NM. (2008) Predictors of decision-making on the Iowa Gambling Task: independent effects of lifetime history of substance use disorders and performance on the Trail Making Test. *Brain and Cognition* 66: 243-252.
- Bartzokis G, Beckson M, Lu PH, et al. (2001) Age-related changes in frontal and temporal lobe volumes in men: a magnetic resonance imaging study. *Archives of General Psychiatry* 58: 461-465.
- Beauregard M, Levesque J and Bourgouin P. (2001) Neural correlates of conscious self-regulation of emotion. *Journal of Neuroscience* 21: RC165.
- Bechara A. (2005) Decision making, impulse control and loss of willpower to resist drugs: a neurocognitive perspective. *Nature Neuroscience* 8: 1458-1463.
- Bechara A. (2007) *Iowa Gambling Task: Professional manual*, Florida: Psychological Assessment Resources.
- Bechara A, Damasio AR, Damasio H, et al. (1994) Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition* 50: 7-15.
- Bechara A, Damasio H, Tranel D, et al. (2005) The Iowa Gambling Task and the somatic marker hypothesis: some questions and answers. *Trends Cogn Sci* 9: 159-162; discussion 162-154.
- Bechara A, Tranel D and Damasio H. (2000) Characterization of the decision-making deficit of patients with ventromedial prefrontal cortex lesions. *Brain* 123 ( Pt 11): 2189-2202.
- Beitchman JH, Zucker KJ, Hood JE, et al. (1991) A review of the short-term effects of child sexual abuse. *Child Abuse and Neglect* 15: 537-556.

- Belleville S, Rouleau N and Van der Linden M. (2006) Use of the Hayling task to measure inhibition of prepotent responses in normal aging and Alzheimer's disease. *Brain and Cognition* 62: 113-119.
- Bender AR and Raz N. (2012) Age-related differences in recognition memory for items and associations: contribution of individual differences in working memory and metamemory. *Psychology and Aging* 27: 691-700.
- Benton AL and Hamsher K. (1989) *Multilingual Aphasia Examination*, Iowa University of Iowa.
- Bertoux M, Funkiewiez A, O'Callaghan C, et al. (2012) Sensitivity and specificity of ventromedial prefrontal cortex tests in behavioral variant frontotemporal dementia. *Alzheimer's and dementia*.
- Best M, Williams JM and Coccaro EF. (2002) Evidence for a dysfunctional prefrontal circuit in patients with an impulsive aggressive disorder. *Proceedings of the National Academy of Sciences of the United States of America* 99: 8448-8453.
- Bezeau SC, Bogod NM and Mateer CA. (2004) Sexually intrusive behaviour following brain injury: approaches to assessment and rehabilitation. *Brain Injury* 18: 299-313.
- Bielak AA, Gerstorf D, Kiely KM, et al. (2011) Depressive symptoms predict decline in perceptual speed in older adulthood. *Psychology and Aging* 26: 576-583.
- Bielak AA, Mansueti L, Strauss E, et al. (2006) Performance on the Hayling and Brixton tests in older adults: norms and correlates. *Archives of clinical neuropsychology* 21: 141-149.
- Bigler ED. (2013) Neuroimaging biomarkers in mild traumatic brain injury (mTBI). *Neuropsychology Review* 23: 169-209.
- Bisiacchi PS, Borella E, Bergamaschi S, et al. (2008) Interplay between memory and executive functions in normal and pathological aging. *Journal of Clinical and Experimental Neuropsychology* 30: 723-733.

- Blair RJ. (2001) Neurocognitive models of aggression, the antisocial personality disorders, and psychopathy. *Journal of Neurology, Neurosurgery and Psychiatry* 71: 727-731.
- Blanchard R and Barbaree HE. (2005) The strength of sexual arousal as a function of the age of the sex offender: comparisons among pedophiles, hebephiles, and teleiophiles. *Sexual Abuse* 17: 441-456.
- Blanchard R, Christensen BK, Strong SM, et al. (2002) Retrospective self-reports of childhood accidents causing unconsciousness in phallometrically diagnosed pedophiles. *Archives of Sexual Behavior* 31: 511-526.
- Blanchard R, Kolla NJ, Cantor JM, et al. (2007) IQ, handedness, and pedophilia in adult male patients stratified by referral source. *Sexual Abuse* 19: 285-309.
- Blanchard R, Kuban ME, Klassen P, et al. (2003) Self-reported head injuries before and after age 13 in pedophilic and nonpedophilic men referred for clinical assessment. *Archives of Sexual Behavior* 32: 573-581.
- Blanchard R, Watson MS, Choy A, et al. (1999) Pedophiles: mental retardation, maternal age, and sexual orientation. *Archives of Sexual Behavior* 28: 111-127.
- Blumer D. (1970) Hypersexual episodes in temporal lobe epilepsy. *The American journal of psychiatry* 126: 1099-1106.
- Boelen DH, Spikman JM and Fasotti L. (2011) Rehabilitation of executive disorders after brain injury: are interventions effective? *Journal of neuropsychology* 5: 73-113.
- Boes AD, Grafft AH, Joshi C, et al. (2011) Behavioral effects of congenital ventromedial prefrontal cortex malformation. *BMC Neurol* 11: 151.
- Bogaert AF. (2001) Handedness, criminality, and sexual offending. *Neuropsychologia* 39: 465-469.



- Bohnen N, Jolles J and Twijnstra A. (1992) Neuropsychological deficits in patients with persistent symptoms six months after mild head injury. *Neurosurgery* 30: 692-695; discussion 695-696.
- Bonora A, Benuzzi F, Monti G, et al. (2011) Recognition of emotions from faces and voices in medial temporal lobe epilepsy. *Epilepsy and behavior* 20: 648-654.
- Bonta J, Law M and Hanson K. (1998) The prediction of criminal and violent recidivism among mentally disordered offenders: a meta-analysis. *Psychological Bulletin* 123: 123-142.
- Boone KB, Miller BL, Lesser IM, et al. (1990) Performance on frontal lobe tests in healthy, older individuals. *Dev Neuropsychol* 6: 215-223.
- Bornhofen C and McDonald S. (2008a) Comparing strategies for treating emotion perception deficits in traumatic brain injury. *Journal of Head Trauma Rehabilitation* 23: 103-115.
- Bornhofen C and McDonald S. (2008b) Emotion perception deficits following traumatic brain injury: a review of the evidence and rationale for intervention. *Journal of the International Neuropsychological Society* 14: 511-525.
- Borod JC, Welkowitz J and Obler LK. (1992) *The New York Emotion Battery*, New York: Mount Sinai Medical Center.
- Bouchard SM, Brown TG and Nadeau L. (2012) Decision-making capacities and affective reward anticipation in DWI recidivists compared to non-offenders: a preliminary study. *Accident Analysis and Prevention* 45: 580-587.
- Bowden C. (1989) *Plethysmographic assessment of sexual arousal in pedophiles: The relationship between intelligence, as measured by the WAIS-R and arousal*, Burnaby, CA: Simon Fraser University Press.
- Bozeat S, Gregory C, Ralph M, et al. (2000) Which neuropsychiatric and behavioural features distinguish frontal and temporal variants of frontotemporal dementia from

- Alzheimer's disease? *Journal of Neurology, Neurosurgery and Psychiatry* 69: 178-186.
- Bradford D. (1992) *Interpretive Reasoning and the Halstead-Reitan Tests*, Vermont: Clinical Psychology Publishing Company.
- Bradford JMW, Fedoroff P and Gulati S. (2013) Can sexual offenders be treated? *International Journal of Law and Psychiatry* 36: 235-240.
- Brand M and Markowitsch HJ. (2010) Aging and decision-making: a neurocognitive perspective. *Gerontology* 56: 319-324.
- Brannen JH, Badie B, Moritz CH, et al. (2001) Reliability of functional MR imaging with word-generation tasks for mapping Broca's area. *AJNR. American Journal of Neuroradiology* 22: 1711-1718.
- Braun CM, Dumont M, Duval J, et al. (2003) Opposed left and right brain hemisphere contributions to sexual drive: a multiple lesion case analysis. *Behav Neurol* 14: 55-61.
- Bravo G and Hebert R. (1997) Age- and education-specific reference values for the Mini-Mental and modified Mini-Mental State Examinations derived from a non-demented elderly population. *International Journal of Geriatric Psychiatry* 12: 1008-1018.
- Brennan M, Welsh MC and Fisher CB. (1997) Aging and executive function skills: an examination of a community-dwelling older adult population. *Perceptual and Motor Skills* 84: 1187-1197.
- Brickman AM, Paul RH, Cohen RA, et al. (2005) Category and letter verbal fluency across the adult lifespan: relationship to EEG theta power. *Archives of clinical neuropsychology* 20: 561-573.
- Broicher SD, Kuchukhidze G, Grunwald T, et al. (2012) "Tell me how do I feel"--emotion recognition and theory of mind in symptomatic mesial temporal lobe epilepsy. *Neuropsychologia* 50: 118-128.

- Brower MC and Price BH. (2001) Neuropsychiatry of frontal lobe dysfunction in violent and criminal behaviour: a critical review. *Journal of Neurology, Neurosurgery and Psychiatry* 71: 720-726.
- Bryan J, Luszcz MA and Crawford JR. (1997) Verbal knowledge and speed of information processing as mediators of age differences in verbal fluency performance among older adults. *Psychology and Aging* 12: 473-478.
- Bugg JM, DeLosh EL, Davalos DB, et al. (2007) Age differences in Stroop interference: contributions of general slowing and task-specific deficits. *Neuropsychology, development, and cognition* 14: 155-167.
- Bulik CM, Sullivan PF and Rorty M. (1989) Childhood sexual abuse in women with bulimia. *Journal of Clinical Psychiatry* 50: 460-464.
- Burgess PW and Shallice T. (1997) *The Hayling and Brixton tests*, Suffolk: Thames Valley Test Company.
- Burns A, Jacoby R and Levy R. (1990) Psychiatric phenomena in Alzheimer's disease. IV: Disorders of behaviour. *The British journal of psychiatry* 157: 86-94.
- Burns JM and Swerdlow RH. (2003) Right orbitofrontal tumor with pedophilia symptom and constructional apraxia sign. *Archives of Neurology* 60: 437-440.
- Butler T, Indig D, Allnut S, et al. (2011) Co-occurring mental illness and substance use disorder among Australian prisoners. *Drug Alcohol Rev* 30: 188-194.
- Butterworth P, Anstey K, Jorm AF, et al. (2004) A community survey demonstrated cohort differences in the lifetime prevalence of self-reported head injury. *Journal of Clinical Epidemiology* 57: 742-748.
- Cantor JM, Blanchard R, Christensen BK, et al. (2004) Intelligence, memory, and handedness in pedophilia. *Neuropsychology* 18: 3-14.

- Cantor JM, Blanchard R, Robichaud LK, et al. (2005a) Quantitative reanalysis of aggregate data on IQ in sexual offenders. *Psychological Bulletin* 131: 555-568.
- Cantor JM, Klassen PE, Dickey R, et al. (2005b) Handedness in pedophilia and hebephilia. *Archives of Sexual Behavior* 34: 447-459.
- Cantor JM, Kuban ME, Blak T, et al. (2006) Grade failure and special education placement in sexual offenders' educational histories. *Archives of Sexual Behavior* 35: 743-751.
- Carabellese F, Candelli C, Vinci F, et al. (2012) Elderly sexual offenders: two unusual cases. *Journal of Forensic Sciences* 57: 1381-1383.
- Carvalho JC, Cardoso Cde O, Shneider-Bakos D, et al. (2012) The effect of age on decision making according to the Iowa gambling task. *The Spanish journal of psychology* 15: 480-486.
- Cavedini P, Bassi T, Ubbiali A, et al. (2004) Neuropsychological investigation of decision-making in anorexia nervosa. *Psychiatry Research* 127: 259-266.
- Cavedini P, Riboldi G, Keller R, et al. (2002) Frontal lobe dysfunction in pathological gambling patients. *Biological Psychiatry* 51: 334-341.
- Charlton RA, Barrick TR, Markus HS, et al. (2009) Theory of mind associations with other cognitive functions and brain imaging in normal aging. *Psychology and Aging* 24: 338-348.
- Chen T and Naveh-Benjamin M. (2012) Assessing the associative deficit of older adults in long-term and short-term/working memory. *Psychology and Aging* 27: 666-682.
- Chou KL. (2012) Childhood sexual abuse and psychiatric disorders in middle-aged and older adults: evidence from the 2007 Adult Psychiatric Morbidity Survey. *Journal of Clinical Psychiatry* 73: e1365-1371.
- Christ SE, White DA, Brunstrom JE, et al. (2003) Inhibitory control following perinatal brain injury. *Neuropsychology* 17: 171-178.

- Clark C and Mezey G. (1997) Elderly sex offenders against children: a descriptive study of child sex abusers over the age of 65. *The Journal of Forensic Psychiatry* 8: 357-369.
- Clark L and Manes F. (2004) Social and emotional decision-making following frontal lobe injury. *Neurocase* 10: 398-403.
- Clark L, Manes F, Antoun N, et al. (2003) The contributions of lesion laterality and lesion volume to decision-making impairment following frontal lobe damage. *Neuropsychologia* 41: 1474-1483.
- Clarys D, Bugajska A, Tapia G, et al. (2009) Ageing, remembering, and executive function. *Memory* 17: 158-168.
- Cohen J. (1992) A power primer. *Psychological Bulletin* 112: 155-159.
- Cohen LJ, McGeoch PG, Watras-Gans S, et al. (2002a) Personality impairment in male pedophiles. *Journal of Clinical Psychiatry* 63: 912-919.
- Cohen LJ, Nesci C, Steinfeld M, et al. (2010) Investigating the relationship between sexual and chemical addictions by comparing executive function in subjects with pedophilia or opiate addiction and healthy controls. *J Psychiatr Pract* 16: 405-412.
- Cohen LJ, Nikiforov K, Gans S, et al. (2002b) Heterosexual male perpetrators of childhood sexual abuse: a preliminary neuropsychiatric model. *Psychiatric Quartely* 73: 313-336.
- Collette F and Van der Linden M. (2002) Brain imaging of the central executive component of working memory. *Neuroscience and Biobehavioral Reviews* 26: 105-125.
- Collette F, Van der Linden M, Delfiore G, et al. (2001) The functional anatomy of inhibition processes investigated with the Hayling task. *Neuroimage* 14: 258-267.
- Colsher PL, Wallace RB, Loeffelholz PL, et al. (1992) Health status of older male prisoners: a comprehensive survey. *American Journal of Public Health* 82: 881-884.

- Colwell LH, Cruise KR, Guy LS, et al. (2005) The influence of psychosocial maturity on male juvenile offenders' comprehension and understanding of the Miranda warning. *Journal of the American Academy of Psychiatry and the Law* 33: 444-454.
- Cooper AJ. (1987) Medroxyprogesterone acetate (MPA) treatment of sexual acting out in men suffering from dementia. *Journal of Clinical Psychiatry* 48: 368-370.
- Cornell DG, Roberts M and Oram G. (1997) The Ray-Osterrieth Complex Figure Test as a neuropsychological measure in criminal offenders. *Arch Clin Neuropsychol* 12: 47-56.
- Coubard OA, Ferruffino L, Boura M, et al. (2011) Attentional control in normal aging and Alzheimer's disease. *Neuropsychology* 25: 353-367.
- Crawford JR and Henry JD. (2003) The Depression Anxiety Stress Scales (DASS): normative data and latent structure in a large non-clinical sample. *The British journal of clinical psychology* 42: 111-131.
- Crawford S, Whitnall L, Robertson J, et al. (2012) A systematic review of the accuracy and clinical utility of the Addenbrooke's Cognitive Examination and the Addenbrooke's Cognitive Examination-Revised in the diagnosis of dementia. *International Journal of Geriatric Psychiatry* 27: 659-669.
- Crone EA, Wendelken C, Donohue SE, et al. (2006) Neural evidence for dissociable components of task-switching. *Cerebral Cortex* 16: 475-486.
- Cross BS, DeYoung GR and Furlong KM. (2013) High-dose oral medroxyprogesterone for inappropriate hypersexuality in elderly men with dementia: a case series. *Annals of Pharmacotherapy* 47: e1.
- Crowe SF. (1998) The differential contribution of mental tracking, cognitive flexibility, visual search, and motor speed to performance on parts A and B of the Trail Making Test. *Journal of Clinical Psychology* 54: 585-591.

- Curtice M, Parker J, Wismayerc FS, et al. (2003) The elderly offender: an 11-year survey of referrals to a regional forensic psychiatric service. *Journal of Forensic Psychiatry and Psychology* 14: 253-265.
- Cutajar MC, Mullen PE, Ogloff JR, et al. (2010) Suicide and fatal drug overdose in child sexual abuse victims: a historical cohort study. *Medical Journal of Australia* 192: 184-187.
- Davidson PS, Gao FQ, Mason WP, et al. (2008) Verbal fluency, trail making, and Wisconsin Card Sorting Test performance following right frontal lobe tumor resection. *Journal of Clinical and Experimental Neuropsychology* 30: 18-32.
- Davis HP, Cohen A, Gandy M, et al. (1990) Lexical priming deficits as a function of age. *Behavioral Neuroscience* 104: 288-297.
- de Carvalho HW, Andreoli SB, Vaidyanathan U, et al. (2013) The structure of common mental disorders in incarcerated offenders. *Comprehensive Psychiatry* 54: 111-116.
- De Luca CR, Wood SJ, Anderson V, et al. (2003) Normative data from the CANTAB. I: development of executive function over the lifespan. *Journal of Clinical and Experimental Neuropsychology* 25: 242-254.
- Deary IJ, Corley J, Gow AJ, et al. (2009) Age-associated cognitive decline. *British Medical Bulletin* 92: 135-152.
- Demakis GJ. (2004) Frontal lobe damage and tests of executive processing: a meta-analysis of the category test, stroop test, and trail-making test. *Journal of Clinical and Experimental Neuropsychology* 26: 441-450.
- Denburg NL, Tranel D and Bechara A. (2005) The ability to decide advantageously declines prematurely in some normal older persons. *Neuropsychologia* 43: 1099-1106.
- Dennis J, Khan O, Ferriter M, et al. (2012) Psychological interventions for adults who have sexually offended or are at risk of offending. *Cochrane Database of Systematic Reviews* 12.

- Deutsher M. (2004) A neuropsychological assessment of adult sex offenders. *Faculty of Life and Social Sciences*. Swinburne University of Technology.
- Devinsky J, Sacks O and Devinsky O. (2010) Kluver-Bucy syndrome, hypersexuality, and the law. *Neurocase* 16: 140-145.
- Diaz-Asper CM, Schretlen DJ and Pearlson GD. (2004) How well does IQ predict neuropsychological test performance in normal adults? *Journal of the International Neuropsychological Society* 10: 82-90.
- Dickey R, Nussbaum D, Chevolleau K, et al. (2002) Age as a differential characteristic of rapists, pedophiles, and sexual sadists. *Journal of Sex and Marital Therapy* 28: 211-218.
- Diehl-Schmid J, Pohl C, Ruprecht C, et al. (2007) The Ekman 60 Faces Test as a diagnostic instrument in frontotemporal dementia. *Arch Clin Neuropsychol* 22: 459-464.
- Dodrill CB. (1997) Myths of Neuropsychology. *The Clinical Neuropsychologist* 11: 1-17.
- Dolan M. (1994) Psychopathy--a neurobiological perspective. *British Journal of Psychiatry* 165: 151-159.
- Dolan M, Millington J and Park I. (2002) Personality and neuropsychological function in violent, sexual and arson offenders. *Medicine, Science and the Law* 42: 34-43.
- Dolan M and Park I. (2002) The neuropsychology of antisocial personality disorder. *Psychological Medicine* 32: 417-427.
- Dominguez JM and Hull EM. (2001) Stimulation of the medial amygdala enhances medial preoptic dopamine release: implications for male rat sexual behavior. *Brain Research* 917: 225-229.
- Douglas KM and Porter RJ. (2009) Longitudinal assessment of neuropsychological function in major depression. *The Australian and New Zealand journal of psychiatry* 43: 1105-1117.



- Drachman DA, Swearer JM, O'Donnell BF, et al. (1992) The Caretaker Obstreperous-Behavior Rating Assessment (COBRA) Scale. *Journal of the American Geriatrics Society* 40: 463-470.
- Dregan A, Stewart R and Gulliford MC. (2013) Cardiovascular risk factors and cognitive decline in adults aged 50 and over: a population-based cohort study. *Age and Ageing* 42: 338-345.
- Dressing H, Obergriesser T, Tost H, et al. (2001) [Homosexual pedophilia and functional networks - An fMRI case report and literature review]. *Fortschritte der Neurologie-Psychiatrie* 69: 539-544.
- Duffy LM. (1995) Sexual behavior and marital intimacy in Alzheimer's couples: A family theory perspective. *Sexuality & Disability* 13: 239-254.
- Dunsieth NW, Jr., Nelson EB, Brusman-Lovins LA, et al. (2004) Psychiatric and legal features of 113 men convicted of sexual offenses. *Journal of Clinical Psychiatry* 65: 293-300.
- Eastman N, Adshead G, Fox S, et al. (2012) *Forensic Psychiatry* Oxford: Oxford University Press.
- Eastvold A, Suchy Y and Strassberg D. (2011) Executive function profiles of pedophilic and nonpedophilic child molesters. *Journal of the International Neuropsychological Society* 17: 295-307.
- Eckart JA, Sturm VE, Miller BL, et al. (2012) Diminished disgust reactivity in behavioral variant frontotemporal dementia. *Neuropsychologia* 50: 786-790.
- Eckert MA, Keren NI, Roberts DR, et al. (2010) Age-related changes in processing speed: unique contributions of cerebellar and prefrontal cortex. *Front Hum Neurosci* 4: 10.
- Edwards-Lee T, Miller BL, Benson DF, et al. (1997) The temporal variant of frontotemporal dementia. *Brain* 120 ( Pt 6): 1027-1040.

- Ekman P and Friesen W. (1976) *Pictures of facial affect*, California: Consulting Psychological Press.
- Elias PK, Elias MF, Robbins MA, et al. (2004) Blood pressure-related cognitive decline: does age make a difference? *Hypertension* 44: 631-636.
- Elliott R. (2003) Executive functions and their disorders. *British Medical Bulletin* 65: 49-59.
- Ellis L and Walsh A. (2003) Crime, delinquency, and intelligence: A review of the worldwide literature. In: Nyborg H (ed) *The scientific study of general intelligence: Tribute to Arthur R. Jensen*. Oxford, UK: Elsevier, 343-365.
- Elsegood KJ and Duff SC. (2010) Theory of mind in men who have sexually offended against children: a U.K. comparison study between child sex offenders and nonoffender controls. *Sexual Abuse* 22: 112-131.
- Elwers M and Critchlow V. (1960) Precocious ovarian stimulation following hypothalamic and amygdaloid lesions in rats. *The American journal of physiology* 198: 381-385.
- Epstein AW. (1961) Relationship of fetishism and transvestism to brain and particularly to temporal lobe dysfunction. *Journal of Nervous and Mental Disease* 133: 247-253.
- Eslinger PJ and Damasio AR. (1985) Severe disturbance of higher cognition after bilateral frontal lobe ablation: patient EVR. *Neurology* 35: 1731-1741.
- Fabian JM. (2012) Neuropsychology, neuroscience, volitional impairment and sexually violent predators: A review of the literature and the law and their application to civil commitment proceedings. *Aggression & Violent Behavior* 17: 1-15.
- Fakhri M, Sikaroodi H, Maleki F, et al. (2012) Age-related frontal hyperactivation observed across different working memory tasks: an fMRI study. *Behav Neurol* 25: 351-361.
- Farrington DP and Welsh BC. (2007) *Saving children from a life of crime: Early risk factors and effective interventions*, New York, NY: Oxford University Press.

- Fastenau PS, Denburg NL and Hufford BJ. (1999) Adult norms for the Rey-Osterrieth Complex Figure Test and for supplemental recognition and matching trials from the Extended Complex Figure Test. *The Clinical Neuropsychologist* 13: 30-47.
- Fazel S and Danesh J. (2002) Serious mental disorder in 23000 prisoners: a systematic review of 62 surveys. *Lancet* 359: 545-550.
- Fazel S and Grann M. (2002) Older criminals: a descriptive study of psychiatrically examined offenders in Sweden. *International Journal of Geriatric Psychiatry* 17: 907-913.
- Fazel S, Hope T, O'Donnell I, et al. (2002) Psychiatric, demographic and personality characteristics of elderly sex offenders. *Psychological Medicine* 32: 219-226.
- Fazel S, Hope T, O'Donnell I, et al. (2001) Health of elderly male prisoners: worse than the general population, worse than younger prisoners. *Age and Ageing* 30: 403-407.
- Fazel S, Lichtenstein P, Grann M, et al. (2011) Risk of violent crime in individuals with epilepsy and traumatic brain injury: a 35-year Swedish population study. *PLoS Med* 8: e1001150.
- Fazel S, O'Donnell I, Hope T, et al. (2007a) Frontal lobes and older sex offenders: a preliminary investigation. *International Journal of Geriatric Psychiatry* 22: 87-89.
- Fazel S, Sjostedt G, Langstrom N, et al. (2006) Risk factors for criminal recidivism in older sexual offenders. *Sexual Abuse* 18: 159-167.
- Fazel S, Sjostedt G, Langstrom N, et al. (2007b) Severe mental illness and risk of sexual offending in men: a case-control study based on Swedish national registers. *Journal of Clinical Psychiatry* 68: 588-596.
- Fein G, Klein L and Finn P. (2004) Impairment on a simulated gambling task in long-term abstinent alcoholics. *Alcoholism, Clinical and Experimental Research* 28: 1487-1491.
- Fernandez-Duque D and Black SE. (2005) Impaired recognition of negative facial emotions in patients with frontotemporal dementia. *Neuropsychologia* 43: 1673-1687.

- Fernandez-Guasti A, Escalante AL, Ahlenius S, et al. (1992) Stimulation of 5-HT<sub>1A</sub> and 5-HT<sub>1B</sub> receptors in brain regions and its effects on male rat sexual behaviour. *European Journal of Pharmacology* 210: 121-129.
- Fernandez-Serrano MJ, Perez-Garcia M, Schmidt Rio-Valle J, et al. (2010) Neuropsychological consequences of alcohol and drug abuse on different components of executive functions. *J Psychopharmacol* 24: 1317-1332.
- Field A. (2009) *Discovering statistics using SPSS*, London: Sage Publications Ltd.
- Finkelhor D. (1984) How widespread is child sexual abuse? *Children Today* 13: 18-20.
- Fischer AL, de Frias CM, Yeung SE, et al. (2009) Short-term longitudinal trends in cognitive performance in older adults with type 2 diabetes. *Journal of Clinical and Experimental Neuropsychology* 31: 809-822.
- Fisher H, Aron A and Brown LL. (2005) Romantic love: an fMRI study of a neural mechanism for mate choice. *The Journal of comparative neurology* 493: 58-62.
- Fisk JE and Sharp CA. (2004) Age-related impairment in executive functioning: updating, inhibition, shifting, and access. *Journal of Clinical and Experimental Neuropsychology* 26: 874-890.
- Fisk JE and Warr P. (1996) Age and working memory: the role of perceptual speed, the central executive, and the phonological loop. *Psychology and Aging* 11: 316-323.
- Fjell AM, Westlye LT, Amlien I, et al. (2009) High consistency of regional cortical thinning in aging across multiple samples. *Cerebral Cortex* 19: 2001-2012.
- Flor-Henry P. (1976) Lateralized temporal-limbic dysfunction and psychopathology. *Annals of the New York Academy of Sciences* 280: 777-797.
- Flor-Henry P. (1987) Cerebral aspects of sexual deviation. In: Wilson DG (ed) *Variant sexuality: Research and theory*. Baltimore: John Hopkins University Press.

- Folstein MF, Folstein SE and McHugh PR. (1975) "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 12: 189-198.
- Fortune N and Wen X. (1999) The definition, incidence and prevalence of acquired brain injury in Australia. *Australian Institute of Health and Welfare*. Canberra.
- Fossati P, Amar G, Raoux N, et al. (1999) Executive functioning and verbal memory in young patients with unipolar depression and schizophrenia. *Psychiatry Research* 89: 171-187.
- Fougere A, Thomas S and Daffern M. (2013) A study of the multiple and complex needs of Australian young adult offenders. *Australian Psychologist* 48: 188-195.
- Fournet N, Roulin JL, Vallet F, et al. (2012) Evaluating short-term and working memory in older adults: French normative data. *Aging and mental health* 16: 922-930.
- Fozard JL, Vercryssen M, Reynolds SL, et al. (1994) Age differences and changes in reaction time: the Baltimore Longitudinal Study of Aging. *Journal of Gerontology* 49: P179-189.
- Frith CD and Frith U. (2007) Social cognition in humans. *Current Biology* 17: R724-732.
- Fuller AK. (1989) Child molestation and pedophilia. An overview for the physician. *JAMA* 261: 602-606.
- Fuster JM. (2002) Frontal lobe and cognitive development. *Journal of neuropsychology* 31: 373-385.
- Fuster JM. (2009) *The Prefrontal Cortex*, New York: Academic Press.
- Gallagher C and Burke T. (2007) Age, gender and IQ effects on the Rey-Osterrieth Complex Figure. *British Journal of Clinical Psychology* 46: 35-45.

- Galski T, Thornton K and Shumsky D. (1990) Brain dysfunction in sex offenders. *Journal of Offender Rehabilitation* 16: 5-80.
- Garcia FD, Delavenne HG, Assumpcao Ade F, et al. (2013) Pharmacologic treatment of sex offenders with paraphilic disorder. *Curr Psychiatry Rep* 15: 356.
- Gasparini M, Masciarelli G, Vanacore N, et al. (2008) A descriptive study on constructional impairment in frontotemporal dementia and Alzheimer's disease. *European Journal of Neurology* 15: 589-597.
- Gelb K. (2007) Recidivism of Sex Offenders Research Paper In: Council SA (ed). Melbourne, Victoria.
- Georgiadis JR and Kringelbach ML. (2012) The human sexual response cycle: brain imaging evidence linking sex to other pleasures. *Progress in Neurobiology* 98: 49-81.
- German TP and Hehman JA. (2006) Representational and executive selection resources in 'theory of mind': evidence from compromised belief-desire reasoning in old age. *Cognition* 101: 129-152.
- Gery I, Miljkovitch R, Berthoz S, et al. (2009) Empathy and recognition of facial expressions of emotion in sex offenders, non-sex offenders and normal controls. *Psychiatry Research* 165: 252-262.
- Gillespie NK and McKenzie K. (2000) An examination of the role of neuropsychological deficits in mentally disordered sex offenders. *The Journal of Sexual Aggression* 5: 21-29.
- Goh JO, An Y and Resnick SM. (2012) Differential trajectories of age-related changes in components of executive and memory processes. *Psychology and Aging* 27: 707-719.
- Goodwin J, Cormier L and Owen J. (1983) Grandfather - granddaughter incest: a trigenerational view. *Child Abuse and Neglect* 7: 163-170.

- Gouveia PA, Brucki SM, Malheiros SM, et al. (2007) Disorders in planning and strategy application in frontal lobe lesion patients. *Brain and Cognition* 63: 240-246.
- Graber B, Hartmann K, Coffman JA, et al. (1982) Brain damage among mentally disordered sex offenders. *Journal of Forensic Sciences* 27: 125-134.
- Green JD, Clemente CD and De Groot J. (1957) Rhinencephalic lesions and behavior in cats: an analysis of the Kluver-Bucy syndrome with particular reference to normal and abnormal sexual behavior. *Journal of Comparative Neurology* 108: 505-545.
- Green RE, Turner GR and Thompson WF. (2004) Deficits in facial emotion perception in adults with recent traumatic brain injury. *Neuropsychologia* 42: 133-141.
- Greenfeld LA. (1997) Sex Offences and Offenders: An Analysis of Data on Rape and Sexual Assault. Minnesota Centre Against Violence and Abuse.
- Gregory C, Lough S, Stone V, et al. (2002) Theory of mind in patients with frontal variant frontotemporal dementia and Alzheimer's disease: theoretical and practical implications. *Brain* 125: 752-764.
- Gregory CA and Hodges JR. (1996) Frontotemporal dementia: use of consensus criteria and prevalence of psychiatric features. *Neuropsychiatry Neuropsychology and Behavioral Neurology* 9: 145-153.
- Gross H, Kling A, Henry G, et al. (1996) Local cerebral glucose metabolism in patients with long-term behavioral and cognitive deficits following mild traumatic brain injury. *Journal of Neuropsychiatry and Clinical Neurosciences* 8: 324-334.
- Guay JP, Ouimet M and Proulx J. (2005) On intelligence and crime: a comparison of incarcerated sex offenders and serious non-sexual violent criminals. *International Journal of Law and Psychiatry* 28: 405-417.
- Gunstad J, Paul RH, Brickman AM, et al. (2006) Patterns of cognitive performance in middle-aged and older adults: A cluster analytic examination. *Journal of Geriatric Psychiatry and Neurology* 19: 59-64.

- Gupta R, Kosciak TR, Bechara A, et al. (2011) The amygdala and decision-making. *Neuropsychologia* 49: 760-766.
- Hamann S, Herman RA, Nolan CL, et al. (2004) Men and women differ in amygdala response to visual sexual stimuli. *Nature Neuroscience* 7: 411-416.
- Hamdi NR and Knight RA. (2012) The relationships of perpetrator and victim substance use to the sexual aggression of rapists and child molesters. *Sexual Abuse* 24: 307-327.
- Hancock M, Tapscott JL and Hoaken PN. (2010) Role of executive dysfunction in predicting frequency and severity of violence. *Aggress Behav* 36: 338-349.
- Hanson RK. (2002) Recidivism and age: Follow-up data from 4,673 sexual offenders. *J Interpers Violence* 17: 1046-1062.
- Hanson RK. (2006) Does Static-99 predict recidivism among older sexual offenders? *Sexual Abuse* 18: 343-355.
- Hanson RK, Babchishin KM, Helmus L, et al. (2012) Quantifying the Relative Risk of Sex Offenders: Risk Ratios for Static-99R. *Sexual Abuse*.
- Hanson RK and Bussière MT. (1998) Predicting Relapse: A meta-analysis of sexual offender recidivism studies. *Journal of Consulting and Clinical Psychology* 66: 348-362.
- Hanson RK, Gordon A, Harris AJ, et al. (2002) First report of the collaborative outcome data project on the effectiveness of psychological treatment for sex offenders. *Sexual Abuse* 14: 169-194; discussion 195-167.
- Hanson RK and Morton-Bourgon KE. (2005) The characteristics of persistent sexual offenders: a meta-analysis of recidivism studies. *Journal of Consulting and Clinical Psychology* 73: 1154-1163.
- Harciarek M and Cosentino S. (2013) Language, executive function and social cognition in the diagnosis of frontotemporal dementia syndromes. *Int Rev Psychiatry* 25: 178-196.



- Hare RD, Forth AE and Strachan KE. (1992) Psychopathy and crime across the life span. In: R. Dev Peters, R.J. McMahon and Quinsey VL (eds) *Aggression and violence throughout the life span*. Newbury Park, CA: Sage, 285-300.
- Harenski CL, Thornton DM, Harenski KA, et al. (2012) Increased frontotemporal activation during pain observation in sexual sadism: preliminary findings. *Archives of General Psychiatry* 69: 283-292.
- Harris GT and Rice ME. (2007) Adjusting actuarial violence risk assessment based on aging or the passage of time. *Criminal Justice and Behavior* 34: 297-313.
- Harris GT, Rice ME, Quinsey VL, et al. (2003) A multisite comparison of actuarial risk instruments for sex offenders. *Psychol Assess* 15: 413-425.
- Hartley DE, Elsabagh S and File SE. (2004) Binge drinking and sex: effects on mood and cognitive function in healthy young volunteers. *Pharmacology, Biochemistry and Behavior* 78: 611-619.
- Harvey PO, Le Bastard G, Pochon JB, et al. (2004) Executive functions and updating of the contents of working memory in unipolar depression. *Journal of Psychiatric Research* 38: 567-576.
- Hashimoto M, Akimoto T and Watanabe Y. (2004) [Hypersexuality. Hypersexuality in persons with dementia]. *Nihon Rinsho* 62 Suppl 4: 67-72.
- Head D, Kennedy KM, Rodrigue KM, et al. (2009) Age differences in perseveration: cognitive and neuroanatomical mediators of performance on the Wisconsin Card Sorting Test. *Neuropsychologia* 47: 1200-1203.
- Hedden T, Lautenschlager G and Park DC. (2005) Contributions of processing ability and knowledge to verbal memory tasks across the adult life-span. *The Quarterly journal of experimental psychology* 58: 169-190.

- Hendricks SE, Fitzpatrick DF, Hartmann K, et al. (1988) Brain structure and function in sexual molesters of children and adolescents. *Journal of Clinical Psychiatry* 49: 108-112.
- Henry JD and Crawford JR. (2004) A meta-analytic review of verbal fluency performance following focal cortical lesions. *Neuropsychology* 18: 284-295.
- Henry JD, MacLeod MS, Phillips LH, et al. (2004) A meta-analytic review of prospective memory and aging. *Psychology and Aging* 19: 27-39.
- Henry JD, Phillips LH and von Hippel C. (2014) A meta-analytic review of theory of mind difficulties in behavioural-variant frontotemporal dementia. *Neuropsychologia* 56C: 53-62.
- Higgins A, Barker P and Begley CM. (2004) Hypersexuality and dementia: dealing with inappropriate sexual expression. *British Journal of Nursing* 13: 1330-1334.
- Hoaken PN, Allaby DB and Earle J. (2007) Executive cognitive functioning and the recognition of facial expressions of emotion in incarcerated violent offenders, non-violent offenders, and controls. *Aggress Behav* 33: 412-421.
- Hodges JR. (2013) Alzheimer's disease and the frontotemporal dementias: contributions to clinico-pathological studies, diagnosis, and cognitive neuroscience. *J Alzheimers Dis* 33 Suppl 1: S211-217.
- Hodges JR, Davies R, Xuereb J, et al. (2003) Survival in frontotemporal dementia. *Neurology* 61: 349-354.
- Hoening J and Kenna JC. (1979) EEG abnormalities and transsexualism. *The British journal of psychiatry* 134: 293-300.
- Hohman TJ, Beason-Held LL, Lamar M, et al. (2011) Subjective cognitive complaints and longitudinal changes in memory and brain function. *Neuropsychology* 25: 125-130.

- Holstege G and Huynh HK. (2011) Brain circuits for mating behavior in cats and brain activations and de-activations during sexual stimulation and ejaculation and orgasm in humans. *Hormones and Behavior* 59: 702-707.
- Holtzer R, Rakitin BC, Steffener J, et al. (2009) Age effects on load-dependent brain activations in working memory for novel material. *Brain Research* 1249: 148-161.
- Hoofien D, Gilboa A, Vakil E, et al. (2001) Traumatic brain injury (TBI) 10-20 years later: a comprehensive outcome study of psychiatric symptomatology, cognitive abilities and psychosocial functioning. *Brain Injury* 15: 189-209.
- Hornak J, Rolls ET and Wade D. (1996) Face and voice expression identification in patients with emotional and behavioural changes following ventral frontal lobe damage. *Neuropsychologia* 34: 247-261.
- Hornberger M, Piguet O, Graham AJ, et al. (2010a) How preserved is episodic memory in behavioral variant frontotemporal dementia? *Neurology* 74: 472-479.
- Hornberger M, Piguet O, Kipps C, et al. (2008) Executive function in progressive and nonprogressive behavioral variant frontotemporal dementia. *Neurology* 71: 1481-1488.
- Hornberger M, Savage S, Hsieh S, et al. (2010b) Orbitofrontal dysfunction discriminates behavioral variant frontotemporal dementia from Alzheimer's disease. *Dementia and Geriatric Cognitive Disorders* 30: 547-552.
- Horning SM, Cornwell RE and Davis HP. (2012) The recognition of facial expressions: an investigation of the influence of age and cognition. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 19: 657-676.
- Hsieh TC, Lin WY, Ding HJ, et al. (2012) Sex- and age-related differences in brain FDG metabolism of healthy adults: an SPM analysis. *Journal of Neuroimaging* 22: 21-27.

- Hubley AM and Jassal S. (2006) Comparability of the Rey-Osterrieth and Modified Taylor Complex Figures using total scores, completion times, and construct validation. *Journal of Clinical and Experimental Neuropsychology* 28: 1482-1497.
- Hucker S and Ben-Aron M. (1985) Erotic preference, gender identity and aggression. In: Langevin R (ed) *Men: New Research Studies*. New Jersey: Lawrence Erlbaum Associates.
- Hucker S, Langevin R, Wortzman G, et al. (1986) Neuropsychological impairment in pedophiles. *Canadian Journal of Behavioral Science* 18: 440-448.
- Hucker S, Langevin R, Wortzman G, et al. (1988) Cerebral damage and dysfunction in sexually aggressive men. *Annals of Sex Research* 1: 33-47.
- Hudson SM, Marshall WL, Wales D, et al. (1993) Emotional recognition skills of sex offenders. *Annals of Sex Research* 6: 199-211.
- Hudson SM and West T. (1996) Introduction to the special issue on relapse prevention *Sexual Abuse* 8: 173-175.
- Huey ED, Goveia EN, Paviol S, et al. (2009) Executive dysfunction in frontotemporal dementia and corticobasal syndrome. *Neurology* 72: 453-459.
- Huizinga M, Dolan CV and van der Molen MW. (2006) Age-related change in executive function: developmental trends and a latent variable analysis. *Neuropsychologia* 44: 2017-2036.
- Hull R, Martin RC, Beier ME, et al. (2008) Executive function in older adults: a structural equation modeling approach. *Neuropsychology* 22: 508-522.
- Ietswaart M, Milders M, Crawford JR, et al. (2008) Longitudinal aspects of emotion recognition in patients with traumatic brain injury. *Neuropsychologia* 46: 148-159.

- Isingrini M and Vazou F. (1997) Relation between fluid intelligence and frontal lobe functioning in older adults. *International Journal of Aging and Human Development* 45: 99-109.
- Jacobsson LJ, Westerberg M, Soderberg S, et al. (2009) Functioning and disability 6-15 years after traumatic brain injuries in northern Sweden. *Acta Neurologica Scandinavica* 120: 389-395.
- Johns EK, Phillips NA, Belleville S, et al. (2009) Executive functions in frontotemporal dementia and Lewy body dementia. *Neuropsychology* 23: 765-777.
- Johnson GM and Knight RA. (2000) Developmental antecedents of sexual coercion in juvenile sexual offenders. *Sexual Abuse* 12: 165-178.
- Johnson JK, Diehl J, Mendez MF, et al. (2005) Frontotemporal lobar degeneration: demographic characteristics of 353 patients. *Archives of Neurology* 62: 925-930.
- Johnson M. (1995) Clinical issues in the treatment of geriatric sex offenders. The Sex Offender: Correction, Treatment and Legal Practice. In: Schwartz B and Cellini H (eds). Kingston, NJ: Civic Research Institute, Inc.
- Jonker C, Geerlings MI and Schmand B. (2000) Are memory complaints predictive for dementia? A review of clinical and population-based studies. *International Journal of Geriatric Psychiatry* 15: 983-991.
- Joyal CC, Beaulieu-Plante J and de Chanterac A. (2014) The neuropsychology of sex offenders: a meta-analysis. *Sexual Abuse* 26: 149-177.
- Joyal CC, Black DN and Dassylva B. (2007) The neuropsychology and neurology of sexual deviance: a review and pilot study. *Sexual Abuse* 19: 155-173.
- Jurado MB and Rosselli M. (2007) The elusive nature of executive functions: a review of our current understanding. *Neuropsychology Review* 17: 213-233.

- Kafka MP and Hennen J. (2002) A DSM-IV Axis I comorbidity study of males (n = 120) with paraphilias and paraphilia-related disorders. *Sexual Abuse* 14: 349-366.
- Kakoullis A, Le Mesurier N and Kingston P. (2010) The mental health of older prisoners. *International Psychogeriatrics* 22: 693-701.
- Kanwisher N, McDermott J and Chun MM. (1997) The fusiform face area: a module in human extrastriate cortex specialized for face perception. *Journal of Neuroscience* 17: 4302-4311.
- Karama S, Lecours AR, Leroux JM, et al. (2002) Areas of brain activation in males and females during viewing of erotic film excerpts. *Human Brain Mapping* 16: 1-13.
- Kasar M, Gleichgerrcht E, Keskinilic C, et al. (2010) Decision-making in people who relapsed to driving under the influence of alcohol. *Alcoholism, Clinical and Experimental Research* 34: 2162-2168.
- Keane J, Calder AJ, Hodges JR, et al. (2002) Face and emotion processing in frontal variant frontotemporal dementia. *Neuropsychologia* 40: 655-665.
- Keightley ML, Chiew KS, Winocur G, et al. (2007) Age-related differences in brain activity underlying identification of emotional expressions in faces. *Soc Cogn Affect Neurosci* 2: 292-302.
- Keightley ML, Winocur G, Burianova H, et al. (2006a) Age effects on social cognition: faces tell a different story. *Psychology and Aging* 21: 558-572.
- Keightley ML, Winocur G, Burianova H, et al. (2006b) Age effects on social cognition: faces tell a different story. *Psychology and Aging* 21: 558-572.
- Keller JN. (2006) Age-related neuropathology, cognitive decline, and Alzheimer's disease. *Ageing Res Rev* 5: 1-13.
- Kelly T, Richardson G, Hunter R, et al. (2002) Attention and executive function deficits in adolescent sex offenders. *Child neuropsychology* 8: 138-143.

- Kerbs J and Jolley J. (2009) A commentary on age segregation for older prisoners: Philosophical and pragmatic considerations for correctional systems. *Criminal Justice Review* 34: 119-139.
- Kinugawa K, Schumm S, Pollina M, et al. (2013) Aging-related episodic memory decline: are emotions the key? *Front Behav Neurosci* 7 (in press).
- Kluver H and Bucy PC. (1997) Preliminary analysis of functions of the temporal lobes in monkeys. 1939. *Journal of Neuropsychiatry and Clinical Neurosciences* 9: 606-620.
- Knopman D, Boland LL, Mosley T, et al. (2001) Cardiovascular risk factors and cognitive decline in middle-aged adults. *Neurology* 56: 42-48.
- Koch J, Berner W, Hill A, et al. (2011) Sociodemographic and diagnostic characteristics of homicidal and nonhomicidal sexual offenders. *Journal of Forensic Sciences* 56: 1626-1631.
- Kolarsky A, Freund K, Machek J, et al. (1967) Male sexual deviation. Association with early temporal lobe damage. *Archives of General Psychiatry* 17: 735-743.
- Krafft-Ebing Rv and King B. (1999) *Psychopathia sexualis : with especial reference to contrary sexual instinct : a clinical-forensic study*, Burbank, Calif.: Bloat.
- Kramer JH, Mungas D, Reed BR, et al. (2007) Longitudinal MRI and cognitive change in healthy elderly. *Neuropsychology* 21: 412-418.
- Krampe RT and Ericsson KA. (1996) Maintaining excellence: deliberate practice and elite performance in young and older pianists. *Journal of Experimental Psychology: General* 125: 331-359.
- Krug EG. (2002) World report on violence and health. Geneva: World Health Organization.
- Kumfor F, Irish M, Hodges JR, et al. (2013) Discrete Neural Correlates for the Recognition of Negative Emotions: Insights from Frontotemporal Dementia. *PLoS One* 8: e67457.

- Kumfor F and Piguet O. (2012) Disturbance of emotion processing in frontotemporal dementia: a synthesis of cognitive and neuroimaging findings. *Neuropsychology Review* 22: 280-297.
- Kunz F. (2011) Criminal behavior and police records: self-reports from elderly individuals. *Zeitschrift fur Gerontologie und Geriatrie* 44: 55-65.
- Lang RA. (1993) Neuropsychological deficits in sexual offenders: implications for treatment. *Sexual and marital therapy* 8: 181-200.
- Langevin R. (2006) Sexual offenses and traumatic brain injury. *Brain and Cognition* 60: 206-207.
- Langevin R and Curnoe S. (2008a) Are the mentally retarded and learning disordered overrepresented among sex offenders and paraphilics? *Int J Offender Ther Comp Criminol* 52: 401-415.
- Langevin R and Curnoe S. (2008b) Assessing Neuropsychological Impairment Among Sex Offenders and Paraphilics. *Journal of Forensic Psychology Practice* 8: 150-173.
- Langevin R and Curnoe S. (2011) Psychopathy, ADHD, and brain dysfunction as predictors of lifetime recidivism among sex offenders. *Int J Offender Ther Comp Criminol* 55: 5-26.
- Langevin R and Curnoe S. (2012) Lifetime criminal history of sex offenders seen for psychological assessment in five decades. *Int J Offender Ther Comp Criminol* 56: 997-1021.
- Langevin R, Curnoe S and Bain J. (2000) A study of clerics who commit sexual offenses: are they different from other sex offenders? *Child Abuse and Neglect* 24: 535-545.
- Langevin R, Curnoe S, Fedoroff P, et al. (2004) Lifetime Sex Offender Recidivism: A 25-Year Follow-up Study. *Canadian Journal of Criminology and Criminal Justice* 46: 531-552.



- Langevin R, Langevin M, Curnoe S, et al. (2008) The prevalence of diabetes among sexual and violent offenders and its co-occurrence with cognitive impairment, mania, psychotic symptoms, and aggressive behavior. *International Journal of Prisoner Health* 42: 83-95.
- Langevin R and Watson R. (1996) Major factors in the assessment of paraphilics and sex offenders. *Journal of Offender Rehabilitation* 23: 39-70.
- Langevin R, Wortzman G, Dickey R, et al. (1988) Neuropsychological impairment in incest offenders. *Annals of Sex Research* 1: 401-415.
- Langevin R, Wortzman G, Frenzel R, et al. (1989a) An examination of brain damage and dysfunction in genital exhibitionists. *Annals of Sex Research* 2: 77-87.
- Langevin R, Wortzman G, Wright P, et al. (1989b) Studies of brain damage and dysfunction in sex offenders. *Annals of Sex Research* 2: 163-179.
- Lanktree C, Briere J and Zaidi L. (1991) Incidence and impact of sexual abuse in a child outpatient sample: the role of direct inquiry. *Child Abuse and Neglect* 15: 447-453.
- Larner AJ. (2007) Addenbrooke's Cognitive Examination (ACE) for the diagnosis and differential diagnosis of dementia. *Clinical Neurology and Neurosurgery* 109: 491-494.
- Larner AJ. (2013) Addenbrooke's Cognitive Examination-Revised (ACE-R): pragmatic study of cross-sectional use for assessment of cognitive complaints of unknown etiology. *International Journal of Geriatric Psychiatry* 28: 547-548.
- Lavenu I, Pasquier F, Lebert F, et al. (1999) Perception of emotion in frontotemporal dementia and Alzheimer disease. *Alzheimer Disease and Associated Disorders* 13: 96-101.
- Lawrence NS, Wooderson S, Mataix-Cols D, et al. (2006) Decision making and set shifting impairments are associated with distinct symptom dimensions in obsessive-compulsive disorder. *Neuropsychology* 20: 409-419.

- Lehmann CA, Marks AD and Hanstock TL. (2013) Age and synchrony effects in performance on the Rey Auditory Verbal Learning Test. *International Psychogeriatrics* 25: 657-665.
- Leon-Carrion J and Ramos FJ. (2003) Blows to the head during development can predispose to violent criminal behaviour: rehabilitation of consequences of head injury is a measure for crime prevention. *Brain Injury* 17: 207-216.
- Leritz EC, McGlinchey RE, Kellison I, et al. (2011) Cardiovascular Disease Risk Factors and Cognition in the Elderly. *Curr Cardiovasc Risk Rep* 5: 407-412.
- Levenson JS. (2011) "But I didn't do it!": ethical treatment of sex offenders in denial. *Sexual Abuse* 23: 346-364.
- Levenson JS and Macgowan MJ. (2004) Engagement, denial, and treatment progress among sex offenders in group therapy. *Sexual Abuse* 16: 49-63.
- Levitt T, Fugelsang J and Crossley M. (2006) Processing speed, attentional capacity, and age-related memory change. *Experimental Aging Research* 32: 263-295.
- Leyton CE, Villemagne VL, Savage S, et al. (2011) Subtypes of progressive aphasia: application of the International Consensus Criteria and validation using beta-amyloid imaging. *Brain* 134: 3030-3043.
- Lezak MD, Howieson DB and Loring DW. (2004) *Neuropsychological Assessment*, Oxford: Oxford University Press Inc.
- Lidaka T, Omori M, Murata T, et al. (2001) Neural interaction of the amygdale with the prefrontal and temporal cortices in the processing of facial expressions as revealed by fMRI. *Journal of Cognitive Neuroscience* 13: 1035-1047.
- Lieb R, Quinsey V and and Berliner L. (1998) Sexual Predators and Social Policy. In: Tonry M (ed) *Crime and Justice* Chicago: University of Chicago, 43-114.

- Lievore D. (2003) Non-reporting and hidden recording of sexual assault: An international literature review. Canberra: Commonwealth Office of the Status of Women.
- Lin H, Chan RC, Zheng L, et al. (2007) Executive functioning in healthy elderly Chinese people. *Arch Clin Neuropsychol* 22: 501-511.
- Liu W, Miller BL, Kramer JH, et al. (2004) Behavioral disorders in the frontal and temporal variants of frontotemporal dementia. *Neurology* 62: 742-748.
- Lockmuller M, Beech A and Fischer D. (2008) Sexual offenders with mental health problems: epidemiology, assessment and treatment. In: Soothill K RP, Dolan M. (ed) *Handbook of Forensic Mental Health*. Willan Publishing, 446-479.
- Logan JM, Sanders AL, Snyder AZ, et al. (2002) Under-recruitment and nonselective recruitment: dissociable neural mechanisms associated with aging. *Neuron* 33: 827-840.
- Loonstra AS, Tarlow AR and Sellers AH. (2001) COWAT metanorms across age, education, and gender. *Appl Neuropsychol* 8: 161-166.
- Losel F and Schmucker M. (2005) The effectiveness of treatment for sexual offenders: A comprehensive meta-analysis. *Journal of Experimental Criminology* 1: 117-146.
- Lothstein LM, Fogg-Waberski J and Reynolds P. (1997) Risk management and treatment of sexual disinhibition in geriatric patients. *Connecticut Medicine* 61: 609-618.
- Lough S, Gregory C and Hodges JR. (2001) Dissociation of social cognition and executive function in frontal variant frontotemporal dementia. *Neurocase* 7: 123-130.
- Lough S, Kipps CM, Treise C, et al. (2006) Social reasoning, emotion and empathy in frontotemporal dementia. *Neuropsychologia* 44: 950-958.
- Lovibond SH and Lovibond PF. (1995) *Manual for the depression anxiety stress scales*, Sydney: Psychology Foundation Monograph.

- Luiselli JK, Aron M, Marchese N, et al. (2000a) Incidence of law-violation behavior in a community sample of children and adolescents with traumatic brain injury. *Int J Offender Ther Comp Criminol* 44: 647-656.
- Luiselli JK, Arons M, Marchese N, et al. (2000b) Incidence of law-violating behavior in a community sample of children and adolescents with traumatic brain injury. *Int J Offender Ther Comp Criminol* 44: 647-656.
- Luria AR. (1980) *Higher cortical functions in man*, New York: Basic Books.
- Lynam D, Moffitt T and Stouthamer-Loeber M. (1993) Explaining the relation between IQ and delinquency: class, race, test motivation, school failure, or self-control? *Journal of Abnormal Psychology* 102: 187-196.
- Mack WJ, Teng E, Zheng L, et al. (2005) Category fluency in a latino sample: associations with age, education, gender, and language. *Journal of Clinical and Experimental Neuropsychology* 27: 591-598.
- MacPherson SE, Phillips LH and Della Sala S. (2002) Age, executive function, and social decision making: a dorsolateral prefrontal theory of cognitive aging. *Psychology and Aging* 17: 598-609.
- Mah LW, Arnold MC and Grafman J. (2005) Deficits in social knowledge following damage to ventromedial prefrontal cortex. *Journal of Neuropsychiatry and Clinical Neurosciences* 17: 66-74.
- Malloy PF and Richardson ED. (1994) Assessment of frontal lobe functions. *Journal of Neuropsychiatry and Clinical Neurosciences* 6: 399-410.
- Manes F, Sahakian B, Clark L, et al. (2002) Decision-making processes following damage to the prefrontal cortex. *Brain* 125: 624-639.
- Mann RE and Barnett GD. (2013) Victim empathy intervention with sexual offenders: rehabilitation, punishment, or correctional quackery? *Sexual Abuse* 25: 282-301.

- Mannarino AP and Cohen JA. (1986) A clinical-demographic study of sexually abused children. *Child Abuse and Neglect* 10: 17-23.
- Margolin L and Craft JL. (1989) Child sexual abuse by caretakers. *Family Relations* 38: 450-455.
- Marques JK, Wiederanders M, Day DM, et al. (2005) Effects of a relapse prevention program on sexual recidivism: final results from California's sex offender treatment and evaluation project (SOTEP). *Sexual Abuse* 17: 79-107.
- Marshall WL, Anderson D and Fernandez Y. (1999) *Cognitive behavioural treatment of sexual offenders*, Chichester: Wiley.
- Marshall WL, Hudson SM, Jones R, et al. (1995) Empathy in sex offenders. *Clinical Psychology Review* 15: 99-113.
- Marshall WL, Laws DR and Barbaree HE. (1990) *Handbook of sexual assault: issues, theories, and treatment of the offender*, New York: Plenum Press.
- Marson D and Hebert KR. (2006) Functional Assessment. In: Attix DK and Welsh-Bohmer KA (eds) *Geriatric Neuropsychology: Assessment and Intervention*. New York: The Guildford Press.
- Martin JE. (1999) Assessment of executive functions in sexual offenders. *Dissertation Abstracts International: Section B: The Sciences & Engineering*, 59 (10-B), 5580. US: University Microfilms International.
- Maschi T, Kwak J, Ko E, et al. (2011) Forget Me Not: Dementia in Prison. *The Gerontologist* 52: 441-451.
- Masel BE and DeWitt DS. (2010) Traumatic brain injury: a disease process, not an event. *Journal of Neurotrauma* 27: 1529-1540.

- Mathuranath PS, Nestor PJ, Berrios GE, et al. (2000) A brief cognitive test battery to differentiate Alzheimer's disease and frontotemporal dementia. *Neurology* 55: 1613-1620.
- Matoso JM, Santos WB, Moreira ID, et al. (2013) Elderly hypertensives show decreased cognitive performance compared with elderly normotensives. *Arquivos Brasileiros de Cardiologia* 100: 444-451.
- Matsumoto H and Matsumoto I. (2008) Alcoholism: protein expression profiles in a human hippocampal model. *Expert Rev Proteomics* 5: 321-331.
- May CP and Hasher L. (1998) Synchrony effects in inhibitory control over thought and action. *Journal of Experimental Psychology: Human Perception and Performance* 24: 363-379.
- Maylor EA, Moulson JM, Muncer AM, et al. (2002) Does performance on theory of mind tasks decline in old age? *British Journal of Psychology* 93: 465-485.
- McCabe DP, Roediger HL, McDaniel MA, et al. (2010) The relationship between working memory capacity and executive functioning: evidence for a common executive attention construct. *Neuropsychology* 24: 222-243.
- McDermott BE and Sokolov G. (2009) Malingering in a correctional setting: the use of the Structured Interview of Reported Symptoms in a jail sample. *Behavioral Sciences and the Law* 27: 753-765.
- McDonald S. (2012) New frontiers in neuropsychological assessment: Assessing social perception using a standardised instrument, The Awareness of Social Interference Test. *Australian Psychologist* 47: 39-48.
- McElroy SL, Soutullo CA, Taylor P, Jr., et al. (1999) Psychiatric features of 36 men convicted of sexual offenses. *Journal of Clinical Psychiatry* 60: 414-420; quiz 421-412.

- McGrath R, J. , Cumming GF, Burchard BL, et al. (2010) Current practices and emerging trends in sexual abuser management: The Safer Society 2009 North American Survey. Brandon, VT: Safer Society Press.
- Meguro K, Shimada M, Yamaguchi S, et al. (2001) Cognitive function and frontal lobe atrophy in normal elderly adults: Implications for dementia not as aging-related disorders and the reserve hypothesis. *Psychiatry and Clinical Neurosciences* 55: 565-572.
- Mejia S, Pineda D, Alvarez LM, et al. (1998) Individual differences in memory and executive function abilities during normal aging. *International Journal of Neuroscience* 95: 271-284.
- Mellott RN and Wagner WG. (1993) Follow-up pilot study on the psychological adjustment of a sample of sexually abused girls *J Child Sex Abus* 2: 37-46.
- Mendez M and Shapira JS. (2011a) Pedophilic behavior from brain disease. *J Sex Med* 8: 1092-1100.
- Mendez M and Shapira JS. (2011b) Pedophilic behavior from brain disease. *Journal of Sexual Medicine* 8: 1092-1100.
- Mendez MF. (2010) The unique predisposition to criminal violations in frontotemporal dementia. *Journal of the American Academy of Psychiatry and the Law* 38: 318-323.
- Mendez MF, Chen AK, Shapira JS, et al. (2005) Acquired sociopathy and frontotemporal dementia. *Dementia and Geriatric Cognitive Disorders* 20: 99-104.
- Mendez MF, Chow T, Ringman J, et al. (2000) Pedophilia and temporal lobe disturbances. *Journal of Neuropsychiatry and Clinical Neurosciences* 12: 71-76.
- Mendez MF and Cummings JL. (2003) *Dementia: A Clinical Approach*, Philadelphia: Elsevier.

- Mendez MF, Lauterbach EC and Sampson SM. (2008) An evidence-based review of the psychopathology of frontotemporal dementia: A report of the ANPA committee on research. *Journal of Neuropsychiatry and Clinical Neuroscience* 20: 130-149.
- Mendez MF and Lim GT. (2004) Alterations of the sense of "humanness" in right hemisphere predominant frontotemporal dementia patients. *Cogn Behav Neurol* 17: 133-138.
- Mendez MF and Perryman KM. (2002) Neuropsychiatric features of frontotemporal dementia: evaluation of consensus criteria and review. *Journal of Neuropsychiatry and Clinical Neurosciences* 14: 424-429.
- Mendez MF, Shapira JS and Saul RE. (2011) The spectrum of sociopathy in dementia. *Journal of Neuropsychiatry and Clinical Neurosciences* 23: 132-140.
- Meston CM and Frohlich PF. (2000) The neurobiology of sexual function. *Archives of General Psychiatry* 57: 1012-1030.
- Mesulam MM. (2001) Primary progressive aphasia. *Annals of Neurology* 49: 425-432.
- Mesulam MM, Grossman M, Hillis A, et al. (2003) The core and halo of primary progressive aphasia and semantic dementia. *Annals of Neurology* 54 Suppl 5: S11-14.
- Meyers JE and Meyers KR. (1995) Rey complex figure test under four different administration procedures. *Clinical Neuropsychologist* 9: 63-67.
- Mezey G, Vizard E, Hawkes C, et al. (1991) A community treatment programme for convicted child sex offenders: a preliminary report. *The Journal of Forensic Psychiatry* 2: 11-25.
- Miller BL, Cummings JL, McIntyre H, et al. (1986) Hypersexuality or altered sexual preference following brain injury. *Journal of Neurology, Neurosurgery and Psychiatry* 49: 867-873.



- Miller BL, Darby A, Benson DF, et al. (1997a) Aggressive, socially disruptive and antisocial behaviour associated with fronto-temporal dementia. *The British journal of psychiatry* 170: 150-154.
- Miller BL, Ikonte C, Ponton M, et al. (1997b) A study of the Lund-Manchester research criteria for frontotemporal dementia: clinical and single-photon emission CT correlations. *Neurology* 48: 937-942.
- Miller LA, Hsieh S, Lah S, et al. (2012) One size does not fit all: face emotion processing impairments in semantic dementia, behavioural-variant frontotemporal dementia and Alzheimer's disease are mediated by distinct cognitive deficits. *Behav Neurol* 25: 53-60.
- Millis SR, Rosenthal M, Novack TA, et al. (2001) Long-term neuropsychological outcome after traumatic brain injury. *Journal of Head Trauma Rehabilitation* 16: 343-355.
- Mills A and Raine A. (1994) Neuroimaging and aggression. *Journal of Offender Rehabilitation* 21: 145-158.
- Mioshi E, Dawson K, Mitchell J, et al. (2006) The Addenbrooke's Cognitive Examination Revised (ACE-R): a brief cognitive test battery for dementia screening. *International Journal of Geriatric Psychiatry* 21: 1078-1085.
- Misdraji EL and Gass CS. (2010) The Trail Making Test and its neurobehavioral components. *Journal of Clinical and Experimental Neuropsychology* 32: 159-163.
- Mitchell DG, Colledge E, Leonard A, et al. (2002) Risky decisions and response reversal: is there evidence of orbitofrontal cortex dysfunction in psychopathic individuals? *Neuropsychologia* 40: 2013-2022.
- Mitrushina M, Boone KB, Razani J, et al. (2005) *Handbook of normative data for neuropsychological assessment*, Oxford: Oxford University Press.
- Mittenberg W, Patton C, Canyock EM, et al. (2002) Base rates of malingering and symptom exaggeration. *Journal of Clinical and Experimental Neuropsychology* 24: 1094-1102.

- Miura H. (2009) Differences in frontal lobe function between violent and nonviolent conduct disorder in male adolescents. *Psychiatry and Clinical Neurosciences* 63: 161-166.
- Miyake A, Friedman NP, Emerson MJ, et al. (2000) The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: a latent variable analysis. *Cogn Psychol* 41: 49-100.
- Moffitt TE and Lynam D, Jr. (1994) The neuropsychology of conduct disorder and delinquency: implications for understanding antisocial behavior. *Progress in Experimental Personality and Psychopathology Research*: 233-262.
- Moffitt TE and Silva PA. (1988) IQ and delinquency: a direct test of the differential detection hypothesis. *Journal of Abnormal Psychology* 97: 330-333.
- Morgan AB and Lilienfeld SO. (2000) A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review* 20: 113-136.
- Morrow DG, Menard WE, Stine-Morrow EA, et al. (2001) The influence of expertise and task factors on age differences in pilot communication. *Psychology and Aging* 16: 31-46.
- Moscovitch M and Winocur G. (1995) Frontal lobes, memory, and aging. *Annals of the New York Academy of Sciences* 769: 119-150.
- Moster A, Wnuk DW and Jeglic EL. (2008) Cognitive Behavioral Therapy Interventions with Sex Offenders. *Journal of Correctional Health Care* 14: 109-121.
- Mouzos J and Makkai T. (2004) Women's experiences of male violence: Findings from the Australian component of the International Violence Against Women Survey. In: *Criminology* AIo (ed). Canberra.
- Mullen PE, Martin JL, Anderson JC, et al. (1994) The effect of child sexual abuse on social, interpersonal and sexual function in adult life. *The British journal of psychiatry* 165: 35-47.

- Mullen PE, Romans-Clarkson SE, Walton VA, et al. (1988) Impact of sexual and physical abuse on women's mental health. *Lancet* 1: 841-845.
- Muller LD, Guhn A, Zeller JB, et al. (2014) Neural correlates of a standardized version of the trail making test in young and elderly adults: A functional near-infrared spectroscopy study. *Neuropsychologia* 56C: 271-279.
- Muscatello MR, Scimeca G, Pandolfo G, et al. (2013) Executive functions and basic symptoms in adolescent antisocial behavior: A cross-sectional study on an Italian sample of late-onset offenders. *Comprehensive Psychiatry*.
- Mychack P, Kramer JH, Boone KB, et al. (2001) The influence of right frontotemporal dysfunction on social behavior in frontotemporal dementia. *Neurology* 56: S11-15.
- Nachschoen I and Deno D. (1987) Violent behavior and cerebral hemisphere function In: S.A. Mednick, T.E. Moffitt and Stack SA (eds) *The causes of crime: new biological approaches*. Cambridge: University Press.
- Nagamatsu LS, Chan A, Davis JC, et al. (2013) Physical activity improves verbal and spatial memory in older adults with probable mild cognitive impairment: a 6-month randomized controlled trial. *J Aging Res* 2013: (in press).
- Nakano S, Asada T, Yamashita F, et al. (2006) Relationship between antisocial behavior and regional cerebral blood flow in frontotemporal dementia. *Neuroimage* 32: 301-306.
- Narayanan NS, Prabhakaran V, Bunge SA, et al. (2005) The role of the prefrontal cortex in the maintenance of verbal working memory: an event-related fMRI analysis. *Neuropsychology* 19: 223-232.
- Nathaniel-James DA, Fletcher P and Frith CD. (1997) The functional anatomy of verbal initiation and suppression using the Hayling Test. *Neuropsychologia* 35: 559-566.
- Naveh-Benjamin M, Craik FI, Guez J, et al. (2005) Divided attention in younger and older adults: effects of strategy and relatedness on memory performance and secondary task

- costs. *Journal of Experimental Psychology. Learning, Memory, and Cognition* 31: 520-537.
- Neary D, Snowden JS, Gustafson L, et al. (1998) Frontotemporal lobar degeneration: a consensus on clinical diagnostic criteria. *Neurology* 51: 1546-1554.
- Nelson HE. (1991) *National Adult Reading Test (NART): Test manual*, Berkshire: NFER Nelson.
- Nelson HE and O'Connell A. (1978) Dementia: the estimation of premorbid intelligence levels using the New Adult Reading Test. *Cortex* 14: 234-244.
- Nettelbeck T and Burns NR. (2010) Processing speed, working memory and reasoning ability from childhood to old age *Personality and Individual Differences* 48: 379-384.
- Newman PD and Krikorian R. (2001) Encoding and complex figure recall. *Journal of the International Neuropsychological Society* 7: 728-733.
- Noel X, Van der Linden M, Schmidt N, et al. (2001) Supervisory attentional system in nonamnesic alcoholic men. *Archives of General Psychiatry* 58: 1152-1158.
- Nordlund A, Rolstad S, Klang O, et al. (2007) Cognitive profiles of mild cognitive impairment with and without vascular disease. *Neuropsychology* 21: 706-712.
- Nyberg L, Lovden M, Riklund K, et al. (2012) Memory aging and brain maintenance. *Trends Cogn Sci* 16: 292-305.
- O'Carroll R. (1989) A neuropsychological study of sexual deviation. *Sexual and marital therapy* 4: 59-63.
- O'Connor C, Colantonio A and Polatajko H. (2005) Long term symptoms and limitations of activity of people with traumatic brain injury: a ten-year follow-up. *Psychological Reports* 97: 169-179.

- O'Neill ME and Thomson PC. (1998) Power and sample size calculations using Microsoft Excel. *Australian Journal of Experimental Agriculture* 38: 617-622
- O'Sullivan PCJ and Chesterman LP. (2007) Older adult patients subject to restriction orders in England and Wales: A cross-sectional survey. *The Journal of Forensic Psychiatry and Psychology* 18: 204-220.
- Odhuba RA, van den Broek MD and Johns LC. (2005) Ecological validity of measures of executive functioning. *The British journal of clinical psychology* 44: 269-278.
- Ogloff JRP, Cutajar MC, Mann E, et al. (2012) Trends and issues in crime and criminal justice no.440. Child sexual abuse and subsequent offending and victimisation: A 45-year follow-up study. *Trends and Issues in Crime and Criminal Justice* 440.
- Oliver CJ, Watson DG, Gannon TA, et al. (2009) The effect of sexual priming cues on emotional recognition in nonviolent child sexual abusers: a preliminary study. *Int J Offender Ther Comp Criminol* 53: 292-304.
- Olver ME, Nicholaichuk TP, Gu D, et al. (2013) Sex offender treatment outcome, actuarial risk, and the aging sex offender in Canadian corrections: a long-term follow-up. *Sexual Abuse* 25: 396-422.
- Oosterman JM, Vogels RL, van Harten B, et al. (2010) Assessing mental flexibility: neuroanatomical and neuropsychological correlates of the Trail Making Test in elderly people. *The Clinical Neuropsychologist* 24: 203-219.
- Oscar-Berman M and Marinkovic K. (2007) Alcohol: effects on neurobehavioral functions and the brain. *Neuropsychology Review* 17: 239-257.
- Ostrosky-Solis F, Jaime RM and Ardila A. (1998) Memory abilities during normal aging. *The International journal of neuroscience* 93: 151-162.
- Overshott R, Rodway C, Roscoe A, et al. (2012) Homicide perpetrated by older people. *International Journal of Geriatric Psychiatry* 27: 1099-1105.

- Page AC, Hooke GR and Morrison DL. (2007) Psychometric properties of the Depression Anxiety Stress Scales (DASS) in depressed clinical samples. *The British journal of clinical psychology* 46: 283-297.
- Park DC, Smith AD, Lautenschlager G, et al. (1996) Mediators of long-term memory performance across the life span. *Psychology and Aging* 11: 621-637.
- Parkin AJ and Java RI. (1999) Deterioration of frontal lobe function in normal aging: influences of fluid intelligence versus perceptual speed. *Neuropsychology* 13: 539-545.
- Perkes I, Schofield PW, Butler T, et al. (2011) Traumatic brain injury rates and sequelae: a comparison of prisoners with a matched community sample in Australia. *Brain Injury* 25: 131-141.
- Phillips LH, MacLean RD and Allen R. (2002) Age and the understanding of emotions: neuropsychological and sociocognitive perspectives. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences* 57: P526-530.
- Piguet O, Grayson DA, Tate RL, et al. (2005) A model of executive functions in very old community dwellers: Evidence from the Sydney Older Persons Study. *Cortex* 41: 27-37.
- Piguet O, Hornberger M, Mioshi E, et al. (2011) Behavioural-variant frontotemporal dementia: diagnosis, clinical staging, and management. *Lancet Neurol* 10: 162-172.
- Pitcher D, Walsh V and Duchaine B. (2011) The role of the occipital face area in the cortical face perception network. *Experimental Brain Research* 209: 481-493.
- Plante TG and Aldridge A. (2005) Psychological Patterns Among Roman Catholic Clergy Accused of Sexual Misconduct. *Pastoral Psychology* 54: 73-80.
- Plunkett A, O'Toole B, Swanston H, et al. (2001) Suicide risk following child sexual abuse. *Ambulatory pediatrics* 1: 262-266.

- Poepl TB, Nitschke J, Dombert B, et al. (2011) Functional cortical and subcortical abnormalities in pedophilia: a combined study using a choice reaction time task and fMRI. *J Sex Med* 8: 1660-1674.
- Poepl TB, Nitschke J, Santtila P, et al. (2013) Association between brain structure and phenotypic characteristics in pedophilia. *Journal of Psychiatric Research* 47: 678-685.
- Poletti M, Lucetti C, Logi C, et al. (2013) Cognitive correlates of negative symptoms in behavioral variant frontotemporal dementia: implications for the frontal lobe syndrome. *Neurol Sci*.
- Ponsford J and Kinsella G. (1992) Attentional deficits following closed-head injury. *Journal of Clinical and Experimental Neuropsychology* 14: 822-838.
- Ponsford JL, Olver JH and Curran C. (1995a) A profile of outcome: 2 years after traumatic brain injury. *Brain Injury* 9: 1-10.
- Ponsford JL, Olver JH, Curran C, et al. (1995b) Prediction of employment status 2 years after traumatic brain injury. *Brain Injury* 9: 11-20.
- Poortinga E, Lemmen C and Majeske K. (2007) A comparison of criminal sexual conduct defendants based on victim age. *Journal of Forensic Science* 52: 1372-1375.
- Porter RJ, Gallagher P, Thompson JM, et al. (2003) Neurocognitive impairment in drug-free patients with major depressive disorder. *British Journal of Psychiatry* 182: 214-220.
- Prentky RA and Lee AF. (2007) Effect of age-at-release on long term sexual re-offense rates in civilly committed sexual offenders. *Sexual Abuse* 19: 43-59.
- Quinsey VL. (2003) The etiology of anomalous sexual preferences in men. *Annals of the New York Academy of Sciences* 989: 105-117; discussion 144-153.
- Quinsey VL, Harris GT, Rice ME, et al. (1998) *Violent offenders: Appraising and managing risk*, Washington DC: American Psychological Association.

- Rabbitt P, Mogapi O, Scott M, et al. (2007) Effects of global atrophy, white matter lesions, and cerebral blood flow on age-related changes in speed, memory, intelligence, vocabulary, and frontal function. *Neuropsychology* 21: 684-695.
- Raine A. (1993) *The psychopathology of crime: Criminal behavior as a clinical disorder*, California: Academic Press.
- Rainero I, Rubino E, Negro E, et al. (2011) Heterosexual pedophilia in a frontotemporal dementia patient with a mutation in the progranulin gene. *Biological Psychiatry* 70: e43-44.
- Rajah MN, Kromas M, Han JE, et al. (2010) Group differences in anterior hippocampal volume and in the retrieval of spatial and temporal context memory in healthy young versus older adults. *Neuropsychologia* 48: 4020-4030.
- Rankin KP. (2007) Social cognition in frontal injury. In: Miller BL and Cummings JL (eds) *The human frontal lobes*. 2nd ed. New York: The Guildford Press.
- Rao V, Rosenberg P, Bertrand M, et al. (2009) Aggression after traumatic brain injury: prevalence and correlates. *Journal of Neuropsychiatry and Clinical Neurosciences* 21: 420-429.
- Rascovsky K, Hodges JR, Knopman D, et al. (2011) Sensitivity of revised diagnostic criteria for the behavioural variant of frontotemporal dementia. *Brain* 134: 2456-2477.
- Rasmusson DX, Zonderman AB, Kawas C, et al. (1998) Effects of age and dementia on the Trail Making Test. *The Clinical Neuropsychologist* 12: 169-178.
- Ratnavalli E, Brayne C, Dawson K, et al. (2002) The prevalence of frontotemporal dementia. *Neurology* 58: 1615-1621.
- Ratti MT, Bo P, Giardini A, et al. (2002) Chronic alcoholism and the frontal lobe: which executive functions are impaired? *Acta Neurologica Scandinavica* 105: 276-281.



- Raz N, Gunning FM, Head D, et al. (1997) Selective aging of the human cerebral cortex observed in vivo: differential vulnerability of the prefrontal gray matter. *Cerebral Cortex* 7: 268-282.
- Raz N, Lindenberger U, Rodrigue KM, et al. (2005) Regional brain changes in aging healthy adults: general trends, individual differences and modifiers. *Cerebral Cortex* 15: 1676-1689.
- Raz N and Rodrigue KM. (2006) Differential aging of the brain: patterns, cognitive correlates and modifiers. *Neuroscience and Biobehavioral Reviews* 30: 730-748.
- Raz N, Rodrigue KM and Acker JD. (2003) Hypertension and the brain: vulnerability of the prefrontal regions and executive functions. *Behavioral Neuroscience* 117: 1169-1180.
- Redoblado MA, Grayson SJ and Miller LA. (2003) Lateralized-temporal-lobe-lesion effects on learning and memory: examining the contributions of stimulus novelty and presentation mode. *Journal of Clinical and Experimental Neuropsychology* 25: 36-48.
- Rees PM, Fowler CJ and Maas CP. (2007) Sexual function in men and women with neurological disorders. *Lancet* 369: 512-525.
- Regestein QR and Reich P. (1978) Pedophilia occurring after onset of cognitive impairment. *Journal of Nervous and Mental Disease* 166: 794-798.
- Reis JP, Loria CM, Launer LJ, et al. (2013) Cardiovascular health through young adulthood and cognitive functioning in midlife. *Annals of Neurology* 73: 170-179.
- Reitan RM and Wolfson D. (1994) A selective and critical review of neuropsychological deficits and the frontal lobes. *Neuropsychology Review* 4: 161-198.
- Remick O, Ross D, Metzger R, et al. (2012) Using a modified lag task to measure adult age differences in working memory. *Psychological Reports* 110: 709-718.
- Reynolds CR. (2002) *Comprehensive Trail-Making Test, Examiner's Manual*, Austin, Texas: PRO-ED.

- Ricci M, Graef S, Blundo C, et al. (2012) Using the Rey Auditory Verbal Learning Test (RAVLT) to differentiate alzheimer's dementia and behavioural variant fronto-temporal dementia. *The Clinical Neuropsychologist* 26: 926-941.
- Rivera B and Widom CS. (1990) Childhood victimization and violent offending. *Violence and Victims* 5: 19-35.
- Robinson G, Shallice T, Bozzali M, et al. (2012a) The differing roles of the frontal cortex in fluency tests. *Brain* 135: 2202-2214.
- Robinson KM. (2003) Understanding hypersexuality: a behavioral disorder of dementia. *Home Healthcare Nurse* 21: 43-47.
- Robinson L, Spencer MD, Thomson LD, et al. (2012b) Facial emotion recognition in Scottish prisoners. *International Journal of Law and Psychiatry* 35: 57-61.
- Robinson RG, Paradiso S, Mizrahi R, et al. (2007) Neuropsychological correlates of normal variation in emotional response to visual stimuli. *Journal of Nervous and Mental Disease* 195: 112-118.
- Roca M, Manes F, Gleichgerrcht E, et al. (2013) Intelligence and executive functions in frontotemporal dementia. *Neuropsychologia* 51: 725-730.
- Rodriguez-Aranda C and Martinussen M. (2006) Age-related differences in performance of phonemic verbal fluency measured by Controlled Oral Word Association Task (COWAT): a meta-analytic study. *Dev Neuropsychol* 30: 697-717.
- Rodriguez-Aranda C and Sundet K. (2006) The frontal hypothesis of cognitive aging: factor structure and age effects on four frontal tests among healthy individuals. *Journal of Genetic Psychology* 167: 269-287.
- Rosen HJ, Gorno-Tempini ML, Goldman WP, et al. (2002a) Patterns of brain atrophy in frontotemporal dementia and semantic dementia. *Neurology* 58: 198-208.

- Rosen HJ, Pace-Savitsky K, Perry RJ, et al. (2004) Recognition of emotion in the frontal and temporal variants of frontotemporal dementia. *Dementia and Geriatric Cognitive Disorders* 17: 277-281.
- Rosen HJ, Perry RJ, Murphy J, et al. (2002b) Emotion comprehension in the temporal variant of frontotemporal dementia. *Brain* 125: 2286-2295.
- Rosen T, Lachs MS and Pillemer K. (2010) Sexual aggression between residents in nursing homes: literature synthesis of an underrecognized problem. *Journal of the American Geriatrics Society* 58: 1970-1979.
- Rosenman S and Rodgers B. (2004) Childhood adversity in an Australian population. *Social Psychiatry and Psychiatric Epidemiology* 39: 695-702.
- Rossion B, Caldara R, Seghier M, et al. (2003) A network of occipito-temporal face-sensitive areas besides the right middle fusiform gyrus is necessary for normal face processing. *Brain* 126: 2381-2395.
- Ruffman T, Henry JD, Livingstone V, et al. (2008) A meta-analytic review of emotion recognition and aging: implications for neuropsychological models of aging. *Neuroscience and Biobehavioral Reviews* 32: 863-881.
- Salthouse T, Atkinson T and Berish D. (2003) Executive function as a potential mediator of age-related cognitive decline in normal adults *Journal of Experimental Psychology: General* 132: 566-594.
- Salthouse TA. (1995) Selective influences of age and speed on associative memory. *The American journal of psychology* 108: 381-396.
- Salthouse TA. (1996) The processing-speed theory of adult age differences in cognition. *Psychological Review* 103: 403-428.
- Salthouse TA. (2000) Aging and measures of processing speed. *Biological Psychology* 54: 35-54.

- Salthouse TA. (2009) When does age-related cognitive decline begin? *Neurobiology of Aging* 30: 507-514.
- Sanchez-Cubillo I, Perianez JA, Adrover-Roig D, et al. (2009) Construct validity of the Trail Making Test: role of task-switching, working memory, inhibition/interference control, and visuomotor abilities. *Journal of the International Neuropsychological Society* 15: 438-450.
- Sander MC, Lindenberger U and Werkle-Bergner M. (2012) Lifespan age differences in working memory: a two-component framework. *Neuroscience and Biobehavioral Reviews* 36: 2007-2033.
- Sarapata M, Herrmann D, Johnson T, et al. (1998) The role of head injury in cognitive functioning, emotional adjustment and criminal behaviour. *Brain Injury* 12: 821-842.
- Sartorius A, Ruf M, Kief C, et al. (2008) Abnormal amygdala activation profile in pedophilia. *European Archives of Psychiatry and Clinical Neuroscience* 258: 271-277.
- Schiffer B, Paul T, Gizewski E, et al. (2008) Functional brain correlates of heterosexual paedophilia. *Neuroimage* 41: 80-91.
- Schiffer B and Vonlaufen C. (2011) Executive dysfunctions in pedophilic and nonpedophilic child molesters. *J Sex Med* 8: 1975-1984.
- Schiltz K, Witzel J, Northoff G, et al. (2007) Brain pathology in pedophilic offenders: evidence of volume reduction in the right amygdala and related diencephalic structures. *Archives of General Psychiatry* 64: 737-746.
- Schiltz K, Witzel JG, Bausch-Holterhoff J, et al. (2013) High prevalence of brain pathology in violent prisoners: a qualitative CT and MRI scan study. *European Archives of Psychiatry and Clinical Neuroscience*.
- Schmidt M. (2004) *Rey Auditory Verbal Learning Test*, California: Western Psychological Services.

- Schmucker M and Losel F. (2008) Does sexual offender treatment work? A systematic review of outcome evaluations. *Psicothema* 20: 10-19.
- Schofield PW, Butler TG, Hollis SJ, et al. (2006) Traumatic brain injury among Australian prisoners: rates, recurrence and sequelae. *Brain Injury* 20: 499-506.
- Schretlen DJ and Shapiro AM. (2003) A quantitative review of the effects of traumatic brain injury on cognitive functioning. *Int Rev Psychiatry* 15: 341-349.
- Schum RL and Sivan AB. (1997) Verbal abilities in healthy elderly adults. *Appl Neuropsychol* 4: 130-134.
- Schwartz S and Baldo J. (2001) Distinct patterns of word retrieval in right and left frontal lobe patients: a multidimensional perspective. *Neuropsychologia* 39: 1209-1217.
- Schwarz L, Penna S and Novack T. (2009) Factors contributing to performance on the Rey Complex Figure Test in individuals with traumatic brain injury. *The Clinical Neuropsychologist* 23: 255-267.
- Scott ML, Cole JK, McKay SE, et al. (1984) Neuropsychological performance of sexual assaulters and pedophiles. *Journal of Forensic Sciences* 29: 1114-1118.
- Scullin MK, Bugg JM, McDaniel MA, et al. (2011) Prospective memory and aging: preserved spontaneous retrieval, but impaired deactivation, in older adults. *Memory and Cognition* 39: 1232-1240.
- Seeley WW, Crawford R, Rascofsky K, et al. (2008) Frontal paralimbic network atrophy in very mild behavioral variant frontotemporal dementia. *Archives of Neurology* 65: 249-255.
- Seidel EM, Pfabigan DM, Keckeis K, et al. (2013) Empathic competencies in violent offenders. *Psychiatry Research* 210: 1168-1175.
- Senathi-Raja D, Ponsford J and Schonberger M. (2010) Impact of age on long-term cognitive function after traumatic brain injury. *Neuropsychology* 24: 336-344.

- Seux ML, Thijs L, Forette F, et al. (1998) Correlates of cognitive status of old patients with isolated systolic hypertension: the Syst-Eur Vascular Dementia Project. *Journal of Hypertension* 16: 963-969.
- Shackley M, Weiner C, Day A, et al. (2013) Assessment of public attitudes towards sex offenders in an Australian population. *Psychology, Crime and Law* (in press).
- Shallice T and Burgess PW. (1991) Deficits in strategy application following frontal lobe damage in man. *Brain* 114 ( Pt 2): 727-741.
- Shany-Ur T, Poorzand P, Grossman SN, et al. (2012) Comprehension of insincere communication in neurodegenerative disease: lies, sarcasm, and theory of mind. *Cortex* 48: 1329-1341.
- Shenai BV, Harrison DW and Demaree HA. (2003) The neuropsychology of depression: a literature review and preliminary model. *Neuropsychology Review* 13: 33-42.
- Shing YL, Werkle-Bergner M, Brehmer Y, et al. (2010) Episodic memory across the lifespan: the contributions of associative and strategic components. *Neuroscience and Biobehavioral Reviews* 34: 1080-1091.
- Shiroma EJ, Ferguson PL and Pickelsimer EE. (2010) Prevalence of traumatic brain injury in an offender population: a meta-analysis. *J Correct Health Care* 16: 147-159.
- Shiroma EJ, Ferguson PL and Pickelsimer EE. (2012) Prevalence of traumatic brain injury in an offender population: a meta-analysis. *Journal of Head Trauma Rehabilitation* 27: E1-10.
- Silva HC, Carvalho MJ, Jorge CL, et al. (1999) [Sexual disorders in epilepsy. Results of a multidisciplinary evaluation]. *Arquivos de Neuro-Psiquiatria* 57: 798-807.
- Silver JM, Kramer R, Greenwald S, et al. (2001) The association between head injuries and psychiatric disorders: findings from the New Haven NIMH Epidemiologic Catchment Area Study. *Brain Injury* 15: 935-945.

- Simpson G, Blaszczynski A and Hodgkinson A. (1999) Sex offending as a psychosocial sequela of traumatic brain injury. *Journal of Head Trauma Rehabilitation* 14: 567-580.
- Slachevsky A, Villalpando JM, Sarazin M, et al. (2004) Frontal assessment battery and differential diagnosis of frontotemporal dementia and Alzheimer disease. *Archives of Neurology* 61: 1104-1107.
- Slaughter B, Fann JR and Ehde D. (2003) Traumatic brain injury in a county jail population: prevalence, neuropsychological functioning and psychiatric disorders. *Brain Injury* 17: 731-741.
- Slessor G, Phillips LH and Bull R. (2007) Exploring the specificity of age-related differences in theory of mind tasks. *Psychology and Aging* 22: 639-643.
- Small SA. (2001) Age-related memory decline: current concepts and future directions. *Archives of Neurology* 58: 360-364.
- Small SA, Stern Y, Tang M, et al. (1999) Selective decline in memory function among healthy elderly. *Neurology* 52: 1392-1396.
- Smith SR and Zahka NE. (2006) Relationship between accuracy and organizational approach on the Rey-Osterrieth Complex Figure and the differential ability scales: a pilot investigation. *Child neuropsychology* 12: 383-390.
- Snell RS. (1992) *Clinical Neuroanatomy for medical students* London: Little Brown and Company.
- Snowden JS, Neary D and Mann DM. (2002) Frontotemporal dementia. *The British journal of psychiatry* 180: 140-143.
- Soderstrom H, Tullberg M, Wikkelso C, et al. (2000) Reduced regional cerebral blood flow in non-psychotic violent offenders. *Psychiatry Research* 98: 29-41.

- Sondenaa E, Rasmussen K, Palmstierna T, et al. (2008) The prevalence and nature of intellectual disability in Norwegian prisons. *Journal of Intellectual Disability Research* 52: 1129-1137.
- Spikman JM, Milders MV, Visser-Keizer AC, et al. (2013) Deficits in facial emotion recognition indicate behavioral changes and impaired self-awareness after moderate to severe traumatic brain injury. *PLoS One* 8: e65581.
- Spinella M, White J, Frank M, et al. (2006) Evidence of orbitofrontal dysfunction in sex offenders. *International Journal of Forensic Psychology* 1: 62-68.
- Spreeen O and Strauss E. (1998) *A compendium of neuropsychological tests: Administration, norms and commentary* New York: Oxford University Press.
- Stano JF. (2004) Test Review: Wechsler abbreviated scale of intelligence. *Rehabilitation Counseling Bulletin* 48: 56-57.
- Stark CP. (2005) Behavioral effects of stimulation of the medial amygdala in the male rat are modified by prior sexual experience. *Journal of General Psychology* 132: 207-224.
- Starr JM, Deary IJ, Inch S, et al. (1997) Age-associated cognitive decline in healthy old people. *Age and Ageing* 26: 295-300.
- Stein DJ, Hugo F, Oosthuizen P, et al. (2000) Neuropsychiatry of hypersexuality. *CNS Spectr* 5: 36-46.
- Stern AE, Lynch DL, Oates RK, et al. (1995) Self esteem, depression, behaviour and family functioning in sexually abused children. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 36: 1077-1089.
- Stojkovic S. (2007) Elderly prisoners: a growing and forgotten group within correctional systems vulnerable to elder abuse. *J Elder Abuse Negl* 19: 97-117.



- Stoleru S, Fonteille V, Cornelis C, et al. (2012) Functional neuroimaging studies of sexual arousal and orgasm in healthy men and women: a review and meta-analysis. *Neuroscience and Biobehavioral Reviews* 36: 1481-1509.
- Stoléru S, Fonteille V and Moulrier V. (2013) Neural correlates of pedophilic sexual attraction. *Annales Médico-psychologiques, revue psychiatrique* (IN PRESS).
- Stoleru S, Redoute J, Costes N, et al. (2003) Brain processing of visual sexual stimuli in men with hypoactive sexual desire disorder. *Psychiatry Research* 124: 67-86.
- Stone MH and Thompson EH. (2001) Executive function impairment in sexual offenders. *Journal of Individual Psychology* 57: 51-59.
- Stone VE, Baron-Cohen S and Knight RT. (1998) Frontal lobe contributions to theory of mind. *Journal of Cognitive Neuroscience* 10: 640-656.
- Strauss E, Sherman EMS and Spreen O. (2006) *A Compendium of Neuropsychological Tests*, Oxford: Oxford University Press.
- Strenziok M, Pulaski S, Krueger F, et al. (2011) Regional brain atrophy and impaired decision making on the balloon analog risk task in behavioral variant frontotemporal dementia. *Cogn Behav Neurol* 24: 59-67.
- Strine TW, Dube SR, Edwards VJ, et al. (2012) Associations between adverse childhood experiences, psychological distress, and adult alcohol problems. *American journal of health behavior* 36: 408-423.
- Stuss DT and Alexander MP. (2000) Executive functions and the frontal lobes: a conceptual view. *Psychological Research* 63: 289-298.
- Stuss DT, Alexander MP, Hamer L, et al. (1998) The effects of focal anterior and posterior brain lesions on verbal fluency. *Journal of the International Neuropsychological Society* 4: 265-278.

- Stuss DT, Craik FI, Sayer L, et al. (1996) Comparison of older people and patients with frontal lesions: evidence from world list learning. *Psychology and Aging* 11: 387-395.
- Stuss DT, Shallice T, Alexander MP, et al. (1995) A multidisciplinary approach to anterior attentional functions. *Annals of the New York Academy of Sciences* 769: 191-211.
- Suchy Y and Kosson DS. (2005) State-dependent executive deficits among psychopathic offenders. *Journal of the International Neuropsychological Society* 11: 311-321.
- Suchy Y, Whittaker JW, Strassberg DS, et al. (2009a) Neurocognitive differences between pedophilic and nonpedophilic child molesters. *Journal of the International Neuropsychological Society* 15: 248-257.
- Suchy Y, Whittaker WJ, Strassberg DS, et al. (2009b) Facial and prosodic affect recognition among pedophilic and nonpedophilic criminal child molesters. *Sexual Abuse* 21: 93-110.
- Sullivan S and Ruffman T. (2004) Social understanding: How does it fare with advancing years? *British Journal of Psychology* 95: 1-18.
- Suzuki A and Akiyama H. (2013) Cognitive aging explains age-related differences in face-based recognition of basic emotions except for anger and disgust. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 20: 253-270.
- Suzuki A, Hoshino T, Shigemasu K, et al. (2007) Decline or improvement? Age-related differences in facial expression recognition. *Biological Psychology* 74: 75-84.
- Swanston HY, Tebbutt JS, O'Toole BI, et al. (1997) Sexually abused children 5 years after presentation: a case-control study. *Pediatrics* 100: 600-608.
- Syngelaki EM, Moore SC, Savage JC, et al. (2009) Executive functioning and risky decision making in young male offenders. *Criminal Justice and Behavior* 36: 1213-1227.
- Szasz G. (1983) Sexual incidents in an extended care unit for aged men. *Journal of the American Geriatrics Society* 31: 407-411.

- Tabachnick BG and Fidell LS. (2013) *Using Multivariate Statistics*, Boston: Pearson.
- Tebbutt J, Swanston H, Oates RK, et al. (1997) Five years after child sexual abuse: persisting dysfunction and problems of prediction. *Journal of the American Academy of Child and Adolescent Psychiatry* 36: 330-339.
- Terada S, Sato S, Nagao S, et al. (2013) Trail Making Test B and brain perfusion imaging in mild cognitive impairment and mild Alzheimer's disease. *Psychiatry Research* 213: 249-255.
- Themanson JR, Hillman CH and Curtin JJ. (2006) Age and physical activity influences on action monitoring during task switching. *Neurobiology of Aging* 27: 1335-1345.
- Thornton D. (2006) Age and sexual recidivism: a variable connection. *Sexual Abuse* 18: 123-135.
- Tiihonen J, Kuikka J, Kupila J, et al. (1994) Increase in cerebral blood flow of right prefrontal cortex in man during orgasm. *Neuroscience Letters* 170: 241-243.
- Timonen M, Miettunen J, Hakko H, et al. (2002) The association of preceding traumatic brain injury with mental disorders, alcoholism and criminality: the Northern Finland 1966 Birth Cohort Study. *Psychiatry Research* 113: 217-226.
- Tombaugh TN. (2004) Trail Making Test A and B: normative data stratified by age and education. *Arch Clin Neuropsychol* 19: 203-214.
- Tombaugh TN, Kozak J and Rees L. (1999) Normative data stratified by age and education for two measures of verbal fluency: FAS and animal naming. *Arch Clin Neuropsychol* 14: 167-177.
- Torralva T, Kipps CM, Hodges JR, et al. (2007) The relationship between affective decision-making and theory of mind in the frontal variant of fronto-temporal dementia. *Neuropsychologia* 45: 342-349.

- Tost H, Vollmert C, Brassens S, et al. (2004) Pedophilia: neuropsychological evidence encouraging a brain network perspective. *Medical Hypotheses* 63: 528-531.
- Tranel D, Bechara A and Denburg NL. (2002) Asymmetric functional roles of right and left ventromedial prefrontal cortices in social conduct, decision-making, and emotional processing. *Cortex* 38: 589-612.
- Treitz FH, Heyder K and Daum I. (2007) Differential course of executive control changes during normal aging. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn* 14: 370-393.
- Troyer AK, Moscovitch M and Winocur G. (1997) Clustering and switching as two components of verbal fluency: evidence from younger and older healthy adults. *Neuropsychology* 11: 138-146.
- Tuominen T, Korhonen T, Hamalainen H, et al. (2013) Neurocognitive disorders in sentenced male offenders: Implications for rehabilitation. *Criminal behaviour and mental health*.
- Uekermann J, Channon S and Daum I. (2006) Humor processing, mentalizing, and executive function in normal aging. *Journal of the International Neuropsychological Society* 12: 184-191.
- Uzoaba J. (1998) *Managing Older Offenders: Where Do We Stand?*, Ottawa: Correctional Services of Canada.
- Vakil E and Blachstein H. (1997) Rey AVLT: Developmental norms for adults and the sensitivity of different memory measures to age. *The Clinical Neuropsychologist* 11: 356-369.
- Vakil E, Blachstein H and Sheinman M. (1998) Rey AVLT: Developmental norms for children and the sensitivity of different memory measures to age. *Child neuropsychology* 4: 161-177.

- Vakil E, Greenstein Y and Blachstein H. (2010) Normative data for composite scores for children and adults derived from the Rey Auditory Verbal Learning Test. *The Clinical Neuropsychologist* 24: 662-677.
- Van der Elst W, van Boxtel MP, van Breukelen GJ, et al. (2005) Rey's verbal learning test: normative data for 1855 healthy participants aged 24-81 years and the influence of age, sex, education, and mode of presentation. *Journal of the International Neuropsychological Society* 11: 290-302.
- van Swieten JC, Staal S, Kappelle LJ, et al. (1996) Are white matter lesions directly associated with cognitive impairment in patients with lacunar infarcts? *Journal of Neurology* 243: 196-200.
- Veneziano C, Veneziano L, LeGrand S, et al. (2004) Neuropsychological executive functions of adolescent sex offenders and nonsex offenders. *Perceptual and Motor Skills* 98: 661-674.
- Waldstein SR. (1995) Hypertension and neuropsychological function: a lifespan perspective. *Experimental Aging Research* 21: 321-352.
- Walhovd KB, Westlye LT, Amlien I, et al. (2011) Consistent neuroanatomical age-related volume differences across multiple samples. *Neurobiology of Aging* 32: 916-932.
- Wallace C, Mullen P, Burgess P, et al. (1998) Serious criminal offending and mental disorder. Case linkage study. *The British journal of psychiatry* 172: 477-484.
- Walter M, Witzel J, Wiebking C, et al. (2007) Pedophilia is linked to reduced activation in hypothalamus and lateral prefrontal cortex during visual erotic stimulation. *Biological Psychiatry* 62: 698-701.
- Ward T, Polaschek DLL and Beech AR. (2006) *Theories of sexual offending*, Chinchester: Wiley.

- Ware J and Bright DA. (2008) Evolution of a treatment programme for sex offenders: Changes to the NSW Custody-Based Intensive Treatment (CUBIT). *Psychiatry, Psychology and Law* 15: 340-349.
- Wasylyshyn C, Verhaeghen P and Sliwinski MJ. (2011) Aging and task switching: a meta-analysis. *Psychology and Aging* 26: 15-20.
- Watt KJ and O'Carroll RE. (1999) Evaluating methods for estimating premorbid intellectual ability in closed head injury. *Journal of Neurology, Neurosurgery and Psychiatry* 66: 474-479.
- Webster SD. (2002) Assessing victim empathy in sexual offenders using the victim letter task. *Sexual Abuse* 14: 281-300.
- Wellman HM, Cross D and Watson J. (2001) Meta-analysis of theory-of-mind development: the truth about false belief. *Child Development* 72: 655-684.
- Welsh-Bohmer KA and Warren LH. (2006) Neurodegenerative dementias. In: Attix DK and Welsh-Bohmer KA (eds) *Geriatric Neuropsychology* New York: The Guildford Press, 56-88.
- Werner KH, Roberts NA, Rosen HJ, et al. (2007) Emotional reactivity and emotion recognition in frontotemporal lobar degeneration. *Neurology* 69: 148-155.
- West LK, Curtis KL, Greve KW, et al. (2011) Memory in traumatic brain injury: the effects of injury severity and effort on the Wechsler Memory Scale-III. *J Neuropsychol* 5: 114-125.
- West R. (2000) In defense of the frontal lobe hypothesis of cognitive aging. *Journal of the International Neuropsychological Society* 6: 727-729.
- West RL. (1996) An application of prefrontal cortex function theory to cognitive aging. *Psychological Bulletin* 120: 272-292.

- Wiederkehr S, Laurin D, Simard M, et al. (2009) Vascular risk factors and cognitive functions in nondemented elderly individuals. *Journal of Geriatric Psychiatry and Neurology* 22: 196-206.
- Williams WH, Mewse AJ, Tonks J, et al. (2010) Traumatic brain injury in a prison population: prevalence and risk for re-offending. *Brain Injury* 24: 1184-1188.
- Willis ML, Palermo R, Burke D, et al. (2010) Orbitofrontal cortex lesions result in abnormal social judgements to emotional faces. *Neuropsychologia* 48: 2182-2187.
- Willis SL, Jay GM, Diehl M, et al. (1992) Longitudinal Change and Prediction of Everyday Task Competence in the Elderly. *Research on Aging* 14: 68-91.
- Wiseman SV, McAuley JW, Freidenberg GR, et al. (2000) Hypersexuality in patients with dementia: possible response to cimetidine. *Neurology* 54: 2024.
- Wood RL and McHugh L. (2013) Decision making after traumatic brain injury: a temporal discounting paradigm. *Journal of the International Neuropsychological Society* 19: 181-188.
- Wood RL and Rutterford NA. (2006) Demographic and cognitive predictors of long-term psychosocial outcome following traumatic brain injury. *Journal of the International Neuropsychological Society* 12: 350-358.
- Wood S, Busemeyer J, Kolling A, et al. (2005) Older adults as adaptive decision makers: evidence from the Iowa Gambling Task. *Psychology and Aging* 20: 220-225.
- Woodworth M, Freimuth T, Hutton EL, et al. (2013) High-risk sexual offenders: an examination of sexual fantasy, sexual paraphilia, psychopathy, and offence characteristics. *International Journal of Law and Psychiatry* 36: 144-156.
- Wright P, Nobrega J, Langevin R, et al. (1990) Brain density and symmetry in pedophilic and sexually aggressive offenders *Annals of Sex Research* 3: 319-328.

- Yeung SE, Fischer AL and Dixon RA. (2009) Exploring effects of type 2 diabetes on cognitive functioning in older adults. *Neuropsychology* 23: 1-9.
- Yeung SE and Thornton WL. (2011) Age-related effects of blood pressure on everyday cognitive function in community-dwelling women. *Neuropsychology, development, and cognition* 18: 733-755.
- Ylikoski A, Erkinjuntti T, Raininko R, et al. (1995) White matter hyperintensities on MRI in the neurologically nondiseased elderly. Analysis of cohorts of consecutive subjects aged 55 to 85 years living at home. *Stroke* 26: 1171-1177.
- Ylikoski R, Ylikoski A, Keski-Vaara P, et al. (1999) Heterogeneity of cognitive profiles in aging: successful aging, normal aging, and individuals at risk for cognitive decline. *European Journal of Neurology* 6: 645-652.
- Yorston G. (2004) Older people. *Criminal behaviour and mental health* 14 Suppl 1: S56-57.
- Yorston GA and Taylor PJ. (2006) Commentary: older offenders--no place to go? *Journal of the American Academy of Psychiatry and the Law* 34: 333-337.
- Yoshida H, Terada S, Honda H, et al. (2011) Validation of Addenbrooke's cognitive examination for detecting early dementia in a Japanese population. *Psychiatry Research* 185: 211-214.
- Young MH, Justice JV and Edberg P. (2010) Sexual offenders in prison psychiatric treatment: a biopsychosocial description. *Int J Offender Ther Comp Criminol* 54: 92-112.
- Zakzanis KK, Leach L and Kaplan E. (1999) *Neuropsychological Differential Diagnosis (Studies on Neuropsychology, Neurology and Cognition)* Netherlands: Psychology Press.
- Zakzanis KK, Mraz R and Graham SJ. (2005) An fMRI study of the Trail Making Test. *Neuropsychologia* 43: 1878-1886.



- Zald DH and Andreotti C. (2010) Neuropsychological assessment of the orbital and ventromedial prefrontal cortex. *Neuropsychologia* 48: 3377-3391.
- Zamarian L, Sinz H, Bonatti E, et al. (2008) Normal aging affects decisions under ambiguity, but not decisions under risk. *Neuropsychology* 22: 645-657.
- Zelazo PD, Craik FI and Booth L. (2004) Executive function across the life span. *Acta Psychologica* 115: 167-183.
- Zhou SS, Fan J, Lee TM, et al. (2011) Age-related differences in attentional networks of alerting and executive control in young, middle-aged, and older Chinese adults. *Brain and Cognition* 75: 205-210.
- Zimmerman ME, Brickman AM, Paul RH, et al. (2006) The relationship between frontal gray matter volume and cognition varies across the healthy adult lifespan. *The American journal of geriatric psychiatry* 14: 823-833.
- Zou Z, Meng H, Ma Z, et al. (2013) Executive functioning deficits and childhood trauma in juvenile violent offenders in China. *Psychiatry Research* 207: 218-224.

**A neuropsychological study of *first-time* sex offenders over the  
age of 50: the possible contribution of cognitive deficits to  
sexual offending**

**Marcelo Rodriguez  
BSc (Psychology), MAPS**

**APPENDICES**

## **Neuropsychological Assessment of offenders Over the age of 50 years old**

My name is Marcelo Rodriguez. I am a psychologist and I am seeking your participation as a subject in my Doctor of Philosophy (PhD) study for the Faculty of Psychological Medicine at the University of Sydney.

You will be asked to complete a series of tasks such as explaining the meanings of words, sorting cards, constructing blocks into a design, arithmetic reasoning, and copying a complex figure. This will take approximately 1 hour 30 minutes.

The above tests are not physically invasive however you may feel fatigued, as you will be concentrating for a lengthy period. However if you require breaks, this will definitely be provided to you. There are no associated risks with this study and it will be conducted at a time convenient to you to minimise any inconvenience.

Your participation is voluntary and you are free to withdraw from participation at any time without any penalty. You will be asked to sign a consent form prior to participation in the study. I am seeking your assistance as a valued participant of the study. All information provided will remain confidential. You will be given a code number and the link between your name and the code number will be broken after all the data is collected. As the study is not looking at an individual case, in this case yours, there is no reason to keep such information.

In the future it is possible that the research data may be published or the results provided to other researchers in this field. At no point will individual personal information be provided. This is to guarantee your anonymity.

Research is the best way to inform clinicians in the field so that improvements in assessment and treatment can be achieved. This type of research is beneficial to better understand offending behaviour and to develop newer, more effective treatments. The hypothesis of my study is that older offenders are more likely to have cognitive deficits (brain function as demonstrated in paper and pencil tests, computer tests or mental calculations), which may contribute to poor decisions (one of which may lead to offending).

You can request a written report of your results in writing should you desire. Should you have any questions regarding the study and your participation, please do not hesitate to ask me in person or in writing. Any further enquiries can be directed to my supervisor Professor Philip Boyce at the University of Sydney.

Appendix 2 - Consent Form

**Neuropsychological Assessment**

I \_\_\_\_\_ agree to participate in a research study “Neuropsychological Assessment of *First Time* Sex Offenders over the age of 50”, conducted by Marcelo Rodriguez.

My agreement is based on:

1. My involvement entails the completion of several neuropsychological tests.
2. The inconvenience and fatigue have been explained to me. There are no physical risks.
3. I have read the attached Information Sheet and understand the contents, the general purpose of the study, and its methods.
4. I understand that the study may not be of direct benefit to me.
5. I am satisfied with the explanation given regarding the study and my consent is given freely, without any incentives.
6. I understand that I can withdraw my consent and participation in the study at any time.
7. I can obtain a written report providing me with my results. I understand that I need to do so in writing.

Signature of Chief Investigator: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Participant: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Witness: \_\_\_\_\_ Date: \_\_\_\_\_

**Please feel free to contact the researcher for any enquiries regarding the study. You can also contact Professor Philip Boyce at the University of Sydney, Faculty of Psychological Medicine.**

## Appendix 3 - Hayling Sentence Completion Test

### Hayling Sentence Completion Test (Burgess & Shallice, 1997)

“In a moment I am going to read you a series of sentences, each of which has the last word missing from it. I want you to listen carefully to each sentence, and when I have finished each one; your job is to give me a word, which completes the sentence. Do you understand?” [Repeat instructions if needed]

“Before we start, I’ll give you a couple of practice sentences so you can get the hang of it. Are you ready?”

Administer the two Practice Items for Section 1. Do not time these.

| Item | Sentence                             | Response | Time |
|------|--------------------------------------|----------|------|
| P1   | The rich child attended a private... |          | N/A  |
| P2   | The crime rate has gone up this...   |          | N/A  |

“OK, that’s the end of the practice items. The next few sentences I’ll read aren’t really any more difficult than the two you’ve just done. But the important thing is that I want you to give me your answer as quickly as you can – the faster the better. Is that clear?” [Give as much further explanation as necessary]

NOTE: Record time in whole second units, which *are not rounded up*. Max time for each trial is 60 seconds; record time latency as 60.

#### Section 1

| Item | Sentence  | Response | Time |  |              |                  |
|------|---|----------|------|--|--------------|------------------|
| 1    | He posted a letter without a...                       |          |      | Raw Score  | Scaled Score | Comment          |
| 2    | In the first space, enter your...                     |          |      | 0  | 7            | High Average     |
| 3.   | The old house will be torn...                         |          |      | 1-9  | 6            | Average          |
| 4.   | It’s hard to admit when one is...                     |          |      | 10-18  | 5            | Moderate Average |
| 5.   | The job was easy most of the...                       |          |      | 19-22  | 4            | Low Average      |
| 6.   | When you go to bed turn off the...                    |          |      | 23-50  | 3            | Poor             |
| 7.   | The game was stopped when it started to...            |          |      | 51-60  | 2            | Abnormal         |
|      |   |          |      | >60  | 1            | Impaired         |
| 8.   | He scraped the cold food from his...                  |          |      | Total Time:<br><br>Raw Score _____<br><br>Scaled Score _____ (A) |              |                  |
| 9.   | The dispute was settled by a third...                 |          |      |  |              |                  |
| 10.  | Three people were killed in a major motorway...       |          |      |  |              |                  |
| 11.  | The baby cried and upset her...                       |          |      |  |              |                  |
| 12.  | George could not believe that his son had stolen a... |          |      |  |              |                  |
| 13.  | He crept into the room without a...                   |          |      |  |              |                  |
| 14.  | Billy hit his sister on the...                        |          |      |  |              |                  |
| 15.  | Too many men are out of...                            |          |      |  |              |                  |

NOTE:

- Change of mind – If the patient changes their mind and gives two responses, record the response and time for their first answer.
- Multi-word answers – Score the first multi-word answer as it stands but before giving the next item, say, “You’ve just given me an answer which was more than one word. This doesn’t matter too much, but I would prefer it if you would try to keep your answers to just one word.” Correct them once only.
- Mishearing – If patients mishear, ask them to repeat the sentence back to you first. If it is incorrect, then repeat the item to them again.
- Strategy development – Some patients may repeat the same word to all trials. This is not permitted. “You’ve already used that answer. Repeating the same word to each sentence is a good way of approaching this test, but it makes it too easy, so I’m afraid that I’m going to have to ask you not to use it. From now on I want a different word each time.” [Score further repeats as Category A responses].

Always administer Section 2 *immediately after* Section 1.

## Section 2

“Now we are going to move onto the second section of the test. In this section, I will read you a set of sentences with the last word missing just like the ones you have already done, but this time I want you to give me a word which does **NOT** fit at the end of the sentence – I want the word you give me to be completely unconnected to the sentence in every way. Do you understand?”

“Before we start, I’ll give you a couple of practice sentences so that you can get the hang of what is required.”

| Item | Sentence                        | Response | Time |
|------|---------------------------------|----------|------|
| P1   | London is a very busy...*       |          | N/A  |
| P2   | Her new shoes were the wrong... |          | N/A  |

\*If incorrect, say “The word you have just given me **DOES** fit at the end of the sentence – the sentence “London is a very busy [patient’s response]” does make sense, doesn’t it? But what I want is a word, which **DOESN’T** fit at the end; one, which is completely unconnected to it. So for instance if you had given me the word “banana”, that would be right, because “banana” is unconnected to the sentence “London is a very busy...” “So can you think of a word which you could have given me instead of [patient’s response]?”

If response is unconnected, say “That’s very good, so I’ll give you one more practice item.”

If response is not acceptable, say “Well that would be still connected to the sentence, isn’t it? So it is not an ideal kind of answer. But I’ll give you another practice sentence to see if you can get the hang of it.” [Correct patient if their answer is again unacceptable, allow another attempt at Practice 2, and then move on]

“Ok that’s the end of the practice items. Remember that the words you give me must be unconnected to the sentence, and that it is important for you to give me your answer as quickly as you can. Are you ready?”

NOTE: Remind patients of the rule if Category A response (i.e. connected) is given during a trial; Remind after each trial if necessary.

| Item | Sentence                                       | Response | Time | Correct | Category A | Category B |
|------|--|----------|------|---------|------------|------------|
| 1.   | The captain wanted to stay with the sinking... |          |      |         |            |            |
| 2.   | They went as far as they...                    |          |      |         |            |            |
| 3.   | Most cats see very well at...                  |          |      |         |            |            |
| 4.   | Jean was glad the affair was...                |          |      |         |            |            |
| 5.   | The whole town came to hear the mayor...       |          |      |         |            |            |
| 6.   | Most sharks attack very close to...            |          |      |         |            |            |
| 7.   | None of the books made any...                  |          |      |         |            |            |
| 8.   | The dough was put in the hot...                |          |      |         |            |            |
| 9.   | She called the husband at his...               |          |      |         |            |            |
| 10.  | All the guests had a very good...              |          |      |         |            |            |
| 11.  | He bought them in the candy...                 |          |      |         |            |            |
| 12.  | His leaving home amazed all his...             |          |      |         |            |            |
| 13.  | At last the time for action had...             |          |      |         |            |            |
| 14.  | The dog chased our cat up the...               |          |      |         |            |            |
| 15.  | At night they often took a short...            |          |      |         |            |            |

|                         |                           |                           |                                   |
|-------------------------|---------------------------|---------------------------|-----------------------------------|
| Total Time (raw): _____ | Cat A Errors (raw): _____ | Cat B Errors (raw): _____ | Converted Score (A+B score) _____ |
|-------------------------|---------------------------|---------------------------|-----------------------------------|

| Raw Score                                   | Scaled Score | Comment      | Errors             | A Score | Errors             | B Score | Converted Score                                 | Scaled Score | Comment     |
|---|--------------|--------------|--------------------|---------|--------------------|---------|---|--------------|-------------|
| 0   | 8            | Good         | 1                  | 3       | 1                  | 1       | 0   | 8            | Good        |
| 1-2   | 7            | High Average | 2                  | 6       | 2                  | 2       | 1-3   | 7            | High Ave    |
| 3-50  | 6            | Average      | 3                  | 10      | 3                  | 3       | 4-9   | 6            | Average     |
| 51-60                                       | 5            | Moderate Ave | 4                  | 14      | 4                  | 4       | 10-12   | 5            | Mod Ave     |
| 61-100                                      | 4            | Low Average  | 5                  | 18      | 5                  | 9       | 13-14   | 4            | Low Average |
| 101-120                                     | 3            | Poor         | 6                  | 24      | 6                  | 14      | 15-17   | 3            | Poor        |
| 121-130                                     | 2            | Abnormal     | 7                  | 30      | 7                  | 19      | 18-29   | 2            | Abnormal    |
| >130  | 1            | Impaired     | 8                  | 36      | 8                  | 24      | >=30  | 1            | Impaired    |
|   |              |              | 9                  | 42      | 9                  | 29      |   |              |             |
|   |              |              | 10                 | 48      | 10                 | 34      |   |              |             |
|   |              |              | 11                 | 54      | >10                | 50      |   |              |             |
|   |              |              | 12                 | 60      |                    |         |   |              |             |
|   |              |              | 13                 | 66      |                    |         |   |              |             |
|   |              |              | 14                 | 72      |                    |         |   |              |             |
|   |              |              | 15                 | 78      |                    |         |   |              |             |
| <b>Total Time (SS): _____</b><br><b>(B)</b> |              |              | Cat A Score: _____ |         | Cat B Score: _____ |         | <b>Hayling 2 errors SS: _____</b><br><b>(C)</b> |              |             |

| Score Summary:                      |  | Total Scaled Score | Overall Scaled Score | Classification   |
|-------------------------------------|--|--------------------|----------------------|------------------|
| (A) _____                           |  | 23                 | 10                   | Very Superior    |
| + (B) _____                         |  | 22                 | 9                    | Superior         |
| + (C) _____                         |  | 21                 | 8                    | Good             |
| = Total Scaled Score _____          |  | 20                 | 7                    | High Average     |
| = <b>Overall Scaled Score</b> _____ |  | 17-19              | 6                    | Average          |
|                                     |  | 15-16              | 5                    | Moderate Average |
|                                     |  | 13-14              | 4                    | Low Average      |
|                                     |  | 11-12              | 3                    | Poor             |
|                                     |  | 10                 | 2                    | Abnormal         |
|                                     |  | <10                | 1                    | Impaired         |

## **The Depression, Anxiety and Stress Scales (DASS)**

### **Instructions**

Participants were asked to use 4-point severity/frequency scales to rate the extent to which they had experienced each state over the past week. These scores ranged from 0, meaning that the offender believed the item "did not apply to them at all", to 3 meaning that the offender considered the item to "apply to them very much, or most of the time". Scores for Depression, Anxiety and Stress were calculated by summing the scores for the relevant items. Total scores range from 0 to 42 on each of the three DASS scales.

## **Hayling Test**

### **Instructions**

The goal of the present study was to investigate the ability of offenders to use inhibitory processes, a proxy measure of executive function, measured by performance on the Hayling test. There were two conditions, automatic (Section 1) and inhibition (Section 2). In the "automatic" condition, the participant was told to listen to the sentence and complete it with the appropriate word as quickly as possible. Two practice sentences were initially presented. Response latencies were recorded with a stopwatch, beginning when this researcher pronounced the last word and ending when the participant began to respond.

### **Section 1 scoring**

If the participant failed to provide a response within 60 seconds, the trial was terminated and recorded as 60 seconds as the latency before moving onto the next item. If a participant provided a response consisting of three words or more on either Section 1 or 2, the item would be scored as it was; however, the participant would be instructed *"You've just given me an answer which was more than one word. This doesn't matter too much, but I would prefer it if you would try to keep the answers to*



*just one word*". If the participant continued to produce long answers, he was not corrected. In the "inhibition" condition, the participant was told to finish the sentence as rapidly as possible with a word that was completely unrelated to the sentence and nonsensical in the context of that sentence. Two examples were also given to participants prior to the task. For all trials, if a participant provided an erroneous response (i.e., related to the sentence), the instructions were repeated and the participant was informed that his response was too closely related to the sentence.

### **Section 2 scoring**

As in Section 1, if the participant failed to provide a response within 60 seconds, the trial was terminated and recorded as 60 seconds as the latency before moving onto the next item. The time measure was derived by adding all the individual response latencies. The score is ascertained from Table B on the scoring sheet. Each response on Section 2 is classified as falling into one of three categories. The first is where the word produced is completely unconnected to the sentence. This response scores zero error points. Category A errors is where the participant completes the sentence in an entirely plausible fashion. Category B errors is where the response is somewhat connected to the meaning of the sentence (or some aspect of it), but is not a direct sentence completion. Category A and B errors are scored together to give a 'Converted score', which is then transformed into a scaled score.

## **Iowa Gambling Test**

### **Instructions and scoring**

Participants were provided with the rules found in the IGT manual. Specifically, the task allows participants to select cards from four decks (A, B, C, and D) displayed on-screen. Participants were instructed that the selection of each card would result in winning money but that every so often a card selection would also result in losing money. Participants were instructed to accumulate as much money as possible. The participants were provided with a laptop and completed the task alone. This researcher supervised the participants while completing the task. The task was completed after 100 selections within 10-15 minutes. The normative data of the IGT

was used to determine scores, generated by the program's software. Offenders failed the task reporting a negative total score, as a result of the selection of more disadvantageous choices than advantageous choices.

## **Trail-Making Test**

### **Instructions and scoring**

The tests were conducted according to the standard administration procedure described by Spreen and Strauss (1998). Participants were required to connect, by making pencil lines, 25 encircled numbers on a page in proper order (Part A) and 25 encircled numbers and letters in alternating order (Part B). The participants were instructed to start the trial at the circle marked *Begin* and continue linking numbers until they reach the endpoint (circle marked *End*). Part B is more complex than Part A because it requires the participant to connect numbers and letters in an alternating pattern (1-A-2-B-3-C, etc.) in as little time as possible (Tombaugh, 2004). If an error was made on Part B, the examiner pointed it out to the participant for correction and instructed to return to and continue from the correct location while the clock remained running. Scores were calculated by adding the time to complete Parts A and B. The normative data from the Comprehensive Trail-making Test (CTMT) (Reynolds, 2002) was used to score TMT performance, including TMT impairment.

## **The FAS test**

### **Instructions and scoring**

The FAS test is comprised of three trials in which the participants are required to orally generate (phonemic fluency) as many words beginning with the letters F, A and S in one minute, excluding proper nouns, numbers and the same word with a different suffix. Thus, perseverative responses and rule break errors (e.g. Susan for 'S') were excluded. The first trial required production of words beginning with the letter F. The successive two trials requested the production of words starting with the letters A and S, respectively, plus total errors (non-words or repetitions). The FAS assesses verbal fluency, which is reflected in the combined sum of all admissible

words across the three trials. Impairment on the FAS was assessed by comparing the scores against the normative data by Tombaugh et al. (1999).

## **The Rey Complex Figure Test (RCF)**

### **Instructions and scoring**

The guidelines for administering the RCF were followed (Meyers and Meyers, 1995). Participants were instructed to copy the RCF from the laminated RCF stimulus card. They were provided with a pencil and a blank response sheet and instructed to “copy that figure onto this sheet of paper”. This trial was timed. In between the Copy trial and the Immediate Recall trial, participants were instructed to perform the FAS. After a 3-minute interval (The Immediate Recall Trial) participants were instructed to draw the RCF from memory. The RCF was scored using a standardized approach based on the scoring criteria developed by Rey (Lezak et al., 2004). Rey’s scoring system divides the complex figure into 18 units, where each unit is scored separately for both accuracy and placement. A score of 0, 0.5, 1, or 2 is assigned to each unit of the figure based on accuracy and placement criteria. Thus, raw scores ranging from 0.0 to 36.0 may be obtained for the Copy and Immediate Recall trials. For each unit of the figure, a score of 2 is assigned if the unit was drawn accurately and placed correctly. A score of 1 is assigned if the unit was drawn accurately, but placed incorrectly. A score of 1 is assigned if the unit was drawn inaccurately, but was placed correctly. A score of 0.5 is assigned if the unit was drawn inaccurately and was placed incorrectly, but is still recognizable. A score of 0 is assigned if the unit was omitted altogether or was drawn inaccurately and placed incorrectly, and was not recognizable.

## **The Rey Auditory Verbal Learning Test**

### **Instructions and scoring**

Participants were instructed to listen to a list of 15 words (List A) and when the examiner stopped, they were to repeat as many words as they could remember in any order. After each trial, the responses were written down. The list was repeated 5 times. The total number of words was obtained by adding all five trials. After trials I to

V were provided, the RAVLT recognition task was administered. Recognition memory was evaluated by using a story format in written form. The participants were evaluated on their ability to recognize the words administered during the word list trials.

## **Facial Expression of Emotion: Stimuli and Tests FEEST**

### **Instructions and scoring**

Participants were shown 60 black-and-white photographs of men and women expressing happiness, surprise, fear, disgust, anger, or sadness for 5 seconds presented on a laptop computer. They were asked to rate the emotion that best described the expression. The best score was 10 out of 10 per emotion, with 0 out of 10 been the worst possible score for detecting an emotion. Therefore the best possible score was 60 (i.e., 10 X 6 faces/emotions). The FEEST total score, as well as each emotion, were scored automatically by the FEEST software. Impairment was assessed using the age norms found in the FEEST manual so that scores below the cut-off scores were rated as impaired.

# Neuropsychological Assessment of *First Time Sex Offenders* over the age of 50

Marcelo Rodriguez  
PhD Candidate  
May 2009

## In a nutshell

“To investigate the possible contribution of brain injury or developmental or acquired cognitive deficits in the commission of sexual offences in individuals over the age of 50, who have committed their first sexual offence after the age of 50”

## Why this Study?

- Introduction – my work
- Little research in this area/lots of confounding issues
- Neuropsychological deficits in sex offenders – the research thus far
- Assist in developing better SO programs for individuals with needs/resource allocation
- Contribute to scientific evidence/legal and ethical **ISSUES** (despite offences, sex offenders have the right to best-practised assessments)

## Methodology

- 3 groups (community and prison), all male
- 2 sexual offenders groups vs. control group
  1. First time offenders
  2. Long history of sexual offending
  3. Non-sexual offenders
- N=150, n=50-60 in each group,
- All subjects over the age of 50 at time of testing
- Inclusion (mental illness, D&A, PD)
- Exclusion criteria (not child pornography offenders)
- Compare scores on a battery of neuropsychological tests

## Neuropsychology Test Battery

- WASI
- ACE-R
- FAS
- RCF
- RAVLT
- Millon Multiaxial Inventory – III
- DASS
- Ekman faces
- Boston Naming Test
- Trails A & B
- NART
- IGT
- Hayling

## Hypotheses

1. FTSO perform worse than the comparison sex offender group and control group
2. That the sex offender groups perform worse than the control group

## Analysis

- T-tests between groups
- ANOVA between the 3 groups
- MANOVA? As there are a few variables
- Multiple regression
- Qualitative data (personality)

## Problems

- What if FTSO committed an offence many years ago but they were not charged?
- Methodological problems (time of testing following the offence) → reduce the time gap between **offence:testing**
- Statistical power (is n=50-60 in each group enough?)
- Data collection Logistics (time duration, amount of tests, inmate test fatigue)