

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**INCIDENCE, EPIDEMIOLOGY AND OUTCOMES OF  
MILD TRAUMATIC BRAIN INJURY IN CLIENTS  
REFERRED TO THE MASSEY UNIVERSITY  
CONCUSSION CLINIC**

A thesis presented in partial fulfilment of the requirements for the degree of  
Master of Arts  
in  
Psychology

at Massey University, Wellington, New Zealand

**Julia Margaret Alexandra Taylor**

**2005**



## **ABSTRACT**

The primary objectives of the present study were: (a) to gain a comprehensive understanding of the epidemiological and demographic variables associated with Mild Traumatic Brain Injury in New Zealand, (b) to investigate the relationship between history of head injury and risk and recovery from future head injuries, (c) to investigate the outcomes of assessment and treatment after Concussion Clinic attendance, and (d) to evaluate the quality of service provided by the Massey University Concussion Clinic.

Data was gained in two stages which involved firstly a review of the cover sheets of clients referred to the Concussion Clinic and secondly, the circulation of a questionnaire and a standardised measure of client satisfaction with services (the Service Satisfaction Survey – 30).

Results indicated that the epidemiological and demographic variables associated with concussion found in our New Zealand sample mirror those trends identified in the international literature. With regards to evaluation of the Concussion Clinic, clients were generally satisfied with the services they received. However, clients did identify some aspects of the service which could be improved.

This study demonstrated the need for an increase in the amount of available literature concerning the incidence and outcomes of Mild Traumatic Brain Injury in New Zealand. It also reinforced the need for ongoing evaluation as means of monitoring service delivery and client satisfaction in health care settings.

## ACKNOWLEDGEMENTS

Firstly, and for a multitude of reasons, I would like to thank my supervisor, Professor Janet Leathem, who presented me with the idea on which this thesis is based and who was a tremendous help through the entire process. Janet, thank you so much for sharing your knowledge with me and for your constant encouragement and enthusiasm towards this project. I really do feel very privileged to have had you as my supervisor and appreciate everything that you have done for me.

Thank you to the staff at the Massey University Concussion Clinic who permitted me to carry out this study and who helped me through the stages of data collection. In particular I would like to thank: Cheryl Woolley, Richard Seeman, Joan Norrie and Annette Ross.

Thank you to all of the participants in this study – I greatly appreciate the time and effort that you put in to answering the questionnaire and survey.

I would also like to thank Sharon Reilly at ACC and Linda Kemp at the Department of Psychology (Massey University, Albany).

Thank you to the graduate Psychology class of 2003. Your friendships most definitely made my Masters degree a more enjoyable experience. Thanks also to Shelley for all of your help with the proof reading.

Finally, but most importantly, I would like to thank my family. Thanks to my grandparents and to my mother whose constant love, support and understanding carried me through this and without which, completion of my degree would not have been possible.

# TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
ACKNOWLEDGMENTS.....	iv
TABLE OF CONTENTS.....	v
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
CHAPTER	
1. INTRODUCTION.....	1
2. TRAUMATIC BRAIN INJURY.....	4
Definition.....	4
Epidemiology.....	5
Classification.....	7
Type of injury.....	8
Severity.....	8
Neuropathophysiology.....	10
Neuropsychological Sequelae.....	11
Assessment.....	13
Recovery.....	14
Rehabilitation.....	14
Summary.....	16
3. MILD TRAUMATIC BRAIN INJURY, CONCUSSION AND POST CONCUSSIVE SYNDROME.....	17
Definitions.....	17
Mild Traumatic Brain Injury.....	17
Concussion.....	18
Post Concussive Syndrome.....	19
Prevalence and Epidemiology.....	20
Mild Traumatic Brain Injury.....	20
Concussion.....	20
Post Concussive Syndrome.....	21

Neuropathophysiology.....	21
Mild Traumatic Brain Injury.....	21
Concussion.....	23
Neuropsychological Sequelae.....	23
Mild Traumatic Brain Injury.....	23
Cognitive Deficits.....	24
Emotional and Personality Changes.....	24
Concussion.....	25
Cognitive Deficits.....	25
Emotional Disturbances.....	26
Post Concussive Syndrome.....	27
Assessment and Severity.....	28
Mild Traumatic Brain Injury.....	29
Concussion.....	29
Standardised Assessment of Concussion (SAC).....	30
Maddocks Questions.....	30
Management / Rehabilitation.....	31
Mild Traumatic Brain Injury / Concussion.....	31
Post Concussive Syndrome.....	32
Predictors of Outcome.....	32
Mild Traumatic Brain Injury.....	32
Concussion.....	33
Post Concussive Syndrome.....	33
Second Impact Syndrome.....	34
Summary.....	34
<b>4. ACC AND THE CONCUSSION CLINICS.....</b>	<b>36</b>
The Accident Compensation Corporation (ACC).....	36
Rehabilitation and Recovery.....	37
Relationships and Partnerships.....	38
ACC and Mild Traumatic Brain Injury.....	39
The Massey University Concussion Clinic.....	43
Previous Studies.....	44
<b>5. THE PRESENT STUDY.....</b>	<b>46</b>
Objectives.....	47

Objective 1: Epidemiology and Demographic Data.....	47
Objective 2: Recovery, History and Response.....	49
Objective 3: The Concussion Clinic.....	51
<b>6. METHOD.....</b>	<b>53</b>
Overview of the Present Study.....	53
Ethical Considerations.....	54
Research Setting.....	54
Participants.....	55
Measures.....	55
Service Satisfaction Survey (SSS-30).....	55
Recovery Rating Scale.....	57
Procedure.....	57
First Stage.....	57
Second Stage.....	58
Data Analysis.....	60
<b>7. RESULTS.....</b>	<b>61</b>
Objective 1: Epidemiology and Demographic Data.....	61
Objective 2: Recovery, History and Response.....	65
Objective 3: The Concussion Clinic.....	68
<b>8. DISCUSSION.....</b>	<b>73</b>
Objective 1: Epidemiology and Demographic Data.....	73
Objective 2: Recovery, History and Response.....	76
Objective 3: The Concussion Clinic.....	78
Limitations of the Present Study.....	81
Recommendations for Future Research.....	81
Summary.....	82
<b>REFERENCES.....</b>	<b>83</b>
 <b>APPENDICES</b>	
A.    Information Sheet.....	98
B.    Service Satisfaction Survey SSS -30: Long Version.....	100
C.    Service Satisfaction Survey SSS-30: Shortened Version.....	109

## LIST OF TABLES

Table 2.1	ACC 'Head Claims' injury statistics 2003/2004.....	6
Table 2.2	ACC 'Head Claims' injury statistics by ethnicity.....	7
Table 2.3	Classification system for severity of brain injury.....	9
Table 2.4	Sequelae of traumatic brain injury.....	12
Table 3.1	Common symptoms of Mild Traumatic Brain Injury.....	24
Table 3.2	Early and late symptoms of concussion.....	27
Table 3.3	Findings from studies on the neuropsychological effects of concussion...	28
Table 3.4	Components of the postconcussive syndrome.....	29
Table 3.5	Grading scale of concussion.....	30
Table 4.1	ACC legislation relevant to rehabilitation of claimants.....	37
Table 4.2	ACC Concussion Clinics in New Zealand.....	39
Table 4.3	Types of services provided by the Concussion Clinics.....	40
Table 4.4	Criteria for MTBI as defined by ACC.....	41
Table 4.5	Criteria for Post-Concussional Syndrome (PCS) as defined by ACC.....	42
Table 6.1	Dimensions of the SSS-30 and the items included within them.....	56
Table 7.1	Number of respondents engaged in study/work pre- and post-injury.....	64
Table 7.2	Cited mechanism of injury for Concussion Clinic referrals.....	65
Table 7.3	Previous history of and present recovery from TBI.....	66
Table 7.4	Ratings of Severity for Respondents and Non Respondents.....	67
Table 7.5	Results of the SSS-30 for each item included in the questionnaire.....	69
Table 7.6	Results of the SSS-30 for each dimension measured.....	70

## LIST OF FIGURES

Fig 2.1	Line graph showing incidence of head injury claims as a function of age.....	5
Fig 6.1	Flowchart illustrating the potential and actual participant sample.....	59
Fig 6.2	Timeline showing when the questionnaires were sent out to participants.....	59
Fig 7.1	Number of male to females referred to the Concussion Clinic.....	62
Fig 7.2	Comparison of the age distribution between ACC claimants and Concussion Clinic referrals.....	63
Fig 7.3	Annual family income of participants pre- and post-injury.....	64
Fig 7.6	Time between date of referral and date of initial assessment for attendees and non-attendees (DNAs).....	71