

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.

**What health changes occur in Māori males after
retirement from playing rugby league?**

**He aha ngā huringa hauora e puta ana i roto i
ngā tāne Māori i muri i te reti mai i te tākaro i te
rīki whutupāoro?**

**A thesis submitted to Massey University
in fulfilment of the degree of
Doctor of Philosophy**

At Massey University, Wellington, New Zealand

TREVOR TUWHAKAEA CLARK

2018

Attestation of Authorship - Whakamanatanga o Kaituhitanga

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any degree or diploma of a university or other institution of higher learning, except where due acknowledgements are made.

.....

Trevor Tuwhakaea Clark

3rd August 2018

ABSTRACT

Māori male participation in rugby league is prolific at all levels in New Zealand; however rugby league has a high incidence of injury. The demands of the sport require players to be athletically fit, strong, and healthy during their playing careers. But does any health advantage remain once retired from participation?

This exploratory study is the first health study of Māori men who have retired from playing competitive rugby league in New Zealand. It uses mixed-methods within a Māori-centered approach producing research led by Māori that involves Māori, and is intended for the benefit of Māori. The mixed method approach creates both quantitative and qualitative data and evidence.

This study researched four groups of ex-players at increasing levels of engagement. One hundred and fifty-four Maori men were involved in the initial survey assessment. This survey was followed by a detailed analysis of 25 players who were assessed on multiple measures of health and physiology. This process was repeated 18 months later with 15 returning respondents and elaborated on (A) Physical well-being post-play; (B) Injuries experienced during play (through a retrospective analysis); (C) Self-assessed well-being; and (D) Change over time for a small group. Lastly 10 players took part in ‘kanohi ki te kanohi’ (face to face) interviews so the players could tell their own stories and their experience of the research in more detail.

As an exploratory study, this research sought to define the factors that contribute to the health status of Māori men who have retired from playing rugby league. The research

tested the use of mixed methods to generate quantitative data from physical and physiological testing, results from self-reported health factors, such as rates of smoking and bodily pain, and the qualitative information about the men's experiences in retirement and of the research experiences from semi structured interviews held kanohi ki te kanohi.

Four key findings come from the study;

- 1) The health disadvantage for Māori males is also seen in retired Rugby league players, in particular weight gain, pain;
- 2) Positive changes in repeated measures provide encouraging evidence;
- 3) Telling personal stories contributed significantly to the research by providing insight into the thinking and experiences of the participants -Whānau (family) was a strong feature in the stories from these men. Most importantly it confirms there is strong potential for intervention to improve and maintain health status for retiring and retired Māori rugby league players, and;
- 4) The presence of a Māori researcher can positively influence engagement with Māori-centered research.

Results yielded evidence of a positive reduction in body weight, improved cardiovascular fitness and increased motivation in some players simply through their participation in this research, possibly through the Hawthorne or observer effect.

This research explored a previously under-researched area and provided insight into Māori male health. It informs an on-going agenda of health related, rugby research by providing a needed Māori voice and evidence.

Preface - Kupu Whakataki

He piko he taniwha he piko he taniwha Waikato Taniwharau
Waikato (river) of a hundred chiefs at every bend a chief, at every turn a chief

Ko Waikato tōku awa (My river is the Waikato)
Ko Maungatautari tōku maunga (My mountain is Maungatautari)
Ko Waikato-Tainui tōku iwi (I am Waikato-Tainui)
Ko Ngāti Korokī-Kahukura tōku hapū (I also descended from Ngāti Korokī-Kahukura)
Ko Trevor Tuwhakaea Clark taku ingoa (My name is Trevor Tuwhakaea Clark)
Tēna koutou tēna koutou tēna ra koutou katoa (Thank you all)

Whakapapa (my ancestral connection)

The essence of the famous Waikato whakataukī (proverb) serves to highlight the significance of the Waikato River and the strength of my people that live and work along its foreshore (from Taupō to Port Waikato – 425km). There are many chiefs (100) positioned along its pathway, so if you chose to travel along its path be respectful, or be prepared for challenges around every bend. The pull of the river (Waikato) always provided new challenges for me and this applied to everything I learnt throughout my life. There have been many challenges on the sports fields with every bend in the river (injury) requiring me to re-assess my physical effort in training. There have also been just as many off-field challenges (the loss of family) which have caused great sadness, but ultimately new strength and determination. I am proudly Waikato-Tainui and I know the strength and mana (pride) of my people have nurtured me on my journey from the Waikato to far-away places around the world. This thesis is my legacy, for my whānau (family), my iwi (tribal affiliation Waikato-Tainui) my hapū (tribal affiliation- Ngāti Korokī-Kahukura) and many friends from all over the world. It contributes new

knowledge to Māori health research and adds to a greater body of work surrounding the global health rugby codes study.

My Journey

I grew up in Hamilton and spent the first 21 years of my life there. I still call it my home and always will. I started playing rugby league at a relatively late age (16) unfortunately this coincided with one of the most devastating episodes in my life, with the loss of my father at the age of 42 from a heart attack. He only got to see me play a few times during that year but I know from talking to family and friends he was proud of what I had achieved in such a short time playing the game. From that moment onward I chose to dedicate my life to the sport in his memory. The loss of my dad is what drove me as I made my way through club (Melville) and representative (Hamilton) teams to eventually be adjudged the best and fairest player in the district aged 19.

One of the most important periods of my rugby league career came in 1983 when I was selected to play for the New Zealand Māori rugby league team. It was significant at the time as the team toured the United Kingdom later that year. During the tour (after my first game) I was asked by the Leeds Rugby League Chairman (Mr Joe Wareham) if I would be interested in turning professional and playing for Leeds RLFC. As you can imagine my world completely changed from that moment onwards.



Source: Richard Bolton collection (Team Trainer – Top right)

The Aotearoa Māori Rugby League team (2nd row standing two in from the right) on the historic 1983 tour to the United Kingdom with the late Dame Te Atairangikaahu (Māori Queen and Patron of AMRL). We returned home undefeated in all 8 matches played on tour. It was the start of my professional career having signed to play for the Leeds Rugby League Club whilst I was on tour, alongside Dean Bell (Kiwi Test Wing).

My Sport

From personal experience of playing (Melville, Huntly South, Hamilton, Waikato, New Zealand Māori, Leeds, Featherstone, Bradford and Taniwharau) and coaching (Melville, Jaradites, Petone, Wellington, New Zealand Universities, Auckland Warriors, Windsor, Erina) rugby league for 30 years, including 12 years as a professional player in the United Kingdom, I'm now coping with the effects of repetitive collision and training injuries suffered during my career in the sport. This has had a detrimental impact on my

current physical activity and overall health status. I suffered from chronic osteoarthritis in both knees and found it very painful to run and descend stairs. The condition was so bad I recently underwent two total bi-lateral knee replacements due to the condition, and complete ruptures of both anterior and posterior cruciate ligaments in both knees.

During my coaching career I have been witness to a multitude of player injuries across many levels of engagement (amateur to professional) and many of these were recorded in published research I also participated in. These injury investigations are ongoing and much of our current research is centred on concussion in sports such as; rugby league, Australian Rules Football (AFL), and rugby union. There is a growing concern within the research and sports medicine community that concussion may lead to debilitating consequences of both physical and mental health simply from participating in these sports. Not only have I had to endure the pain of suffering my own injuries, I also agonised over my two son's injuries through playing rugby league.

My Whānau (My immediate family)

I have two sons who were both born in Pontefract, West Yorkshire, England. My oldest son Regan (born 03/02/1991) retired from playing competitive rugby league at the age of 18 after breaking numerous bones in his body whilst playing. He was a standout player during his junior years winning multiple 'player of the year' awards in both rugby league and athletics. He was a natural athlete during his playing career, blessed with speed and the ability to score at will. He still follows and loves the game but for now he chooses not to play.

My youngest son Mitch (born 30/03/1993) is following in my footsteps and plays full-time in England previously with Doncaster, Bradford and Hull Kingston Rovers; he recently signed a two year contract from 2018 with Castleford Tigers in the Super League. He also played in Sydney for the Penrith Panthers winning the Holden Cup Grand Final in 2013 beating the New Zealand Warriors. He has represented the New Zealand Junior Kiwi Rugby League Team in 2013. He has also suffered a number of injuries including a broken arm and dislocated ankle (both requiring surgery). These injuries resulted in many missed days of both training and playing. He plays as a prop forward, probably the toughest position to play in the team and relishes the collision and challenge of every game.

My Research

During my playing career in England I was fortunate enough to complete a Bachelor of Arts (Hons) and a Master of Science degree at Leeds Beckett University, majoring in exercise physiology and sport psychology. It was my interest and passion for sport and health that led to the development of this study. After all that has happened throughout my playing and coaching career and subsequently my own sons' careers I wondered if the same consequences had befallen other Māori players retired from a lifetime of playing rugby league. This exploratory research project was designed to support the implementation of mixed methods within a Māori-centered approach. My intention was to build a body of new evidence to provide future direction to support players, coaches and health professionals. It is intended that this project will add new knowledge to the field of Māori health research with specific reference to improving health outcomes for male Māori rugby league players who have retired from playing the sport.

Acknowledgements - Nga Mihi

I would like to thank my primary supervisor Professor Chris Cunningham for his patience and faith in me to fulfil one of my lifelong goals.

To Dr Doug King my secondary supervisor and lifetime friend and colleague who inspired and motivated me to become the person I am today. We've travelled many roads together and I look forward to many more.

I would also like to thank Dr Marg Wilkie for her support during the final push toward the try line. It proved invaluable during the examination process. Her Ngāti Porou and Ngāpuhi mana (pride) shone through and served as a constant reminder of the fight needed to succeed.

The New Zealand Health Research Council's financial and political support was immense during tough times during a very scary and sometime gut-wrenching journey, but one well-travelled by so many Māori PhD students who cannot see the roses let alone smell them. I have the deepest respect for the organisation and its leaders.

I'd also like to acknowledge the Tainui Māori Trust Board for their unwavering support. I am Waikato-Tainui which makes the significance of this project especially important.

E rite ahau ki te whakawhetai ki te Tainui Māori Trust Board mo to ratou tautoko, puta noa i toku haere PhD. Ko te he huarahi pakeke, engari te pai

utu te utu. Titiro atu ahau ki hoatu hoki ki taku iwi, Tainui, ki ngā ākonga i te katoa i runga i te ao.

To my mum Rita who has been my most ardent supporter from day one, often heard shouting from the side-line (during my playing days) – “get off my son” (most often), you have always been a constant which I have treasured every day. To my brothers, sisters, aunties, uncles, cousins and friends it was your support that kept me going when I could have easily thrown in the towel (like that was ever an option for a Tuwhakaea Clark).

A special mention to my beautiful wife Christine who would keep asking me every day “have you worked on your PhD” this was motivation enough to make that commitment to complete the project...and keep her quiet. To my two son’s Regan and Mitch, this is as much for you as it is for me. Another challenge to aspire to because all I want is for you both to be proud of me as I am of both of you. You are both my biggest and best achievements in life. To Hollie and Monique, thank you for sharing your lives, it makes your mum and me very happy and content as a family.

To all the players I have played with and coached you know the journey. It is a tough road to tread rugby league, it is never easy, no matter what the score. The thousands of tackles given and taken will never diminish the love for the game we all know so well. Lastly, but not least to all the participants involved in this study who became my rugby league whānau, thank you for being there and giving your time so willingly and unselfishly I will always treasure your contribution to this discovery.

Table of Contents

| | |
|---|-------------|
| Attestation of Authorship - Whakamanatanga o Kaituhitanga | ii |
| Abstract..... | iii |
| Preface - Kupu Whakataki | v |
| Whakapapa (my ancestral connection)..... | v |
| My Journey | vi |
| My Sport..... | vii |
| My Whānau (My immediate family)..... | viii |
| My Research | ix |
| Acknowledgements - Nga Mihi | x |
| Chapter 1: Introduction to my Thesis - Whakataki ki taku Tuhinga | 1 |
| 1.1 Introduction | 1 |
| 1.2 Thesis Structure | 5 |
| Chapter 1: Introduction. | 5 |
| Chapter 2: Approach and Methods. | 5 |
| Chapter 3: Background and Literature. | 5 |
| Chapter 4: Research Findings. | 5 |
| Chapter 5: Conclusions. | 6 |
| Post Script: | 6 |
| References:..... | 6 |
| Appendices 1-16. | 6 |
| 1.3 A Setting for the Research..... | 6 |
| 1.3.1 Historical Context | 7 |
| 1.3.2 The Treaty of Waitangi | 7 |
| Article One..... | 8 |
| Article Two | 8 |
| Article Three | 8 |
| 1.4. Changing Times..... | 9 |
| 1.4.1 Whānau Ora | 10 |
| 1.5 Health Impact | 11 |
| 1.5.1 Sport, Physical Activity and Health | 13 |
| 1.5.2 Health impact for Māori..... | 15 |
| 1.6 Rugby League in New Zealand | 16 |
| 1.7 Conclusion..... | 19 |
| Chapter 2: Approach and Methods - Tikanga o te Rangahau | 21 |

| | |
|--|-----------|
| 2. 1 Introduction | 21 |
| 2.1.1 Mixed Methods..... | 21 |
| 2.2 Māori Health Models..... | 22 |
| 2.2.1 Te Whare Tapa Whā (four-sided house) | 23 |
| (1) Taha wairua (spiritual health)..... | 24 |
| (2) Taha hinengaro (thoughts and feelings) | 24 |
| (3) Taha tinana (physical health)..... | 24 |
| (4) Taha whānau (the health of family)..... | 25 |
| 2.2.2 Te Wheke (The Octopus) | 26 |
| 2.2.3 Te Pae Māhutonga (Southern Cross Star Constellation) | 27 |
| (1) Mauriora (cultural identity) | 29 |
| (2) Waiora (physical environment) | 29 |
| (3) Toiora (healthy lifestyles)..... | 29 |
| (4) Te Oranga (participation in society) | 29 |
| (1) Nga Manukura (community leadership) | 29 |
| (2) Te Mana Whakahaere (autonomy) | 29 |
| 2.3 Whānau (family)..... | 30 |
| (1) Whakapapa whānau..... | 31 |
| (2) Kaupapa whānau..... | 32 |
| (3) Statistical whānau | 32 |
| 2.4 Whakapapa (genealogy) | 33 |
| 2.5 Kaupapa Māori Research (Māori Philosophy Research) | 37 |
| 2.5.1 Research at the Interface..... | 40 |
| 2.6 Ethical approval..... | 41 |
| 2.7 Methods | 41 |
| Part A:..... | 42 |
| Part B:..... | 42 |
| 2.8.1 Participants | 43 |
| 2.8.2 Rugby League Tournaments..... | 44 |
| 2.9 Physical Assessments | 45 |
| 2.9.1 Part A: Tournament based players..... | 46 |
| 2.9.2 Part B: Zonal based players..... | 46 |
| 2.9.2.1 Blood tests..... | 46 |
| 2.9.2.2 Physiological Evaluation | 48 |
| 2.9.2.3 Anthropometric Assessment | 48 |
| 2.9.2.4 Physiological Capacity Assessments | 48 |
| 2.9.2.5 Short-Form 36 Version 2.0 (SF-36v2)..... | 49 |

| | |
|--|------------|
| 2.9.2.6 Medical History questionnaire | 51 |
| 2.10 Kānohi ki te kānohi Interviews..... | 51 |
| 2.11 Testing Procedures | 52 |
| 2.11.1 Part A: | 52 |
| 2.11.2 Part B: | 53 |
| 2.12 Quantitative analysis..... | 58 |
| 2.13 Qualitative analysis..... | 58 |
| 2.14 Conclusion | 59 |
| Chapter 3: Background and Literature..... | 63 |
| Tātaritanga ā Rangahau Hāngai..... | 63 |
| 3. Introduction | 63 |
| 3.1 The Māori Population..... | 63 |
| 3.1.1 Health Loss | 65 |
| 3.1.2 Life Expectancy | 68 |
| 3.1.3 Burden of Disease and Risk Factors | 72 |
| 3.1.4 Income..... | 74 |
| 3.1.5 Education | 75 |
| 3.1.6 Employment/ Unemployment | 77 |
| 3.2 Quality of Life (QOL) | 77 |
| 3.3 Chronic Disease | 81 |
| 3.3.1 Ischaemic Heart Disease (IHD) | 85 |
| 3.3.2 Cardiovascular Disease (CVD)..... | 87 |
| 3.3.3 Diabetes Mellitus | 91 |
| 3.4 Smoking..... | 92 |
| 3.5 Alcohol | 94 |
| (1) Risk factors | 96 |
| (2) Cholesterol measures | 96 |
| 3.5.1 Alcohol in Sport..... | 100 |
| 3.6 Body Composition..... | 102 |
| 3.7 Māori Sporting Context..... | 104 |
| 3.8 Demands of Rugby League | 106 |
| 3.8.1 Rugby League Injuries..... | 111 |
| 3.8.2 Concussion..... | 116 |
| 3.8.3 Osteoarthritis..... | 119 |
| 3.9 Conclusion | 122 |

| | |
|---|------------|
| 3.9.1 Note on Wider Body of Knowledge | 124 |
| Chapter 4: Research Findings - Ngā hua rangahau | 127 |
| 4.1 Introduction | 127 |
| 4.2 Section 1 Taha Tinana (Physical Side - Measured)..... | 127 |
| 4.2.1 Anthropometric profiles | 128 |
| 4.2.3 Strength and Girth Assessment..... | 131 |
| 4.2.4 Blood pressure, fasting cholesterol and glucose | 136 |
| 4.2.5 Åstrand-Rhyming submaximal cycling test..... | 140 |
| 4.2.6 InBody230 Bio-impedance assessment (BIA)..... | 144 |
| 4.3 Taha Tinana (Physical – Self-report) | 147 |
| 4.3.1 Medical history | 147 |
| 4.3.2 Tobacco intake..... | 148 |
| 4.3.3 Injuries | 150 |
| 4.4 Section 2 Short Form 36 version 2 questionnaire (SF-36v2) | 156 |
| 4.4.1 Part A Tournament participants (SF-36v2)..... | 156 |
| 4.4.2 Part B (Zonal) participants (SF-36v2) | 157 |
| 4.4.3 SF-36v2 and New Zealand Health Survey..... | 159 |
| 4.5 Section 3 Kanohi ki te Kanohi Interviews (Part B)..... | 168 |
| 4.5.1 Test-Re-test evaluations | 169 |
| 4.5.2 Body Anthropometrics | 171 |
| 4.5.3 Health evaluation..... | 173 |
| 4.5.4 Influences and skill development | 176 |
| 4.6 Taha Whānau (Health of the family)..... | 178 |
| 4.6.1 Retirement from playing rugby league | 181 |
| 4.7 Discussion of the Findings | 183 |
| 4.7.1 Limitations of the Research..... | 186 |
| 4.8 Conclusion..... | 187 |
| Chapter 5: Discussion and Conclusions - Nga Whakatau Me Nga Tohutohu | 190 |
| 5.1 Introduction | 190 |
| 5.2 Health disadvantage for male Māori | 190 |
| 5.3 Changes in repeated measures..... | 192 |
| 5.4 Telling of personal stories | 193 |
| 5.5 Presence of a Māori researcher..... | 193 |
| 5.6 Future Research | 195 |
| Post Script - Tuhinga O Mua | 198 |

| | |
|--|------------|
| Whakapapa | 198 |
| Whānau..... | 198 |
| Rugby League..... | 199 |
| Research..... | 199 |
| Where to from here? | 200 |
| References | 202 |
| Appendix 1: Example of kanohi ki te kanohi interview questions..... | 244 |
| Appendix 2: Example of participant Information Sheet..... | 246 |
| Appendix 3: Example of Participant consent form | 249 |
| Appendix 5: Copy of letter of support from New Zealand Māori Rugby League ... | 251 |
| Appendix 6: Copy of letter of endorsement from New Zealand Rugby League..... | 252 |
| Appendix 7: Copy of letter of support from Wellington Rugby League..... | 253 |
| Appendix 8: Medical History Questionnaire..... | 254 |
| Appendix 9: Copy of SF-36v2 Short Form Health Survey | 255 |
| Appendix 10: Detailed Explanation of the Qaulity of Life Questionnaire | 261 |
| Appendix 11: Health and Disability Ethics Committees Ethics Approval CEN/09/09/067 | 267 |
| Appendix 12: Health and Disability Ethics Committees Ethics approval CEN/09/12/104..... | 269 |
| Appendix 13: Research Outputs Completed During My PhD Candidacy (2011-2017) | 271 |
| Appendix 14: Semi-Professional Rugby League Players have Higher Concussion Risk than Professional or Amateur Participants: A Pooled Analysis. <i>Sports Medicine</i> . (2017)..... | 273 |
| Appendix 15: Concussion in amateur rugby league players in New Zealand: A review of player concussion history. <i>New Zealand Journal of Sports Medicine</i> . 2014. | 282 |
| Appendix 16: Nature of tackles that result in injury in professional rugby league. <i>Research in Sports Medicine</i> . 2012 | 288 |

LIST OF TABLES

| | | |
|---------|---|----|
| Table 1 | National Heart Foundation (2005) guidelines for Lipid thresholds utilised to calculate the prevalence of hyperlipidaemia. | 47 |
| Table 2 | Māori ethnic group population summary | 64 |

| | | |
|----------|---|-----|
| Table 3 | Health status, health behaviours and risk factors for Māori adults by percent of population in the 2006/07, 2011/12 and 2015/16 reporting periods and differences from 2006/16..... | 71 |
| Table 4 | Total personal income of resident New Zealand Māori population by census year | 75 |
| Table 5 | Identified highest academic qualification attained of resident New Zealand Māori population by number at the 2006 and 2013 census. | 76 |
| Table 6 | Reported leading specific conditions causing health loss in resident New Zealand Māori in 2006 ranked by DALY and percentage. | 81 |
| Table 7 | Reported leading specific conditions causing health loss in resident total population in New Zealand in 2006 ranked by DALY and percentage. | 82 |
| Table 8 | Adjusted rate ratio of adults diagnosed with ischaemic heart disease by gender, ethnicity and socioeconomic deprivation from the 2012/2013 New Zealand Health Survey..... | 86 |
| Table 9 | Summary of risk factors, exposure definitions, sources of exposure data, theoretical minimum risk exposure distributions (TMRED) and linked conditions for chronic disease in New Zealand. | 87 |
| Table 10 | Incidence of cardiovascular disease for total New Zealanders, Māori, Pacific peoples, Indian and Other ethnicities resident in New Zealand in 2008. | 89 |
| Table 11 | The adjusted rate ratio of adults who are daily current smokers (at least monthly, weekly or daily) by gender, ethnicity and socioeconomic deprivation status. | 92 |
| Table 12 | Prevalence of alcohol consumption in the last 12 months among total population in New Zealand aged 16–64 years by ethnicity group. | 95 |
| Table 13 | Unadjusted prevalence of drinking alcohol daily in the last 12 months for past-year drinkers, total adults aged 16–64 years and estimated number of adults by ethnic group. | 96 |
| Table 14 | Summary of indicators of alcohol consumption from study surveys. | 97 |
| Table 15 | Alcohol consumption by gender, frequency of drinking, volume consumed and average daily volume for Māori and Non-Māori. | 99 |
| Table 16 | Demographics, body mass index, body composition, bioelectrical impedance and skinfolds of male New Zealand resident Māori, and Europeans by means and standard deviation. | 103 |
| Table 17 | Missed training and match injuries by injury site, type, cause, severity and position per 1000 training player hours..... | 114 |
| Table 18 | Conditions resulting from major injuries (established by medical examination) from participation in professional rugby league by retired players. | 120 |
| Table 19 | Anthropometric characteristics of retired Māori rugby league players at national tournaments (Part A; n=125) and from a zonal region (part B) at baseline (n=25) and at re-test (n=15). | 128 |
| Table 20 | Reported reference man values for age, body mass, height and body mass index in 1975 and 1995. | 129 |

| | | |
|----------|--|-----|
| Table 21 | Comparison of anthropometric characteristics of retired Māori rugby league players (n=15) in a zonal region for baseline and retest. | 129 |
| Table 22 | Anthropometric characteristics comparisons of retired Māori rugby league players (n=15) in a zonal region at baseline and retest in years from retirement. | 130 |
| Table 23 | Girth and strength characteristics comparisons of retired Māori rugby league players (n=15) in a zonal region. | 132 |
| Table 24 | Girth and strength characteristics comparisons of retired Māori rugby league players (n=15) in a zonal region at baseline and retest periods. | 134 |
| Table 25 | Comparisons of retired Māori rugby league players (n=15) in a zonal region at baseline and retest periods for blood pressure, fasting cholesterol and fasting glucose results. | 137 |
| Table 26 | Comparisons of retired Māori rugby league players in a zonal region by retirement group at baseline and retest periods | 138 |
| Table 27 | Comparisons of retired Māori rugby league players (n=15) in a zonal region at baseline and retest periods for Åstrand-Rhyming submaximal cycling test..... | 140 |
| Table 28 | Pearson correlations coefficients (r) of components of the Åstrand-Rhyming submaximal cycling test of retired Māori rugby league players (n=15) in a zonal region at baseline testing. | 141 |
| Table 29 | Pearson correlations coefficients (r) of components of the Åstrand-Rhyming submaximal cycling test of retired Māori rugby league players (n=15) in a zonal region at retest. | 141 |
| Table 30 | Comparisons of retired Māori rugby league players in a zonal region by 0-5 year (n=5), 6-10 year (n=5) and 11-15 year (n=5) post-retirement groups at baseline and retest periods for Åstrand-Rhyming submaximal cycling test..... | 142 |
| Table 31 | Comparison of baseline and retest results for the InBody230 of retired Māori rugby league players (n=15) from a zonal region..... | 145 |
| Table 32 | Comparison of baseline and retest results for the In-Body230 of Māori rugby league players by 0-5 year (n=5), 6-10 year (n=5) and 11-15 year (n=5) post-retirement groups. | 146 |
| Table 33 | Summary of neurological, physical, medical and musculoskeletal medical concerns reported for retired Māori rugby league players (n=25) from a zonal region. | 148 |
| Table 34 | Current smoking status (%). | 148 |
| Table 35 | Changes in daily smoking prevalence by ethnicity between 2006 and 2012 as reported by the New Zealand Health Survey (NZHS) | 149 |
| Table 36 | Summary of the SF-36v2 Results (Part A)..... | 156 |
| Table 37 | Comparison of baseline and retest SF-36V2 scale and component summary results (Part B) | 157 |
| Table 38 | Comparison of baseline and retest SF-36V2 scale and component summary results of retired Māori rugby league players. | 158 |

| | | |
|----------|--|-----|
| Table 39 | Comparison of SF-36v2 scale and results of retired Māori rugby league players at tournaments and the New Zealand Health Survey 2006/07 for age group comparisons of 25-34 yrs., 35-44 yrs. and 45-54 yrs. | 161 |
| Table 40 | Comparison of SF-36v2 scale and results of retired Māori rugby league players at tournaments and the New Zealand Health Survey 2007/07 for age group comparisons of 55-64 yrs. and 65-74 yrs. | 162 |
| Table 41 | Comparison of SF-36V2 data for the combined data of retired Māori rugby league players in a zonal region at baseline and retesting with New Zealand (2006-2007 survey results) and South Australia (2004 survey results) by mean and standard deviation... | 164 |
| Table 42 | Comparison of SF-36v2 scale baseline and retesting results of retired Māori rugby league players at a zonal region with the New Zealand Health Survey 2006/07 by mean with 95% confidence interval | 164 |
| Table 43 | Summary of indicative Findings..... | 184 |

LIST OF FIGURES

| | | |
|----------|--|----|
| Figure 1 | Te Whare Tapa Whā Māori Health Model (Durie, 1985)..... | 24 |
| Figure 2 | Te Wheke Māori Health Model (Pere, 1997) | 26 |
| Figure 3 | Te Pae Māhutonga (Durie, 1999b) | 28 |
| Figure 4 | The disability-adjusted life year calculation | 66 |
| Figure 5 | DALY counts reported in 2006 Ministry of health loss for Māori and non-Māori in New Zealand by age group | 66 |
| Figure 6 | DALY rates, reported in 2006 Ministry of health loss for Māori and non-Māori in New Zealand by age group. | 67 |
| Figure 7 | Population demographics of Māori residents in New Zealand for male and female by age group as reported in 2006 census (left graph) and in 2013 census (right graph) Source: Statistics New Zealand, 2014. | 68 |
| Figure 8 | Percentage of population smoking daily by age standard prevalence by reporting year for the 1996 to 2012 reporting periods. | 94 |