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**Rapua te mea ngaro.**

Exploring the access of Māori to Veterinary  
Education in Aotearoa New Zealand

A thesis presented in partial fulfilment  
of the requirements for the degree  
of Doctor of Philosophy  
at  
Massey University,  
Palmerston North,  
New Zealand

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## ABSTRACT

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Currently there is no research literature regarding the ethnicity of veterinary applicants, veterinary students, or the veterinary workforce in New Zealand. Recent unpublished data indicates only 2% of veterinarians identify as Māori, despite Māori comprising 16.5% of the New Zealand population. This PhD is the first step in addressing this gap and bringing to light the important issues of Māori representation and inclusion in veterinary education and subsequently the veterinary profession in New Zealand. The thesis has two overarching goals. The first is to explore how the access of Māori to veterinary education, and therefore the veterinary workforce, is influenced by sociodemographic factors under three separate admission processes. The second is to explore the impact of sociodemographic factors and academic achievement prior to admission on the academic success of Māori once selected into the program.

The studies in this thesis were conducted with Kaupapa Māori research positioning. The thesis presents a quantitative analysis of veterinary applicant and selected student data from 2003 to 2019. Descriptive statistics and linear and logistic regression are utilised to explore the representation of Māori in the veterinary applicant and selected student cohorts, the association of sociodemographic variables and selection assessments, and academic outcomes of Māori and non-Māori once selected.

From this thesis it has been shown that Māori were underrepresented in the veterinary applicant pool and experienced more educational barriers than non-Māori. Māori are also underrepresented in the selected student cohort, and had 0.37 times the odds of selection than non-Māori prior to introduction of an equity process for Māori student selection. Scores on five of the six selection assessments were associated with ethnicity, with Māori receiving lower scores. However, once selected into the veterinary programme, there was no difference in the academic outcomes of Māori and non-Māori. Introduction of the equity process for Māori was not associated with a decrease in academic outcomes post-selection, and introduction of non-academic criteria into the selection process was associated with an improvement in academic outcomes.

The veterinary profession is not representative of New Zealand. Māori underrepresentation is also seen in the veterinary applicant and selected student cohorts. This needs to be addressed for reasons of Indigenous rights, social justice, social mobility, and to ensure the veterinary profession benefits from Māori worldviews and therefore is relevant to a growing Māori population. Enacting initiatives aimed to widen access to the veterinary programme, with the eventual goal of improving representation of Māori in the veterinary workforce, needs to be a priority for Massey University, the sole provider of veterinary education in Aotearoa, and the wider profession.



## DEDICATION

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To all Māori veterinary applicants and students past, present, and future, this thesis is for you.

Without you, my hopes for the veterinary profession cannot be realised.

You are the key.

I commend you for your perseverance in the face of trial. Should you join this profession, I hope that it will help you to reach your goals and enable success for yourself and your whānau.

I also dedicate this thesis to the New Zealand veterinary profession and its members. You are my profession and I care immensely for you. I hope that you see this PhD as an opportunity for us to move forward and be the best that we can for all of New Zealand society.

To do so we need to be more inclusive of Māori.



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*Ehara taku toa i te toa takitahi, engari he toa takitini.*

*It is not by my strength alone but by the strength of many that I achieve this accomplishment.*

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They say that "Behind every successful woman is a tribe of other successful women, who have her back". I am thankful for the women in the various tribes in my life who certainly have had my back during this PhD. My work wives, Jenny Weston, Dani Aberdein, Sue Gribbin and Ngāwari Matthews-Carr, have all covered various aspects of my job at times and provided laughter, supportive ears, and hot chocolates to make the journey smoother. I couldn't have done it without you. The fabulous Fitzherbert Foxes (Amy Valentine, Tara McLaughlin, Ngaio Beausoleil, Kate Hill, Lizzie Daly, George Phillips, and Tess Kirner) have provided hugely appreciated girls' nights and general all-around support. Megan Bryce, thanks also to you for helping with having my boys at your house and all the ride sharing to their sports. I'm so grateful for the friendship and support of all these great women.

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Finally, to my wider whānau and especially my parents, Marina and Peter. You two are an inspiration to me and I would never have been in this position of writing this PhD without you and your support throughout my life. I love you both immensely. To all my brothers, Tony, Steve, Greg, Arama and Dan, I appreciate each one of you for your influence in my life. To my sister Kiri, you may not know it, but you are and always have been a huge example to me in my life. I am so grateful for the relationship we have and for all the talks and support from afar. I wish we lived closer to each other.

To Isaiah, Jarom and Noah - yes, I am done my PhD.

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## GLOSSARY AND ABBREVIATIONS

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BVSc	Bachelor of Veterinary Science
CASPer	Computer-Based Assessment for Sampling Personal Characteristics
EML	English Main Language. This classification was used for anyone for whom English was the main language spoken in the home in which they were raised.
First in family	An individual who was the first person in their family to attend university.
GPA	Grade Point Average
Hauora	Wellbeing
kaiarahi Māori	Māori cultural advisor
kaitiakitanga	Guardianship or stewardship
kaumatua	A person, usually older, of status within a whānau or community
kōhanga reo	Māori language preschool
kura kaupapa	Primary school operating under Māori tikanga and using te reo Māori as the medium of instruction.
MAPAS	The Māori and Pacific Admission Scheme in the Faculty of Medical and Health Sciences at the University of Auckland.
manaakitanga	Process of showing respect, generosity and care for others
matatika	right, straight, ethical, fair, equitable, honest, impartial, unbiased, upright, moral
mātauranga Māori	Māori knowledge
mihi whakatau	Māori welcome ceremony
MMI	Multiple mini-interview
MMIComm	The total score of the communication assessments in the MMI process
MMINC	The total score of the assessment of the other attributes of interest, not including communication, in the MMI process.
NCEA	National Certificates of Educational Achievement. New Zealand's qualification for secondary school students
New Zealand	Aotearoa, New Zealand
OECD	Organisation for Economic Cooperation and Development
OSCE	Objective, structured, clinical examination
Pacific	Pacific peoples.
Pacific peoples	A term to describe people resident in New Zealand whose ancestry is from a heterogeneous group of Pacific Island countries.
pākehā	New Zealander of European descent - probably originally applied to English-speaking Europeans living in Aotearoa/New Zealand.
Passing on the first attempt	Passing all courses in the first semester of the professional phase on the first attempt
PISA	Programme for International Student Assessment. A comparison of education internationally conducted by the OECD.

pōwhiri	Māori welcoming ceremony
Pre-vet GPA	Grade point average used in the selection process. It does not include any grades from the professional phase of the BVSc programme.
Professional phase GPA	Grade point average in the first semester of the professional phase (BVSc1 Semester two). It does not include grades from courses taken in the pre-vet phase.
rangatahi	Younger generation
rangatira	Māori chiefs
Rater	The interviewer in the MMI is referred to as the rater.
Scores 03-16	Selection assessment scores 2003-2016 dataset
Scores 17-19	Selection assessment scores 2017-2019 dataset
Selection	Selection into the professional phase of the BVSc
Selection Database	The School of Veterinary Science database for the selection process which includes data such as the names and identifier of each applicant, their selection assessment scores, and selection outcome.
SJT	Situational Judgement Test
SMS Database	The student management system (SMS) database holds all of the official information for students enrolled at Massey University.
STAT	Special Tertiary Admissions Test. Offered by Acer Australia
Student ID	Massey University student identification number
tauirā	Student
te ao Māori	The Māori world
Te Puni Kōkiri	Ministry of Māori Development
te reo	Māori language
tikanga	Māori cultural customs
tino rangatiratanga	Self-determination
Tū Kahika	A one-year Indigenous specific bridging programme at the University of Otago
UK	United Kingdom
University entrance award	The minimum standard that students under the age of 20 must meet in order to enrol in a New Zealand university.
USA	United States of America
VCNZ	Veterinary Council of New Zealand. VCNZ is the registration board for veterinarians in NZ.
whakapapa	Ancestry, genealogy or lineage
whakawhanaungatanga	Process of establishing relationships
whānau	Family

# Chapter One

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## 1. INTRODUCTION

The title of this thesis, *Rapua te mea ngāro*, is commonly translated to mean ‘seeking the unknown’ but can also be interpreted as *revealing the unknown, or making visible the invisible*. This title relates to my hopes to bring light to the representation and inclusion of Māori, the tangata whenua (Indigenous people) of Aotearoa New Zealand in veterinary education and the veterinary profession in New Zealand. It also relates to my own journey of understanding my identity as Māori.

### 1.1. MY STORY

Understanding a little about who I am, who my whānau (family) are and how these factors influenced me is important to understanding why I am doing this thesis.

I am Māori through my ancestry on the side of my mother, Marina Te Moengahau Watene. However, having Māori ancestry, identifying as Māori, and knowing what being Māori actually means to me are vastly different matters. This has been an evolving landscape for me and has played a substantial part in the direction and execution of this thesis.

I am the youngest of seven children. Being the youngest probably says a bit about me, and my siblings would say that I was spoiled and got away with much more than they ever did. As far as whānau go, I think I was pretty fortunate. We are not a perfect family, but we have two parents who loved and cared for us, and ensured our needs were met. We were raised to have strong values of integrity, respect for others, a good work ethic, and to be fairly self-sufficient (it is pretty hard to helicopter parent when there are seven kids). We were one of the least well-off families in an otherwise middle

class-to-affluent neighbourhood. I was fortunate to attend good schools where my initial inklings of talent in mathematics and science were encouraged. I know that not all Māori taura (student) get that same benefit, and I feel very grateful to have had it. My father is an eternal optimist and he often told me variants of 'you can be anything you want to if you're willing to work for it'. From a young age, I knew I wanted to become a veterinarian and due to my privilege of a supportive upbringing and education I always believed that I would be able to do so.

When I was seven years-old, we moved to Canada. I always understood the motivation for the move was for our whānau, and particularly my father, who had been living in New Zealand for close to 30 years by that stage, to be nearer to his aging parents. However, a few years ago my father commented to me that along with being nearer to his family, part of the desire to move was to take us way from New Zealand where there was a stigma associated with being Māori. That comment could be seen as a reflection of how he viewed Māori. However, knowing my father, I don't believe that was his perspective. I wonder if perhaps it instead reflected his impressions of how New Zealand society saw and treated Māori, and the discrimination that Māori experience in many areas (Robson et al., 2007). Irrespective of the motivation, moving away from New Zealand came with a significant cost and consequence in that I was raised distant to and without the influence of mātauranga Māori (Māori knowledge), te reo Māori (Māori language), and tikanga (Māori cultural customs).

I spent the remainder of my childhood and my teenage years in Canada, away from extended whānau, and away from significant Māori cultural influences. While I always knew I was Māori, in these years my identity was stronger as a Canadian (albeit with a bit of a tan). My maternal grandmother was able to speak te reo, however the assimilation and anti-te reo policies in the early 1900's (Berryman et al., 2012) under which she was raised ensured that she did not pass the language onto her children. As my mother was not raised with te reo, tikanga or mātauranga Māori, she did not have this knowledge to pass on to my siblings or myself. I was not fortunate enough to be raised with these taonga (treasures), and I feel the continued weight of that loss. I also cannot help but wonder how much of who I am, and what my life is, would have differed from my current reality if I had grown up in New Zealand. Would I have been able to speak te reo? Would I have been seen as a capable learner? Would I have become a veterinarian or undertaken a PhD?

As a child I loved animals. I did not have a lot of pets growing up (and the ones I did have unfortunately often had a pretty short life) and I had no exposure to farm animals, yet I knew from the age of around four that I wanted to be a veterinarian. My plans to become a veterinarian drove my subject study choices in high school and university undergraduate study. As I progressed through my veterinary

degree, my career intention narrowed to wanting to become a specialist small animal surgeon. I had no intention of becoming a university academic. I also had no idea of the opportunities that would present themselves in my life that would see me undertake specialty training in clinical pathology rather than surgery (I saw the light of what a pathologist's life is like in comparison a surgeon's!), and eventually lead me to this point of undertaking a PhD. While my initial career focus was animals and pathology, my interests have subsequently become more focused around the people side of the veterinary profession, and hence the latter are the subjects of this thesis.

### **1.1.1. *My journey of conscientisation***

When I returned to New Zealand to attend university to become a veterinarian, I knew I was Māori, but I didn't have a strong sense of what that meant to and for me. As such, I have been on a journey over the past almost 25 years to determine this. During my time as a student at the veterinary school there was no Māori influence in the school or Māori academic staff, and no opportunities or encouragement to develop my identity as Māori. I did not appreciate at the time the failing that this represented on the part of the veterinary school.

Marrying my husband just over 20 years ago had a significant effect on the development of my Māori identity. My mother-in-law, Doreen Ngawai Erueti, was a well-respected kaumātua within both the Māori and Pākehā communities in Taranaki. While she was a fluent speaker of te reo, much like my grandmother she was raised in a time when speaking te reo was actively discouraged. Thus, my husband and his eight siblings were not raised to speak te reo. Interestingly, she was later influential in bringing the kohanga reo movement to their area. Doreen influenced me greatly and, for that, I will always be grateful. While my husband was raised in a Māori environment, with some connection to his marae, wider community and tikanga, his te reo was largely developed during post-graduate study at Te Wānanga o Raukawa. This time also enabled his process of conscientisation. My own conscientisation journey had hardly begun at that time, and I recall us having conversations in which I would comment that he was 'getting all activisty'. While I may not have appreciated it at the time, on reflection I am truly grateful for his ever-deepening commitment to his Māori identity as it has also influenced me significantly.

While my identity journey has encompassed numerous large and small moments, I share three now for the purpose of demonstrating my journey.

Soon after my return to New Zealand, I was giving directions to someone and in my strongly Canadian accented voice said they needed to 'Turn left on 'Kay-teen' Street'. They couldn't understand what street I meant, so I wrote it down on a piece of paper 'K A T E N E Street'. 'Oh, you mean "KAH-teh-

neh Street’ they said with appropriate Māori pronunciation. It was a small but poignant learning moment for me. Not only did I not know how to pronounce a word in the language of my ancestors, but I didn’t even realise that it was a Māori word. It was in that moment I realised that I needed to start the journey to understand my identity as Māori that I continue on now.

The second experience was in more recent years when I attended a Te Tiriti o Waitangi (see Section 3.2) hui for Māori staff at Massey University. While I thought I had appreciated the fraught colonial history of our country, it was during and after reflecting on the learning from this workshop that I realised that my understandings were strongly influenced by the colonialist version of this history. From that workshop I have come to appreciate how entrenched hegemonic colonialist perspectives are not only for Pākehā<sup>1</sup> but for some Māori as well. Since that time, I have felt a more urgent need to understand more about the historical and ongoing barriers contributing to the inequities experienced by many of my people, and to ‘do the work’ needed to enable this understanding.

And finally, more recently, I was home while an ‘aunty’ who sometimes helps look after our children was there. She is not a biological aunt to my children but, as is common in Māori whānau, adults close to the whānau are often referred to as aunty or uncle. My son had just done something kind of silly and poorly thought out, and she responded ‘You’re such a Māori’ in a joking tone. My heart sank to hear Māori referred to in my home in a way that perpetuated the negative stereotypes of Māori, even jokingly. Even more sad was the fact that this aunty is also Māori, yet she subconsciously ascribes to the hegemonic portrayal of Māori as a lesser people. Understanding something of how this portrayal of Māori as lesser has developed in our colonial society, I feel that I need to contribute to critiquing and addressing it, so that my children and my mokopuna (grandchildren) might have the chance to grow up with less of that portrayal overshadowing them.

The educational system in New Zealand as a whole serves Māori less well than European and Asian students, as is clearly demonstrated in the educational performance statistics (Ministry of Education, 2017). Of course, there are Māori who thrive and are successful in the educational system: however, there are far too many that do not. It also seems that too many Māori who want to be successful in the educational system have to do so at the expense of their Māori identity. That is what happened to my husband, and while I didn’t choose to forego my identity for education, that was essentially the reality for me having been raised distant to Aotearoa and the opportunity to develop my Māori identity. As a mother of three Māori boys, the statistics around educating Māori, particularly Māori

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<sup>1</sup>New Zealander of European descent - probably originally applied to English-speaking Europeans living in Aotearoa/New Zealand

males, in this country terrify me. As parents, my husband and I will do everything in our power to ensure that our boys do not become defined by those statistics. As a university educator, I need to do everything in my power to influence those statistics. While I can't change all the statistics, I can impact on those in my sphere of influence, hence my desire to do this particular PhD topic.

## **1.2. CONTEXT**

Becoming a doctor or veterinarian are highly sought-after careers. Thus, student selection processes for medical and veterinary programmes are required as the number of applicants usually greatly exceeds the number of places available (Kogan & McConnell, 2001; Prideaux et al., 2011; Rees et al., 2016; Salvatori, 2001). In Western countries, the attrition rate of selected medical and veterinary students is low, so the vast majority of students will graduate and become practitioners (Prideaux et al., 2011). Thus, the goals of the student selection processes are not only to identify those applicants who are most likely to succeed as students, but who will also be competent practitioners and adequately serve society (Patterson, Knight, et al., 2016; Salvatori, 2001). As medical or veterinary student selection processes essentially determines who will join the profession, these selection processes may be the single most important assessment conducted in those programmes (Andrews, 2009; Eva, Rosenfeld, et al., 2004; Greenhill, 2015).

Historically, selection into health professional training programmes has aimed at selecting the 'best and brightest' through a focus on academic performance (Patterson, Zibarras, et al., 2016). Academic performance is often assessed through the grade point average (GPA). While GPA prior to selection is often the best determinant of academic performance within training programmes, particularly during the pre-clinical years (Fuentelba et al., 2011; Molgaard et al., 2015; Roush et al., 2014), there is little evidence to suggest GPA is well correlated with performance as a practitioner. Although academic ability is necessary, alone it does not ensure that a selected student will become a successful, competent health professional (Conlon et al., 2012; Patterson, Knight, et al., 2016; Roberts et al., 2008). Thus, the question is increasingly asked as to whether the "best" practitioners are necessarily defined by who is the "brightest" as assessed by academic performance, or whether "the best" practitioners are those who have the characteristics to allow them to meet the needs of the society they serve.

There is increasing pressure on the medical and veterinary professions to become more representative of the populations that they serve (Curtis et al., 2017; L. M. Greenhill, 2007; Razack et al., 2015) for reasons of social justice and addressing health inequities (Jones et al., 2019; Steven et al., 2016), enabling Indigenous rights (United Nations, 2007), as well as educating of students to create



more culturally aware practitioners (Coffman, 2002; Hung et al., 2007; Whitla et al., 2003). However, there is tension between the traditional practice of selecting on academic attainment, and the desire to become more inclusive of students from minoritised groups (Eva, 2015; Juster et al., 2019; Prideaux et al., 2011).

### **1.3. THE PROBLEM MOTIVATING THIS STUDY**

#### **1.3.1. *Brief history***

The veterinary profession in many Western countries is not ethnically inclusive. In the United States of America (USA) 95% of the profession is White (US Bureau of Labor Statistics, 2014), while in the United Kingdom (UK) only 3.5% of veterinarians identify as being black or from minoritised ethnicities (Royal College of Veterinary Surgeons, 2021). The veterinary profession globally has been attempting for some time to improve its ethnic representation through increased efforts to recruit minoritised ethnicity applicants into veterinary programmes (Chastain et al., 2007; L. M. Greenhill, 2007). Despite some improvement, the ethnic composition of the applicant pool, and subsequently selected student cohorts overseas, is still poorly reflective of the general population (L. M. Greenhill, 2007; Greenhill, 2009; Nelson, 2004). In the USA, minoritised ethnicities comprised just under 23% of the veterinary applicants in 2019 (Association of American Veterinary Medical Colleges, 2019). In contrast, these groups comprise ~40% of the American population (United States Census Bureau, 2018), and by 2045 are projected to increase to over 50% of the American population (Vespa et al., 2018). In the UK, 96% of applicants for veterinary science, agriculture and related courses were White (Andrews, 2009) compared with 86% of the population (Office for National Statistics (GB), 2012).

#### **1.3.2. *Development of the issue***

The veterinary profession in New Zealand is similarly poorly representative of the ethnic composition of New Zealand society. In 2018, the Veterinary Council of New Zealand (VCNZ) commenced collection of ethnicity data as part of the annual practising certificate registration process of veterinarians. Of those who provided self-identified ethnicity data in 2019 (n=2974, 85.3%), 2% were Māori, 0.4% were Pacific Peoples<sup>2</sup> ('Pacific'), 4% were Asian and 91% were European (McLachlan 2019)<sup>3</sup>. In comparison, from the 2018 Census results of the New Zealand population, 16.5% of people self-identified as Māori, 8.1% as Pacific, 15.1% as Asian and 70.2% as European (Statistics New Zealand, 2019a). The

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<sup>2</sup> Pacific Peoples is a term to describe people resident in New Zealand whose ancestry is from a heterogeneous group of Pacific island countries.

<sup>3</sup> Unpublished data provided with permission by Iain McLaughlin (Registrar, VCNZ, Wellington).

underrepresentation of Māori is also seen in other health professions: for example, Māori comprise 3.8% of doctors (Medical Council of New Zealand, 2020), 7% of nurses (Nursing Council of New Zealand, 2018) and 3.1% of dentists (Dental Council, 2017)

It has been shown from medical education in New Zealand that Māori historically have been underrepresented in the applicant pool and selected student cohorts (Collins et al., 1993; Crampton et al., 2012; Fitzjohn et al., 2003). However, the sociodemographic factors, including ethnicity, of veterinary applicants and selected students are currently unknown. It is also unknown to what extent the veterinary student selection processes influences the entry of Māori to veterinary education, and therefore the veterinary profession.

#### **1.4. RESEARCH AIMS**

Currently there is no research literature regarding the ethnicity of veterinary applicants, veterinary students, or the veterinary workforce in New Zealand. This thesis is the first step in addressing this gap and bringing to light the important issue of Māori representation and inclusion in the veterinary profession in New Zealand. The thesis presents a quantitative analysis of veterinary applicant and selected student data from 2003 to 2019. This seventeen-year time period included two significant changes to the selection process: 1) the introduction of a Māori equity selection process in 2007, and 2) the introduction of non-academic performance assessment into the selection process in 2017.

The thesis has two overarching goals. The first is to explore how the access of Māori to veterinary education, and therefore the veterinary workforce, is influenced by sociodemographic factors under three separate admission processes. The second is to explore the impact of sociodemographic factors and academic achievement prior to admission on the academic success of Māori once selected into the programme.

Specifically, the aims of the thesis are to:

1. Describe the ethnicity of the veterinary applicant pool over a seventeen-year period and determine if Māori and non-Māori applicants have differing sociodemographic backgrounds relevant to widening access to veterinary education and the veterinary profession.
2. Describe the ethnicity and other sociodemographic factors of students selected into the veterinary programme and evaluate whether the veterinary student selection process has influenced access to veterinary education for Māori.

3. Explore whether scores on assessments used in veterinary student selection differ between Māori and non-Māori, taking into account other sociodemographic factors.
4. Determine whether academic outcomes once selected into the veterinary programme are the same for Māori and non-Māori, and whether they have been affected by changes to the selection process.

The PhD will not capture qualitative feedback of the experience of Māori applicants, but rather will analyse their sociodemographic data, and data generated through the selection processes in which they participated. This by no means suggests that applicant voice regarding their experience is unimportant, but rather that it was outside of the scope of this thesis. It is an area that should be explored in future studies.

## **1.5. OVERVIEW OF THESIS STRUCTURE**

In this chapter I have introduced the topic and aims of this thesis, as well as introducing myself in terms of my identity as Māori. In chapter two, I will describe my researcher positioning including an overview of Kaupapa Māori theory and research and explain how this has influenced this research. Both of these chapters are presented in the first person, whereas from chapter three onwards third person perspective is utilised.

This thesis represents an intersection of several topics, and as such the literature review and background material will be presented over three separate chapters. Chapter three will contain a brief history and a current glimpse at the state of education for Māori in New Zealand. Chapter four is an overview of student selection and widening access to the health professions more broadly, while chapter five is a locally focussed explanation of veterinary student selection in New Zealand over the period of the study.

This thesis contains four related studies, each of which addresses one of the four aims of this thesis. An overview of the studies including the methods and materials (data collection, and variables used in the thesis) is found in chapter six. In chapters seven through ten, the four studies will be presented, in journal article format, including a discussion of the results of that study. The first study, Chapter 7, has been published. The published article has been edited and formatted to align with the rest of this thesis so, while very similar, Chapter 7 is not identical to the final published article. A link to the final article is included in the appendix of research outputs associated with this thesis.

There would be considerable overlap in the introduction and materials and methods of each of these studies if it were written in full for each study. Therefore, in an attempt to minimise repetition for the reader, the relevant introductory material for each study is presented in detail in the background chapters. The introduction to each study then focuses on connecting to the previous study or studies, briefly summarising the key background information (the detail of which is presented in the background chapters) and presenting the study aim. The list of the variables and description of the statistical analyses for each study will be outlined in the study chapters themselves. The method for building multivariable models was the same throughout the studies. A detailed description of the model building methodology is presented in full in the first study in which it is utilised, and then referred to in subsequent studies.

Following the four study chapters, chapter eleven is a general discussion relevant to addressing the overarching goals of this thesis and of Māori access to veterinary education and the profession more broadly. The recommendations arising from this thesis and conclusion are presented in Chapter Twelve. This is followed by the list of references, and then a brief appendix containing a list of research outputs associated with this thesis.



## Chapter Two

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### 2. RESEARCHER STANDPOINT AND KAUPAPA MĀORI POSITIONING

In the previous chapter I provided a brief history and description of who I am, as well as introducing this thesis. This chapter follows on from the history of who I am, to describe my researcher positioning.

#### 2.1. RESEARCHER STANDPOINT

The positivist approach of the typical quantitative research paradigm is characterised by the researcher being an uninvolved observer (Grant & Giddings, 2014), for whom the notion of ‘researcher positioning’ is thought to be irrelevant. On the other hand, this notion of an uninvolved observer has been challenged in many scientific disciplines, such that it is generally understood that an observation reflects, to a greater or lesser extent, the interaction between the observer and the phenomenon that is being observed. Consequently, all researchers have some connection to and involvement in their research, which drives what questions they ask, the methods they use to seek answers to those questions and the way they interact with the phenomena that they are observing.

Walter and Andersen (2013) described researcher standpoint as “Who we are, the values that underpin our concept of self, our perspectives on the world and our own position within it, our realities, and our understandings of how knowledge is construed and constructed” (p. 45). The authors further elaborated on this definition to note that a researcher’s standpoint is composed of the researcher’s social position, ontology, epistemology, and axiology. In the previous chapter I discussed the evolution of my identity as Māori, and my social position as a daughter, wife, mother, and veterinarian, raised in a middle-class socioeconomic environment. These perspectives underpin my researcher standpoint, which has influenced the way that I have approached this project. A researcher

whose social position was different from mine, or who was non-Māori, would inevitably have a different researcher standpoint in approaching the same questions.

Ontology is the philosophical study of existence, of being. In the context of research relating to people it refers to the nature of social reality (Chilisa, 2012; Curtis, 2016). Just as societies vary, so too does what is perceived or seen as real between cultures or other groups of people, often based on differing belief systems. Thus, social reality for Māori commonly differs from that of non-Māori. Due to the effects of colonisation, Western perspectives have been positioned as normal (Moewaka Barnes, 2000), and it is therefore commonplace for Māori reality to be disregarded as invalid by the non-Māori majority. In this research I will acknowledge the social reality of Māori as being valid, and therefore reject notions that blame Māori for the negative outcomes they experience.

Epistemology has been described as ‘ways of knowing’ (Chilisa, 2012; Walter & Andersen, 2013). Walter and Andersen (2013) further elaborate that epistemological theory is about “understanding how the mostly unwritten rules about what is counted as knowledge are set – what is defined as knowledge, who can and cannot be ‘knowledgeable’, which ‘knowledges’ are valued, and, by extension, which are marginalized” (p. 48).

Mātauranga Māori is commonly defined as meaning Māori knowledge, which, while convenient, is an oversimplified interpretation. Royal (2012) describes mātauranga Māori as a “body or continuum of knowledge with Polynesian origins” (p. 33). Broughton and McBreen (2015) describe mātauranga Māori as the Indigenous knowledge system of Aotearoa that includes “Māori knowledge and all that underpins it, as well as Māori ways of knowing” (p. 83). Both authors note that while mātauranga has historical origins and is passed between generations, it is also growing and iterative and reflects current knowledge (Broughton & McBreen, 2015; Royal, 2012). Thus, mātauranga Māori reflects a knowledge system based on that of Polynesian ancestors, combined with current Māori learning and experiences. Mātauranga Māori is sometimes discussed in New Zealand in relation to Western Science, however, it is more than science and instead is a complete knowledge system.

The legitimacy of mātauranga Māori has often been discounted by Western epistemology as this knowledge was not developed through methods consistent with Western definitions of evidence. Colonial government policy and systems have privileged Western epistemology and marginalised Mātauranga Māori to the point that for many in New Zealand “Western epistemology ... can seem like the only possible framework” (Broughton & McBreen, 2015, p. 84). While mātauranga Māori is not the dominant knowledge system in New Zealand, it does not negate the fact that mātauranga Māori is wisdom and knowledge in its’ own right, often developed through experience in applied settings

(e.g. trial and error). Having been educated in a Western positivist scientific system, I realise that I too had subscribed to the concept of a single reality and truth. I now appreciate that there are multiple knowledge systems that can be valid and recognise mātauranga Māori as such.

Axiology has been described as the study of value. In the context of research, axiology is the “ethics or morals that guide the search for knowledge and judge which information is worthy of searching for”(Wilson, 2008, p. 34). Such considerations inform the ethics and value systems (Chilisa, 2012) which, in turn, underpin the way research is conducted (Curtis, 2016). My upbringing has had a significant impact on my ethics and values, which guide my worldview, influencing both the personal and working aspects of my life. While I wasn’t privileged to have had a strong explicitly Māori influence in my earlier years, I appreciate now that many of the values I was raised with are consistent with Māori tikanga. Two value concepts which I believe are important to my standpoint as a researcher are manaakitanga and matatika.

Manaakitanga is defined as the process of showing respect, generosity and care for others (Moorfield, 2021). Politically and personally, I believe we have a responsibility to care for others, which should be a crucial aspect of any research. This leads into matatika, which is defined as ‘right, straight, ethical, fair, equitable, honest, impartial, unbiased, upright, moral’ (Moorfield, 2021). I want to conduct ethical research that will benefit Māori and help to address historical and ongoing inequities, because it is the right thing to do. In my area of research that concerns enabling Māori to access the veterinary profession.

My researcher standpoint then underpins the methodology for my PhD. Rather than ascribing to a specific Western methodology that may or may not be appropriate for dealing with the topic of this thesis, I will take a Kaupapa Māori research position that is founded on Kaupapa Māori theory.

## **2.2. ORIGINS OF KAUPAPA MĀORI THEORY**

Kaupapa Māori as a theory crystallised against the backdrop of a time of increased conscientisation of Māori (Mahuika, 2008; Smith, 2003) and increasing resistance against the effects of colonisation on Māori (Pihama, 2010) in the 1970’s through 1990’s. During this time there was a “whole transformation of thinking about Māori” (Durie, 2012, p. 21) and an ethnic revitalisation occurring in New Zealand (Bishop, 1998).

As part of this conscientization, many Māori were dissatisfied with a public education framework that was not seen to be serving their needs, and instead desired to have an educational framework based on their own philosophies of language, identity, culture and knowledge (Mahuika, 2008; Pihama et al.,



2002; Smith, 2003; Smith, 2011). The phrase Kaupapa Māori was coined in relation to education during a meeting between whānau and the Minister of Education in the early stages of what would become Kura Kaupapa (primary school operating under Māori custom and using Māori as the medium of instruction) schooling (G. Smith, 2012; Smith, 2011). Graham Hingangaroa Smith, in his 1997 PhD thesis, expanded the phrase to form “Kaupapa Māori theory” (Smith, 1997).

Kaupapa Māori theory also developed out of a significant dissatisfaction with prevailing Western research methodologies (Bishop, 1998; Moewaka Barnes, 2000; L. T. Smith, 2012; Walker et al., 2006), in which the research characteristically focused on the non-Māori researcher’s agenda rather than Māori interests and reality (Bishop, 1998). This resulted in a backlash regarding the negative stereotypes and outcomes that characterised research conducted by non-Māori on Māori (L. T. Smith, 2012). In the ground breaking book, *Decolonising Methodologies* (first published in 1999), author Linda Tuhiwai Smith discussed the hugely detrimental effect that colonisation and imperialist research had on Māori, with the resulting level of distrust that developed for many Māori regarding not only non-Māori researchers, but also research itself (L. T. Smith, 2012). Kaupapa Māori theory was conceived to be a set of transforming ideas with both political and cultural roots (Pihama, 2010; G. Smith, 2012) that would ensure research was conducted in culturally appropriate ways to enable a difference to be made for Māori.

Reflecting its origins in education, Kaupapa Māori theory was initially used in educational research with a more qualitative focus. Over time Kaupapa Māori theory has become more widely embraced in other social science and more recently quantitative research spaces. The early Kaupapa Māori theorists and practitioners are often credited with the genesis of Kaupapa Māori theory, however, as noted by Smith, it is not the creation of any individual, but rather “it is ours” (Smith, 2011, p. 10). In other words, Kaupapa Māori theory as a basis for research belongs to all Māori researchers past, present and future.

### **2.3. DESCRIBING KAUPAPA MĀORI THEORY**

Defining what Kaupapa Māori theory is, is neither a quick nor simple exercise as there is no universal definition. Explanations of Kaupapa Māori theory often include descriptors such as fluid, organic and not limited to one way of doing things, which reflects how practitioners will be able to continue to create, grow and modify what it will be in the future (Pihama, 2010; Smith, 2011).

Several authors describe, rather than define Kaupapa Māori. On a summarised level, Leonie Pihama describes Kaupapa Māori theory as “a theoretical framework that ensures a cultural integrity is

maintained when analysing Māori issues” (Pihama, 2010, p. 10). Walker and colleagues suggested the following overarching explanation “Kaupapa Māori research has been used as both a form of resistance and a methodological strategy, wherein research is conceived, developed, and carried out by Māori, and the end outcome is to benefit Māori.” (Walker et al., 2006, p. 331).

Many authors purposely resist defining precisely what Kaupapa Māori theory is, as they consider that doing so plays into the power of colonisation and Western perceptions of methodology (Moewaka Barnes, 2000). Moreover, there is the feeling that to try to standardize what Kaupapa Māori theory is might eventually limit its scope and transformative capability, and could risk it becoming just a checklist of criteria to tick off (Mikaere, 2011).

Thus, in the absence of a specific definition, researchers need to actively engage with the concepts and elements of Kaupapa Māori by studying the works of previous Kaupapa Māori researchers (Pihama, 2011). It has been suggested that the process of grappling with what Kaupapa Māori theory is, and coming to an understanding of how it will be enacted in each practitioner’s context, is a key aspect of Kaupapa Māori theory (Smith, 2011).

## **2.4. WHAT KAUPAPA MĀORI THEORY ENABLES**

Perhaps more useful than trying to define what Kaupapa Māori theory is, is to explore what it enables through Kaupapa Māori research. In this discussion I have grouped my understanding into principles that I used to guide my research.

### **2.4.1. *Centralises Māori and retains control and power with Māori***

Perhaps one of the most essential aspects of what Kaupapa Māori theory does, is that it centralises Māori in the research (G. Smith, 2012; Smith, 2003) thereby allowing for research that has been described as “*for, by and with Māori*” (L. T. Smith, 2012, p. 298). Considering the centrality of the concept of “*for and with Māori*”, this thesis ensures that Māori are centralised in the setting of the research questions, data analysis and interpretation.

In relation to “*by Māori*”, Kaupapa Māori theory requires Māori to define, develop and execute research in ways that increase the likelihood of appropriate questions being asked and interpretation of findings that are relevant and beneficial to Māori (Moewaka Barnes, 2000) rather than in the interests of the researcher (Bishop, 1998). By centralising Māori researchers in the project from conception to completion, control is maintained within the hands of Māori (Pihama, 2011; Walker et al., 2006). As “*control is closely aligned with power*” (Moewaka Barnes, 2000, p. 14), this then allows

the power associated with the project to also remain with Māori. By maintaining the power and control of the research with Māori, Kaupapa Māori theory creates space for researchers to be Māori in who they are and the way they conduct their research (Smith, 2011). Researchers can be explicit about who they are and how that influences their research without having to compromise themselves or their views to fit into a prescribed Western framework.

The involvement of non-Māori researchers in Kaupapa Māori research is somewhat controversial and there is no uniform agreement (L. T. Smith, 2012). The position of some Kaupapa Māori researchers is that “by Māori” excludes any involvement of non-Māori in Kaupapa Māori research (G. Smith, 2012). In contrast, other researchers feel that there can be involvement of non-Māori in Kaupapa Māori research as long as the determination of the research agenda and control of the research remains with Māori (Bishop, 1996). Involvement of non-Māori in Kaupapa Māori research comes with some risk, but at times it may be necessary or beneficial (G. Smith, 2012). In veterinary science, there are two Māori academics that I am aware of (including myself) and, as such, I need the contribution of non-Māori “allies” (Bishop, 1994) to support me to achieve the research agenda in this thesis. The people I have chosen are largely aligned with my position but on occasion there have been tensions. Ultimately, as G. Smith (2012) noted “This is not a black and white issue; it is about people, it is about relationships” (p. 19). Māori researchers are centralised in this thesis as this research is led by me as the thesis student, with support from a senior Kaupapa Māori research supervisor. Non-Māori supervisors have contributed technical support rather than direction with setting the research agenda. For example, editorial support and statistical guidance have been provided, such as supporting understanding of the modelling methodology and output, but not interpretation of meaning of results.

#### **2.4.2. *Enables positive change and transformative outcomes for Māori***

Kaupapa Māori theory led research should lead to positive change and beneficial outcomes for Māori (Pihama, 2011; Walker et al., 2006). Linda Smith (2012, p. 309) stated “Kaupapa Māori approaches to research are based on the assumption that research that involves Māori people as individuals or communities, should set out to make a positive difference for the researched”.

But more than just positive change, many authors suggest that Kaupapa Māori research should also lead to transformative change (Jackson, 2011; Pihama, 2010; Royal, 2012; G. Smith, 2012; Smith, 2011). G. Smith (2012) further elaborates that rather than just making things more Māori friendly, outcomes that result in transformative change are not just desirable but are a requirement of Kaupapa Māori theory and research. In turn, if it is to be transformative, Kaupapa Māori theory needs to create recommendations, solutions or opportunities to allow Māori to successfully participate in life in

Aotearoa whilst continuing to be themselves as Māori (Durie, 2012; G. Smith, 2012; Smith, 2011). Kaupapa Māori theory should address Māori aspirations, support Māori achievement and make a difference and a change in people's lives (G. Smith, 2012; Smith, 2003). The transformative potential from this thesis will be outlined in Chapter 12 Recommendations and Conclusion.

### **2.4.3. *Privileges mātauranga Māori and te ao Māori***

The underlying ideas and concepts of Kaupapa Māori are based on ancient concepts (Pihama et al., 2002) whilst also incorporating modern reflections of tikanga and mātauranga Māori (Broughton & McBreen, 2015; Royal, 2012). In Western research, these concepts as well as te reo Māori worldview and ways of being have been ignored or actively discouraged (Bishop, 1998). Conversely, Kaupapa Māori theory is informed by these concepts, and the fundamentally different ways that Māori may have of seeing and thinking about the world (Mahuika, 2008). These concepts become inherent and valued parts of research rather than alternative concepts.

Epistemology, or “ways of knowing” (Walter & Andersen, 2013), is also important to understanding what Kaupapa Māori theory enables. Particularly in academic circles, hegemonic views or Western ways of knowing are usually accepted as “normal”, while Māori ways of knowing may be seen as “outside the norm” or “other” (Moewaka Barnes, 2000). Kaupapa Māori challenges the narrow view of what constitutes knowledge and knowledge construction in Western epistemology, and instead privileges mātauranga Māori and Te Ao Māori (Māori worldview) (Eketone, 2008; Walker et al., 2006).

Alongside Māori knowledge, Kaupapa Māori theory legitimises and validates Māori values and ways of being (Walker et al., 2006). It carves out the space for Māori ways to be seen as normal and acceptable, rather than alternative. Kaupapa Māori was “deliberately evoked as a ‘strategy’, or ‘a plan of action’ to ‘make space’ for Māori people, culture, knowledge and values in the academy... to validate its use there. Critically, in such a context, Kaupapa Māori is also about transformation” (Royal, 2012, p.31) In this thesis, portrayal of Māori as other and Māori ways as alternative is rejected, and making space for Māori in veterinary education is positioned as an Indigenous right (United Nations, 2007).

### **2.4.4. *Recognizes varying Māori realities and allows Māori to define themselves***

Colonisers in New Zealand have continually defined and redefined Māori, for the benefit of the coloniser majority, often to control access of Indigenous people to resources or benefits (Jackson, 2010; Kukutai, 2004). Terms such as half-caste, or a fractional description (e.g. one quarter Māori) relate to the concept of “blood quantum”, which is an imperialist view of defining Māori. This differs

to the way Māori define themselves, in which anyone with Māori whakapapa (ancestry) is Māori (Jackson, 2010). In order to push back against coloniser definitions of Māori, and to achieve some social goals and political outcomes, Māori identity has in part had to be asserted as homogenous and stable (Hoskins, 2012). While this assertion has served a purpose, it isn't aligned with the reality that identity as Māori and the experience of being Māori varies between people with no single right way (Penetito, 2011). In this thesis, all applicants who have self-identified as Māori are considered Māori. Additionally, the reality of the differences in educational experience between Māori and non-Māori will be acknowledged, whilst also recognising that within Māori the experience is also not uniform.

#### **2.4.5. *Rejects cultural blaming and critiques power imbalances and barriers***

Educational researcher, Bishop (1998, p. 200) described the “social pathology research approach” of much early research on Māori that suggested Māori were inferior to the colonisers. Rejecting the cultural deficit theorising commonplace in Western research regarding Māori is an important part of the Kaupapa Māori positioning of this thesis. Rather than blaming Māori for the disparities they experience (Curtis, 2016), the power imbalances in New Zealand society (Bishop, 1998; Pihama et al., 2002) and societal or institutional barriers (G. Smith, 2012; L. T. Smith, 2012) that predispose these outcomes will be critiqued, and recommendations for institutional change rather than changing Māori will be considered. This political analysis is viewed as essential to Kaupapa Māori theory by many authors. Pihama (2002, p. 35) stated “Given the historical imposition of Pākehā structures, language, and knowledge onto Māori people, there is without doubt a political drive that is crucial to current expressions of Kaupapa Māori.” G. Smith (2012) describes this political analysis and action as critical to enabling transformative change.

Being deliberate and careful with the language used in research with Māori, is important as language creates the reality of the way things are viewed (Grant & Giddings, 2014). Common language or discourse develops within a historical and political context, and as such usually reflects the dominant social group (Grant & Giddings, 2014), so care must be taken with the language and terminology used in Māori research. In this thesis there will be intentional uses of language that may not be commonly used. This is purposeful and specific in order to direct focus to the power imbalances and institutional structures or processes that exist and have led to and continue to propagate the inequities and barriers that Māori experience. For example, I will refer to “minoritised ethnicities” instead of the more commonly used “ethnic minorities” to emphasise that, as in the case of Māori, that these ethnicities are not in fact minor, but have been positioned as such by the majority. An additional example relates to academic attainment. The term “received” will be used rather than “achieved” to

highlight the role and power of the assessor in determination of academic attainment, that remains hidden with the term achieved.

#### **2.4.6. *Enables high quality research***

Kaupapa Māori theory allows high quality relevant research for Māori (Curtis, 2016) through culturally appropriate approaches to understand Māori phenomena from a valid perspective. In many instances these will be Māori approaches, whilst at other times the Kaupapa Māori researcher may utilise appropriate Western methods.

For quantitative research, a commitment is required to use the highest quality data possible, especially for ethnicity data. Where ethnicity data are collected for the purpose of the study, the Statistics NZ approved ethnicity question is recommended (Statistics New Zealand, 2017). Additional techniques to improve ethnicity data collection or analyses may include specified sampling of Māori to enable adequate explanatory power, age-matching of data, and pooling of data to enable adequate sample size for analysis (Simmonds et al., 2008). Whether primary or secondary data, data cleaning and collation should follow approved recommendations e.g. Ministry of Health Ethnicity Data Protocols (2017). In this thesis, I have committed to using appropriate statistical analyses (Curtis, 2016), including comparison of Māori and non-Māori to investigate inequity (Wikaire et al., 2016).

Utilising Kaupapa Māori theory also supports Māori researcher development (Penetito, 2011). Both Smith (2011) and Pihama (2010) have emphasised the value of Kaupapa Māori theory led research to enable researchers to think and explain their research using Māori values and theories. “It provides a way of supporting Māori researchers... to do the kind of research they want to do.... in a Māori space” (Smith, 2011, p. 12). Nonetheless, Kaupapa Māori theory is not easily defined and coming to understand the meaning and interpretation in their own context requires deep consideration and thought and is part of the researcher’s development. As noted by Smith (2011, p. 15) “you free your own thinking in the process of figuring out what Kaupapa Māori is.” Kaupapa Māori theory is not restricted to any particular discipline and as such enables discourse between Māori across disciplines, which can also support new researcher development (Smith, 2011; L. T. Smith, 2012). This is particularly valuable where the academic training in their discipline area has not appropriately prepared them with the skills and knowledge to work with Māori communities (L. T. Smith, 2012). As an emerging researcher, utilising Kaupapa Māori theory in this thesis has enabled my development as a researcher especially around my researcher positioning and approach to interpreting and telling the story of the data and results. It has also enabled development of greater expertise when considering Māori in veterinary related research than has previously existed.

### **2.4.7. Decolonising and emancipatory**

In the past most research about or on Māori has inappropriately used Western frameworks based on Western (mainstream) worldviews, paradigms and theories resulting in the dehumanisation of Māori (L. T. Smith, 2012) or cultural blaming (Bishop, 1998). The fraught history of Western research about or on Māori, has led many Māori to either partially or completely reject all theory and research. “One of the challenges for Māori researchers working in this context has been to retrieve some space ... to convince Māori people of the value of research for Māori” (L. T. Smith, 2012, p. 297). While the inadequacy of mainstream methodologies has initiated this distrust among Māori regarding research, it has also fostered the need for Kaupapa Māori research.

Kaupapa Māori theory informed research has provided an avenue to challenge the relevance of using Western approaches, epistemology, paradigms, and theories in projects researching Māori life and experiences (Eketone, 2008; Henry & Pene, 2001; Smith, 2003). In this challenge, Kaupapa Māori theory also draws attention to the cultural and interest laden nature of many mainstream theories, despite assertions of neutrality (Smith, 2003). At its essence, what Kaupapa Māori theory does is critique Pākehā worldview and hegemony (Bishop, 1998; Pihama et al., 2002) and instead favours Māori worldview and approaches (Walker et al., 2006).

Tino Rangatiratanga (self-determination) is widely embraced as a key aspect of Kaupapa Māori theory and research. Smith (1997) noted that “the principle of ‘Tino Rangatiratanga’ reinforces the goal of seeking more meaningful control over one’s own life and cultural wellbeing” (Smith, 1997, p. 466). Rather than presenting it as a separate principle, I have chosen to include it here to conclude this discussion as it underpins many of the principles that I have presented above as guiding my Kaupapa Māori researcher position. The importance of Tino Rangatiratanga (self-determination) will be seen in Chapter 12 Recommendations and Conclusion.

## **2.5. SUMMARY**

The principles I have discussed above have both similarities and differences to those of other Kaupapa Māori researchers and represent what I see as important to my Kaupapa Māori positioning. In this thesis, Māori have been centralised in the research team, data analyses, and interpretation, thereby allowing a “by Māori, for Māori, with Māori” approach, that will reject blaming Māori for the inequity they experience. Instead of requiring Māori to change, there will be consideration of what needs to change externally to Māori in society, academic institutions etc. It is anticipated that the Kaupapa Māori positioning in this thesis will better enable positive, transformative change for Māori.

## Chapter Three

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### 3. MĀORI AND EDUCATION IN NEW ZEALAND

In this chapter a brief history of education for Māori will be provided to aid understanding the current educational context in New Zealand, including access of Māori to higher education.

#### 3.1. THE STATE OF EDUCATION FOR MĀORI IN NEW ZEALAND

Internationally the United Nations Declaration on the Rights of Indigenous Peoples confirms the right of Indigenous individuals to “all levels and forms of education of the State without discrimination” (United Nations, 2007, p. 15). In an equitable education system, all students should be able to experience success irrespective of their ethnicity, socioeconomic status, gender etc. Currently Māori experience marked inequity in education and educational outcomes in Aotearoa, and addressing these issues is an urgent imperative (Bolton, 2017; Tertiary Education Commission, 2019). Thus, access to equitable education is an Indigenous right which is currently not being met in New Zealand. The 1840 signing of te Tiriti o Waitangi should also have ensured equitable participation of Māori in state education, however, as will be shown this has not been the case.

#### 3.2. TE TIRITI O WAITANGI

In 1835, in response to threats of colonisation and the need for a national flag to fly on Māori ships to prevent their seizure, multiple rangatira (Māori chiefs) in Northern New Zealand signed “He Whakaputanga o te Rangatiratanga o Nu Tirene, Declaration of Independence” (Keane, 2012). In this document, New Zealand was declared an independent state under control of the Te Wakaminenga o



Nu Tirene, the United Tribes of New Zealand. This document was subsequently recognised by the British King (Mutu, 2010).

Te Tiriti o Waitangi, a treaty agreement between the Crown (British Queen) and a large number of Māori chiefs, was signed five years later in 1840 (Ministry of Justice, 2020; Orange, 2012). Te Tiriti o Waitangi is recognised as one of the core constitutional documents of New Zealand (Ministry of Justice, 2020) and the founding document of government in New Zealand (Office of the Governor-General, 2021). The treaty was originally drafted in English (“Treaty of Waitangi”) and then translated, incorrectly, into te reo Māori (“Te Tiriti o Waitangi”), such that the meaning of the text differed between the versions. Over 500 rangatira signed the te reo Māori version, while just 39 rangatira and the Crown’s representative signed the English version (Orange, 2012).

The first two articles of the treaty had substantive disagreement between the versions. In the English version the Queen was given sovereignty over the land and allowed for Māori to possess or use the land. In contrast, Te Tiriti o Waitangi was seen as a commitment by the Crown to govern British subjects that were behaving lawlessly in New Zealand, whilst reaffirming the authority and sovereignty of rangatira over all the lands (Mutu, 2010). In other words, there was no intention by rangatira to give up their mana and establish the queen as the sovereign of the nation. The third article was broadly similar between the two versions, and extended to Māori the queen’s protection and the rights and privileges of British subjects (Orange, 2012). It is through article three that equitable education for Māori should have been provided, as is reflected in the strategy of the Tertiary Education Commission (Tertiary Education Commission, 2019).

While signing of Te Tiriti of Waitangi should have enabled peaceful co-existence and partnership between the British and Māori (Mutu, 2010; Orange, 2012) the differing meaning between the Māori and English versions, as well as repeated breaches by the Crown of even well agreed aspects of the treaty, have led to marked conflict (Orange, 2012) and oppression of Māori (Mutu, 2010).

### **3.3. HOW HAS EDUCATIONAL INEQUITY FOR MĀORI ARISEN?**

Multiple authors have suggested that the current disparity in educational outcomes experienced by Māori have been heavily influenced by New Zealand’s colonial history and subsequent educational policy decisions in the nineteenth and twentieth century (Berryman et al., 2012; Bishop, 2015; Waitangi Tribunal, 1999). Still more authors would suggest that these outcomes are not accidental but rather are the result of the deliberate use of education as a means of colonisation, assimilation and

ensuring the inability of Māori to compete with Pākēha<sup>4</sup> (Matthews & Jenkins, 1999; Simon, 1992; Theodore et al., 2015). A summary of historical events relevant to the current state of Māori education in New Zealand and understanding the perspectives of these authors is provided below.

### **3.3.1. History of Education in New Zealand Relevant to Māori**

Māori were initially very interested to learn colonial knowledge and technology to augment their own knowledge, so much so that they contributed money and land to support the building of both mission and state-controlled schools (Simon, 1992; Theodore et al., 2015). However, the aspirations for acquisition of this knowledge by Māori were not realised, as what was taught was controlled initially by missionaries and later the settler government with the intent to ‘civilise’ (convert to Christianity) or culturally assimilate Māori, to maintain social order and to support Pākēha economic interests in part by creation of a Māori labour force (Matthews & Jenkins, 1999; Simon, 1992).

The first ‘mission school’, or non-state controlled school in which missionaries taught Māori in te reo, was built in 1816 in the Bay of islands in Northern New Zealand (Berryman et al., 2012). To the missionaries, civilisation and Christianity were one and the same, so literacy was taught in te reo using scriptures with the aim of saving Māori by conversion to Christianity (Simon, 1992). These mission day schools persisted until the introduction of the Education Ordinances Act in 1847, which commenced state support for the mission schools. This also marked the start of the state-driven process of assimilation of Māori through education (Berryman et al., 2012).

The colonial government held deficit perspectives (Silverman, 2011) of Māori students as evidenced by the statements in 1862 of School Inspector Henry Taylor. In a report to the House of Representatives he noted that “a refined education or high mental culture” would be inappropriate for Māori “if we take account of the position they are likely to hold for many years to come in the social scale”, and because “they are better calculated by nature to get their living by manual than by mental labour” (Simon, 1992, p. 6).

In 1867 the Native Schools Act was passed which saw mission schools replaced by a state-controlled school system. Concurrently, there was a marked decline in Māori-settler relations, with land wars occurring in various parts of the country. Hugh Carleton, a government school inspector and Member of the House of Representatives noted in 1862 that schooling for Māori had a “double object – the

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<sup>4</sup> Pākēha is defined as a New Zealander of European Descent – probably originally applied to English-speaking Europeans living in Aotearoa/New Zealand. Moorfield, J. C. (2021). *Maori Dictionary. Te Aka Māori-English, English-Māori Dictionary*. Retrieved June from <https://maoridictionary.co.nz/>.

civilisation of the race<sup>5</sup> and the quieting of the country” (Simon, 1992, p. 4).

Establishment of schools was central to the Government’s desire to assimilate Māori and inculcate them with European values and customs. It was hoped that these assimilated Māori would then return home and instil those values in their people (Matthews & Jenkins, 1999; Smith, 2009). To assist the assimilation process, English was the language of instruction (Royal, 2010) and in 1903 speaking te reo in schools was banned nationwide and enforced with corporal punishment. As a result, the proportion of Māori that could fluently speak te reo decreased from 95% to 25% between 1900-1960 (Berryman et al., 2012). An attempt by the New Zealand Federation of Teachers in the early 1930’s to have te reo introduced into the curriculum was thwarted by the Director of Education, who noted that “the natural abandonment of the native tongue involves no loss to the Māori” (Berryman et al., 2012).

As outlined in a 1916 government report, rather than a focus on academic subjects, the state school curriculum concentrated on manual or domestic skills as deemed best suited to Māori (New Zealand Government, 1916). Further comments by the Director of Education reinforced the government position on educating Māori to be an agricultural workforce noting that education “should lead the Māori lad to be a good farmer and the Māori girl to be a good farmer’s wife” (Berryman et al., 2012; Simon, 1992). In opposition to these guidelines, a headmaster of Te Aute College provided an academic curriculum and rigorously prepared his students for university matriculation examinations. Some of these graduates went on to become leaders in the Māori community and Members of Parliament. However, he soon came under pressure from the Ministry of Education to stop the academic curriculum and teach agriculture instead. While the admonitions were couched as being from a place of concern for Māori, what was advocated would serve only to ensure that Māori would be subsistence farmers or handymen, unable to compete with Pākēha farmers (Simon, 1992).

Unsurprisingly, a wide gap in educational outcomes between Māori and non-Māori developed which was highlighted in the 1960 Hunn report. In this report it was concluded that these differences were due to Māori indifference to education and poverty stricken homelives (Harris, 2008). Rather than either continued attempts at assimilation or conversely strengthening Māori cultural identity, the

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<sup>5</sup> The term “race” is used here in a quote. The concept of race does not align with Kaupapa Māori positioning, as categorisations of race are based on colonial logic, values, and politics and do not align with how Indigenous people define themselves (Cormack, D., Reid, P., & Kukutai, T. (2019). Indigenous data and health: Critical approaches to ‘race’/ethnicity and Indigenous data governance. *Public Health*, 172, 116-118. <https://doi.org/10.1016/j.puhe.2019.03.026> ). Additionally, historical categorisations of race are not supported by biological or genetic evidence, and have led to notions of superiority that have fuelled racist beliefs (Yudell, M., Roberts, D., Desalle, R., & Tishkoff, S. (2016). Taking race out of human genetics. *Science*, 351(6273), 564-565. <https://doi.org/10.1126/science.aac4951> ). As such the term race will only be used in this thesis when referencing a quote or if it would not be appropriate to replace it with an alternate term.

author recommended that integration of Māori into Pākēha society was the best way to address the disparity issues, and would also prevent a “colour problem” (Ministry for Culture and Heritage, 2017; Royal, 2010).

In 1998, the continuing underachievement of the state-education system for Māori was highlighted in a report by Te Puni Kōkiri (Ministry of Māori Development) which led to the development of the first Māori education strategy (Berryman et al., 2012). Over 20 years later, while there has been improvement, the inequity in the New Zealand education system for Māori persists.

As noted by Berryman and Woller (2013, p. 827) “It is the subsequent intergenerational suppression of cultural values, reinforced by the education system that continues to be a marginalising factor in Māori student achievement today”. Deficit perspectives of Māori children were established in the history of New Zealand education which continue to persist today (Bolton, 2017). A cultural deficit perspective is “a view that individuals from some cultural groups lack the ability to achieve just because of their cultural background.” (Silverman, 2011, p. 446). Researchers have demonstrated that some teachers hold deficit perspectives of Māori student ability and subsequently have lower expectations of Māori students (Alton-Lee, 2003; Bishop et al., 2009; Bishop et al., 2003; St George, 1983; Turner et al., 2015). These deficit perspectives can lead to poor relationships between the student and teacher, which reinforces lower expectations, resulting in lesser learning opportunities being afforded to those students and self-fulfilling outcomes of poorer Māori student achievement (Bishop et al., 2003; Rubie-Davies et al., 2006; St George, 1983).

St George (1983) and Turner et al. (2015) reported that in their studies, the teachers with deficit perspectives of Māori children often attributed the gap in performance as being due to deficient homelives, which served to exonerate the teachers from taking some personal responsibility for their students’ achievement. In contrast, Bishop et al. (2003) reported that students, their whānau and school principals felt that the most important influence on the achievement of Māori students was the quality of the interaction and relationships with their teachers. This has been evidenced by improved Māori student outcomes when the relationships and interactions between students and their teachers have improved as a result of teacher professional development (Bishop et al., 2009; Bishop et al., 2003).

Decreased expectations and negative stereotypes may also lead to stereotype threat. Stereotype threat has been defined as the fear of confirming a negative stereotype about one’s group (Smith & Hung, 2008; Steele & Aronson, 1995), which may lead to a disruptive psychological state that can undermine performance and may inadvertently confirm the stereotype (Spencer et al., 2016).

Interestingly, an individual does not have to believe the negative stereotype about their group generally or about themselves specifically to be susceptible to stereotype threat (Allen & Webber, 2019; Steele, 1997). The lower expectations and deficit perceptions of Māori students in New Zealand can lead to stereotype threat (Allen & Webber, 2019). For high performing students, this may lead to a tension between their academic identity and their ethnic identity, where they feel they need to choose one or the other. This reflects the challenge facing the New Zealand education system of enabling Māori to succeed as Māori (Berryman & Eley, 2017; Durie, 2012) rather than having to “leave their Māori identity at the door” (Linda Smith as cited by Husband, 2015).

### **3.4. WHAT IS THE EVIDENCE OF EDUCATIONAL INEQUITY FOR MĀORI?**

There are multiple markers of educational inequity for Māori with some being academic attainment, attendance, stand-downs and suspensions, student voice regarding belonging and safety, and university participation. The national qualification for senior secondary school students in New Zealand is called the National Certificate of Educational Achievement (NCEA) and is offered under the oversight of the New Zealand Qualification Authority (New Zealand Qualifications Authority, 2020b). NCEA is designed to enable students to achieve success in both traditional and alternative subject areas. Students usually take a range of subjects while in years 11-13, to complete the three NCEA certificate levels (numbered 1-3) (New Zealand Qualifications Authority, 2020b). The New Zealand Ministry of Education and the New Zealand Qualification Authority report their NCEA achievement data in slightly different ways, but both show that despite some improvement in NCEA level 3 attainment, Māori still receive substantially lower rates of NCEA level 3 attainment than Pacific, European and Asian students (Ministry of Education, 2019a; New Zealand Qualifications Authority, 2020a). This pattern has been consistent over time and is also seen in both NCEA Level 1 and 2 results.

The Organisation for Economic Cooperation and Development (OECD) runs an international research programme entitled the Programme for International Student Assessment (PISA) (May et al., 2019). PISA data are collected to enable comparison of the education systems in varying countries. Overall, New Zealand performs well with reading, math and science literacy scores above the average (May et al., 2019). However, closer inspection shows that this high level of achievement is not shared equally. Asian and Pākēha students received scores above the OECD average in reading, math and science literacy, while results received by Māori and Pasifika students were below the OECD average and among the lowest scores across the OECD countries in all three areas (Bolton, 2017). However, these averages do not reflect the wide variation in performance amongst Māori students on these assessments. While around one third of Māori were in the lowest performance band for reading,

mathematics, and science, up to one fifth of Māori students were in the high-performance bands for these areas.

Qualitative measures of the experiences of Māori in the educational system are also cause for concern. Over one third (37%) of Māori students did not feel like they belonged at school, and just over one-quarter (28%) did not agree that their teacher understands them. Additionally, Māori students were more likely to report experiencing bullying behaviours, and 24% of Māori students reported not feeling safe at school (Ministry of Education, 2020a).

School attendance is crucial to learning and is an important marker of educational success as it is associated with both academic attainment and student wellbeing (Ministry of Education, 2020c). Recent data has shown that any decrease in attendance impacts on learning in essentially a linear relationship (Ministry of Education, 2020f), such that even 5-10% decreases in attendance were linked to decreases in the number of NCEA credits obtained (Ministry of Education, 2020c). Māori students have lower attendance rates than other ethnicities in New Zealand (Bolton, 2017; Ministry of Education, 2020c), which is even more pronounced when considering chronic absence (< 70% attendance). Thus, the learning impacts of lower school attendance are experienced by Māori to a greater level than other ethnicities.

Another marker of educational outcomes are the disciplinary actions given to students of stand-down, suspension, exclusion, and expulsion rates. Māori students, especially boys, continue to receive higher rates of all these disciplinary actions than any other ethnicity (Bishop et al., 2009; Ministry of Education, 2017, 2020a, 2020b). Māori experience student stand-down rates double those of European students (Ministry of Education, 2020a), while suspension rates are more than two and a half times those of European/Pākehā students (Ministry of Education, 2020b). There are no specific guidelines on what behaviours warrant which level of disciplinary action, so whether or not a student is merely warned versus stood down or suspended varies by the school. The school principal determines the disciplinary actions, and thus, a principal with a deficit perspective (Silverman, 2011) of Māori is more likely to stand down or suspend Māori students than European students. These disciplinary actions also result in more missed school which further impacts learning.

Despite improvements in many areas, Māori continue to experience poorer outcomes than their non-Māori counterparts across a wide variety of pre-tertiary educational measures. Irrespective of their ethnicity or socioeconomic background, all students should have access to quality education which unfortunately is not the reality for Māori (Bolton, 2017).

The inequity in education from the educational policies from the 1860's onwards has also affected tertiary outcomes, with almost complete exclusion of Māori from university education prior to and into the 1960's (Theodore et al., 2015). This started changing in the 1970's and 1980's, and since then there has been significant growth in Māori university participation (Durie, 2009) such that in 2019 Māori comprised 11% of domestic students completing a bachelor's degree that year (Ministry of Education, 2020d, 2020e). This is a marked improvement on the past, and is now almost within 5% of population parity, however there is still a need to further improve university access for Māori, and to consider the barriers that exist for Māori progressing to or completing university.

Theodore et al. (2015) surveyed Māori graduates (n=626) and reported that almost half (48.4%) were the first in their family to attend university and one third (32.9%) were parents. Both of these factors can influence completion of university study. A key barrier to progression to university is the lower university entrance award attainment of Māori in comparison to all other ethnicities in New Zealand (New Zealand Qualifications Authority, 2020a). The university entrance award is the minimum standard that students under the age of 20 must meet in order to enrol in a New Zealand university. However, attainment of university entrance isn't sufficient for entry to highly selective programmes like medicine and veterinary science. Selection into these programmes is very competitive (Curtis, Wikaire, et al., 2012) and requires a greater level of secondary school preparation than meeting the minimum standards for university entrance (Massey University, 2020a; University of Auckland, 2020; University of Otago, 2020). Currently the New Zealand secondary school system is not adequately providing this level of preparation for Māori (Curtis, Wikaire, et al., 2015; Wikaire, 2015). As such, Māori have historically been underrepresented in the applicant pool and selected student cohorts for medicine (Collins et al., 1993; Crampton et al., 2012; Curtis et al., 2017; Fitzjohn et al., 2003). In recognition of this, equity focused recruitment and admissions policies have been implemented which have markedly improved the number of applicants and students selected into medicine (Crampton et al., 2018; Curtis et al., 2017).

The importance of enabling an ethnically representative health workforce has been a focus for some time, however, in the New Zealand veterinary profession the concept of an ethnically representative workforce has yet to gain traction, and currently the ethnicity of veterinary applicants and selected students has not been reported.

### **3.5. SUMMARY**

There is long-standing disparity in the educational outcomes of Māori in comparison to other ethnicities in New Zealand. New Zealand's colonial educational history reflects a deliberate, and largely successful, attempt to control the amount and type of knowledge shared with Māori for the purposes of colonisation and assimilation. Deficit perspectives of Māori were promulgated during this time, and unfortunately still persist. Teachers with deficit perspectives often blame the disparity in outcomes on the individual, their whānau, homelife and socioeconomic factors. Rather, greater self-reflection by teachers on their role in these outcomes, and broader consideration of the societal and institutional barriers that might contribute to these outcomes is warranted. The history of education for Māori in New Zealand is directly related to the current disparity in educational outcomes that Māori experience. While there have been some improvements in outcomes, further progress is needed to ensure equitable access for Māori to quality education from the primary to university level. These issues are highly relevant to this thesis considering access of Māori to veterinary education in New Zealand.





## Chapter Four

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### 4. SELECTION PROCESSES AND WIDENING ACCESS INTO THE MEDICAL AND VETERINARY PROFESSIONS

Following on from the consideration of the state of education for Māori including university access in the previous chapter, this chapter commences by exploring the literature with regard to selecting students for admission into human and veterinary medical education programmes. There is then consideration of how the selection processes influence access to these professions, and the impact of widening participation for underrepresented groups. There is only a small amount of literature regarding representation or inclusion in veterinary medicine, hence much of the literature cited in this chapter hails from medical student selection.

#### 4.1. STUDENT SELECTION

The number of applicants to health profession programmes such as veterinary science and medicine usually markedly exceeds the number of available positions (Kogan & McConnell, 2001; Prideaux et al., 2011; Rees et al., 2016; Salvatori, 2001). Of these applicants, many could undertake such a degree, whilst others lack the academic preparation or other attributes required for degree completion and career success. Consequently, a selection process is required to reduce the number of applicants to: (i) the number of students that can be accommodated in the programmes; (ii) those applicants who are likely to be able to complete the degree; and ideally, (iii) those applicants who are likely to be able to successfully practice in that profession and serve society (Salvatori, 2001; Terregino et al., 2020).

There are multiple stakeholders of the selection process, including applicants, their whānau and communities, educational institutions, the profession, the government, and society as a whole (Eva &

Reiter, 2004; Kelly et al., 2018). These stakeholders have varying agendas that make determining how to select the most appropriate students a complex and high-stakes decision process (Patterson et al., 2018). Applicants and their whānau are primarily focused on the applicant achieving their goal of becoming a health professional with the associated financial security and social status (Rosenfeld et al., 2008). Educational institutions define their selection policies based on local and national regulations and needs, their missions and values, and choosing students who are likely to complete the programme (Patterson et al., 2018). The profession and society need selected students to be competent (Rosenfeld et al., 2008) and able to meet the needs of the society that they serve. In addition, considerations of social mobility, social justice and Indigenous rights dictate a need for fair access to education for all society members and especially for Indigenous individuals (Dowell et al., 2015; Gallagher et al., 2009; United Nations, 2007). In countries where the government heavily subsidises university study, selected students should reflect the society they serve and be able to complete their qualifications so that public funding is not wasted. Balancing these sometimes-competing expectations is difficult. As such, administrators of health professional programmes have long been searching for ideal selection processes to enable fair and transparent selection of applicants who are likely to be successful (Patterson, Knight, et al., 2016; Salvatori, 2001) and who are representative of society (Cleland et al., 2012; Curtis et al., 2017).

The last two decades have seen substantial evolution of thinking in regard to selection processes. The 2010 Ottawa Conference consensus statement on selection for the healthcare professions emphasized that “selection processes need to be credible, fair, valid and reliable, and above all publicly defensible” (Prideaux et al., 2011, p. 215). However, by 2018, the focus of the Ottawa Conference consensus statement had changed from the methods used in the selection process to the underpinning philosophy and impacts of the selection process (Patterson et al., 2018). Selection processes and philosophies can broadly be considered in three categories, respectively focused on (i) individual merit, (ii) personal competency; and (iii) social accountability (Patterson et al., 2018). Merit-based processes are characteristically centred upon the capacity of the individual to be successful, usually as assessed by past academic performance. Competency-based processes are focused upon selecting for attributes and behaviours that are considered important for success as a student or practitioner. Finally, and more recently, there has been a stronger emphasis on selection processes that are based in social accountability, often referred to as widening access, widening participation,

increasing diversity or inclusivity. This is particularly important in New Zealand in consideration of honouring te Tiriti o Waitangi and Indigenous rights of access to education (United Nations, 2007).

Traditionally, selection into health professional degree programmes has focused upon academic performance (Cleland et al., 2012; Juster et al., 2019; Patterson et al., 2018; Patterson, Zibarras, et al., 2016). In the USA, this focus developed out of recommendations from the Flexner report (1910), which radically changed medical education in the USA and had global influences. These recommendations refocused medical education upon scientific training, knowledge discovery and affiliation with a university (Duffy, 2011; Lakhan, 2003). Recommendations also affected medical student selection, resulting in closure of all three schools that were exclusively for training women and five of the seven schools for training Black doctors, and introducing meritocratic student selection. These and other recommendations in the report reinforced discrimination against women, Black/African Americans, and lower socioeconomic classes, leading some authors to suggest these changes propelled the continuing struggle for the lack of diversity in the medical profession (Lakhan, 2003; Sullivan & Suez Mittman, 2010). Changes due to the Flexner report laid the foundation for selection processes across most of the Western world to develop a primary focus upon academic attainment. Unsurprisingly, therefore, this approach has largely been reflected in general medical and veterinary student selection in New Zealand, where academic performance has been the predominant factor in the selection process (Massey University, 2020a; University of Auckland, 2020; University of Otago, 2020).

It is necessary to ensure that chosen applicants have the background knowledge and academic ability to complete their education. However, the students with the highest academic attainment do not necessarily become the best doctors, and academic ability it is not sufficient on its own to ensure that a student will become a competent, successful health professional (Conlon et al., 2012; Hecker & Norman, 2017; Patterson, Knight, et al., 2016; Roberts et al., 2008). Thus, multiple authors have noted that both academic (cognitive) and non-academic (non-cognitive) attributes should be included in the assessment of applicants (Eva, Reiter, et al., 2004a; Roberts et al., 2008; Salvatori, 2001). What is less clear is which non-academic attributes should be included and how they should be assessed (Patterson, Knight, et al., 2016; Salvatori, 2001).

The attrition rate of students in health profession programmes in Western countries is low, so most students will become practitioners (Eva & Reiter, 2004; Kelly et al., 2018; Prideaux et al., 2011). Student selection then becomes a proxy for practitioner selection, and as such, may be the single most important assessment that a health professional programme conducts (Eva, Rosenfeld, et al., 2004; Greenhill, 2015).

## **4.2. RELIABILITY AND VALIDITY OF ASSESSMENTS FOR STUDENT SELECTION.**

Reliability and validity have historically been considered as key determinants of the value of a selection method. Reliability is the consistency of the scores that would be obtained from an assessment if the same attributes of the same participants were re-assessed under different conditions (such as time, venue, or assessor) (Field, 2013; Joint Committee on the Standards for Educational and Psychological Testing, 2014; Royal & Hecker, 2016). In a more applied manner, reliability conveys the proportion of variance in a score that is due to systematic differences between participants rather than to random error (Royal & Hecker, 2016). As such, reliability is a necessary precursor to validity, but strong reliability does not guarantee strong validity. There are multiple methods of assessing reliability, so it is essential that an appropriate model for estimating reliability is used to avoid erroneous results and conclusions (Royal & Hecker, 2016).

The classic definition of validity is the degree to which a test or method assesses what it is purported to assess (Hammond & Moss, 2017). The concept of validity has evolved considerably, from multifaceted, to the triad of construct, criterion (predictive) and content validity (Brennan, 2006), to the unitary concept of validity proposed by Messick (1989) and further adapted by Kane (2006). The latter defined validity as “the extent to which the evidence supports or refutes the proposed interpretations and uses (of the scores)” (Kane, 2006, p. 17).

In other words, reliability and validity should not be considered as qualities of the measures *per se*, but rather are associated with the interpretation or use of the scores generated by the methods used (Kane, 2006; Kane, 2013; Messick, 1989). As an example, scores from a mathematics assessment designed to assess the mathematical ability of 15-year-olds may be highly valid for that age group. However, the same assessment would not be valid for assessing 8-year-olds. Thus, one could not simply state whether or not the assessment is valid as it depends upon the context and planned use of the scores. These nuances have not been widely translated into the practice of selection into health profession degrees, where the literature often focuses upon a single facet of validity rather than the unitary concept of validity, or are often noted to support the validity of the assessment method rather than the validity of the scores or results produced from the method.

## **4.3. SELECTION METHODS AND PROCESSES**

There are a wide range of methods used in student selection for health profession programmes. The term ‘cognitive’ has commonly been used to refer to academic attainment or performance, especially grade point average (GPA) and the results of standardised aptitude or achievement tests. The term

'non-cognitive' has been widely used to capture a variety of behaviours, personality characteristics and attitudes other than academic attainment (Gutman & Schoon, 2013). However, very little human behaviour does not involve cognition (Borghans et al., 2008), so the term 'non-cognitive' in this context is confusing and inaccurate. As such, some authors have avoided using the terms cognitive and non-cognitive, preferring instead to use the terminology of academic and non-academic (Prideaux et al., 2011).

There has been a progressive move towards the use of both academic and non-academic performance assessment in student selection, and increasing acceptance that consideration of both should be included in the selection process (Salvatori, 2001). The USA and Canada were early adopters of such methods for the selection of students for health professional programmes. Outside of these countries some institutions have also implemented assessment of non-academic performance into the selection process, while others continue to focus wholly on academic performance (Pelzer & Jillings, 2017).

#### **4.3.1. Academic performance**

Measurement of academic performance or academic attainment continues to be the cornerstone of health profession selection (Patterson et al., 2018), and is most commonly measured by grade point average (GPA) or standardised testing. Prior academic performance is reported to be the best predictor of academic performance in a veterinary or medical programme (Confer, 1990; Curtis et al., 2017; Danielson & Burzette, 2020; Prideaux et al., 2011; Salvatori, 2001; Zachary & Schaeffer, 1994), although with greater accuracy of prediction of performance in the pre-clinical than clinical years (Fuentelba et al., 2011; Molgaard et al., 2015; Roush et al., 2014).

The GPA is a score that reflects an individual's academic performance over a period of time. The GPA is calculated from the grades received in completed courses during that time and takes into account the respective credit values of those courses. While pre-veterinary GPA is the most common criterion used for student selection into veterinary qualifications (Roush et al., 2014), there is little consistency in the way in which it is measured across institutions.

Pre-admission GPA only explains a small amount of the variance in performance in health profession programmes, which indicates that other variables also contribute (Salvatori, 2001). There is also little evidence to suggest that applicants with higher GPA become better doctors (Patterson, Knight, et al., 2016). One study that did support this notion was that of Carr et al. (2014) who showed that medical student GPA had a small but significant correlation ( $r = 0.257$ ) with the assessment of junior doctor performance. Given the small amount of the variance in doctor performance that GPA explains, clearly more is required than just academic performance. There have been few studies assessing the

predictive validity of performance in a health profession programme for performance post-graduation as a health professional. The lack of such studies in part reflects the difficulty in determining an appropriate outcome variable (Carr et al., 2014).

Moreover, due to disparities in educational opportunities, students of lower socioeconomic status, those from minoritised ethnicities and others may receive lower academic attainment than White or high socioeconomic background students (Cleland et al., 2012; Griffin & Hu, 2015; Mian et al., 2019). As such, heavy reliance on academic attainment may adversely affect the likelihood of selection for some demographic groups (Juster et al., 2019; Patterson, Knight, et al., 2016; Prideaux et al., 2011; Tiffin et al., 2012).

Standardised aptitude or achievement test scores are also commonly used in the selection of students into health-related degree programmes. Such tests include the Medical College Admission Test (MCAT), Graduate Record Examination (GRE), Undergraduate Medicine Admission Test (UMAT), Graduate Medical Schools Admission Test (GAMSAT), University Clinical Aptitude Test (UCAT), and the Special Tertiary Admissions Test (STAT) Test. For medical student selection, MCAT scores have been shown to be predictive of academic success in medical programmes (Lucey & Saguil, 2020; Prideaux et al., 2011; Salvatori, 2001). The most common standardised test utilized for veterinary student selection, particularly in the United States, is the GRE. However, agreement is lacking as to whether GRE scores are predictive of performance in veterinary programmes, with some authors suggesting they are (Confer, 1990; Danielson & Burzette, 2020; Fuentealba et al., 2011; Molgaard et al., 2015), while others find that they are not (Danielson et al., 2011; Roush et al., 2014). There is concern as to the impact on minoritised groups of GRE use in veterinary student selection, and in a recent Association of American Veterinary Medical Colleges AAVMC research review, veterinary institutions are encouraged to reconsider their use of the GRE (Lloyd, 2021).

At Massey University, the standardised test used for veterinary student selection is the STAT test, which is administered by the Australian Council for Educational Research. Coates and Friedman (2010), reported on the predictive validity of the use of the STAT test as a selection tool for university admission and for first year academic performance (GPA). They reported that the STAT test was predictive of first year GPA. For science and health study the coefficients of determination ( $R^2$ ) were only 4% and 3% respectively of variance explained. Data specific to veterinary science were not reported.

As seen with academic attainment and GPA, overemphasis on standardised test scores negatively impacts the chances of applicants from underrepresented groups of being selected into the

programme as they historically do not perform as well on these assessments (Kreiter, 2013; Steinecke et al., 2007). These tests may act as a barrier to underrepresented students, particularly if test performance can be improved by paid coaching which not all applicants can access (Kelly et al., 2018).

#### **4.3.2. *Non-Academic Performance***

There are multiple ways in which non-academic performance may be assessed in veterinary and medical student selection, with varying advantages and disadvantages. Some common methods include referees' reports, prior experience, personal statements, interviews (one on one, panel, or multiple mini-interviews) and situational judgement tests.

Referees' reports are widely used in employee and student selection, however there is little research regarding their utility, and even less evidence for the reliability or validity of their use (Cleland et al., 2012; Kelly et al., 2018; Salvatori, 2001). On the other hand, they are well accepted by applicants (Cleland et al., 2012; Patterson, Knight, et al., 2016; Patterson et al., 2018). It has been suggested that their greatest value could be for identifying unsuitable applicants (Patterson et al., 2018). However Miller et al. (1988) found that letters of recommendation were characteristically overly positive and therefore of limited use. Moreover, applicants would usually be unlikely to request a referees' report from someone who may report unfavourably. Also, referees tend not to focus on applicants' areas of weakness (Reiter & Eva, 2011), or on providing positive and negative comments fairly or evenly between applicants (Stedman et al., 2009). Screening reference letters is time consuming and makes intensive demands upon selection personnel (Cleland et al., 2012) for what appears to be little discriminant or predictive ability. Overall, there is little evidence to support the use of reference letters (Reiter & Eva, 2011; Salvatori, 2001).

Applicants are often required to demonstrate their prior work, animal, clinical and/or research experience, and many institutions have minimum requirements which can vary from a few days to hundreds of hours (Association of American Veterinary Medical Colleges, 2016). While it may be possible to quantify applicants' reported levels of experience, verification is time-consuming and difficult, and making valid comparisons between the experiences completed by applicants is problematic. The purpose of veterinary experience hours is to enable the individual to get a better understanding of the veterinary profession. In a study of the applicants to veterinary school in 2019, the authors noted that 97% of applicants agreed that the veterinary experience they participated in was critical to learning more about the veterinary profession (Lloyd & Greenhill, 2020). Requirements for experience may adversely affect underrepresented groups who, for economic or other reasons, are unable to undertake relevant volunteer experience (Angel, 2000). Without guidance, it may be



more difficult for students from lower socio-economic backgrounds or without connections in the medical or veterinary communities to access these experiences (Cleland et al., 2012). This was supported by the findings of Lloyd and Greenhill (2020), who reported that applicants who were ethnically underrepresented in veterinary medicine reported a significantly greater difficulty in getting hours with a veterinarian. In countries where recent school leavers can be considered for Bachelor-level medical or veterinary degrees, the limited time between finishing high school and commencing university usually precludes completion of large amounts of work experience.

Personal statements may be requested by universities in support of applications for selection. While many universities use personal statements for selecting students into medical and other health profession programmes, the evidence suggests that results from assessment of these statements have low validity and reliability, particularly for those statements which are completed without independent supervision (Cleland et al., 2012; Hecker & Violato, 2010; Kelly et al., 2018; Patterson, Knight, et al., 2016; Salvatori, 2001). When there are multiple markers, low reliability can reflect poor grading consistency or inadequate marking rubrics. If the statement is completed unsupervised, it is difficult to determine whether the work is a true reflection of the applicant's abilities, as it may be heavily edited or even written by someone else, or sourced from the internet (Hecker & Violato, 2010). This may further disadvantage applicants from lower socioeconomic groups who may not have the resources to access outside support (Cleland et al., 2012). While applicant acceptability of personal statements is high (Patterson, Knight, et al., 2016; Patterson et al., 2018) these limitations indicate that the use of unsupervised personal statements in high stakes selection is not ideal.

Interviews are a common, but not ubiquitous, assessment method of selection for admission into health-related degrees (Goho & Blackman, 2006; Prideaux et al., 2011). The formats of traditional interviews vary from unstructured through to highly structured and tend to be a single event with one or more interviewers (Prideaux et al., 2011; Salvatori, 2001). The evidence suggests that unstructured interviews do not produce valid or reliable scores to use for admissions decisions (Reiter & Eva, 2011), while greater structure may increase reliability and validity (Patterson, Knight, et al., 2016; Prideaux et al., 2011). One of the detractors for interviews is how highly resource intensive they are from both a financial and human resourcing perspective (Rosenfeld et al., 2008).

#### **4.3.2.1. Multiple mini-interviews as an assessment of non-academic performance**

The multiple mini-interview (MMI) is an example of a highly structured interview, in which applicants rotate through a series of timed interview stations with different interviewers (raters) at each station. Each station is designed to assess personal attributes that are valued by the individual programme

(Eva, Rosenfeld, et al., 2004; Pau et al., 2013). Station content may vary and could include a difficult written scenario to read and consider, interacting with an actor, or occasionally interacting with other applicants.

The MMI process has its origins in occupational selection and was first incorporated into medical student selection at McMaster University in the early 2000's in a bid to find an interview process which yielded reliable and valid scores, overcame issues of context specificity, and minimised the influence of a single interviewer on candidate scores (Eva, Rosenfeld, et al., 2004; Reiter & Eva, 2011). Since its inception, increasingly large numbers of health profession programmes have adopted the MMI for student selection, including veterinary medicine (Eva et al., 2019; Hecker et al., 2009; Patterson, Knight, et al., 2016). While there has been a significant amount of research published on MMI for medical student selection, only a small amount has been published about the use of MMI's for selecting veterinary students (Hecker et al., 2009; Hecker & Violato, 2011; Oliver et al., 2014).

Eva et al. (2004) noted that the MMI is a flexible assessment, which can be tailored to assess various contexts, contents or attributes. Indeed, an MMI is not a single entity, but rather is an assessment methodology that may vary greatly in its implementation (Eva et al., 2019). These variations must be taken into account when considering the literature regarding MMIs, particularly in regard to reliability and validity, both of which can be affected by local context.

Nonetheless, there is an increasing amount of evidence to show that the MMI can produce scores which are reliable, acceptable, and feasible, and have greater validity than unstructured interviews (Patterson, Knight, et al., 2016; Pau et al., 2013; Reiter & Eva, 2011). Cronbach's alpha coefficients are reported as a measure of reliability, and for MMI processes commonly equal or exceed 0.70 which is seen as acceptable (Eva, Reiter, et al., 2004b; Hofmeister et al., 2009; Reiter & Eva, 2011; Roberts et al., 2008). However, it has been suggested that the alpha coefficient is not well suited as an assessment of reliability for the MMI, as the stations may assess different attributes. As such, assessment of the generalizability coefficient (G-coefficient) has also been used in preference. Hecker and Violato (2011) reported a G-coefficient of 0.79 for the 7-station MMI in their study. In a study of a 12-station MMI, which was repeated in consecutive years, the generalizability coefficient increased from 0.58 to 0.71 by replacing a seemingly "easy" station (Uijtdehaage et al., 2011, p. 1036). In another study of a 6-station MMI, the G-coefficient reported was 0.7 (Roberts et al., 2014). There is also increasing evidence that the MMI shows predictive validity for future performance (Siu & Reiter, 2009). Husbands and Dowell (2013) evaluated the selection assessments of applicants to a UK medical school in 2009-2010 and reported that the MMI was the most consistent predictor of performance in assessments in

the medical programme. Knorr et al. (2018) studied the applicants to a German medical school and found that MMI scores were a significant predictor of suitability for the medical profession as assessed by current medical practitioners and by performance on an objective, structured, clinical examination (OSCE) 18 months into the programme.

Running an MMI is a resource intensive process, from human, financial and logistical perspectives. Development of the station scenarios is demanding and, like any assessment item, requires blueprinting, careful construction and review (Eva et al., 2019). The most common model of MMI administration requires gathering multiple raters and applicants in a single venue over one or more days or weeks. Tiller et al. (2013) reported offering online MMI's for international dental and medical applicants and found that interviewers were able to make valid and reliable decisions about the applicants.

Most authors have reported positive feedback from applicants and raters who participated in MMIs (Brownell et al., 2007; Eva, Rosenfeld, et al., 2004; Harris & Owen, 2007; Hofmeister et al., 2008; Kelly et al., 2018; Uijtdehaage et al., 2011). Furthermore, in a systematic review of stakeholder views of selection methods, Kelly et al. (2018) found widespread acceptance of the MMI process amongst applicants to medical programmes.

Multiple studies have examined the relationship between the use of the MMI and access of different social groups to medical degree programmes. There are a small number of reports of MMI scores for Indigenous applicants to medical schools in Canada. Reiter et al. (2012) found that mean MMI scores were lower for Aboriginal than non-Aboriginal applicants at their institution. In contrast, at a school where selecting Indigenous students at population parity was a specific aim, there was no difference between the MMI scores of Indigenous or non-Indigenous applicants (Mian et al., 2019). Similarly, Moreau et al (2006) found no difference between Aboriginal and non-Aboriginal applicants; however the group sizes in that study were very small (n=5 and 7, respectively). With regard to other ethnic groups, Juster et al. (2019) found no significant difference in the mean MMI scores of African Americans and White applicants, however non-Hispanic/non-Latino applicants received higher scores than Hispanic/Latino applicants. The latter difference was smaller than the difference shown with academic assessments in that study.

The effects of gender on MMI scores varied between reports. In a study of medical applicants (n= 5253) at six Canadian medical schools over two years, the MMI scores were unrelated to gender (Reiter et al., 2012). This was also the case in a veterinary school (Hecker et al., 2009). In other medical institutions, however, females received higher MMI scores than males (Juster et al., 2019; Ross et al.,

2017). Reiter et al. (2012) also noted that MMI scores were positively correlated with age. Conversely, Kelly et al. (2014) found that MMI scores of first year medical students in Ireland were unrelated to age. Reiter et al. (2012) also noted that MMI scores were unrelated to socioeconomic position and size of the community of origin of the applicant. The lack of impact of socioeconomic background upon MMI score was also reported by Kelly et al. (2014), however, they did report that students for whom English was not their first language received significantly lower MMI scores ( $P < 0.001$ ).

As the MMI is an assessment modality rather than a specific assessment, it is unsurprising to see that the impact on widening access varies in different studies at different institutions. There is certainly potential for the MMI to enable widening access, but the varying results noted above reinforce the need for institutions to assess their process as to its effect on inclusion and access.

#### **4.3.2.2. Situational Judgment Tests as an assessment of non-academic performance**

Situational judgment tests (SJTs) utilise hypothetical scenarios designed to assess the reactions and judgments of individuals in relation to specific personal attributes. SJT scenarios are created after the development of a test specification that highlights the desired personal attributes, based on job or programme analysis in conjunction with subject matter experts, and may be presented in video or written format. The question format can vary depending on the experience and age of applicants and may use a free text response, or require applicants to rate, rank or choice between options (Patterson, Zibarras, et al., 2016; Tiffin et al., 2020).

SJTs have been commonly used since the 1990s in personnel selection (Tiffin et al., 2020) in a variety of occupations and have been used in selection of students into medical degree programmes in the last decade (Patterson, Zibarras, et al., 2016). While SJT's may be offered via paper or computer based at a fixed location, they can also be offered online to large numbers of applicants at their own location. In this way, SJT's allow for assessment of the personal attributes of larger numbers of applicants (Patterson, Zibarras, et al., 2016) than is logistically feasible with MMI's (Reiter & Eva, 2011).

Initial research regarding the reliability and validity of SJT scores has been promising (Patterson, Knight, et al., 2016; Patterson, Zibarras, et al., 2016). In a systematic review of 39 international research articles between 1990-2010 regarding SJT use, Patterson et al. (2012) noted that the SJT had higher levels of reliability, predictive validity and incremental validity than personality and IQ tests. Lievens (2013) reported on the use of video vignette SJT's for medical student selection in Belgium between 1999 and 2002, finding that the SJT provided significant added value over cognitive assessments for the prediction of outcomes related to non-academic factors, even though cognitive tests were the better predictors of academic outcomes. Similarly, a separate study of video based SJT

scores at the time of selection found they demonstrated moderate predictive validity for national licensure outcomes of personal/professional characteristics taken three to six years after admission to medical school (Dore et al., 2017). Furthermore, Patterson (2017) found that SJT scores of applicants to medical and dental programmes were correlated with mean supervisor judgement ( $p < 0.001$ ) and overall judgments rating ( $p < 0.5$ ) of performance in problem-based tutorial sessions. Likewise, Sahota and Taggar (2020) reported that lower SJT scores were significantly associated with an increased risk of professionalism concerns.

Developing a bespoke, high-quality SJT is a time-consuming, relatively costly, complex, multistep process, with ongoing requirements to create new scenarios. There are also ongoing analysis costs which will vary depending on whether the results are analysed in-house or contracted out. In contrast, utilisation of a commercially available video-based SJT for student selection (CASPer; Section 5.3.6) has little to no human or financial resourcing cost to the institution (Altus Assessments, 2021; Dore et al., 2009) and more recently has shown promise for improving inclusivity of underrepresented ethnicities (Juster et al., 2019). Several studies have found that candidates have a high level of acceptance of SJTs (Husbands et al., 2015; Patterson, Knight, et al., 2016; Patterson, Zibarras, et al., 2016).

Several studies on SJTs have assessed whether there are differences in performance related to ethnicity, gender or socioeconomic status. Lievens et al. (2016) reported that in a study of UK medical and dental applicants in 2012-13 the SJT scores white candidates received were on average half an SD higher than Black or other minoritised ethnicity candidates. In a 2019 study of US medical applicants, the scores White candidates received were higher than those of Black candidates, and scores of non-Hispanic/non-Latino candidates were higher than Hispanic/Latino candidates, although differences were of a smaller magnitude than those seen with academic metrics (Juster et al., 2019). In another study of medical school applicants in which various SJT scoring methods were assessed, it was found that Western applicants received higher scores than the non-Western applicants across all scoring methods (De Leng et al., 2017). No reports regarding Indigenous students and SJT were found. In large-scale studies of medical applicants in Belgium, Austria and the USA, females received higher SJT scores than males (Juster et al., 2019; Lievens, 2013; Luschin-Ebengreuth et al., 2015).

With regard to socio-economic status, Lievens et al. (2016) found that the SJT scores received by medical and dental applicants from higher socioeconomic groups were significantly higher than those received by medical and dental applicants from lower socioeconomic groups. However, the authors noted that the size of the difference was smaller than for academic assessments. Juster et al. (2019)

found similar differences between high and low socioeconomic applicants, although, again, the differences were small.

Several reviews have noted a moderately positive effect of SJT on widening access, however this appears to be more related to increasing the proportion of women, who have traditionally been underrepresented in medicine, gaining entry to degree programmes rather than improving the proportions of Indigenous, other minoritised ethnicities, or lower socioeconomic candidates.

#### **4.4. THE STUDENT SELECTION AND WIDENING ACCESS RELATIONSHIP**

There have been calls for some time to widen access to medical and veterinary education to underrepresented groups. These calls have increased in volume and frequency such that in Western countries generally there is now broad acknowledgement of the need for these professions to become more representative of the populations that they serve (Coffman, 2002; Crampton et al., 2018; Greenhill, 2009; Lakhan, 2003; Patterson et al., 2018). There is a breadth of literature that foregrounds the need for the medical profession to become more inclusive of Indigenous peoples (Bristowe, 2012; Crampton et al., 2018; Curtis et al., 2017). Similar literature, while needed, is lacking, for the veterinary profession.

There has been a significant focus on addressing the inadequate representation of the breadth of society in the health professions through student selection. However, there is also a considerable number of studies which suggest that in order to increase the number of applicants to be considered at selection efforts also need to be directed earlier in the pipeline (Curtis, Wikaire, et al., 2012; Ferguson et al., 2012; Martin et al., 2018; Reiter et al., 2012). The pipeline is a framework to consider recruitment into the health professions that considers stages and activities from primary through tertiary education and into the professions (Curtis, Wikaire, et al., 2012; Middleton et al., 2019).

Hence, there are two main foci to attempts to widen access to currently underrepresented groups. Firstly, as the student selection process is, essentially, the gateway to becoming a practitioner, it is a crucial point at which widening access must be addressed (Grabowski, 2018). Secondly, it is important to address the pipeline of potential applicants from underrepresented groups through outreach activities to improve the awareness of medical education and careers, and programmes to reduce the barriers to high school attainment and increase general preparedness for university. While not the emphasis of the present discussion, once selected, support for retention and completion is needed.

#### **4.4.1. *Managing the selection process as a means of widening access***

There is significant and often hostile debate over whether admission processes for highly sought-after programmes such as veterinary or human medicine should be based entirely on the individual merit of each applicant, which may include academic and non-academic criteria, or whether there should be processes or pathways to widen access (Turner et al., 2012). Despite the evidence of the benefits of widening access to the students (Hung et al., 2007; Whitla et al., 2003), the profession (Coffman, 2002) and society (Saha et al., 2008), there still exists a tension between an applicant's individual rights and the collective rights of the society they will serve (Patterson et al., 2018).

Indeed, of the many barriers to improving representation in the medical and veterinary professions, the principle of meritocracy in student selection is arguably the most significant. Meritocracy is defined in the Cambridge dictionary as 'a social system, society, or organization in which people get success or power because of their abilities, not because of their money or social position' (Cambridge Dictionary, 2020). In the context of selection into restricted programmes such as human or veterinary medicine, meritocracy is the principle that selection favours those who have performed the most highly or are the most well-qualified, usually as measured by academic performance (Alon & Tienda, 2007). One of the defining features of a truly meritocratic system is equality of opportunity. While meritocracy may seem laudable, given that some sociodemographic groups characteristically experience poorer academic outcomes due to systemic racism and other structural barriers, there is evidence of lack of equality of opportunity and thus a claim of meritocracy is invalid. Consequently, maintaining an absolute focus on academic performance in the student selection process will have the effect of favouring applicants from privileged backgrounds and, therefore be contrary to the principle of widening access beyond such groups (Alon & Tienda, 2007; Cleland et al., 2012; Heller et al., 2014).

The concept of meritocracy, and the perception of applicants who may not have been accepted into medicine historically as being in some way 'lesser', is also widespread. This process of othering, or excluding those who have traditionally been marginalized in society (Kumashiro, 2000), can be seen commonly in the media, in which the perception that selecting underrepresented students at the expense of 'more deserving' applicants is promulgated along with the view that this amounts to an 'unfair' preferential treatment of these applicants (Bacchi, 2004; Duff, 2018; Johnston, 2004; Van Beynen, 2020). These views reflect the commonly-held erroneous conception that 'excellence' means (only) 'academic excellence', and thereby fails to ascribe value to the societal benefits of selecting a representative cohort of students (Saha et al., 2008)

Moreover, the attitude of universities themselves to widening access can be equivocal. For example, some university ranking systems include the average academic scores of selected students in their calculations. Thus, as pre-entry academic attainments of underrepresented groups may be lower than those of well-represented applicants, by attempting to select more applicants from underrepresented groups the average academic scores of selected cohorts may decrease (Heller et al., 2014). Cleland (2012) and Heller et al. (2014) both raised concerns that a desire to maintain high entry standards for rankings may be at odds with aims of widening access.

Juster et al. (2019) summarized the matter as follows. Admissions committees have the task of using valid evidence to select applicants into their degree programmes. However, this evidence must be balanced against the expectations that schools should produce graduates who broadly represent society as a whole. Traditional measures of academic ability, such as grade point average (GPA) and standardised aptitude tests, are used ubiquitously in medical school admissions due to their perceived 'objectivity', strong psychometric qualities, and ease of use. However, these measures disfavour those societal groups who have traditionally been underrepresented in medicine. Consequently, sole or heavy use of these admissions methods jeopardises the social mandate to widen access to medical education. Measurements of non-academic competencies, however, have complex issues such as being resource intensive and often lacking in validity evidence. On the other hand, psychometric evidence is insufficient to ensure the fairness and defensibility of selection processes. This paradox is at the heart of the 'diversity–validity dilemma'. (precised from Juster et al. 2019, p 1197)

The work of Cleland and Fahey Palma (2018), who reported on interviews with the Admission Deans or staff from 24 of the 32 medical schools in the UK, is interesting in this regard. They aimed to determine how values regarding widening access are communicated in the context of medical student selection, from the perspective of whether "othering" was taking place. They found that the language and descriptions of applicants who might be regarded as 'non-mainstream' reinforced that these applicants were seen as 'them' and different to the traditional applicants who were seen as 'us'. While the aim of widening access was ostensibly espoused, the choice of language suggested these applicants were perceived as outside the norm, which reinforced perceptions of these applicants as 'lesser'. A similar contradiction was noted by Ellaway et al. (2019) in an axiological analysis of admission at a single medical school. In that study, the authors found that the publicly espoused values in the social mission of the school, didn't align with the perception of primary emphasis on academic performance in the selection process.



Similarly, Razack et al (2015) reported a revealing piece of research regarding discourse analysis of language used in medical school websites (n=17), policy documents of regulatory bodies (n=15), interview responses of admission committee members (n=9) and medical school applicants (n=14). They found that in the websites and policy documents, the discourse regarding excellence highly valued academic measure of excellence, with less regard for or emphasis on other forms of excellence such as service to society and societal representation. Admission committee members recognized that “notions of merit, and of what is seen as meritorious, are imbued with the complex intersectionalities of class and privilege” (Razack et al., 2015, p. 43). In other words, whilst the foundation of meritocracy ostensibly supports the prestige of the medical profession, the privileged characteristics of selected students in fact opposes the assumption of meritocracy (Cleland et al., 2012). Consequently, the authors challenged the medical profession to “courageously make explicit the hidden *aristo-* or elitist aspect contained within the *merito-* of the cherished notion of the medical meritocracy” (Razack et al., 2015, p. 46).

#### **4.4.1.1. Varying the assessments used in selection**

A common approach for improving access at the point of selection is varying the type and weighting of different selection assessment methods. Several authors have performed differential weighting studies or “what-if” studies on their applicant pool to assess the impact of the weighting of academic and non-academic selection assessments on diversity.

Terregino et al. (2015) conducted a study of over one thousand three hundred applicants to a single medical school over a three-year period. They utilised four different weightings of the MMI, in various combinations with GPA, MCAT and in one instance a bespoke score of service, clinical and research experience. In considering the impact of alternative weights on the composition of the resulting selected cohorts, the authors reported that increasing the weighting of the MMI may enhance ethnic diversity in the selected cohorts.

Juster et al. (2019) conducted a study of over nine thousand applicants to a single medical school over a two-year period. They utilised 4 weighting combinations of academic (MCAT and GPA) and non-academic (CASPer) assessment and assessed the resulting cohorts that would have been invited to the interview stage. The authors found that as the weighting of CASPer increased, the number of females, African Americans and Hispanic/Latino applicants invited to interview increased. Interestingly, the results for socioeconomic position were mixed; in comparison to academic only assessment, the number of applicants from low socioeconomic background invited to interview decreased when CASPer was included with low weighting, but increased with 100% CASPer weighting. The authors

concluded that inclusion of CASPer in the screening review had the potential to improve access for several groups underrepresented in medicine.

Reiter et al. (2012) conducted a study of over five thousand applicants over a two-year period at six Canadian medical schools. They utilised three different weightings of the MMI and GPA and analysed the composition of the resulting selected cohorts. The authors unexpectedly found that when academic scores were not used in the shortlisting process, while the individuals selected changed, there was no difference in the proportion of the class from lower socioeconomic background or smaller communities of origin as compared to when academic scores were used in shortlisting for interview. This led the authors to conclude that efforts to widen access to medicine should be addressed upstream on pipeline programmes.

Similarly Kreiter (2013) concluded that given the highly selective nature of medical schools, and the magnitude of difference in GPA and MCAT scores between groups, focusing solely on academic achievement would essentially eliminate selection of some minoritised ethnicities. Lucey and Saguil (2020) have noted that due to structural racism and decreased educational opportunity, applicants from underrepresented ethnicities in the USA receive lower mean scores in the MCAT and other academic measures than applicants from well-represented groups. However, they also note that success in medical school is compatible with a wide range in MCAT score, not just the highest MCAT scores. As such, these authors recommend that rather than using the MCAT to rank applicants, it would be better used as a tool by which to rule out those who are unprepared for medical study. Use of the MCAT in this way would enable selection of a more inclusive cohort of medical students (Lucey & Saguil, 2020).

Overall, adjustment of the type of methods and weighting of the selection methods, has the potential to widen access to underrepresented groups, but does not necessarily guarantee it. Other methods such as equity pathways and holistic assessment also show some promise.

#### **4.4.1.2. Equity pathways**

Another option to improve access at the point of selection is the use of specified pathways for underrepresented groups. These pathways may be known by several names such as social justice pathways, equity pathways, alternate pathways, affirmative action, quotas etc. In keeping with the researcher position for this thesis they will be referred to as equity pathways in recognition of the social justice impetus for their development which reflects a need to counteract the effects of previous or ongoing discrimination.

In New Zealand, there are equity pathways for entry of Indigenous peoples into medicine (and other health professions) at the University of Auckland and the University of Otago. The mandate for both programmes include addressing Indigenous health inequities and enabling the rights of Indigenous peoples to education (United Nations, 2007), and includes Māori and Indigenous Pacific students.

The University of Auckland offers an equity pathway for applicants of Māori and Indigenous Pacific ancestry called the Māori and Pacific Admission Scheme (MAPAS) (Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). MAPAS is an Indigenous led process that “supports students through their cultural and education journey within the Faculty of Medical and Health Sciences to help them successfully complete their studies and graduate” (University of Auckland, 2021) through extensive academic, cultural and pastoral support. The MAPAS pathway has enabled greater numbers of Māori and Indigenous Pacific applicants to be selected into the medical degree. In a study of 1676 University of Auckland medical students over a 10-year period, Curtis et al. (2017) compared the outcomes of students from the general selection pathway, the MAPAS pathway and a rural student pathway. The MAPAS pathway was crucial to improving the number of Māori or Pacific students selected into the medical programme. Despite differences in prior academic performance and background when entering the programme, once educational background and sociodemographic factors were considered, there was no difference between the graduation rate of MAPAS students and students admitted through the general pathway. The study findings reaffirmed the importance of the equity pathway to widening access, upholding Indigenous rights, and allowing graduation of a cohort more reflective of the society in which they would be working.

The University of Otago instituted the “Mirror on Society” policy in 2012, in which the aim is for the students selected into their health professions programmes to reflect the ethnic and socioeconomic profile of New Zealand. Crampton et al. (2018) reported a 179% increase in Māori students into their medical programme from 2010 (n=78) to 2016 (n=218). Unfortunately, this success was not reflected in the socioeconomic status of the profile of their students which from 2010 to 2016 remained skewed toward those from higher socioeconomic backgrounds.

In Australia there are 26 accredited medical schools (Australian Medical Council, 2020), most of which have some form of equity pathway for Aboriginal or Torres Strait Islanders. The Leaders in Indigenous Medical Education (LIME) network provide an online resource for Indigenous pathways into medicine<sup>6</sup> that demonstrates the widespread use of equity pathways or processes for Indigenous students in

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<sup>6</sup> <https://www.limenetwork.net.au/students/pathways/>

Australia. There are seven veterinary schools in Australia. Several schools have some form of equity pathway entrance for Aboriginal or Torres Strait Islanders, but information is not collated as for medicine or easily found. A single publication was found that referenced a pathway at Murdoch University in Western Australia, to encourage Aboriginal or Torres Strait Islanders to study to become veterinarians, and noted that academic and personal support were provided to these students (Barnes, 2000).

In the UK some universities offer gateway programmes, in which entry to the 5-year medical degree is facilitated by enrolment of disadvantaged students in a “Year 0” preparatory year (Curtis et al., 2014). In a study of 3 UK medical programmes, the UCAT academic attainment and aptitude score at both entry and exit were compared between gateway (Year 0) and standard (Year 1) students selected to the medical degree (Curtis & Smith, 2020). While the standard entry students had higher academic attainment and aptitude at both entry and exit, once the entry scores were accounted for, the difference in both exit measures dropped to less than 2%. The gateway courses were seen to allow students from under-represented groups to achieve greater academic potential.

As part of the affirmative action movement in the USA, quotas, in which a proportion of places were reserved for minoritised ethnicities, previously existed. In 1978, quotas were ruled unconstitutional by the Supreme Court and could not be used to resolve the impacts of previous discrimination. However, the Court also ruled that ‘race’ could be used as a factor in admission if a more diverse study body would enable the institution to better meet their mission (Garces & Mickey-Pabello, 2015; Lakhani, 2003). Given the legal situation in the USA, as equity pathways are not viable, holistic review and admission may enable ‘race-conscious’ admission to be achieved, provided they are in line with the mission of the institution.

Equity pathways can be successful methods to enable greater numbers of underrepresented students access to health profession education. Particularly when focused on Indigenous students, an equity pathway is most effective when it is combined with wrap-around support in the form of culturally appropriate recruitment processes such as early exposure activities, comprehensive orientation and pre-entry programmes, academic and pastoral support, mentoring, tutoring programmes, and institutional changes to ensure safer environments for Indigenous students (Curtis, Wikaire, et al., 2012; Taylor et al., 2019). However, there is a risk of negative public perception, particularly by the majority population, of equity pathways as being preferential treatment (Bacchi, 2004) for minoritised groups. To counter this perception, equity pathways need to be more than ‘tick-box’ exercises and universities need to implement them in an authentic, culturally appropriate manner.

#### **4.4.1.3. Holistic assessment to widen access at the point of selection**

In contrast to the wholly or heavily academically focused approach to student selection, there is a move to focus on consideration of the whole individual, and assessment of the potential of an applicant to succeed in higher education taking into account the context and circumstances in which their academic attainment was achieved (Patterson et al., 2018). This use of contextual data has been noted as laudable, but also contentious and difficult to implement (Cleland et al., 2012).

One example of the use of contextual data is in a Canadian medical school for which social accountability and representation were key drivers for the school's establishment. Mian et al. (2019) reported that between 2006-2015, the proportion of admitted students who were Indigenous was 6.7% at this institution as compared to the national average of under 1%. The authors attributed these results to the use of a bespoke context score, which was higher for those who identified as Indigenous. They also credited use of the MMI, involvement of an Indigenous Admissions subcommittee throughout the entire admission process and a high school outreach programme for Indigenous students as supporting the higher rate of Indigenous student admission.

The MAPAS equity pathway for Indigenous students at the University of Auckland is also an example of holistic admission. Entrance to MAPAS centres on holistic assessment of applicants' potential for success, rather than maintaining a rigid focus on academic performance. Commonly MMI's are used to rank candidates, whereas an Indigenous specific MMI process is used to gather contextual information in a culturally appropriate manner which is taken into account alongside academic performance to better understand the applicants' potential for success in foundation or bachelor level study (Curtis, Wikaire, et al., 2015).

In a similar vein, admission using holistic review is being advocated by the American Association of Medical Colleges (AAMC) as a method to improve the representation of the medical profession. The AAMC defines holistic review as students selection or admission processes that are aligned to the school mission that "take into consideration applicants' experiences, attributes, and academic metrics as well as the value an applicant would contribute to learning, practice, and teaching... allows admissions committees to consider the "whole" applicant, rather than disproportionately focusing on any one factor" (American Association of Medical Colleges, 2020).

One medical school in the USA reported doubling of the enrolment of underrepresented minorities from 13% to 26% between 2009 and 2016 (Capers et al., 2018). While multiple changes were made to focus on greater diversity and inclusion in their student selection, the authors noted that implementation of holistic review at the screening process was the most important step in enabling

greater access for underrepresented groups. In that institution, holistic review was defined as giving equal emphasis to the experiences, personal attributes, and academic metrics of the candidates.

Grabowski (2018) reported on the use of holistic admission between 2011-2015 in a new private medical school in the USA. The author compared the cohort composition of the students who were invited to interview using holistic review with the same number of students who would have been invited using an academic only model. When comparing the applicants from the two groups, the holistic review group had significantly greater percentages of females, students who were the first generation in their families to attend university, applicants from ethnic groups underrepresented in medicine, and self-identified disadvantaged applicants than the academic metrics only group. The study design used by Grabowski was repeated at a publicly funded medical school in the USA, with similar findings (Harrison, 2019). Both authors noted that holistic review allowed a more diverse pool of applicants to be invited to interview in comparison to academic metrics alone, and that academic-only review creates barriers to enrolling a more diverse cohort of students (Grabowski, 2018; Harrison, 2019).

The concept of holistic review and contextual data allows consideration of more than just academic metrics, and considers the opportunities an applicant has had in light of their education and socioeconomic background (Cleland et al., 2015) as well as the value that the applicant may contribute to the programme or society (American Association of Medical Colleges, 2020).

#### **4.4.2. *Managing the pipeline as a means of widening access***

Multiple authors have suggested that widening access in the health professions requires a focus on the pipeline rather than just the point of selection. In a retrospective analysis of over one million applicants to UK universities in 2002-2004, Ferguson et al. (2012) found that applicants to medicine were more likely to be female, non-white, from higher socioeconomic backgrounds and have attended a fee-paying (private) school, as compared to applicants for other university programmes. The authors of that study concluded that, given the difference that exists at the point of admission, more effort should be directed earlier to try to increase the likelihood of those from underrepresented groups to applying to study medicine. The study of Martin et al (2018) supports this notion. They examined barriers to applying for medicine amongst school age (Year 9, Year 12) students likely to be from lower socioeconomic backgrounds, finding that the students had limited knowledge about the medical profession. They concluded that these gaps in knowledge may contribute to the importance of 'social capital' which is seen as important in facilitating access to medical education. The authors felt there

was a role for medical schools in outreach to help address these knowledge gaps, which may in turn influence applicant numbers.

Curtis, Wikaire, et al. (2012) published a literature review regarding recruitment of Māori into tertiary health programmes. The authors identified six principles regarding Indigenous student recruitment which included: 1) Framing initiatives within indigenous worldviews 2) Demonstrating a tangible institutional commitment to equity 3) Framing interventions to address barriers to indigenous health workforce development 4) Incorporating a comprehensive pipeline model 5) Increasing family and community engagement and 6) Incorporating quality data tracking and evaluation (Curtis, Wikaire, et al., 2012).

#### **4.4.2.1. Outreach programmes as a means of widening access**

At Massey University, a summer programme for 11-14 year old Māori or Pacific students was held, in which they participated in various activities designed to increase their interest in science and their awareness of veterinary science as a potential career (Jillings et al., 2018). Surveys at the start and end of the programme showed that students developed enhanced perceptions of veterinarians as scientists ( $p=0.002$ ), science as a part of everyday life ( $p=0.002$ ), greater interest in working with animals ( $p=0.002$ ) and becoming a scientist ( $p=0.002$ ). In addition, qualitative feedback from the participants and their whānau was positive. At the time of writing, these students had not yet progressed to the age of applying to university so longer-term follow-up was not available.

Chastain et al. (2007) reported on the 'Pathways to Success' programme at the University of Missouri College of Veterinary Medicine. This programme aimed to overcome the lack of veterinary role models from under-represented groups, and to provide opportunities to gain veterinary experience that might otherwise have been prohibitively difficult to obtain, through a range of funded summer programmes aimed at enabling veterinary career exploration. In the thirteen-year period reported, 30 of 195 participants had progressed to veterinary programmes, as compared to having only 39 graduated from minoritised ethnicities in the previous 48 years of the veterinary school's history.

In the US, fifteen of the twenty-eight veterinary schools in 2013 were noted as offering some form of outreach programme for either pre-tertiary or undergraduate students varying from workshops of a few hours, to residential on-campus programmes. There is however little published information available on these programmes.

The University of Auckland has a well-developed outreach programme, the Whakapiki Ake Project, for recruiting and preparing Indigenous students for health study (Bryers et al., 2021). This initiative

involves a range of early intervention activities with Year 9 to 13 (high school) students based on published principles of Indigenous recruitment (Curtis, Wikaire, et al., 2012). These engagements are designed to support the students in their academic preparedness for university and health science study, as well as their cultural identity journey (Bryers et al., 2021). The WAP project includes Hui-ā-Rohe, or visits to regional areas in New Zealand to provide information about the pathways and requirements of pursuing medicine directly to Indigenous students, whānau and community groups (Curtis, Stokes, et al., 2015). There is a strong focus on involvement of the students, their parent(s) and wider whānau in the Whakapiki Ake Project. Students and whānau report not only increased knowledge of the pathways to the health professions and becoming better prepared, but also improved cultural identity on the part of the students (Bryers et al., 2021).

In Australia, multiple medical schools offer an outreach programme. The University of Western Australia runs camps for Aboriginal or Torres Strait Island high school students including a week-long residential programme on the campus to experience university life. Of the 370 students who attended the week-long programme over a 17-year period, 16% were still in high school, but 36% had continued to university, with 15% entering a health related course (Paul, 2013). A joint medical programme is offered at the University of Newcastle and the University of New England (Holliday et al., 2015). A five-day intensive course is offered to Aboriginal or Torres Strait Islanders that involved problem-based learning to give an indication of the learning style in the medical programme. From the first cohort, 12 of 18 participants were offered a place in the joint programme. Students who had participated in the intensive course noted that it was very valuable to their learning and preparation for their medical study.

#### **4.4.2.2. Improving university preparedness as a means of widening access**

Secondary schooling does not prepare all students equally for university study (Curtis, Wikaire, et al., 2015), and students of lower socioeconomic status, those from minoritised ethnicities and others may receive lower academic attainment than White or high socioeconomic students (Cleland et al., 2012; Griffin & Hu, 2015; Mian et al., 2019). To address this, access or foundation courses may be offered to bridge the gap in knowledge and preparation that an individual might have prior to commencing university. Many universities offer these as general university preparation or content specific preparation such as science or mathematics.

The University of Otago and the University of Auckland both offer Indigenous specific bridging or foundation programmes. These programmes are undertaken prior to attempting the first year of a Bachelor-level degree in health science or biomedical science, after the first year of which individuals



may apply for selection into the medical degree. The University of Otago offers a one-year Indigenous specific bridging programme (Tū Kahika) to provide comprehensive academic, cultural, financial and pastoral support to help prepare Māori students for entering Bachelor level health study (Bristowe, 2012; University of Otago, 2021b). The holistic wrap-around support in the programme is positively impacting Māori by including a diverse socioeconomic profile of students, and enhancing students confidence which is reflected in enabling a high retention rate (82.1%) of Māori students who continue onto future health study at the University of Otago (Bristowe, 2012; Houia-Ashwell, 2020). At the University of Auckland, a bespoke 1-year bridging/foundation programme is offered which is designed to provide further academic and university skills preparation specifically for Indigenous students aspiring to become health professionals. In a study of the outcomes for MAPAS students admitted into the medical degree, completion of the bridging programme was identified as a key predictor of better academic outcomes in terms of GPA and degree completion (Curtis et al., 2017).

Pūhoro STEM Academy is a Massey University initiative that commenced in 2016 that aims to “transform national statistics on Māori student engagement and success in STEM” (Leonard et al., 2020). Pūhoro is a culturally embedded and holistic programme in which staff work with and mentor students from Year 11 onwards to facilitate their recruitment into and success in science, as well as helping to develop their identity as Māori. Students are required to sit at least three NCEA external science units, plus attend tutorials and on-campus wānanga to facilitate their success (Leonard et al., 2020). The pass rates of Pūhoro students have annually either met or exceeded the nationwide pass rates of non-Māori in NCEA Level 1, 2 and 3 sciences since the programme’s inception (Davis, 2021). Importantly, many students and their whānau commented on the strong impact participation in the Pūhoro programme had on the students identity development as Māori (Leonard et al., 2020).

In the UK there are access courses for individuals who do not have the academic qualifications for application into medicine via the traditional routes (Patterson & Price, 2017). Contrary to the previously described gateway programmes in the UK, completion of access courses does not guarantee progression directly into a medical degree.

While there is data to support programmes such as those described above and at other institutions, early intervention and outreach programmes are usually highly resource intensive, both in terms of human and financial resourcing. Some programmes may have limited scalability that can be difficult to replicate or standardise to achieve the benefits elsewhere (Cleland et al., 2012; Reiter et al., 2012). Some institutions may not appreciate the value of outreach programmes, or if they do, may still be unwilling to engage in them due to resourcing constraints.

#### **4.4.3. *Summary of the methods of widening access***

Widening access requires movement from traditional, academic only selection processes. In New Zealand, equity pathways in medicine have been highly effective in enabling selection of cohorts approaching population parity for Indigenous students. In other countries the legal and political climate may render equity pathways less viable, and in those contexts' options such as contextual data and holistic admissions hold promise. While programmes aimed at the pipeline are highly resource intensive, they are an important supplement to promoting access at the point of selection.

#### **4.5. SUMMARY**

The process of selecting students for admission into health education programmes is the gateway not only to the programmes but to the professions themselves. There are multiple methods of assessment that may be used in the selection process, each of which has advantages and disadvantages and produce scores that differ in terms of validity and reliability. While academic assessment methods often demonstrate higher reliability and validity, they have been shown to discriminate against minoritised ethnicities and to negatively impact access for these groups. On the other hand, factors outside of academic performance may have lower psychometric properties, but their consideration may improve access to currently underrepresented groups. If the selection processes are predicated upon assessments of academic attainment which discriminate against some groups more than others, then adherence to meritocracy on the basis of those assessments of academic attainment reinforces the inequity experienced by those groups.

Widening access to underrepresented groups in general is an important goal with beneficial outcomes for the students, profession, and society. In Aotearoa the position of Māori as Indigenous peoples reinforces that importance as access to higher education is an Indigenous right. Multiple methods have been discussed regarding recruitment and selection for widening access, with the greatest success in New Zealand coming from culturally appropriate recruitment and equity pathways. In order to assess whether progress on widening access is being made, it is important to identify who is applying for and selected into a health profession programme and evaluating how the selection methods influence those selection outcomes.



## Chapter Five

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### 5. VETERINARY STUDENT SELECTION IN NEW ZEALAND

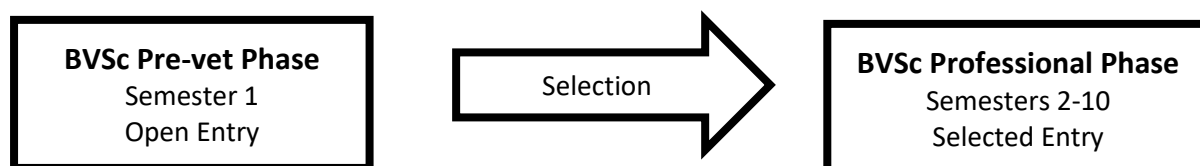
In the previous chapter, selection of students into human and veterinary medicine was explored in detail with consideration of the relationship of selection and widening access to underrepresented groups. In this chapter the veterinary degree and the selection process for veterinary students in New Zealand is described. The degree structure and selection process differ from those in other parts of the world and understanding these details is important to understanding the data collection and results interpretation of this thesis.

#### 5.1. THE STRUCTURE OF THE VETERINARY DEGREE IN NEW ZEALAND

In order to register to practice as a veterinarian in New Zealand, one must hold a veterinary degree that is registrable with the Veterinary Council of New Zealand. Veterinary education in New Zealand is offered at a single institution, Massey University, as a five-year undergraduate Bachelor of Veterinary Science (BVSc) degree. The BVSc is composed of two phases: a pre-vet phase (one semester) and a professional phase (nine semesters over 4.5 years) as shown in Figure 5.1.

The pre-vet phase occurs annually in semester one (late February to mid-June). Entry to the pre-vet phase is open to any individual who meets the minimum university entrance standards (Massey University, 2019a). These standards allow for admission of individuals who either have recently successfully completed their secondary school qualification or who have pursued other university studies or careers post-secondary school. In the pre-vet phase, students formally submit their application for selection into the professional phase and undertake compulsory courses and selection assessments to attempt to meet the eligibility criteria for selection (described in section 5.2).

The professional phase of the BVSc commences in semester two (mid-July to mid-November). Entry is by selection, as the number of applicants usually exceeds the number of places in the professional phase by three to four-fold. The number of places for domestic students in the professional phase is determined and subsidised by the New Zealand government (during the period 2003-2012: n= ~76; 2013-2016: n=~84; 2017-2019: n=100). In the professional phase, students undertake academic courses and work experience that, upon successful completion, will allow them to graduate and register to practice as veterinarians in New Zealand (and certain other countries).



**Figure 5.1 Overview of BVSc programme phases**

## **5.2. ELIGIBILITY CRITERIA FOR SELECTION INTO THE PROFESSIONAL PHASE**

There are eligibility criteria (outlined below) that applicants must meet in order to be selected into the professional phase of the BVSc. Applicants who do not meet these criteria are rendered ineligible for selection. Those who meet the criteria, and have not withdrawn their application, are considered in the mid-year process for selection.

The eligibility criteria require that applicants must:

1. Complete 80 hours of observation/practical work in a veterinary clinic; and
2. Pass all of the four pre-requisite courses (which include content on organic chemistry, physics, cell biology and animal biology); and
3. Achieve a grade point average (GPA) of  $\geq 5$  ( $\geq B$  equivalent) in their university study; and
4. Complete the required additional selection assessments, as outlined in section 5.3, in the same year of application.

These criteria are described on the university webpage and discussed in detail with prospective applicants at information sessions. Additionally, students can meet with a veterinary selection advisor who can reaffirm these criteria, as well as provide other support in planning their academic study.

Observation in a veterinary clinic has been a long-standing eligibility requirement for selection, with the intention to ensure applicants have had some exposure to the reality of a veterinary career. Private veterinary practices in New Zealand are accustomed to this requirement, and the vast majority of clinics accommodate these students. The total number of hours required is set at a level which a school

leaver could complete in the summer before commencing the pre-vet phase, while also aiming to minimise the burden on the applicants and the veterinary clinics. However, for applicants from lower socioeconomic backgrounds, who might need to work to support themselves or their family, two weeks may still pose an unrealistic barrier (Angel, 2000). Additionally, while there is evidence from applicants in the USA that they highly valued experience in a veterinary clinic (Lloyd & Greenhill, 2020), there is no New Zealand based evidence to verify that this observation period is valuable to applicants decision making or awareness of the profession. It would be worth investigating the value of the practical work to inform ongoing decisions about the necessity of this criteria.

If an applicant has already completed the pre-requisite courses, they must choose alternative science courses that include content that they have not previously studied. These and other courses that meet the criteria for inclusion into their pre-vet GPA are included in the GPA calculation.

The minimum GPA requirement of  $\geq 5$  (equivalent to a B grade or better) is the level that previous BVSc leadership teams have determined that a student requires to successfully manage the workload and academic rigour of the veterinary degree. The actual GPA required to be selected varies each year, based on the number and the calibre of the applicants in that year, but is usually substantially higher.

All applicants were required to complete all of the academic and non-academic assessments applicable in their year of application. The selection assessments are outlined in the following section.

### 5.3. SELECTION ASSESSMENTS

Over the period of 2003-2019, six selection assessments have been used. The GPA and Special Tertiary Admission Test (STAT) were used in all years. The remaining four assessments: written communication; multiple mini-interview (MMI); and two forms of situational judgement testing (SJT and CASPer), were each were piloted with volunteers in 2016 and used in actual selection in 2017-2019.

#### 5.3.1. Grade point average

At Massey University the range for the GPA score is zero through nine, with each grade having a numerical equivalent as shown in Table 5.1. For a definition of GPA see Section 4.3.1.

**Table 5.1 Numerical equivalent for each grade type for GPA calculation**

Grade	A+	A	A-	B+	B	B-	C+	C	C-	Failing grades D, E, F, DC <sup>a</sup>
Number	9	8	7	6	5	4	3	2	1	0

<sup>a</sup> DC = did not complete. This grade would also be given to students who did not sit final examinations.

The GPA for selection into the professional phase of the BVSc includes grades from university science courses taken in up to the four, most recent, full-time, semesters, in the three years preceding the selection meeting in July (Massey University School of Veterinary Science, 2020). To clarify, if an applicant sought selection in 2019, grades from university courses completed in the four most recent semesters in the preceding three years (i.e. August 2016 through July 2019) would be eligible for inclusion in the GPA calculation. If the applicant had no prior university experience before their year of application, their GPA would be calculated from the university courses (n=4) that they completed in the pre-vet phase (semester one 2019). Conversely, if an applicant had been studying at university full-time since semester one 2016 and finished their degree at the end of semester two 2018 (and did not study in semester one 2019), the grades from the courses in semesters one and two of 2017 and 2018 (n=16) would be included in the GPA for selection.

### **5.3.2. *Special Tertiary Admissions Test (STAT)***

The STAT test is offered by the Australian Council for Educational Research and is a standardised, 70-question multiple choice aptitude test that evaluates verbal and quantitative reasoning (Australian Council for Educational Research, 2020). This assessment is formulated and marked by the Australian Council for Educational Research, who provide a score for each applicant between 100 and 200, with scores usually ranging between 120 and 180. The STAT test was introduced into the selection process in 1996 as a first step in the process of moving away from selection solely on the basis of GPA.

### **5.3.3. *Written Communication***

The written communication assessment is a bespoke assessment specific to Massey University. After consultation with a written communication expert at the university, rather than asking applicants to draft a piece of writing, they were asked to correct a standardised poorly written piece of text in the form of a letter to a client from a veterinarian. The text was originally a professionally written piece by a senior staff member of the school. It was subsequently edited by a Professor of Communication and Writing to introduce a judgmental tone, grammatical errors, spelling mistakes and poor paragraphing, such that ideas on the same subject were scattered throughout the text. Applicants are required to improve the poorly constructed text within a 1-hour time period. The assessments are marked using a rubric and assigned a score out of 12. In order to maximise marking consistency, the marking is contracted to a single person, who is a specialist in writing. The same letter was used in 2017-2019 to facilitate comparison of results across years. However, reuse of the letter may have introduced potential for test-retest improvement effects. The assessment was full recovery (all materials were returned at the end of the test) in an attempt to minimise the potential for content

sharing, however it is still possible that it could have occurred between previous and current applicants.

#### **5.3.4. *Multiple mini-interview***

In the MMI at Massey University, veterinary applicants participate in eight interview stations of eight minutes duration, each with a single rater. At each station the applicant is presented with a bespoke text-based scenario to read and consider that is based on a dilemma that might be encountered by a veterinary student in their study or personal life. The rater at each station utilises a rubric to assign the applicants two scores out of 5, one score for the attribute around which the scenario was designed (e.g. empathy, integrity, working with others, or problem solving) and the second score for communication. In 2017, one scenario had two attribute scores as well as communication, and as such applicants in 2017 received three scores out of 5 on that scenario. For each applicant, two total scores were generated from the MMI, an assessment of communication (MMIComm) based on the combined communication scores across all the scenarios, and an assessment of the other attributes of interest (MMINC) across all the scenarios.

To improve fidelity of the scenarios, the ideas for the scenarios were sourced from current veterinary students by asking them to describe difficult situations they had encountered. These ideas were then formatted into MMI scenarios by teams of academic staff and current students.

In 2016-2017 a senior faculty member with significant MMI experience from an overseas veterinary institution was consulted regarding MMI scenario development. This individual helped oversee MMI development and the training of staff to write the MMI scenarios. In later years, the local staff had developed their expertise at blueprinting and writing the scenarios, and so the formal consultation was discontinued. With the exception of one scenario from 2017 that was re-used in 2018, all other scenarios were created and used for a single year. Thus, the scenarios differed between years, but all applicants within a single year had the same scenarios.

#### **5.3.5. *Bespoke test based situational judgment test***

In the bespoke text based situational judgment test (SJT), applicants read challenging scenarios and then rate the appropriateness of multiple possible courses of action that could be undertaken by a character in the scenario. Like the MMI scenarios, the SJT scenarios are written in the context of a difficult situation that a veterinary student might encounter in their study or personal life. Multiple options (usually 3-8) are provided that a character in the scenario could undertake as a next step in response to the scenario. Applicants rate the appropriateness of each option from one of the following



choices: totally appropriate; somewhat appropriate; somewhat inappropriate; totally inappropriate. Descriptors for each rating choice are provided to the students. Applicants are instructed to rate each option independently from the other options, and not to rank or compare the options when determining their rating. This makes it possible for multiple options to be given the same rating.

The SJT process was developed in consultation with Work Psychology Group Ltd. (WPG, Derby, UK), an organisational psychology consulting company that provides research-informed approaches for selecting staff and students. Developing and implementing the SJT was a highly resource intensive process from the perspective of time, human resourcing, and expense. Scenario development, like the MMI, is bespoke and requires blueprinting and significant resourcing (Patterson, Zibarras, et al., 2016). Scenario ideas are usually from current BVSc students, with subject matter experts (SMEs) crafting the scenarios, and then an extensive process of piloting and further refining prior to live implementation.

Applicants' responses are computer marked, with post-marking analysis undertaken by WPG consultants. WPG provides a final score for each applicant, with possible score ranges varying annually depending on how many scenarios and items per scenario are used in each year. Given the markedly varying total scores across the three years, the SJT scores were normalised for each year using a z-distribution, and then converted into a t-score with a possible score range of 1-100 and mean of 50.

### **5.3.6. *Situational judgement test – CASPer***

CASPer is an online situational judgement test offered by Altus Assessments Inc., Toronto, Canada. This test has 12 sections in which the applicant is provided with a hypothetical, realistic scenario (eight video and four text-based scenarios) and then has 5 minutes to type responses to three open-ended questions related to the scenario. A score of 1-9 is then provided for each applicant.

Each test section is scored by a different trained and vetted rater, thus enabling rater diversity. Raters are recruited, trained, and paid by Altus Assessments. The raters who mark the assessments of applicants attending Australian or New Zealand institutions are recruited from those countries.

For clarity, institutions are not involved in generating or reviewing content for CASPer assessment. As the number of institutions in Australia utilising CASPer (n=13) exceed New Zealand (n=1), the video content is filmed in Australia due to resource constraints. It would be preferable to have videos filmed in New Zealand, but as that isn't an option Massey University staff have been allowed to preview the scenarios to ensure they are relevant to the New Zealand context, including checking that they do not include terminology that would be unfamiliar in New Zealand.

## 5.4. SELECTION PROCESS OVERVIEW

A selection committee determines which applicants will be offered admission to the professional phase of the programme. Selection decisions are made in the three to four-week window between semester one examinations concluding and semester two commencing. Approximately 7-10 days prior to the commencement of semester two, grades from semester one courses are made available to the selection committee for GPA calculation. The selection committee then meets to determine the outcomes of all applicants. A selection score is determined for each applicant based on the selection policy applicable in that year, as outlined in section 5.5. If the eligibility criteria for selection into the professional phase have not been met, students are ruled ineligible for admission. Eligible applicants are ranked in descending order by selection score and offered places in the professional phase in rank order until the available places are filled. Each applicant receives a final decision of selected or not selected based on three possible outcomes.

1. Ineligible for selection: Applicants who do not meet all the eligibility criteria are not selected.
2. Eligible for selection but not selected: Applicants meet all the eligibility criteria but are not selected as they are not ranked highly enough to be offered a position.
3. Eligible for selection and selected: Applicants who meet all the eligibility criteria and are selected as their ranking is high enough to be offered a position.

Applicants who are not selected can apply for selection into the professional phase again in a later year. In the meantime, they usually enrol in another degree and take courses, the grades from which may be included in their GPA for a future application. During the period of this thesis, there was no minimum period required between applications, and applicants did not have to complete another degree before applying again. There was also no limitation on the total number of applications that an individual could submit.

There are currently no reserved places for applicants on the basis of prior university experience or degree completion, hence all first-time applicants and reapplicants are considered together for selection. To enable fair comparison, all students are required to take courses containing content that they have not previously taken and at an appropriate level based on their previous study. This means that students may not repeat courses they have already completed, and graduates may not take 100-level (first-year university) courses.

## 5.5. SELECTION POLICY

During the period of the current study, the selection policy underwent two substantial changes, resulting in three time periods with different selection policies: 2003-2006, 2007-2016, and 2017-2019. During these periods the selection assessments and calculation of the selection score varied as shown in Table 5.2 and described below.

**Table 5.2 Summary of the selection score calculation including weighting of academic and non-academic assessment and contributing assessment components.**

Time Period	Overall Weighting	Selection assessments and their weighting
2003-2006	100% Academic	GPA: 80%, STAT: 20%
2007-2016	100% Academic	GPA: 80%, STAT: 20%
2017-2019	50% Academic 50% Non-academic	GPA: 80%, STAT: 10%, Written communication: 10% MMIComm: 50%, MMINC: 16.67%, SJT: 16.67%, CASPer: 16.67%

### 5.5.1. Selection Policy 2003 - 2006

Prior to 2007, all applicants underwent the same standard selection process using only two selection parameters. A selection score for each applicant was calculated based on their GPA (80% weighting) and their score on the STAT (20% weighting). Eligible applicants were ranked in descending order by selection score and offered places in the professional phase in rank order until the places were filled.

### 5.5.2. Selection Policy 2007 - 2016: Introduction of the Treaty of Waitangi process

In 2007, a new selection process was introduced in which Māori applicants could be given additional consideration for positions in the professional phase. This was referred to as the Treaty of Waitangi selection process and was developed with the input of the Deputy Vice Chancellor-Māori at the time. Applicants through the Treaty of Waitangi Process did not receive additional support in the pre-vet phase or once selected into the professional phase. Instead, the Treaty of Waitangi process was applied at the point of selection into the professional phase, such that an applicant who otherwise would not have been selected in the standard process might be selected. To be eligible to receive additional consideration at selection, Treaty of Waitangi Process applicants had to demonstrate Māori whakapapa (ancestry), meet all the eligibility criteria for selection into the professional phase as outlined in Section 5.2, and demonstrate activity in their Māori community.

The evidence required to determine whakapapa varied and included but was not limited to iwi registration letters, birth certificates of the individual and ancestors, ancestry tree and verification letters from kaumātua.

In order to assess whether the applicant demonstrated sufficiently strong activity in the Māori community, Treaty of Waitangi Process applications were reviewed by the Kaiārahi Māori (Māori cultural advisor) for the College of Science, who made a holistic assessment of each individual. Final determination of the level of activity (low, moderate, high) was made by the committee, taking into account the feedback of the Kaiārahi Māori. While there were no specific criteria for being considered active in the Māori community, participating in traditional cultural activities (kapa haka, marae activities), having attended a kohanga reo/kura kaupapa Māori, having te reo language skills, or participating in events in which there was role modelling for Māori rangatahi were regarded favourably. In retrospect, it is acknowledged that this process includes value laden assessments of cultural engagement (Curtis & Reid, 2013) and potentially supports a cultural essentialist approach (Hoskins, 2012) that promotes a homogenous colonial perspective of defining Māori (Jackson, 2010) that is not well aligned with the diverse realities of contemporary Māori society today (Penetito, 2011). Assessment of activity in the Māori community was subjective and evolved over time. In the earlier years, the judgement of activity in the Māori community was aligned with a cultural essentialist approach. With time the selection committee became more aware of their lack of qualification to make such a judgement, such that by the final time period of this thesis (2017-2019) they were substantially more accepting in their assessment of applicant's activity in the Māori community.

The selection scores for Treaty of Waitangi Process applicants were calculated using the same method as for applicants in the standard process; namely 80% weighting on GPA, and 20% weighting on STAT. There was no set quota of places for Treaty of Waitangi Process applicants. Treaty of Waitangi Process applicants who met the eligibility criteria for selection to the professional phase of the BVSc, including a GPA of  $\geq 5$ , who demonstrated sufficiently strong activity in their Māori community, and had an appropriate selection score were selected.

Determination of what constituted an appropriate selection score for Treaty of Waitangi Process applicants also evolved over time and with greater experience of the selection committee. Initially, the applicants that were selected had a selection score either above or closely below the selection score of the lowest ranked applicant selected in the standard process in that year. In the later years of this time period (~2014-2016), applicants who met the eligibility criteria for selection into the professional phase, and who demonstrated sufficiently strong activity in their Māori community were

likely to be selected regardless of how close their selection score was to the selection score of the lowest ranked applicant selected in the standard process in that year.

After accommodating the selected Treaty of Waitangi Process applicants (usually 0-4 in any year), the remaining places in the professional phase were offered to the standard applicants in descending rank order of selection score until all available places were filled.

### **5.5.3. *Selection Policy 2017 - 2019: Introduction of non-academic assessment***

In response to changes in accreditation requirements, international research, and feedback from the New Zealand Veterinary profession, a new selection process was implemented in 2017 which included assessment of non-academic performance assessment. The aim of the revised process was to allow the selection of students who not only had the academic capacity but who also possessed the communication skills and other personal attributes needed for success in both the degree and a veterinary career.

In addition to assessment of academic performance via GPA and the STAT test, an assessment of written communication was introduced. Non-academic performance was assessed through the MMI, SJT and CASPer as previously described (section 5.3).

All applicants were required to complete all of the academic and non-academic assessments. The method for calculation of the selection score for both Treaty of Waitangi Process and standard applicants changed substantially. Prior to 2017 it was calculated entirely from academic components. From 2017 it was calculated with a weighting of 50% for academic performance assessment and 50% for non-academic performance assessment. The components of the selection score calculation over this time period, as well as for the previous two time periods, are summarised in Table 5.2. The academic performance score (50% overall) was based on GPA (80%), STAT (10%) and written communication (10%). The non-academic performance score (50% overall) was based on MMIComm (50%), MMINC (16.67%), SJT (16.67%) and CASPer (16.67%).

All Treaty of Waitangi Process applicants who were assessed as having demonstrated sufficient activity in their Māori community and had also met the eligibility criteria were selected into the professional phase regardless of how close their selection score was to the selection score of the lowest ranked applicant selected in the standard process in that year. The remaining places in the professional phase were offered to applicants in the standard process in the same way as in 2007-2016, in descending rank order of selection score until filled.

## **5.6. INDIGENOUS INVOLVMENT IN THE SELECTION PROCESS**

Greater level of Indigenous input is needed for selecting Indigenous students than was provided during the period of study in this thesis. The selection committee oversees all decisions made regarding the selection process. During the period of this thesis, the committee had either nine or eleven committee members, of which one (from 2006) was Indigenous. The committee initiated the equity process for selection of Māori from 2007, the ongoing management of which was under non-Indigenous control. The committee were well meaning, but there was limited ongoing critical analysis from an Indigenous lens of key issues that influence Indigenous, such as Indigenous rights, the ongoing impact of colonisation, educational inequity, and social justice. Establishment of the new selection assessments utilised from 2017, had little Indigenous input, with development of several assessments (MMI, SJT, CASPer) guided by non-Indigenous experts from outside New Zealand. The lack of Indigenous input means there was a lack of Indigenous worldview associated with assessment development, and scenario development specifically for the MMI and SJT. This is concerning as racism and bias weren't strong considerations in the development of the assessments and therefore were not meaningfully addressed.

## **5.7. SUMMARY**

The veterinary student selection process at Massey University over the period of 2003-2019 has been outlined above, including introduction of the Treaty of Waitangi process in 2007 and the use of non-academic assessments from 2017. Introduction of the Treaty of Waitangi Process was a positive change, but as noted above, there was room for improvement in the assessment of Māori activity, and consideration is needed as to whether or not that was a culturally appropriate eligibility criterion. Introduction of non-academic performance assessment into the selection process was a major change in keeping with current recommendations and research literature. The involvement of Indigenous individuals with an Indigenous worldview in developing, implementing, or marking the non-academic selection assessments was low overall, and the assessments did not contain Indigenous specific content or address Indigenous issues. This raises concern as to whether these assessments are relevant for Māori or may negatively bias against Māori, an issue which needs to be explored.



## Chapter Six

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### 6. OVERVIEW OF THESIS STUDIES

#### 6.1. INTRODUCTION AND ETHICAL APPROVAL

In the previous three chapters, the state of education for Māori in New Zealand, selection and widening access to health professions, and veterinary selection in New Zealand have been discussed. In this chapter an overview of the studies in this thesis is provided, including description of the methods of data collection, data handling and variables used in the studies.

The studies in this thesis were conducted under ethical approval from Massey University Human Ethics Committee Southern B. The ethics approvals were MUHECB 14-24 and 15-77, with four approved amendments to MUHECB 15-77 over 2017-2019.

#### 6.2. STUDY AIMS

As previously noted in the introduction, this thesis has two overarching goals. The first is to explore how the access of Māori to veterinary education is influenced by sociodemographic factors under three separate admission processes. The second is to explore the impact of sociodemographic factors and academic achievement prior to admission on the academic success of Māori once selected into the programme. Specifically, the aims of the thesis are to:

1. Describe the ethnicity of the veterinary applicant pool over a seventeen-year period and determine if Māori and non-Māori applicants have differing sociodemographic backgrounds relevant to widening access.



2. Describe the ethnicity and other sociodemographic factors of students selected into the veterinary programme and evaluate whether the veterinary student selection process has influenced access to veterinary education for Māori or other sociodemographic groups.
3. Explore whether scores on assessments used in veterinary student selection differ between Māori and non-Māori and with different sociodemographic factors.
4. Determine whether academic performance once selected into the veterinary programme has been affected by changes to the selection process and whether the effects were the same for Māori.

Four studies are included in this thesis, each of which address one of the aims listed above.

## **6.3. MATERIALS AND METHODS**

### **6.3.1. *Description of data collection***

For the purpose of this study, a veterinary applicant was defined as a domestic student who applied to and was assessed for selection into the professional phase of the BVSc degree at Massey University over the period between 2003 and 2019. Domestic students were defined as (i) New Zealand citizens or residents, or (ii) Australian citizens or residents who were living in New Zealand (Massey University, 2020b). Applicants who did not meet these criteria (e.g. international students) were not included in the analyses, nor were individuals who withdrew their selection application after submission but prior to the annual selection meeting occurring in early July.

Data were retrieved for all veterinary applicants in the period 2003-2019 from two sources, namely the Massey University Student Management System database ('SMS database') and the School of Veterinary Science data, which included the selection application data ('selection database') and progression data. The earliest year of data collection (2003) for the study was determined by the availability of electronic data for veterinary applicants.

The university student management system (SMS) changed in August 2017, which had implications for the way in which applicants applied for selection into the professional phase of the BVSc and, consequently, the usage of the data. Prior to 2017 applicants submitted a single online application for selection which included supplementary questions. The data from this application were collected into the veterinary school database and formed the annual list of applicants for selection into the BVSc. From 2018, applicants submitted two applications. The first was an application for admission to the professional phase of the BVSc through the university admission application portal, the data from

which populated the SMS database. The second was a separate supplementary application, which included the supplementary questions, collected by the veterinary school. Thus, from 2018 the list of applicants was drawn from the SMS database.

#### **6.3.1.1. Veterinary school data**

The veterinary school data includes data from the selection database and also progression data. The supplementary application questions collected by the veterinary school varied over time, generally with more questions added in later years, which covered sociodemographic and education background topics.

The list of individuals applying for selection each year is used to populate a veterinary selection database. The responses to some of the questions from the veterinary supplementary questions are imported into the database. The scores of each applicant on the selection assessments are entered in this database as they are generated. The combination of these data is referred to as the “selection database”. Eligibility for selection and selection outcome are found in the selection database, as is the university experience of the applicant.

The list of applicants for consideration in this thesis was collated from the veterinary selection database and included all domestic applicants in 2003 -2019 who had not withdrawn from the selection process as at the time of the selection meeting. A list of the Massey university student identification numbers (‘student ID’) of these applicants was provided to staff who retrieved the data from the SMS database.

Progression data is collated by the School of Veterinary Science for each applicant. This includes the GPA for each year of their study, and their overall GPA after degree completion. Also recorded is whether they passed their courses in that year on the first attempt or required a supplementary assessment, which is a second attempt to pass the course assessment for any course.

#### **6.3.1.2. SMS database**

The data populating the SMS database were provided by individuals when they applied for admission to the university. The data were retrieved by student ID (by staff members outside of the veterinary school) and provided as an excel database/spreadsheet. The data provided for each individual included: date of birth, gender, ethnicity, highest school qualification, name of high school attended, whether they were the first in their family (“first in family”) to attend university, citizenship, New Zealand resident or not, country at time of enrolment, region at time of enrolment, city at time of

enrolment. Grades from courses completed by all students at the university are held in the SMS database and were retrieved to calculate the GPA of individuals.

### 6.3.2. Description of variables

#### 6.3.2.1. Time Period

In order to allow meaningful analysis, the 17-year duration of this study is divided into three time periods. The three time periods reflect two significant changes in the selection process, being the introduction of the Treaty of Waitangi pathway for Māori students in 2007, and implementation of non-academic assessment in the selection process in 2017. Thus, the time periods are 2003-2006, 2007-2016, and 2017-2019 as shown in Table 6.1.

**Table 6.1 Factors used to determine the three time period categories into which the duration of the study was divided.**

	2003 - 2006	2007 - 2016	2017 - 2019
Existence of Treaty of Waitangi selection process <sup>a</sup>	No	Yes	Yes
Assessment of non-academic performance in the selection process <sup>b</sup>	No	No	Yes

<sup>a</sup> The Treaty of Waitangi selection process introduced in 2007 enabled additional consideration to be given at the point of selection for Māori applicants who demonstrated Māori whakapapa and were active in their Māori community.

<sup>b</sup> Prior to 2017, the selection process considered only academic performance.

#### 6.3.2.2. Ethnicity

In order to maximise the use of high-quality ethnicity data, two different data sources were used over the study period to determine the self-identified ethnicity of applicants. Ideally, these data would have been obtained from a single source; however, introduction of a new SMS database system in mid-2017 resulted in incomplete ethnicity data for applicants in 2018 and 2019. Collection of ethnicity data in the veterinary school database commenced in 2017, however in 2017 the amount of missing ethnicity data in the veterinary school database exceeded that in the SMS database. Thus, it was decided to use both sources of ethnicity data for this study: the SMS database for 2003-2017 and the veterinary school database for 2018 and 2019.

The format of the ethnicity question in both sources differed slightly from each other and also from the format used by Statistics NZ (Statistics New Zealand, 2018b). A key element of the Statistics NZ ethnicity question is that individuals can select as many ethnicities as they identify with. While in both sources applicants could identify with more than one ethnicity, in the ethnicity question in the enrolment process, applicants were limited to a maximum of three ethnicities, which is not ideal. The ethnicity data from both sources were prioritised into the following Level 1 categories specified by Statistics NZ as used in the New Zealand census: European, Māori, Pacific, Asian, and Other (Statistics New Zealand, 2020). Statistics New Zealand uses an additional level one category called Middle

Eastern/Latin American/African (MELAA). The MELAA category was not utilised in the present thesis in alignment with the ethnicity data protocols of the Ministry of Health (Ministry of Health, 2017). As there were only a very small number of candidates whose ethnicity would have been categorized as MELAA; they have instead been categorized as Other.

In this thesis, ethnicity is reported in two ways: Total response ethnicity; and Māori versus non-Māori (all other ethnic categories combined). In total response ethnicity, individuals are included in each of the ethnicities with which they identify, so an individual can appear in more than one ethnic category. This is consistent with ethnicity reporting in the New Zealand census (Statistics New Zealand, 2019b). The categorization of ethnicity as Māori versus non-Māori was also used, which aligns with the guidelines in the Ministry of Health Ethnicity Data Protocols (2017). Applicants who identified as Māori, either solely or as one of multiple ethnicities, were categorised as Māori and excluded from the non-Māori category, whereas applicants who did not identify as Māori (i.e. Pacific, Asian, European and/or Other) were categorized as non-Māori. This categorisation is also consistent with a Kaupapa Māori approach that reflects the Treaty relationship between Māori and non-Māori by centralising Māori in the data analyses and foregrounding the inequity between Māori and non-Māori applicants (Wikaire et al., 2016).

#### **6.3.2.3. Gender**

Each applicant's self-declared gender was retrieved from the SMS database. Up to and including 2019, the gender question in the SMS database only allowed for the binary responses of male or female.

#### **6.3.2.4. Age**

Each applicant's self-declared date of birth was retrieved from the SMS database. The date of birth was used to calculate the applicant's age on July 1 of each year to best approximate the applicant's age when the selection committee meeting occurs (first week of July annually).

#### **6.3.2.5. Decile of High School Attended**

The name of the high school attended by each applicant was retrieved from the SMS database. The high school name was matched to a publicly available Ministry of Education dataset (Ministry of Education, 2018) to retrieve the decile and type of school attended by each applicant.

The decile rating of a school, from 1-10, is a government-determined measure of the socio-economic position of a school's student community in relation to other schools throughout the country (Ministry of Education, 2019b). In the present study, the decile rating of 1-10 was used in the inferential statistical analyses, while in descriptive analyses the decile of each high school was categorised as low

(deciles 1-3, high deprivation), medium (deciles 4-7), high (deciles 8-10, low deprivation) and missing (overseas schools, home schooled students, and New Zealand schools without a decile rating). School decile is often used as a proxy for socioeconomic position (Curtis et al., 2017; Meehan et al., 2019; Wikaire et al., 2017), however, as it is an average of the socioeconomic position of the school community, it may not reflect the socioeconomic position of each student (Hattie, 2002; Strathdee & Engler, 2012).

#### **6.3.2.6. Type of High School Attended**

The type of high schools attended by applicants in New Zealand was categorised as state, state integrated, or independent ('private'), while high schools attended outside New Zealand were categorised as overseas. Both state and state-integrated schools are government-funded and teach the New Zealand national curriculum, however, state-integrated schools also have their own special character (e.g. a particular philosophical/educational method or religious belief) as part of their school programme (Meehan et al., 2019). Private schools usually charge substantial fees and, while they are not required to follow the New Zealand curriculum, they must follow a learning programme of at least the same quality.

#### **6.3.2.7. Prior university Experience**

The tertiary study history of the applicants was retrieved from the veterinary school database. Applicants were classified into five groups based on the amount of university study they had completed by the beginning of the year in which they applied for selection: 1) no prior experience, 2) part-graduates, 3) graduates, 4) part-graduates new start, and 5) graduates new start. Applicants enrolled in university for the first time in the year of their selection application were classified as having no prior university experience. Applicants were classified as part-graduates if they had completed at least one semester of study but had not completed a degree. Applicants who had completed one or more university degrees were classified as graduates. The new start category was given to part-graduates and graduates who had not studied full-time for at least one semester within 36 months of July 1 of the year they were applying for selection. For such students, their grades were outside the defined period for consideration in the selection process (Massey University School of Veterinary Science, 2020), so they were required to undertake additional study to generate a new GPA as a current measure of their academic performance. The five groups were further classified into the binary variable of prior university experience, with no prior experience being classified as No, and any level of prior university experience (part-graduates, graduates, part-graduates new start, graduates new start) classified as Yes.

#### **6.3.2.8. First in Family to Attend University**

Applicants were asked whether they were the first in their family to attend university ('first-in-family' or 'FIF') from 2013 in the university admission process, and from 2017 in the veterinary supplementary questions. The response option to this question was yes/no. Introduction of the new SMS system in mid-2017 resulted in significant missing data for this question for the 2018-2019 applicants. As such, first-in-family data were retrieved and utilised from the SMS database for applicants in any of 2013 through 2017 and from the veterinary school database for applicants in 2018 or 2019.

#### **6.3.2.9. English as Main Language**

From 2017 in the veterinary supplementary application, applicants were asked 'what was the MAIN language that was spoken in the home you were raised in?' (English Main Language or 'EML'). Applicants could select a language (e.g. English, Chinese, Māori) or provide a free text response of their choice. The responses were classified into a binary variable called English Main Language ("EML"), where English was classified as Yes, and any language that was not English was classified as No.

#### **6.3.2.10. Pre-vet GPA**

The pre-vet GPA is calculated as part of the selection process by veterinary school staff, based upon the regulations for GPA calculation in that year. Grades from eligible courses completed in the pre-vet phase prior to the year of application are calculated into a previous GPA, and the previous GPA as well as number of credits used in the previous GPA are entered into the veterinary selection database. Grades from courses completed in semester one of the year of application are imported into the veterinary selection database from the SMS database and a semester one GPA (including current credits) is calculated in the veterinary selection database. The pre-vet GPA is automatically calculated in the selection database from the previous GPA and semester one GPA. The GPA range is 0 (Fail) to 9 (A+) as described in Section 5.3.1.

#### **6.3.2.11. Eligible for selection**

Each applicant was assessed for completion of the eligibility requirements for selection into the professional phase of the BVSc (Section 5.2). Applicants who met the eligibility criteria for selection were categorised as eligible, while those who did not meet these criteria were categorised as ineligible. The categorisation of eligibility for selection was made just prior to the selection meeting in early July annually.

#### **6.3.2.12. Selection outcome**

Of the students who were selected, the vast majority accept their position, while a small number either decline their offer by the deadline or accept their offer and matriculate but subsequently withdraw prior to the academic penalty date. The selection outcome of each individual in the veterinary selection database was therefore coded as one of the following four categories: not selected, selected, selected but declined offer, or selected but withdrew (before the academic penalty date). The selection outcome variable for this thesis was binary: not selected (as above) or selected (all other classifications).

#### **6.3.2.13. Selection assessments**

Each of the selection assessments has been described in detail in Section 5.3. The name of each assessment as well as the range of possible scores for each assessment are: STAT Test (100-200), written communication (0-12), MMI (0-85), SJT (0-100) and CASPer (0-9).

#### **6.3.2.14. Professional phase GPA**

For students selected into the professional phase, a GPA from the courses completed in their first semester in the professional phase is determined using the SMS system GPA calculator, which uses the official grades for courses as recorded in the SMS. The professional phase GPA were entered into a spreadsheet of progression data and provided for use in this thesis. For clarity, the grades from courses taken in the pre-vet semester are included in the pre-vet GPA and are not included in the professional phase GPA.

#### **6.3.2.15. Passing all courses on first attempt in the professional phase**

Students may have two attempts to pass a course in the veterinary programme. If they do not pass the course on the first attempt, they may sit a supplementary assessment, which is a second attempt to provide evidence that they have satisfied the learning outcomes for the course. Supplementary assessments are offered in the summer holiday period following each academic year. A supplementary assessment may only be given if the student has not exceeded the maximum limit of failed first attempts as specified in the regulations for that year. Where a student has exceeded the maximum limit, they are not offered supplementary assessments and fail the year overall. A student who does not pass their supplementary assessment for one of more courses, will also fail the year overall. Any student who fails the year overall, must retake and pass all courses in that year in order to progress to the subsequent year of the programme.

A binary variable (yes/no) was created to reflect whether selected students passed all their courses in the first semester of the professional phase on their first attempt ('passing on the first attempt'). Those who did were coded as yes, while any student who did not pass all their courses in the first semester of the professional phase on their first attempt (whether they were offered supplementary assessments or exceeded the limit for supplementary assessments) was coded as no.

### **6.3.3. Datasets**

#### **6.3.3.1. Sociodemographic dataset**

The first dataset created for this thesis was a collation of the sociodemographic variables of each applicant plus their selection outcome. It included the following variables: year of application, unique identifier, DOB, age, gender, high school name, high school decile (1-10), high school decile category (low, medium, high), type of high school attended, ethnicity (total response and Māori /non-Māori). This dataset was the basis for the analyses conducted in Studies 1 and 2 (Chapters 7 and 8).

#### **6.3.3.2. Selection assessment scores dataset 2017-2019 (Scores17-19)**

The second dataset for this thesis was a collation of the selection scores from all assessments in 2017-2019 (GPA, STAT, written communication, MMI, SJT, CASPer). The scores of each of these assessments were imported from the selection database for each year. These data, along with the sociodemographic dataset, were the basis for the analyses conducted in Study 3 (Chapter 9).

#### **6.3.3.3. Selection assessment scores dataset 2003-2016 (Scores03-16)**

The third dataset for this thesis was a collation of the scores from all the selection assessments in 2003-2016 (GPA, STAT). The scores of each of these assessments were imported from the selection database for each year.

#### **6.3.3.4. Outcomes dataset**

The professional phase GPA and passing on first attempt data are entered into the veterinary progress database, along with other variables for Years 2-5 of the BVSc programme. A subset of the professional phase GPA and passing on first attempt data for all selected students was created from the progress database to make the outcomes dataset for this thesis. Outcomes in years 2-5 of the programme were not able to be assessed as the 2019 cohort had only complete their first year of the BVSc at the time of data collection.

This dataset along with the sociodemographic dataset, the Scores17-19 dataset, and the Scores03-16 dataset were the basis for the analyses conducted in Study 4 (Chapter 10).



## **6.4. SUMMARY**

In this chapter the collection and processing of the variables was described. In the next four chapters, four studies will be presented which address each of the four aims of the present thesis. The variables in each study will be noted, with the reader directed back to this chapter for greater detail regarding the collection or procession of any of the variables.

## Chapter Seven

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### 7. STUDY 1 DESCRIPTIVE ANALYSIS OF VETERINARY APPLICANTS

#### 7.1. INTRODUCTION

The ethnic composition of the veterinary profession in New Zealand is not representative of New Zealand society, as the proportion of Māori veterinarians (2%) is substantially lower than Māori nationally (16.5%). A similar lack of inclusion of Māori is seen in medicine (3.8%), nursing (7%), and dentistry (3.1%) in New Zealand. Poor ethnic representation is also found in the veterinary profession in Western countries overseas.

In New Zealand, there is an Indigenous rights argument for Māori to access higher educational opportunities, as expressed within the United Nations Declaration on the Rights of Indigenous Peoples (2007) and reinforced via Te Tiriti o Waitangi (The Treaty of Waitangi), and the government's Tertiary Education Commission strategy (Tertiary Education Commission, 2019). In addition, widening participation of minoritised ethnicities in the health professions is desirable for many reasons including benefits to the profession (Coffman, 2002), students (Hung et al., 2007; Whitley et al., 2003), and society (Curtis et al., 2017; L. M. Greenhill, 2007; Razack et al., 2015; Steven et al., 2016).

The ethnicity of veterinary applicants has not been reported in New Zealand. Given that the ethnicity of applicants and students selected into veterinary training will determine the future ethnic composition of the veterinary profession, these data are important for analysing the adequacy and appropriateness of the recruitment and selection processes with regard to widening access to the veterinary degree and for veterinary workforce planning in New Zealand. On a larger scale these data are also important for addressing social justice and Indigenous rights issues.

From medical education in New Zealand, it has been shown that Māori historically have been underrepresented in the applicant pool and selected student cohorts (Collins et al., 1993; Crampton et al., 2012; Fitzjohn et al., 2003), however, this has markedly improved recently due to the implementation of equity focused admissions policies (Crampton et al., 2018; Curtis et al., 2017). It was hypothesised that as has previously been seen in medical education in New Zealand, Māori would be underrepresented in the veterinary applicant pool.

Veterinary education in New Zealand is offered solely at Massey University, as a five-year undergraduate Bachelor of Veterinary Science degree, composed of a pre-vet phase (one semester) and a professional phase (4.5 years). Prior to 2007 all applicants underwent the standard selection process. In 2007, a selection process was introduced in which Māori applicants might be given additional consideration at the point of selection. This was referred to as the Treaty of Waitangi selection process.

The aims of this study were to describe the ethnicity of domestic applicants for selection into the professional phase of veterinary education in New Zealand from 2003 through 2019 and to compare this with the ethnic composition of New Zealand society. This study also aimed to explore whether there were differences in the demographic features and educational backgrounds of Māori applicants as compared to non-Māori applicants that may be relevant to widening access to veterinary education.

## **7.2. METHODS AND MATERIALS**

This study was conducted with a Kaupapa Māori research positioning (Curtis, 2016; Pihama, 2011; G. Smith, 2012), which “ensures a cultural integrity is maintained when analysing Māori issues” (Pihama, 2010, p. 10). For more detail regarding Kaupapa Māori positioning for this study the reader is directed to sections 2.3 and 2.4 of Chapter 2.

This study was conducted under ethical approval from Massey University Human Ethics Committee Southern B (MUHECB 14-24 and 15-77).

### **7.2.1. Description of Data**

The variables in this study are: time period (3 categories: 2003-2006, 2007-2016, 2017-2019); applicant ethnicity (total response and Māori, non-Māori); gender (male, female); age (years); the decile of high school attended (low: decile 1-3, medium: decile 4-6, high: decile 8-10); the type of high school attended (state, state integrated, private or overseas); prior university experience (no prior experience, part graduate-NS, part-graduate, graduate-NS, graduate); and whether applicants were

the first in their family to attend university (yes, no). The collection of the data and full description of all the variables utilised in this study are provided in the general Materials and Methods (Section 6.3).

### **7.2.2. Statistical analysis**

Data were analysed for descriptive and inferential statistics using R studio software version 1.3.1056 (Rstudio Inc. Boston Massachusetts, USA) and R statistical software version 3.6.6 (R core team, R Foundation for Statistical Computing, Vienna, Austria).

In Stage One, total response ethnicity was used. The number and percentage of each ethnicity from all applications for veterinary selection between 2003 and 2019 were stratified into three time periods (2003-2006, 2007-2016, 2017-2019). Differences in the proportions of each ethnic category (European, Māori, Pacific, Asian, and Other) across the three time periods were examined using Chi-squared analysis. While individuals could submit more than one application, repeat measures analyses were not performed, as the selection score components for an applicant change between applications (so they are effectively no longer the same individual), the average number of applications per individual was below the level likely to impact analysis, and the applicant data is population level rather than sample data.

Consistent with Kaupapa Māori theory, describing and analysing ethnicity was stratified by time period rather than individual years. This enabled larger numbers in ethnic groups that otherwise would have had small numbers which may have precluded meaningful statistical analyses.

In Stage Two, the ethnicity of all individuals at their first application for selection was categorised as Māori or non-Māori (i.e. Pacific, Asian, European, and Other combined). Summary descriptive statistics for gender, mean age, high school type and decile, university experience and being first-in-family for Māori and non-Māori were performed. Chi squared analysis was used to determine differences between Māori and non-Māori applicants for the proportion of applicants by gender (male vs. female), high school decile (low, medium, high), university experience (no prior experience, part-graduates, graduates, part-graduates new start, graduates new start) and being the first in the family to attend university (yes, no). Differences in mean age and in the proportions attending each type of high school (state, state integrated, private, overseas) between Māori and non-Māori applicants were analysed using t-test and Fisher's exact test respectively.

### 7.3. RESULTS

During the period 2003-2019, 3819 individual applicants submitted 4802 applications for selection into the professional phase of the veterinary programme. Of these, 3018 applied once, 650 applied twice, 124 applied three times, 23 applied four times and 4 individuals applied five times.

**Table 7.1 Number and (percentage) of applications for selection into the veterinary programme between 2003 and 2019, stratified by applicant ethnicity and time period.**

<b>Ethnicity<sup>a b</sup></b>	<b>2003-2006 Applications<sup>c</sup> (n=968)</b>	<b>2007-2016 Applications (n=2857)</b>	<b>2017-2019 Applications (n=977)</b>	<b>All Years Applications (n=4802<sup>d</sup>)</b>
<b>Māori</b>	50 (5.2%)	167 (5.8%)	57 (5.8%)	274 (5.7%)
<b>European</b>	853 (88.1%)	2359 (82.6%)	823 (84.2%)	4035 (84%)
<b>Pacific Peoples</b>	7 (0.7%)	33 (1.2%)	16 (1.6%)	56 (1.2%)
<b>Asian</b>	76 (7.9%)	392 (13.7%)	161 (16.5%)	629 (13.1%)
<b>Other<sup>e</sup></b>	58 (6%)	141 (4.9%)	24 (2.5%)	223 (4.6%)
<b>Missing</b>	3 (0.3%)	10 (0.4%)	0 (0%)	13 (0.3%)

<sup>a</sup> Ethnicity is total response ethnicity. In total response ethnicity, individuals are included in each of the ethnicities they identified as, so an individual could appear in more than one ethnic category.

<sup>b</sup> Percentage totals are not 100 for every category due to rounding and because individuals could identify as more than one ethnic group.

<sup>c</sup> Applications is all applications in the time period including those from individuals who applied more than once.

<sup>d</sup> Data were from 3819 individuals who submitted 4802 applications for selection into the veterinary programme.

<sup>e</sup> Other – comprises ethnicities that were not included in the four previous categories of ethnicity and includes individuals who could have been categorised as Middle Eastern, Latin American or African

The total response ethnicity from all applications (n=4802), stratified by time period, is shown in Table 7.1. Applicants who identified as Māori (5.7%) or Pacific (1.2%) were underrepresented in the veterinary applicant pool as compared to the New Zealand population (Māori = 16.5%, Pacific = 8.1% and European=70.2%), while those who identify as European were overrepresented (84%) (Statistics New Zealand, 2019a). The proportion of applicants that identified as Asian (13.1%) was just under that of the New Zealand population (15.1%) (Statistics New Zealand, 2019a). There were no differences by time period for the proportion of applicants identifying as Māori (p=0.72) or Pacific (p=0.17). There was a decrease in the proportion of applicants who identified as European (p<0.001), and an increase in those who identified as Asian (p<0.001) over the time period.

In Table 7.2, the individual applicants (n=3808) are categorised by ethnicity as either Māori (6%) or non-Māori (94%). There were 3819 individual applicants in total, however 11 applicants did not provide their ethnicity so could not be included in this analysis. Females comprised slightly more than three quarters of all applicants, and the mean applicant age was just over 20 years. Of the total applicants, 82% had no university experience prior to the year in which they were applying for veterinary selection.

**Table 7.2 The demographic features and educational background of all individual applicants at their first attempt for veterinary selection between 2003-2019, stratified by Māori or non-Māori.**

	Māori Applicants All years (n=230)	non-Māori Applicants All Years (n=3578)	Comparison of Māori and non- Māori (p)	Total Applicants All Years (n=3808 <sup>a</sup> )
<b>Gender</b>				
Female	183 (79.6%)	2755 (77%)	(p=0.41)	2938 (77.2%)
Male	47 (20.4%)	823 (23%)		870 (22.8%)
<b>Mean Age (SD)</b>	20.5 (4.14)	20.2 (3.61)	(p=0.31)	20.2 (3.64)
<b>High school type</b>				
State	169 (73.5%)	2329 (65.1%)	(p=0.003)	2498 (65.6%)
State Integrated	36 (15.7%)	534 (14.9%)		570 (15%)
Private	18 (7.8%)	404 (11.3%)		422 (11.1%)
Overseas	5 (2.2%)	277 (7.7%)		282 (7.4%)
Missing	2 (0.9%)	34 (1%)		36 (0.9%)
<b>High school decile</b>				
Low (1-3)	26 (11.3%)	166 (4.6%)	(p<0.0001)	192 (5%)
Medium (4-7)	115 (50%)	1218 (34%)		1333 (35%)
High (8-10)	81 (35.2%)	1849 (51.7%)		1930 (50.7%)
Unknown <sup>b</sup>	8 (3.5%)	345 (9.6%)		353 (9.3%)
<b>Prior university experience<sup>c</sup></b>				
No prior experience	189 (82.2%)	2933 (82%)	(p=0.69)	3122 (82%)
Part Graduate	14 (6.1%)	233 (6.5%)		247 (6.5%)
Part Graduate – NS <sup>d</sup>	5 (2.2%)	113 (3.2%)		118 (3.1%)
Graduate	9 (3.9%)	92 (2.6%)		101 (2.7%)
Graduate - NS	13 (5.7%)	207 (5.8%)		220 (5.8%)

Note: Percentages may not total 100 due to rounding.

<sup>a</sup> Data were from 3819 individuals, 11 of whom did not state their ethnicity and have been excluded from this ethnicity based analysis (Total n=3808).

<sup>b</sup> Unknown decile includes all overseas schools, students who were home-schooled and New Zealand schools for which a decile was not specified by the Ministry of Education.

<sup>c</sup> University experience is the amount of university study an applicant had completed by the beginning of the year in which they applied for selection (excluding the pre-selection semester).

<sup>d</sup> NS = new start. This designation was given to students who had not studied in the most recent three years prior to the veterinary student selection process and were required to undertake additional study to generate a current measure of their academic performance.

Almost two-thirds of all applicants attended state schools. When comparing Māori and non-Māori, there was a difference (p=0.003) in the type of school attended, with more Māori attending state schools. Half of the total applicants attended high decile schools, which was ten times the proportion of applicants from low decile schools. There was a difference between Māori and non-Māori applicants for the decile of high school attended (p <0.001), in that the proportion of Māori who attended low decile schools was 2.5 times higher than non-Māori, and for high decile schools was 1.5 times lower than non-Māori. There was no difference between Māori and non-Māori applicants by gender (p=0.41), mean age at application (p=0.31), or university experience prior to the year of application (p=0.69).

First in family status data were reliably available only for 2013 to 2019. During this time Māori applicants were more likely than non-Māori to be the first in their family to attend university ( $p=0.001$ ). Of the Māori applicants, 47 of 106 (44.3%) were the first in their family to attend university as compared to 438 of 1538 (28.5%) of non-Māori applicants.

## **7.4. DISCUSSION**

This study is the first description of the ethnicity of applicants for selection into the professional phase of veterinary education in New Zealand. Māori (5.7%) and Pacific (1.2%) people are underrepresented in the veterinary applicant pool compared to the New Zealand population, in which Māori are 16.5% and Pacific are 8% (Statistics New Zealand, 2019a). If comparison is made to Ministry of Health age matched data, in which the proportion of Māori aged 15-24 is 18.5%, the under-representation of Māori in the applicant pool as compared to New Zealand is even greater (Ministry of Health, 2018). There was no difference in the proportion of Māori applicants across the time periods ( $p=0.82$ ), thus the introduction of a Māori student selection pathway in 2007 did not appear to increase the number of Māori applicants.

Māori were more likely than non-Māori to have attended a lower decile school, more likely to have attended a state school and less likely to have attended a private or overseas school; and were more likely to have been the first in their family to attend university. In contrast, there was no difference in the proportion of female and male applicants, mean age at application, or university experience prior to the year of application between Māori and non-Māori.

While applicants identifying as Māori or Pacific were underrepresented in the applicant pool, the proportion of applicants who identified as European (84%) exceeded that of the general New Zealand population (74%). The proportion of applicants identifying as Asian closely approximated the New Zealand population, and when categorised by time period (Table 2), increased similarly to the New Zealand population (2001 = 7%, 2006=9%, 2013=12% and 2018= 16%). This differs from data from the USA, where Asian applicants were underrepresented, but otherwise there was a similar overrepresentation of Whites, and underrepresentation of all other minoritised ethnicities (Association of American Veterinary Medical Colleges, 2021; Greenhill, 2015). Outside of the USA, currently very few countries routinely collect and report veterinary applicant ethnicity data.

It is anticipated that increasing the number of Māori applicants will enable the selection of more Māori veterinary students. Access to higher level education for Māori is an Indigenous right, as outlined specifically in the United Nations Declaration on the Rights of Indigenous People (United Nations,

2007) and reaffirmed in Te Tiriti o Waitangi. Increased access to veterinary education and the profession will enable Indigenous students, along with their whānau and communities, to benefit from the higher income and opportunities associated with this level of educational achievement (Curtis, Wikaire, et al., 2015; Tertiary Education Commission, 2019; Theodore et al., 2017). Increased access will in turn help to address the intergenerational effects of poverty and inequitable social outcomes experienced by many Māori (Robson et al., 2007). Thus, social mobility and social justice (Steven et al., 2016) are intertwined with an Indigenous rights mandate.

A key driver for widening the participation of Māori in human medicine is to create a health workforce that reflects te ao Māori, from population numbers to culturally appropriate healthcare delivery, with the expectation that this will help to reduce the health inequities experienced by Māori (Curtis, Wikaire, et al., 2012; Ratima et al., 2007). From studies in human medicine, the benefits of an inclusive student population include an enhanced educational experience, deeper classroom discussion, and greater cultural awareness in students and graduates when dealing with people different from themselves (Hung et al., 2007; Whitla et al., 2003). It is anticipated that greater inclusion of Māori students would similarly enable better understanding of all veterinary graduates of engaging with Māori. Having graduates with these qualities would ultimately benefit the veterinary profession by increasing the ability of practitioners to value, engage with, understand, incorporate and leverage the different worldviews that individuals of varying ethnicities bring (Coffman, 2002).

In human medicine, patients who had the option to choose a doctor ethnically similar to themselves usually did so, and those who had a doctor ethnically similar to themselves (ethnic concordance) reported higher levels of satisfaction than those who did not (Laveist & Nuru-Deter, 2002) and were more likely to see their health provider (Ma et al., 2019). It is reasonable to consider that the interactions between clients (e.g. pet owners and farmers) and their veterinarian could also be impacted by ethnicity (Greenhill 2007). As the proportion of Māori in the NZ population is increasing, so must the ability of the veterinary profession to appropriately engage with Māori. Having veterinarians who not only understand but also hold a Māori worldview could benefit Māori, individually and collectively, and the wider New Zealand community. This would be important for companion animal veterinarians as almost 70% of Māori have pets (New Zealand Companion Animal Council Inc., 2016), but also for the agricultural sector.

Māori representation and leadership are needed in the agriculture and food animal farming. Currently just under 20,000 Māori are employed in the primary industries, of which two thirds are in lower skill labouring type roles (Business and Economic Research Limited, 2021). There is uncomfortable irony in



the overrepresentation of Māori labouring in agriculture and the value of agriculture to the Māori economy and wider New Zealand economy *versus* the underrepresentation of Māori among large animal veterinarians. A stronger Māori presence in the veterinary workforce could benefit the health, welfare, and productivity of livestock, particularly in marginalised rural communities. Additionally, as the agriculture, forestry and fishing industries comprise just under 35% of the total Māori asset base and are the largest contributors to GDP from the Māori economy, (Business and Economic Research Limited, 2021), having production animal veterinarians who hold Māori perspectives could benefit the Māori economy, and consequently the national economy.

Further economic arguments for greater inclusion in the veterinary profession exist. From the Foresight project in the USA, it was concluded that there would be an economic benefit to the profession of improving the diversity of the profession, as it would lead to “broader understanding of the profession [by society] and wider use of veterinary medical services”(Willis et al., 2007, p. 18). Additionally, educating veterinary students is expensive and, in New Zealand, this cost is heavily subsidised by the government through taxpayer dollars. Thus, it is appropriate that all ethnic groups, and particularly Indigenous, should have equitable access to veterinary education.

While there are many reasons to improve inclusion in the veterinary profession from both an Indigenous rights and a needs-based perspective, ultimately this theorisation must stimulate action.

In the present study, Māori applicants were more likely than non-Māori to have attended a lower decile school, more likely to have attended a state school and more likely to be first in their family to attend university. These are among the pre-university factors which have been shown elsewhere to influence the likelihood of attending university, including inadequate career advice (Chesters et al., 2009; Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015), socioeconomic position (Engler, 2010; Marie et al., 2008; Steven et al., 2016), school decile (Choat, 1998; New Zealand Qualifications Authority, 2019), type of school (Choat, 1998) and being first in their family to attend university (Marie et al., 2008; Theodore et al., 2015). Ethnicity based analysis is needed to highlight the inequities that exist between Māori and non-Māori that might otherwise remain hidden. In New Zealand, multiple sources have concluded that its colonial history and subsequent discriminatory educational policy decisions from 1840 onwards have influenced, and continue to impact on, the current disparity in educational performance (Berryman et al., 2012; Bishop, 2015; Simon, 1992; Waitangi Tribunal, 1999) and levels of university participation (Theodore et al., 2015) of Māori compared to non-Māori. In data on secondary school students' performance from 2010 through 2019, Year 13 Māori students

experienced poorer attainment of university entrance qualifications than other ethnicities (2019: Māori 30%, European 55%, and Asian 59%) (New Zealand Qualifications Authority, 2020a).

The present study has highlighted systemic structural inequities which need to be addressed if opportunities for access to veterinary education are to become equitable. It has demonstrated that Māori veterinary applicants attended lower decile schools than non-Māori: a finding which is consistent with the results of Māori students applying for entry into medicine via the Māori and Pacific Admission Scheme (MAPAS) at the University of Auckland (Curtis et al., 2017). On a national level, just under half of Māori students (45%) are enrolled in low decile schools, while just over one third (38%) are in medium decile schools, with the remainder (16%) enrolled in high decile schools (Ministry of Education, 2016). This is important as the 2018 New Zealand Qualifications Authority annual report showed that students from lower decile schools had lower levels of university entrance attainment (30%) as compared to those in medium (47%) and high decile schools (65%) (New Zealand Qualifications Authority, 2020a). This association has been documented since the late 1990s. Choat (1998) followed the university enrolment of school leavers in 1996 and found that the proportion of students in high decile schools that progressed to university was four times higher than that of students in low decile schools. The relationship between school decile and progress to university is reflected in the data in the present study, in that the Māori students who applied for selection into the veterinary programme were from higher decile schools than Māori students nationally, suggesting that attending a lower decile school may be a barrier to applying for veterinary selection.

Multiple sources have noted the key role of socioeconomic position as a predictor of progression to university (Engler, 2010; Marie et al., 2008; Steven et al., 2016) and therefore a key driver of the underrepresentation at university of students from economically disadvantaged backgrounds (Strathdee & Engler, 2012). School decile reflects the average socioeconomic position of the schools' student community, and not necessarily that of each individual student attending the school (Hattie, 2002; Strathdee & Engler, 2012). This is most relevant for medium decile schools which may reflect a wide range of students from low and high socioeconomic homes (Hattie, 2002). For schools in the higher or lower decile ranges, there may be greater likelihood that the decile reflects individual socioeconomic position as there will be less variability in socioeconomic position in the communities from which they draw (Engler, 2010). School decile is often used as a proxy for socioeconomic position (Curtis et al., 2017; Meehan et al., 2019; Wikaire et al., 2017). While the average socioeconomic position indicated by the school decile may not reflect that of all students in a school, there are also schooling characteristics that all students will be exposed to that may influence progression to university. These may include the ethos and expectations of the school (Strathdee & Engler, 2012),

access to information about tertiary study (Leach & Zepke, 2005), and the level of motivation in the learning environment (Engler, 2010).

A similar issue is apparent in relation to school type. Over the study period, the proportion of Māori applicants who attended state schools (74%) was higher than non-Māori applicants (65%) while the proportion of Māori applicants who attended private schools (8%) was lower than non-Māori applicants (11%). This difference is relevant as high school type has been shown to have an effect on progression to and performance at university (Choat, 1998). In a study of New Zealand school leavers in 1996, 49% of students who attended private school enrolled at university, as compared to 36% from high decile state schools and 9% from low decile state schools (Choat, 1998). School type is also related to socioeconomic position. Given that private schools usually charge substantial fees, without a scholarship, attending a private school will be unlikely for students from economically disadvantaged backgrounds (Hattie, 2002). This effect is also noted in the UK, where the majority of medical students from less economically advantaged backgrounds attended state funded schools (Kumwenda et al., 2017).

Māori veterinary applicants were more likely to be the first in their family to attend university than non-Māori. This finding is supported by a longitudinal 25-year study of 1265 children born in New Zealand, in which the authors reported that non-Māori had lower rates of parents without formal educational qualifications than Māori ( $p < 0.0001$ ) (Marie et al., 2008). This finding is pertinent as not having had a parent attend university decreases the likelihood of a student attending university (Theodore et al., 2015). Some explanations for this decrease are that these applicants may not have access to the benefits of parental role modelling and expectations of acquiring higher education, parental engagement in their academic pursuits or advice from parents about what to expect at university (Engler, 2010; Wikaire, 2015). Without the latter Māori applicants have to rely on other people for advice regarding university, who may hold a deficit perspective in relation to Indigenous students or may not be adequately prepared to advise Indigenous students (Chesters et al., 2009; Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015).

The underrepresentation of Māori veterinary applicants is concerning. In addition to the barriers to university progression of lower school decile, state schooling and being first in family to attend university, other contributing factors are possible. As there is no literature regarding ethnicity and the veterinary profession in New Zealand, factors suggested in parallel literature regarding the inadequate representation of minoritised ethnicities in the veterinary applicant pool in the USA will be considered.

As the membership of veterinary profession in North America is predominantly White, the lack of role models for minoritised ethnicities (Chastain et al., 2007; Elmore, 2004) has been suggested as a possible barrier to application. This may be a relevant factor inhibiting Māori from applying for the veterinary degree inasmuch as there are few Māori veterinarians (2%), and even fewer Māori veterinary school staff, to role model the veterinary pathway. Thus, it may be difficult for Māori to see themselves in the veterinary profession as there are few veterinarians like themselves.

Coffman (2002) suggests another barrier for veterinary application by minoritised ethnicities could be the impact of negative stereotyping of them and subsequently their performance. This could be a possible barrier for Māori applying to veterinary school as multiple researchers have noted that many teachers still hold deficit perspectives and lower expectations of Māori students (Alton-Lee, 2003; Bishop et al., 2009; Bishop et al., 2003; Bolton, 2017; St George, 1983; Turner et al., 2015). Paradies et al. (2008, p. 2) define racism as “avoidable and unfair actions that further disadvantage the disadvantaged, or further advantage the advantaged”. The authors noted the interrelationship between racism, oppression and privilege, and the key role of systemic racism on inequalities in education for Indigenous peoples.

L. M. Greenhill (2007) raises the likelihood of finance as a barrier to applying to veterinary school in the USA. This is likely to be relevant for Māori applying to veterinary school in New Zealand as 45% of Māori attend lower decile schools (Ministry of Education, 2016) and as such are from communities with higher economic deprivation. Further, in comparison to non-Māori, Māori are overrepresented in those earning under \$40,000 and underrepresented in those earning over \$40,000 (Statistics New Zealand, 2018a). Greater attractiveness of other health professions, which may partly be due to differences in income, has also been suggested as a possible factor in the underrepresentation of minoritised ethnicities in the American veterinary applicant pool (Elmore, 2004). While this hasn't been explicitly explored for Māori, it could be relevant and would be worth exploring in the future.

Concerningly, often reasons suggested for the underrepresentation of various groups problematise the minoritised ethnicities, by suggesting the reason for their lower application resides within them, with little consideration of the external factors that might influence their application to veterinary science. One such common misconception, more often held by those well-represented in the veterinary profession, is that certain groups are underrepresented because they are not interested in becoming veterinarians (Lowrie et al., 2013).

Elmore (2004) cited the findings of several authors including Brown (2002) to suggest that “differing cultural and ethnic biases regarding animals” (p. 414) may influence the low numbers of ethnically

underrepresented students applying for veterinary medicine. However, the data supporting this notion is by no means conclusive. In a survey of 76 African American and 57 White veterinary students, Brown (2002) concluded that White students had higher pet attachment levels and higher levels of pet ownership than Black veterinary students. However, the author of that study noted that the measured difference in pet attachment in that study may reflect a difference in the way attachment is expressed in different cultures rather than a difference in level of attachment *per se*. In other words the measure of attachment used in the study may not have been relevant for both populations. As the study by Brown (2002) was focussed on comparing outcomes between White and Black people in the USA, conclusions regarding pet attachment are not necessarily applicable to other ethnicities. To extrapolate these findings to all minoritised ethnicities is concerning and raises a problematic view of minoritised ethnicities as all being the same, and inherently different than the White majority. Additionally, unless the effects of other potentially confounding variables (e.g. socioeconomic deprivation, geography (urban versus rural) were accounted for, 'ethnicity' may merely have been a proxy for such confounding factors. There also appears to be an implicit assumption that intention to enrol in a veterinary programme is motivated by attachment to and ownership of pets, and ignores the motivation provided by involvement with other animals such as livestock, horses or wildlife, or the differential access between ethnicities to varying sectors of animal care. Even so, it is unlikely that pet ownership pertains to the present study, given that Māori pet ownership (68%) is similar to that of European New Zealanders (67%) (New Zealand Companion Animal Council Inc. 2016).

While interest in a veterinary career or animal attachment has not been compared for Māori and non-Māori, some guidance can perhaps be found in considering some of the values that underpin te ao Māori, such as whakapapa (genealogy or lineage) and kaitiakitanga (guardianship). Whakapapa reflects that there is “unity between humans and the universe” (Kawharu, 2000, p. 351), or in other words that Māori and all flora and fauna are bound together through genealogical relationships as descendants of Ranginui and Papatūānuku. The concept of kaitiakitanga (guardianship) for the land and all living things is then driven by these genealogical relationships rather than just a sense of responsibility (Harmsworth & Awatere, 2013; Roberts et al., 1995). Māori values such as whakapapa and kaitiakitanga make it seem unlikely that Māori would have lower attachment to or interest in animals than non-Māori.

This study is the first to report the ethnicity of New Zealand veterinary applicants and the underrepresentation of Māori (5.7%) applicants as compared to the New Zealand population (16.5%). It is also the first description of some of the differences in the educational background of Māori and non-Māori veterinary applicants, which have been shown elsewhere to be barriers to university

attendance. This is valuable information in widening access to veterinary education and demonstrating the need for action.

## **7.5. SUMMARY**

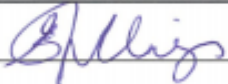

Māori are underrepresented in the veterinary applicant pool and the veterinary profession in comparison to the New Zealand population. When compared with non-Māori, more Māori applicants experienced pre-university educational barriers. While these issues cannot be solely addressed by the university, the university and the veterinary profession as a whole need to act to help mitigate their effects. Enacting activities and processes aimed to widen access to the veterinary programme with the eventual goal of improving the ethnic representation of the veterinary workforce needs to be a priority for the university and profession.



GRADUATE  
RESEARCH  
SCHOOL

## STATEMENT OF CONTRIBUTION DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the candidate and the candidate's Primary Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of candidate:	Eloise Jillings
Name/title of Primary Supervisor:	Naomi Cogger
In which chapter is the manuscript /published work:	Chapter 7
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## Chapter Eight

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### 8. STUDY 2 SELECTION AND THE VETERINARY COHORT

#### 8.1. INTRODUCTION

In the previous study, the underrepresentation of Māori veterinary applicants (5.7%) in comparison to Māori in the New Zealand population (16.5%) (Statistics New Zealand, 2019a) was demonstrated. Also shown was that differences in other sociodemographic and education factors exist between Māori and non-Māori applicants in that Māori applicants attended lower decile schools, were more likely to attend state schools, and were more likely to be the first in their family to attend university. These factors have been shown in other studies to be potential barriers to university study. What is unknown is the impact of these and other sociodemographic factors on the probability of selection into the veterinary programme.

In the USA, the veterinary profession has “the dubious distinction of being the least diverse of all health professions” (Reed, 2013, p. viii). In 2021, underrepresented ethnicities in veterinary medicine (URVM) comprised just over 20% of the selected student intake in the USA (Association of American Veterinary Medical Colleges, 2021), which is just over half of the proportion these ethnicities comprise in the American population (United States Census Bureau, 2018).

The demographic composition of the students selected into the professional phase of the veterinary degree in New Zealand is currently unknown. Given the inequity experienced by Māori in the New Zealand education system (Bishop et al., 2009; Bolton, 2017; Ministry of Education, 2020a; Simon, 1992; Theodore et al., 2015), the underrepresentation of Māori veterinary applicants demonstrated in the first study in this thesis, and the lack of representation in the selected veterinary student data



from the USA, it is hypothesised that the proportion of selected students that identify as Māori would be below population parity with Māori in the New Zealand population.

There are multiple assessment methods and processes used in selection of medical and veterinary students used to assess either academic or non-academic performance, which may variably affect efforts to widen access. From studies in other countries, solely academic or heavily academically focused selection systems tend to disfavour the admission of minoritised ethnicities, while inclusion of non-academic assessments has been reported to have some positive effects on widening access to underrepresented groups (Juster et al., 2019; Terregino et al., 2015). Equity pathways have also shown positive outcomes for improved selection of Indigenous students in New Zealand and Australia (Crampton et al., 2018; Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015; Paul, 2013), and the use of contextual data and holistic review in admissions also holds promise to help widen access for Indigenous and other minoritised ethnicities (Capers et al., 2018; Cleland et al., 2015; Grabowski, 2018; Mian et al., 2019).

As discussed in detail in chapter 5, the introduction of the Treaty of Waitangi process in 2007, and introduction of non-academic selection assessments in 2017 were significant changes to the veterinary student selection process in New Zealand. It is unknown what impact these changes had on the demographic composition of selected students, particularly with reference to Māori. These data are needed to enable analysis of the adequacy and appropriateness of the selection process with regard to access for Māori to the veterinary profession.

Thus, the aim of this study was to evaluate whether the veterinary student selection processes have influenced access to veterinary education for Māori and other sociodemographic groups. As part of this aim, the ethnicity and other sociodemographic features of the selected cohort will be described and compared between Māori and non-Māori, with ethnicity also compared to the population of New Zealand.

## **8.2. METHODS AND MATERIALS**

This study was conducted with a Kaupapa Māori research positioning (Curtis, 2016; Pihama, 2011; G. Smith, 2012), which “ensures a cultural integrity is maintained when analysing Māori issues” (Pihama, 2010, p. 10). For more detail regarding Kaupapa Māori positioning for this study the reader is directed to sections 2.3 and 2.4 of Chapter 2.

This study was conducted under ethical approval from Massey University Human Ethics Committee Southern B (MUHECB 14-24 and 15-77).

### **8.2.1. Description of Data**

The dependent or output variable in this study was selection into the professional phase of the degree (selected, not selected). The independent variables in this study are: time period (3 categories: 2003-2006, 2007-2016, 2017-2019); applicant ethnicity (Māori, non-Māori); gender (male, female); age (years); type of high school attended (state, state integrated, private, or overseas); and level of prior university experience (none, some); pre-vet GPA (0-9) and STAT score (100-200). School decile is also an independent variable and is presented as a categorical variable (low [1-3], medium [4-7] and high [8-10]) for the summary descriptive data and in a comparison of Māori and non-Māori applicants, and as a continuous variable (1-10) in the regression analyses.

The collection of the data and full description of all the variables utilised in this study are provided in Section 6.3. Being first in family to attend university was unable to be assessed in the present study as those data were not available for all the years included in the multivariable model.

### **8.2.2. Statistical Analysis**

Data were analysed for descriptive and inferential statistics using R studio software version 1.3.1056 (Rstudio Inc. Boston Massachusetts, USA) and R statistical software version 3.6.6 (R core team, R Foundation for Statistical Computing, Vienna, Austria).

For all applications in 2003-2019, a binary outcome variable was used to code for selection outcome (selected or not selected). Summary descriptive statistics for the individuals submitting applications are presented stratified by selection outcome and include ethnicity, gender, mean age, high school type and decile and prior university experience (Table 8.1). The mean and standard deviation are presented for age, while the number of applicants and success rate, being the number of students selected divided by the number of applicants, are presented for all other variables.

For those students who were selected into the programme, summary statistics were performed for gender, mean age, high school type and decile, and prior university experience at the time of application, mean pre-vet GPA, and mean STAT score, all stratified by prioritised ethnicity (presented as Māori or non-Māori; Table 8.2). Chi squared analysis was used to determine differences between Māori and non-Māori selected students for the proportion of applicants by gender, high school decile (low, medium, high), and prior university experience (no, yes). Differences between selected Māori and non-Māori students for mean age and pre-vet GPA were analysed using a t-test, while differences in the proportion who attended each type of high school (state, state integrated, private, overseas) were analysed using Fisher's exact test.

The success rate (number of selected students divided by number of applicants x 100) stratified by time period and ethnicity was calculated. A Woolf test to assess homogeneity across the time periods was performed and the odds of selection, stratified by ethnicity (Māori, non-Māori) in each of the time periods were calculated (Table 8.3). A Cochran-Mantel-Haenszel test was undertaken to assess whether the effect of ethnicity and time period on selection outcome were independent of each other. The mean and standard deviation of pre-vet GPA for selected applicants stratified by time period were calculated, and the difference in GPA between the time periods was assessed via ANOVA.

#### **8.2.2.1. Regression modelling**

For all applications in 2003-2019, a binary outcome variable for selection outcome (selected or not selected) was used. To determine the association between selection outcome and the independent variables (time period of applying for selection, ethnicity, age, gender, school decile, school type, and university experience), separate, unmatched, univariate logistic regression models were performed. Missing data were excluded in the regression analyses.

A multivariable logistic regression model was then performed to determine the association between the variables collectively and selection outcome. It was pre-determined that only independent variables associated with selection outcome at  $p < 0.25$  in the univariate regression analysis were included in the model. A preliminary main effects model was built using a backward elimination in which variables were removed one at time until all variables remaining were associated at  $p < 0.05$  as assessed using the deviance test statistic. Ethnicity (Māori vs non-Māori) was the exception to this, as an *a priori* decision was made to retain ethnicity in the model irrespective of the final p-value, consistent with a Kaupapa Māori approach of centralising Māori in the analysis. Next, the assumption of linearity with the logit for each continuous predictor in the model was assessed by the inclusion of a quadratic term. The variable was non-linear if the deviance test statistic was statistically significant at  $p < 0.05$ . For a non-linear variable, the quadratic term was retained in the model.

A second *a priori* decision was made to look for all two-way interactions between ethnicity and other variables retained in the model after the backward elimination. The significance of the interaction terms was assessed by calculating the deviance test statistic. When the significance of the interaction term was  $p < 0.05$ , rather than include the interaction term, to ease interpretation a new variable was created that stratified ethnicity by the other variable in the interaction term. For example, ethnicity and time period was created and included in the model. The fit of the final model with the fixed effect for ethnicity was assessed through the estimation of the Hosmer-Lemeshow goodness of fit statistic

(Hosmer & Lemeshow, 2000), as well as assessment of Pearson residuals by covariate patterns and individual Pearson residuals.

### 8.3. RESULTS

Between 2003-2019, 4802 applications for professional phase were submitted, with 30% (n=1447) of individuals selected and offered places (Table 8.1). In the selected student cohort (Table 8.2), 4.6% (n=66) of students identify as Māori. Māori comprised 2.6% (n=8) of the selected cohort in 2003-2006, 5.6% (n=46) in 2007-2016, and 4% (n=12) in 2017-2019 (Table 8.3).

**Table 8.1 Mean (SD) and number (%) of sociodemographic variables and time period of applications for selection into the BVSc professional phase in 2003-2019 stratified by selection outcome.**

	Not Selected n=3355 (70%)	Selected n=1447 (30% <sup>a</sup> )
<b>Time Period</b>		
2003-2006	655 (68%)	313 (32%)
2007-2016	2026 (71%)	831 (29%)
2017-2019	674 (69%)	303 (31%)
<b>Prioritised ethnicity</b>		
Māori	208 (76%)	66 (24%)
Non-Māori	3138 (70%)	1377 (30%)
Unknown	9 (69%)	4 (31%)
<b>Gender</b>		
Male	757 (70%)	328 (30%)
Female	2598 (70%)	1119 (30%)
<b>Mean age (SD)</b>	20.2 (3.36)	21.0 (4.07)
<b>High School Type</b>		
State	2244 (72%)	874 (28%)
State Integrated	518 (70%)	226 (30%)
Private	345 (64%)	196 (36%)
Overseas	217 (63%)	127 (37%)
Unknown	31 (56%)	24 (44%)
<b>Prior university experience</b>		
None	2365 (75%)	771 (25%)
Some	990 (59%)	676 (41%)
<b>High School Decile</b>		
Low (1-3)	194 (85%)	35 (15%)
Medium (4-7)	1225 (73%)	443 (27%)
High (8-10)	1652 (67%)	800 (33%)
Unknown	284 (63%)	169 (37%)

Due to rounding, percentages may not equal 100.

<sup>a</sup> Selected percentage aka success rate=(number of selected students / the total number of applicants X 100).

There was no significant difference between selected Māori and non-Māori students with regard to the sociodemographic variables. However, Māori received lower mean pre-vet GPA than non-Māori (p=0.002) (Table 8.2).

**Table 8.2 Mean (SD) and number (%) of sociodemographic variables and pre-vet GPA of students selected into the veterinary programme in 2003-2019 stratified by Māori vs non-Māori.**

	Māori n=66	non-Māori n=1377	p-value <sup>b</sup>	Total n=1443 <sup>a</sup>
<b>Gender</b>				
Male	18 (27%)	310 (23%)	0.45	328 (23%)
Female	48 (73%)	1067 (77%)		1115 (77%)
<b>Mean age (SD)</b>	21.8 (5.65)	21.0 (3.97)	0.28	21.0 (4.07)
<b>High School Type</b>				
State	41 (64%)	833 (61%)	0.40	874 (61%)
State Integrated	12 (19%)	214 (16%)		226 (16%)
Private	9 (14)	187 (14%)		194 (14%)
Overseas	2 (3%)	125 (9%)		127 (9%)
<b>Prior university Experience</b>				
None	28 (42%)	743 (54%)	0.08	771 (53%)
Some	38 (58%)	634 (46%)		672 (47%)
<b>High School Decile</b>				
Low (1-3)	4 (6%)	31 (2%)	0.07	35 (2%)
Medium (4-7)	25 (38%)	418 (30%)		443 (31%)
High (8-10)	33 (50%)	767 (56%)		800 (55%)
Unknown	4 (6%)	161 (12%)		165 (11%)
<b>Pre-vet GPA</b>	7.22 (0.98)	7.61 (0.80)	0.002	7.59 (0.82)

Due to rounding percentages may not equal 100.

<sup>a</sup> Ethnicity of four applicants was unknown so data is included from 1443 applicants.

<sup>b</sup> Significance of difference between groups

Māori had lower odds of selection than non-Māori in all time periods, however the difference was only statistically significant in the 2003-2006 time period (Table 8.3). The Woolf test for homogeneity across the time periods ( $p=0.09$ ) reconfirmed that the odds of selection for Māori varied across the time periods. A Cochran-Mantel-Haenszel test ( $p=0.03$ ) showed that the effect of ethnicity and time period on selection outcome were not independent of each other.

**Table 8.3 The number (%) of Māori and non-Māori selected between 2003-2019 stratified by time period, and the odds of selection (95% confidence interval) of Māori and non-Māori applicants.**

	2003-2006	2007-2016	2017-2019
<b>Number (%) Māori selected</b>	8 (3%)	46 (6%)	12 (4%)
<b>Number (%) non-Māori selected</b>	304 (97%)	782 (94%)	291 (96%)
<b>Odds ratio Māori v non-Māori (95% CI)</b>	0.38 (0.16-0.78)	0.92 (0.64-1.30)	0.58 (0.29-1.07)
p-value	0.01	0.65	0.10

The mean pre-vet GPA of all selected students stratified by time period was statistically different by time period ( $p<0.001$ ), 7.31 (0.80) in 2003-2006, 7.78 (0.68) in 2007-2016, and 7.35 (1.02) in 2017-2019.

### 8.3.1. Regression Analyses

The univariate logistic regression results are presented in Table 8.4 and show that Māori had lower odds of selection than non-Māori ( $p=0.03$ ). In contrast, gender ( $p=0.94$ ) was not associated with probability of selection. The odds of selection in the later time periods (2007-2016, 2017-2019) were

not significantly different to the reference time period (2003-2006). Increasing school decile was associated with a small but significant increase in the odds of selection ( $p < 0.001$ ).

**Table 8.4 Univariate logistic regression results for the association of sociodemographic variables with selection of applicants in 2003-2019.**

Variables	Unadjusted Estimate	SE <sup>a</sup>	Odds Ratio (95%CI)	p-value
<b>Ethnicity</b>				
Non-Māori			REF	
Māori	-0.32	0.14	0.72 (0.54 – 0.96) <sup>b</sup>	0.03
<b>Time Period</b>				
2003-2006			REF	
2007-2016	-0.15	0.080	0.86 (0.73 - 1.00)	0.06
2017-2019	-0.06	0.098	0.94 (0.78 - 1.14)	0.53
<b>Gender</b>				
Female			REF	
Male	0.006	0.075	1.01 (0.87 - 1.16)	0.94
<b>Age (continuous)</b>	0.06	0.008	1.06 (1.04 - 1.08)	<0.001
<b>School type</b>				
Private			REF	
State	-0.38	0.10	0.69 (0.57 - 0.83)	<0.001
State Integrated	-0.26	0.12	0.77 (0.61 - 0.97)	0.03
Overseas	0.03	0.14	1.03 (0.78 - 1.36)	0.84
<b>School Decile (continuous)</b>	0.10	0.015	1.10 (1.07 - 1.14)	<0.001
<b>Prior university experience</b>				
No			REF	
Yes	0.74	0.065	2.09 (1.84 - 2.38)	<0.001

<sup>a</sup> SE = Standard Error.

<sup>b</sup> Māori had significantly lower odds of selection than non-Māori

**Table 8.5 Results of multivariable logistic regression for the association of sociodemographic variables with selection of applicants in 2003-2019.**

Variables	Adjusted Estimate	SE	Odds Ratio (95%CI)	P
<b>Ethnicity and Time Period</b>				0.02
Non-Māori in 2003-2006	-	-	REF	
Māori in 2003-2006	-1	0.423	0.37 (0.15 - 0.79) <sup>a</sup>	0.02
Non-Māori in 2007-2016	-0.23	0.089	0.79 (0.67 - 0.94)	0.008
Māori in 2007-2016	-0.19	0.197	0.83 (0.56 - 1.21)	0.34
Non-Māori in 2017-2019	-0.12	0.107	0.88 (0.72 - 1.09)	0.25
Māori in 2017-2019	-0.62	0.348	0.54 (0.26 - 1.03)	0.08
<b>Age</b>	0.04	0.012	1.04 (1.01 - 1.06)	0.002
<b>School Decile (continuous)</b>	0.10	0.016	1.10 (1.07 - 1.14)	<0.001
<b>Prior university experience</b>				
No	-	-	REF	
Yes	0.59	0.078	1.8 (1.54 - 2.10)	<0.001

<sup>a</sup> After taking into account all other variables, Māori applicants in 2003-2006 had 0.37 times the odds of selection when compared to non-Māori in 2003-2006.

From the multivariable model, the odds of selection were highest for older, non-Māori applicants in 2003-06, from higher decile schools, and with prior university experience (Table 8.5). The effect of ethnicity on probability of selection was not independent of time period and as such a combined variable was created. In 2003-2006, non-Māori had 2.7 times higher odds of selection when compared to Māori in the same time period ( $p = 0.02$ ). In both of the latter time periods (2007-2016 and 2017-2019), the odds of selection of Māori were not significantly different to the odds of selection of non-Māori in 2003-2006.

Non-Māori applicants in 2007-2016 were less likely to be selected ( $p = 0.008$ ) than non-Māori applicants in 2003-2006, whereas there was no significant difference when comparing the latter to non-Māori applicants in 2017-2019 ( $p=0.25$ ). The odds of selection increased with each additional year of age ( $p = 0.002$ ), and each additional school decile ( $p<0.001$ ). Having had prior university experience led to 1.8 times the odds of selection ( $p <0.001$ ). The Hosmer-Lemeshow goodness of fit test was not significant ( $p=0.445$ ), which suggests that the model is not a poor fit for the data.

## **8.4. DISCUSSION**

This study is the first description of ethnicity and other sociodemographic characteristics of students selected into the veterinary programme in New Zealand. It shows that Māori are underrepresented among the students selected into the veterinary programme (4.6%) as compared to the New Zealand population (16.5% Māori) (Statistics New Zealand, 2019a). This study demonstrated that the selection process has a large impact on the access of Māori to veterinary education. The overall (2003-2019) selection success rate of Māori applicants (24%) was lower than non-Māori (30%). Māori in 2003-2006 had 2.7 times lower odds of being selected than non-Māori ( $p=0.02$ ) in the same time period. There was no difference between Māori and non-Māori students selected into the professional phase with regard to the sociodemographic variables of gender, age, high school type and decile, and prior university experience. However, the mean pre-vet GPA of Māori was significantly lower than non-Māori (7.22 v 7.61;  $p=0.002$ ).

With regard to the other sociodemographic variables in this study, in both the univariate and multivariable analysis, increasing age ( $p=0.002$ ), increasing high school decile ( $p<0.001$ ), and having had prior university experience ( $p<0.001$ ) were associated with increased odds of being selected. While applicants from state and state integrated schools had lower odds of selection in the univariate analysis, after taking into account all other factors this variable was not significant in the multivariable analysis. There was no difference in the odds of selection of male and female applicants.

In this study it was demonstrated that the proportion of Māori students selected into the professional phase of the BVSc programme is well below population parity with New Zealand society. The underrepresentation of Māori is also seen in other health professions: for example, Māori comprise 3.8% of doctors (Medical Council of New Zealand, 2020), 7% of nurses (Nursing Council of New Zealand, 2018) and 3.1% of dentists (Dental Council, 2017). The underrepresentation of Māori in these professions is problematic, as participation and success in education at all levels is an Indigenous right (Jones et al., 2019) as specified in the United Nations Declaration on the right of Indigenous peoples (United Nations, 2007) and also reinforced in te Tiriti o Waitangi and New Zealand government policy (Tertiary Education Commission, 2019). Additionally, the veterinary profession is not benefitting from the broader worldviews of graduates who represent the wider society (Coffman, 2002), the greater cultural competence of graduates learning in more inclusive cohorts (Hung et al., 2007; Whitla et al., 2003), or the economic benefits of being able to better serve a more diverse society (Lloyd, 2013).

Prior to 2007, non-Māori had 2.7 times higher odds of selection than Māori ( $p=0.02$ ), whereas after 2007 the odds for selection of Māori vs non-Māori (2003-2006) did not statistically differ. These findings demonstrate that the selection process does affect the access of Māori to veterinary education. In 2007, an equity process for Māori student selection was introduced in which Māori students who met the eligibility criteria for selection into the professional phase and who could demonstrate commitment to and activity within the Māori community could be given additional consideration. The equity process appears to have decreased the inequity Māori faced in selection prior to 2007, such that their odds of selection from 2007 onwards was no longer statistically different to that of non-Māori in 2003-2006. A similar positive impact of equity pathways on access of Indigenous students to medicine has also been reported (Crampton et al., 2018; Curtis et al., 2017; Paul, 2013). Equity pathways instituted at the University of Otago and the University of Auckland have improved the access of Māori to medical education, such that the participation of Māori has almost reached population parity (Crampton et al., 2018; Curtis et al., 2017). The lower odds of selection experienced by Māori prior to 2007 demonstrated in the present study is supported by an analysis of the selection of medical students ( $n=117,214$ ) over 9 years through the centralised application process in the UK (Kumwenda et al., 2018). In that study the odds of selection of applicants from minoritised ethnicities was also lower than that of White students, with the odds of selection of black students being a little over half that of White students.

The probability of selection of Māori from 2017 onwards was not significantly different to non-Māori in 2003-2006. This lack of difference could be a real effect or may reflect the narrow time range (three years) and therefore the smaller number of Māori in this time period. Analysis should be repeated in



the future when more years are able to be considered that include non-academic selection. Having said that, in 2017-2019, all Māori students (n=12, or 4/year) who met the eligibility criteria were selected. There were no minimum standards for the non-academic assessments, thus the eligibility criteria that were barriers to Māori student selection were the academic requirements to pass all of the pre-requisite courses, and to achieve a pre-vet GPA  $\geq 5.0$  (B average). The New Zealand education system is not equitable (Bolton, 2017), as indicated by the lower NCEA Level 3 and university entrance attainment rates (New Zealand Qualifications Authority, 2019) and PISA international testing results (OECD, 2019) of Māori as compared with European or Asian students. Studies have concluded that the secondary school education system does not adequately prepare Māori for tertiary study (Curtis, Wikaire, et al., 2015; Wikaire et al., 2016). The barrier to university progression of inadequate preparation from secondary school is compounded for admission to selective degrees such as veterinary or human medicine that have much higher entrance standards (Massey University, 2020a; University of Auckland, 2020; University of Otago, 2020) which require a greater level of secondary school preparation than is currently being provided for Māori. Elsewhere it has been shown that activities such as quality counselling (Chesters et al., 2009) and assessment of the “best starting point” (Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015, p. 3) prior to commencement of university study, as well as equity pathways (Crampton et al., 2018; Curtis et al., 2017; Paul, 2013), and comprehensive pastoral and academic support (Curtis, Wikaire, et al., 2015; Lawson et al., 2007; Taylor et al., 2019) at university are beneficial for Indigenous applicants to medicine. These activities are likely to also apply to Indigenous veterinary applicants and greater effort from the university in these areas may be similarly beneficial in addressing the underrepresentation of Māori in veterinary education.

The pre-vet GPA was the highest between 2007 and 2016 (7.78), but in 2017-2019 decreased to a level similar (7.35) to 2003-2006 (7.31). The increase in pre-vet GPA seen in 2007 to 2016 corresponds with substantial increases in the number of applicants per year, and only a small increase in the number of positions available in the professional phase: 76 up until 2012 and 84 from 2013. The decrease in pre-vet GPA in 2017-2019 corresponds with an increase in the class size from 84 in 2016, to 100 in 2017, as well as a decrease in the weighting of pre-vet GPA (from 80 to 40%) in the selection score calculation from 2017. Conlon et al. (2012) noted the necessity of both academic and personal/professional skills for veterinary career success. Thus, non-academic selection assessments were introduced in 2017 and the weighting of academic performance was decreased in the hopes of enabling selection of students who had both sufficient academic ability and possessed the personal skills and attributes to be

successful in the veterinary programme and in their career. As such, it was anticipated that there would be a decrease in mean pre-vet GPA required for selection over that time period.

The present study showed that the mean pre-vet GPA of Māori students selected into the programme across all years (7.22, SD=0.98) was lower ( $p=0.002$ ) than that of non-Māori (7.61, SD=0.80). To put this into perspective, the mean pre-vet GPA of both Māori and non-Māori students falls within the A-grade range (i.e. GPA of 7-7.99), which equates to average marks in the range of 80 to 84.99% and is considered as high-level academic performance (Massey University, 2019c). With regard to equity pathways, there can be a misconception that these pathways allow for selection of academically inadequate students (Patterson et al., 2018), an assertion which is refuted by these data.

In this study the decile of high school attended was associated with selection outcome ( $p<0.001$ ), and as the school decile increased, so did the odds of selection. Thus, applicants from low decile schools had a lower selection success rate, with only 2% of the selected cohort being from low decile schools compared with 55% from high decile schools. Additionally, while Māori applicants were more likely to have attended a lower decile school than non-Māori applicants (Chapter 7), the data in this study show that the significant difference in decile of school attended no longer existed between Māori and non-Māori students selected into the veterinary cohort. Thus, the selection process appears to pose a further barrier for students from low decile schools, which is especially problematic for Māori as nationally almost half of Māori (45%) are enrolled in low decile schools with only 16% enrolled in high decile schools (Ministry of Education, 2016). School decile reflects the average socioeconomic position of the area from which a school draws its students, and as such is not necessarily an accurate marker of an individual's socioeconomic status (Hattie, 2002; Strathdee & Engler, 2012). However, in the absence of other measures, decile may be used as an indicator of socioeconomic status (Curtis et al., 2017; Meehan et al., 2019; Wikaire et al., 2017). Socioeconomic status has been explored in detail with regard to widening access to medicine, as the underrepresentation of students from lower socioeconomic backgrounds in medicine has been clearly demonstrated (Cleland et al., 2012; Kumwenda et al., 2017; Mathers et al., 2011). While the privilege in selection towards those of high socioeconomic status has not been shown as clearly in veterinary science, the results of this study suggest it is a problem that warrants further investigation.

Over half (60%,  $n=874$ ) of the selected cohort attended state high schools, which reflects the larger number of applicants coming from state schools, as the success rate of applicants who attended state schools was lower (28%) than those who attended private schools (36%). However, when considered in the multivariable model, school type was not associated with selection outcome. Thus, of the

differences in sociodemographic variables previously demonstrated between Māori and non-Māori applicants for decile of school attended and school type, decile appears to be the most relevant barrier to selection.

When comparing Māori and non-Māori students selected into the programme, there was no significant difference in the mean age or level of prior university experience. In both the univariate and multivariable analysis, after accounting for all other variables, increasing age was associated with a significant, small increase in the odds of being selected, and having prior university experience increased the odds of selection by 1.8 times. The reason for these findings is unknown but suggests that the transition to university is quite important. In a study of admission over a 10-year period to an Australian undergraduate veterinary programme with a mandate to train rural veterinarians, the authors reported that the mean age of selected students was 20, with a range of 17-35 (S. L. Raidal et al., 2019), and that while increasing age was positively associated with the interview score, age was not significantly associated with being offered a position in the programme (S. Raidal et al., 2019). The same authors reported that there was no difference in the odds of selection for those who had prior university experience as compared to those who did not (S. Raidal et al., 2019). Why these differences exist in comparison with the findings in the present study is unknown but may be related to the differing contexts of the programmes including country, selection processes, and differences in the mandate or social mission of the programmes.

## **8.5. SUMMARY**

The study presented in this chapter is the first report of the underrepresentation of Māori in the veterinary student population (4.6%) as compared to the New Zealand population (16.5%) (Statistics New Zealand, 2019a). This study also demonstrated that changes in the selection process have impacted the admission of Māori students, with Māori applicants experiencing almost three times lower odds of selection prior to introduction of the Treaty of Waitangi process for selecting Māori students in 2007. The study also showed that while there was a significant difference in the mean pre-vet GPA of Māori and non-Māori students selected into the BVSc, practically the pre-vet GPA of both groups was in the A- range, a high academic achievement. This finding contest suggestions that equity processes lead to selection of inferior students. Finally this study also found that there was no significant difference in the sociodemographic characteristics between Māori and non-Māori students selected into the programme. Access to veterinary education for Māori needs to be addressed for reasons of social justice, Indigenous rights and benefits for veterinary students and the profession.

## Chapter Nine

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### 9. STUDY 3 EXPLORING THE SELECTION ASSESSMENTS

#### 9.1. INTRODUCTION

Māori are underrepresented in the cohort of students applying to and selected into the veterinary programme in comparison to the New Zealand population, and are selected at a lower rate than non-Māori (Chapter 7 and 8). Applicants from low decile schools were also less likely to be selected, with Māori being more likely to attend lower deciles schools than non-Māori. Poorer access to veterinary education for Māori is problematic, given the right of Indigenous people to access higher education (United Nations, 2007), and the benefits to the profession and society of selecting cohorts of students for medicine and veterinary science that are representative of the wider population (Coffman, 2002; Hung et al., 2007; Saha et al., 2008; Whitla et al., 2003). In exploring access to veterinary education, it would be useful to consider the relationship between the assessments used in the veterinary student selection process and applicants' sociodemographic variables, particularly those shown to be associated with lower selection success relevant to Māori.

Selection of students into veterinary science and medicine, along with consideration of the assessments used in selection and their impact on widening access, were discussed in detail in Chapter 4. In summary, while academic assessment has been the mainstay of student selection, programmes are increasingly using holistic consideration of the applicants or assessments of non-academic performance to determine which students to admit. The expansion beyond selection based solely on academic criteria is in recognition of the fact that factors other than academic performance need to be considered to promote equity and social justice (Dowell et al., 2015; Gallagher et al., 2009), and to

ensure that the individuals selected have the academic and personal attributes to allow them to be successful in their professional education and career (Conlon et al., 2012; Roberts et al., 2008)

The veterinary degree at Massey University includes a pre-vet semester, from which students are selected to advance into the professional phase of the degree. In 2017, three non-academic performance assessments and one additional academic performance assessment were introduced into the selection process. Thus, from 2017-2019, six selection assessments were utilised while in the previous years (2003-2016) only two assessments were utilised.

It is unknown whether, or to what extent, the scores in the veterinary selection assessments are influenced by various sociodemographic characteristics. Given the lack of Indigenous involvement in development of the new assessments, as well as the inequity in preparation of Māori for tertiary study, it is hypothesised that Māori will receive lower scores on some assessments. The aim of this study is to explore whether scores received in the assessments used in veterinary student selection differ between Māori and non-Māori, taking into account other sociodemographic factors.

## **9.2. METHODS AND MATERIALS**

This study was conducted with a Kaupapa Māori research positioning (Curtis, 2016; Pihama, 2011; G. Smith, 2012), which “ensures a cultural integrity is maintained when analysing Māori issues” (Pihama, 2010, p. 10). For more detail regarding Kaupapa Māori positioning for this study the reader is directed to sections 2.3 and 2.4 of Chapter 2.

This study was conducted under ethical approval from Massey University Human Ethics Committee Southern B (MUHECB 14-24 and 15-77).

### **9.2.1. Description of Data**

The dependent variables in this study are the selection assessment scores (‘test scores’), namely pre-vet GPA (‘GPA’), STAT, written communication, multiple mini-interview (MMI), the bespoke text based situational judgement test (SJT) and the video based situational judgement test (CASPer). Data for all of these assessments are only available for 2017-2019, so the study is based upon this period.

The independent variables in this study are applicant ethnicity (Māori, non-Māori), gender (male, female), age (years), the decile of high school attended (1-10), the type of high school attended (state, state integrated, private, or overseas), prior university experience (yes, no), whether applicants were the first in their family to attend university (yes, no), and whether English was their first/main language (yes, no). School decile is also presented as a categorical variable (low [1-3], medium [4-7] and high

[8-10]) for the summary descriptive data in a comparison between Māori and non-Māori applicants. The collection of the data and full description of all the variables utilised in this study are provided in the general Materials and Methods (Section 6.3).

### **9.2.2. Statistical Analysis**

Data were analysed using R studio software version 1.3.1056 (Rstudio Inc. Boston Massachusetts, USA) and R statistical software version 3.6.6 (R core team, R Foundation for Statistical Computing, Vienna, Austria). The number and percentage of applications for selection during 2017 to 2019 stratified by ethnicity (Māori, non-Māori) were summarised for each sociodemographic variable (gender, age, high school type and decile, previous university experience, first in family status, and English main language). Pearson correlation analyses were performed using the bivariate correlations procedure in SPSS software (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY) to determine the relationships between the scores of each assessment with every other assessment.

#### **9.2.2.1. Regression analyses**

Separate univariate linear regression models were produced to explore the association between each test score and each independent variable (ethnicity, gender, age, school type, school decile, prior university experience, English as main language and whether the applicant was the first in their family to attend university). Missing data were excluded in the regression analyses.

To determine the association between each test score and all of the independent variables, a multivariable model was performed for each test score. It was pre-determined that only independent variables associated with the test score at  $p < 0.25$  in the univariate regression would be included in the multivariable linear regression model. A preliminary main effects model was built using a backward elimination in which variables were removed one at time until all variables remaining were associated at  $p < 0.05$  as assessed using the deviance test statistic. An exception to this was ethnicity (Māori vs non-Māori), as an *a priori* decision was made to retain ethnicity in the model irrespective of the final p-value, consistent with a Kaupapa Māori approach of centralising Māori in the analysis. The assumption of linearity for each continuous predictor in the model was assessed by the inclusion of a quadratic term. The variable was non-linear if the deviance test statistic was statistically significant at  $p < 0.05$ . For a variable that was non-linear the quadratic term was retained in the model.

A second *a priori* decision was made to look for all two-way interactions between ethnicity and other variables retained in the model after the backward elimination. The significance of the interaction terms was assessed by calculating the deviance test statistic. When the significance of the interaction

term was  $p < 0.05$ , rather than include the interaction term, to ease interpretation a new variable was created that stratified ethnicity by the other variable in the interaction term. For example, ethnicity and prior university experience was created and included in the model for pre-vet GPA. Normality of the residuals was assessed by visual inspection of a QQ plot. A plot of residuals against fitted values was used to assess the assumption of equal variance of the model. The presence of significant outliers was assessed by examining the observations' leverage and Cook's distance. Any abnormalities from these analyses are described in the results.

### 9.3. RESULTS

From 2017 to 2019, 977 applications were submitted, of which 6% ( $n=57$ ) were from Māori and 94% ( $n=920$ ) were from non-Māori (Table 9.1). Māori applicants attended lower decile schools ( $p=0.002$ ) and were more likely to be the first in their family to attend university ( $p=0.04$ ) than non-Māori .

**Table 9.1 Number and (percentage) of applications for selection into the veterinary programme between 2017 - 2019 stratified by ethnicity (Māori, non-Māori) and other sociodemographic factors.**

	Māori (n=57)	non-Māori (n=920)	p-value	Total (n=977)
<b>Gender</b>				
Female	49 (86%)	730 (79%)	0.30	779 (80%)
Male	8 (14%)	190 (21%)		198 (20%)
<b>Mean Age (SD)</b>	20.1 (3.98)	20.3 (3.16)	0.70	20.3 (3.21)
<b>High school type</b>				
State	45 (79%)	583 (63%)	0.06	628 (64%)
State Integrated	9 (16%)	166 (18%)		175 (18%)
Private	2 (4%)	104 (11%)		106 (11%)
Overseas	1 (2%)	67 (7%)		68 (7%)
<b>High school decile</b>				
Low (1-3)	4 (7%)	31 (3%)	0.002	35 (4%)
Medium (4-7)	31 (54%)	311 (34%)		342 (35%)
High (8-10)	21 (37%)	503 (55%)		524 (54%)
Unknown <sup>b</sup>	1 (2%)	75 (8%)		76 (8%)
<b>Previous University experience</b>				
No	41 (72%)	562 (61%)	0.14	603 (62%)
Yes	16 (28%)	359 (39%)		374 (38%)
<b>First in family</b>				
Yes	25 (44%)	271 (30%)	0.04	296 (30%)
No	32 (56%)	637 (69%)		669 (69%)
Missing	0 (0%)	12 (1%)		12 (1%)
<b>English as first language</b>				
Yes	57 (100%)	784 (87%)	0.006	841 (86%)
No	0 (0%)	120 (13%)		120 (12%)
Missing	0 (0%)	16 (0%)		16 (2%)

Note: Percentages may not total 100 due to rounding. <sup>b</sup> Unknown includes overseas schools, students who were home-schooled and New Zealand schools for which a decile was not specified by the Ministry of Education.

### 9.3.1. Correlation

For the total applicant population, each test score had some correlation (ranging from 0.17 to 0.43) with every other test score, with all correlations being significant ( $p < 0.001$ ) (Table 9.2). The strongest correlations were between GPA and STAT, which are both used as measures of academic performance, and between MMI and CASPer, which are both used as measures of non-academic performance. For Māori, the strongest correlations were between GPA and written communication ( $p < 0.001$ ), which are both used as measures of academic performance, and GPA and CASPer ( $p < 0.001$ ), which are measures of academic and non-academic performance respectively. For non-Māori, similar results were seen as for the total population.

**Table 9.2 The mean and (SD) of test scores and the correlation between the test scores used in veterinary student selection in 2017-2019 stratified by ethnicity.**

Assessment	Variable		Correlation (r) and level of significance				
	n	Mean (SD)	GPA <sup>a</sup>	STAT <sup>b</sup>	WrCom <sup>c</sup>	MMI <sup>d</sup>	SJT <sup>e</sup>
<b>All Applicants</b>							
GPA	975	5.1 (2.39)	-				
STAT	976	149.9 (11.55)	0.43***	-			
WrCom	976	6.1 (2.63)	0.31***	0.27***	-		
MMI	977	57.4 (8.98)	0.37***	0.21***	0.28***	-	
SJT	976	50.0 (10.01)	0.18***	0.17***	0.31***	0.29***	-
CASPer <sup>f</sup>	971	5.1 (0.76)	0.28***	0.23***	0.27***	0.40***	0.21***
<b>Māori</b>							
GPA	57	3.8 (2.51)	-				
STAT	57	145.9 (11.59)	0.38**	-			
WrCom	57	5.2 (2.53)	0.47***	0.31*	-		
MMI	57	54.5 (9.86)	0.26	0.12	0.34*	-	
SJT	57	49.2 (9.94)	0.03	-0.03	0.19	0.01	-
CASPer	56	5.0 (0.9)	0.48***	0.33*	0.39**	0.36**	0.22
<b>Non-Māori</b>							
GPA	918	5.2 (2.36)	-				
STAT	919	150.2 (11.51)	0.42***	-			
WrCom	919	6.1 (2.63)	0.29***	0.26***	-		
MMI	920	57.6 (8.9)	0.34***	0.21***	0.27***	-	
SJT	919	50.1 (10.01)	0.19***	0.19***	0.32***	0.31***	-
CASPer	915	5.1 (0.75)	0.26***	0.22***	0.26***	0.40***	0.21***

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

<sup>a</sup> GPA – Grade point average.

<sup>b</sup> STAT – An MCQ verbal and quantitative reasoning test.

<sup>c</sup> WrCom - Assessment of written communication.

<sup>d</sup> MMI – Multiple mini-interview.

<sup>e</sup> SJT – Situational judgement test.

<sup>f</sup> CASPer – An online situational judgement test



### **9.3.2. Regression analyses**

#### **9.3.2.1. GPA**

In the univariate model, Māori had significantly lower GPA than non-Māori ( $p < 0.001$ ; Table 9.3). In the multivariable model, the effect of ethnicity on GPA was not independent of prior university experience (Table 9.4). Specifically, the GPA of Māori applicants with no prior university experience was, on average, 1.52 points less ( $p < 0.001$ ) than non-Māori applicants with no prior university experience (the reference group), whereas the GPA of Māori applicants with prior university experience was not significantly different to the reference group. In contrast, the GPA of non-Māori applicants with prior university experience was, on average, 0.95 points ( $p < 0.001$ ) higher than non-Māori applicants without prior university experience. In addition, lower GPA scores were observed in applicants from lower decile schools and those that were the first in their family to attend university. Applicants' gender, age, type of school attended and whether English was their main language were not significantly associated with the outcome and were dropped from the model.

#### **9.3.2.2. STAT**

In the univariate model, the STAT scores of Māori were significantly lower than non-Māori ( $p = 0.007$ ; Table 9.5). In the multivariable model, STAT scores of Māori applicants were, on average, 3.24 points less ( $p = 0.03$ ; Table 9.6) than non-Māori applicants after accounting for all other factors in the model. In addition, lower STAT scores were also observed in applicants who were female, from lower decile schools, did not have English as their main language, or had no prior university experience. Applicants' age, type of school attended, and whether they were the first in their family to attend university were not significantly associated with the outcome and were dropped from the model.

#### **9.3.2.3. Written communication**

In the univariate model, the written communication scores of Māori and non-Māori were not significantly different ( $p = 0.16$ ; Table 9.7). In the multivariable model, the effect of ethnicity on the written communication score was not independent of first in family status (Table 9.8). Specifically, Māori applicants who were not the first in their family to attend university had written communication scores that were, on average, 1.46 points less ( $p = 0.002$ ) than non-Māori applicants who were also not the first in their family to attend university (the reference group). The written communication scores for Māori who were first in family to attend university were not significantly different from the reference group ( $p = 0.4$ ). In contrast, non-Māori who were the first in their family to attend university had written communication scores that were, on average, 0.50 points less ( $p = 0.007$ ) than non-Māori who were not the first in their families to attend university. In addition, lower written communication

scores were also observed in applicants who were male, had no prior university experience, or did not have English as their first language. Applicants' age, type and decile of school attended, or whether they were the first in their family to attend university were not significantly associated with the outcome and were dropped from the model.

#### **9.3.2.4. MMI**

Māori received lower MMI scores than non-Māori in both the univariate ( $p=0.01$ ; Table 9.9) and multivariable models ( $p=0.03$ ; Table 9.10). Lower scores were also received by applicants who attended lower decile schools, had no prior university experience, or did not have English as their main language. Applicants' gender, age, type of school attended and whether the applicant was the first in their family to attend university were not significantly associated with MMI scores in the multivariable model so were dropped from the model.

#### **9.3.2.5. SJT**

In the univariate model, the SJT scores of Māori were not significantly different to non-Māori ( $p=0.55$ ; Table 9.11). After accounting for all other factors in the model, ethnicity was not associated with the SJT score ( $p=0.36$ ; Table 9.12). Lower scores were received by applicants who were younger, male, attended a lower decile school, had no prior university experience, or did not have English as their main language. Whether the applicant was the first in their family to attend university and the type of school attended were not significantly associated with SJT in the multivariable model so were dropped from the model.

#### **9.3.2.6. CASPer**

In the univariate model, the CASPer scores of Māori were not significantly different to non-Māori ( $p=0.24$ ; Table 9.13). In contrast, in the multivariable model (Table 9.14), ethnicity was associated with the CASPer score, but its effect was modified by school decile, such that increasing decile had a greater effect on the CASPer score of Māori applicants (Figure 9.1). Lower scores were received by applicants who were male, or who attended state, state integrated, or lower decile schools. Applicants' age, whether they had previous university experience, were the first in their family to attend university or had English as their main language were not significantly associated with the CASPer score in the multivariable model so were dropped from the model.

**Table 9.3 Univariate linear regression for the association of sociodemographic variables with the pre-vet grade point average (Pre-vet GPA)<sup>a</sup> in 2017-2019.**

Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	P
<b>Ethnicity</b>					
Non-Māori	5.22 (2.36)	REF <sup>a</sup>			
Māori	3.77 (2.51)	-1.44	0.32	-4.46	<0.001
<b>Gender</b>					
Female	5.07 (2.39)	REF			
Male	5.39 (2.39)	0.32	0.19	1.69	0.09
<b>Age (per year)</b>	-	0.08	0.02	3.20	0.001
<b>School type</b>					0.02
Private	5.61 (2.22)	REF			
State	4.97 (2.42)	-0.64	0.25	-2.54	0.01
State Integrated	5.30 (2.32)	-0.31	0.29	-1.05	0.29
Overseas	5.51 (2.49)	-0.09	0.37	-0.25	0.80
<b>School Decile (per decile)</b>	-	0.21	0.04	5.58	<0.001
<b>Prior university experience</b>					
No	4.71 (2.65)	REF			
Yes	5.82 (1.70)	1.11	0.15	7.23	<0.001
<b>English Main Language</b>					
No	5.44 (2.29)	REF			
Yes	5.13 (2.39)	-0.31	0.23	-1.34	0.18
<b>First in Family</b>					
No	5.32 (2.36)	REF			
Yes	4.67 (2.44)	-0.65	0.17	-3.93	<0.001

<sup>a</sup> Pre-vet GPA range is 0-9. <sup>b</sup> REF = reference

**Table 9.4 Multivariable linear regression model for the association of applicant sociodemographic variables and pre-vet grade point average (Pre-vet GPA)<sup>a</sup>.**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity and Prior University Experience</b>				
Non-Māori without uni experience	REF <sup>b</sup>			
Māori without uni experience	-1.52 <sup>c</sup>	0.37	-4.13	<0.001
Non-Māori with uni experience	0.95	0.16	5.85	<0.001
Māori with uni experience	0.92	0.59	1.55	0.12
<b>School Decile (per decile)</b>	0.18	0.04	5.01	<0.001
<b>First in family</b>				
No	REF			
Yes	-0.44	0.17	-2.67	0.008

Adjusted R<sup>2</sup> = 0.10, F (5, 883) = 21.05, p<0.001

<sup>a</sup> Pre-vet GPA range is 0-9. <sup>b</sup> REF = reference

<sup>a</sup> REF = reference. <sup>c</sup> After accounting for all other factors in the model, Māori without prior university experience had a GPA 1.52 points lower than non-Māori without prior university experience.

**Table 9.5 Univariate linear regression for the association of sociodemographic variables with the Special Tertiary Admission Test (STAT<sup>a</sup>) score in 2017-2019.**

Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	P
<b>Ethnicity</b>					
Non-Māori	150.16 (11.51)	REF <sup>b</sup>			
Māori	145.93 (11.59)	-4.23	1.57	-2.69	0.007
<b>Gender</b>					
Female	148.83 (10.98)	REF			
Male	154.16 (12.74)	5.34	0.90	5.90	<0.001
<b>Age (per year)</b>					
		0.35	0.12	3.00	0.003
<b>School type</b>					
Private	152.95 (11.44)	REF			0.03
State	149.38 (11.32)	-3.57	1.21	-2.95	0.003
State Integrated	149.65 (11.99)	-3.30	1.42	-2.33	0.02
Overseas	150.66 (12.17)	-2.29	1.79	-1.28	0.20
<b>School Decile (per decile)</b>					
		0.7	0.18	4.39	<0.001
<b>Prior university experience</b>					
No	148.10 (11.46)	REF			
Yes	152.82 (11.12)	4.73	0.75	6.34	<0.001
<b>English Main Language</b>					
No	148.64 (11.96)	REF			
Yes	150.23 (11.49)	1.59	1.13	1.41	0.16
<b>First in Family</b>					
No	150.28 (11.60)	REF			
Yes	148.84 (11.33)	-1.44	0.80	-1.79	0.07

<sup>a</sup>STAT possible score range is 100-200 but the common range is 120-180. <sup>b</sup> REF = reference

**Table 9.6 Multivariable linear regression model for the association of applicant sociodemographic variables and score on the Special Tertiary Admissions Test (STAT<sup>a</sup>).**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity</b>				
Non-Māori	REF <sup>b</sup>			
Māori	-3.24 <sup>c</sup>	1.51	-2.15	0.03
<b>Gender</b>				
Female	REF			
Male	5.44	0.91	5.98	<0.001
<b>English Main Language</b>				
No	REF			
Yes	3.48	1.19	2.94	0.003
<b>School Decile (per decile)</b>				
	0.69	0.17	3.96	<0.001
<b>Prior University Experience</b>				
No	REF			
Yes	4.66	0.76	6.15	<0.001

Adjusted R<sup>2</sup> = 0.10, F (5, 880) = 20.18, p<0.001

<sup>a</sup>STAT possible score range is 100-200 but the common range is 120-180. <sup>b</sup> REF = reference.

<sup>c</sup> After accounting for all other factors in the model, Māori receive 3.24 less points on the STAT than non-Māori.

**Table 9.7 Univariate linear regression for the association of sociodemographic variables with the written communication score<sup>a</sup> in 2017-2019.**

Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	P
<b>Ethnicity</b>					
Non-Māori	6.1 (2.63)	REF <sup>b</sup>			
Māori	5.23 (2.53)	-0.87	0.36	-2.42	0.16
<b>Gender</b>					
Female	6.17 (2.62)	REF			
Male	5.55 (2.64)	-0.62	0.21	-2.97	0.003
<b>Age (per year)</b>	-	0.09	0.03	3.68	<0.001
<b>School type</b>					0.86
Private	6.25 (2.62)	REF			
State	6.02 (2.62)	-0.24	0.28	-0.86	0.39
State Integrated	6.02 (2.75)	-0.23	0.32	-0.72	0.48
Overseas	6.03 (2.5)	-0.23	0.41	-0.55	0.58
<b>School Decile (per decile)</b>	-	0.06	0.04	1.50	0.14
<b>Prior university experience</b>					
No	5.58 (2.59)	REF			
Yes	6.79 (2.53)	1.21	0.17	7.16	<0.001
<b>English Main Language</b>					
No	5.58 (2.86)	REF			
Yes	6.12 (2.59)	0.55	0.26	2.13	0.03
<b>First in Family</b>					
No	6.14 (2.61)	REF			
Yes	5.76 (2.65)	-0.39	0.18	-2.11	0.04

<sup>a</sup> Written communication score range is 0-12. <sup>b</sup> REF = reference

**Table 9.8 Multivariable linear regression model for the association of applicant sociodemographic variables and score on the written communication assessment<sup>a</sup>.**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity and First in Family</b>				
Non-Māori and not First in Family	REF <sup>b</sup>			
Māori and not First in Family	-1.46 <sup>c</sup>	0.46	-3.18	0.002
Non-Māori and First in Family	-0.50	0.19	-2.68	0.007
Māori and First in Family	-0.43	0.52	-0.83	0.4
<b>Gender (Male)</b>				
Female	REF			
Male	-0.57	0.21	-2.75	0.006
<b>Prior University Experience</b>				
No	REF			
Yes	1.20	0.17	7.06	<0.001
<b>English Main Language</b>				
No	REF			
Yes	0.69	0.25	2.78	0.006

Adjusted R<sup>2</sup> = 0.072, F (6, 941) = 13.17, p<0.001

<sup>a</sup> Written communication score range is 0-12. <sup>b</sup> REF = reference. <sup>c</sup> After accounting for all other factors in the model, Māori who are not the first in their family to attend university, receive a written communication score 1.46 marks lower than non-Māori who are not the first in their family to attend university.

**Table 9.9 Univariate linear regression for the association of sociodemographic variables with the multiple mini-interview (MMI<sup>a</sup>) score in 2017-2019.**

Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	P
<b>Ethnicity</b>					
Non-Māori	57.57 (8.90)	REF			
Māori	54.54 (9.86)	-3.02	1.22	-2.47	0.01
<b>Gender</b>					
Female	57.64 (8.89)	REF			
Male	56.43 (9.29)	-1.21	0.71	-1.69	0.09
<b>Age (per year)</b>		0.24	0.09	2.64	0.008
<b>School type</b>					<0.001
Private	60.58 (8.06)	REF			
State	56.60 (8.87)	-3.98	0.93	-4.27	<0.001
State Integrated	58.91 (8.53)	-1.66	1.09	-1.52	0.13
Overseas	55.84 (10.8)	-4.74	1.38	-3.44	<0.001
<b>School Decile (per decile)</b>	-	0.91	0.14	6.67	<0.001
<b>Prior university experience</b>					
No	55.92 (8.98)	REF			
Yes	59.77 (8.47)	3.85	0.58	6.66	<0.001
<b>English Main Language</b>					
No	54.78 (8.61)	REF			
Yes	57.82 (8.93)	3.04	0.87	3.50	<0.001
<b>First in Family</b>					
No	57.84 (8.80)	REF			
Yes	56.29 (9.32)	-1.55	0.63	-2.48	0.01

<sup>a</sup> MMI score range is 0-85 (2017) and 0-80 (2018-2019). <sup>b</sup> REF = reference

**Table 9.10 Multivariable linear regression model for the association of applicant sociodemographic variables and score on the multiple mini-interview (MMI<sup>a</sup>).**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity</b>				
Non-Māori	REF <sup>b</sup>			
Māori	-2.51 <sup>c</sup>	1.16	-2.16	0.03
<b>School Decile (per decile)</b>	0.87	0.13	6.55	<0.001
<b>Prior University Experience</b>				
No	REF			
Yes	4.07	0.58	7.0	<0.001
<b>English Main Language</b>				
No	REF			
Yes	3.81	0.91	4.19	<0.001

Adjusted R<sup>2</sup> = 0.11, F (4, 882) = 27.83, p<0.001

<sup>a</sup> MMI score range is 0-85 (2017) and 0-80 (2018-2019). <sup>b</sup> REF = reference. <sup>c</sup> After accounting for all other factors in the model, Māori receive 2.51 less points on the MMI than non-Māori.

**Table 9.11 Univariate linear regression for the association of sociodemographic variables with the bespoke situational judgement test (SJT<sup>a</sup>) score in 2017-2019.**

Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	P
<b>Ethnicity</b>					
Non-Māori	50.05 (10.01)	REF <sup>b</sup>			
Māori	49.23 (9.95)	-0.82	1.37	-0.60	0.55
<b>Gender</b>					
Female	50.69 (9.90)	REF			
Male	47.30 (9.99)	-3.38	0.79	-4.29	<0.001
<b>Age (per year)</b>		0.19	0.10	1.91	0.06
<b>School type</b>					
Private	51.55 (9.38)	REF			0.01
State	49.66 (10.03)	-1.89	1.05	-1.81	0.07
State Integrated	51.32 (9.49)	-0.23	1.23	-0.19	0.85
Overseas	47.34 (11.34)	-4.20	1.55	-2.72	0.007
<b>School Decile (per decile)</b>	-	0.4	0.16	2.56	0.01
<b>Prior university experience</b>					
No	48.86 (10.13)	REF			
Yes	51.84 (9.54)	2.98	0.65	4.58	<0.001
<b>English Main Language</b>					
No	43.72 (11.39)	REF			
Yes	50.97 (9.42)	7.25	0.95	7.67	<0.001
<b>First in Family</b>					
No	49.88 (9.90)	REF			
Yes	50.17 (10.29)	0.30	0.70	0.42	0.67

<sup>a</sup> SJT score range is 1 to 100.

<sup>b</sup> REF = reference

**Table 9.12 Multivariable linear regression model for the association of applicant sociodemographic variables and score on the bespoke situational judgement test (SJT<sup>a</sup>).**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity</b>				
Non-Māori	REF <sup>b</sup>			
Māori	-1.21 <sup>c</sup>	1.31	-0.92	0.36
<b>Age (per year)</b>	0.34	0.13	2.72	0.007
<b>Gender (Male)</b>				
Female	REF			
Male	-2.69	0.79	-3.41	<0.001
<b>School Decile (per decile)</b>	0.46	0.15	3.02	0.003
<b>English Main Language</b>				
No	REF			
Yes	2.66	0.72	3.68	<0.001
<b>Prior University Experience</b>				
No	REF			
Yes	6.94	1.03	6.72	<0.001

Adjusted R<sup>2</sup> = 0.094, F (6, 879) = 16.37, p<0.001 <sup>a</sup> SJT score range is 1 to 100. <sup>b</sup> REF = reference

<sup>c</sup> After accounting for all other factors in the model, there is no significant difference in the SJT scores received by Māori and non- Māori.

**Table 9.13 Univariate linear regression for the association of sociodemographic variables with the CASPer<sup>a</sup> score in 2017-2019.**

Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	P
<b>Ethnicity</b>					
Non-Māori	5.13 (0.75)	REF <sup>b</sup>			
Māori	5.00 (0.90)	-0.12	0.10	-1.18	0.24
<b>Gender</b>					
Female	5.16 (0.76)	REF			
Male	4.97 (0.77)	-0.19	0.06	-3.04	0.002
<b>Age (per year)</b>		-0.007	0.007	-0.86	0.39
<b>School type</b>					<0.001
Private	5.43 (0.69)	REF			
State	5.05 (0.77)	-0.38	0.08	-4.38	<0.001
State Integrated	5.22 (0.69)	-0.21	0.09	-2.28	0.02
Overseas	5.04 (0.88)	-0.39	0.12	-3.38	<0.001
<b>School Decile (per decile)</b>		0.06	0.01	5.05	<0.001
<b>Prior university experience</b>					
No	5.08 (0.75)	REF			
Yes	5.19 (0.78)	0.11	0.05	2.14	0.03
<b>English Main Language</b>					
No	4.94 (0.77)	REF			
Yes	5.15 (0.75)	0.22	0.07	2.95	0.003
<b>First in Family</b>					
No	5.16 (0.77)	REF			
Yes	5.03 (0.73)	-0.13	0.05	-2.52	0.01

<sup>a</sup>CASPer score range is 1-9. <sup>b</sup> REF = reference

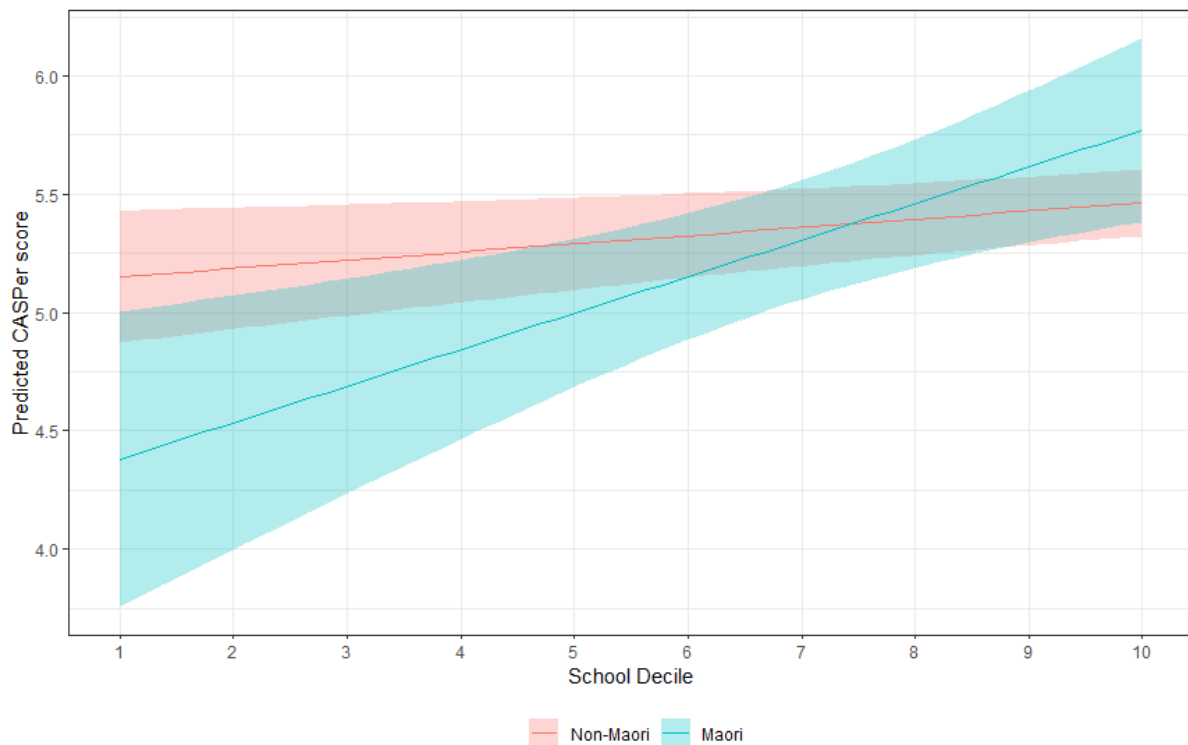
**Table 9.14 Multivariable linear regression model for the association of applicant sociodemographic variables and score on CASPer<sup>a</sup>.**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity</b>				
Non-Māori	REF <sup>b</sup>			
Māori	-0.89 <sup>c</sup>	0.36	-2.46	0.01
<b>School Decile (per decile)</b>	0.03	0.01	2.53	0.01
<b>Ethnicity X school decile</b>	0.12	0.05	2.37	0.02
<b>Gender (Male)</b>				
Female	REF			
Male	-0.19	0.06	-3.07	0.002
<b>School Type</b>				
Private	REF			
State	-0.27	0.09	-3.09	0.002
State Integrated	-0.17	0.09	-1.78	0.07

Adjusted R<sup>2</sup> = 0.05, F (6, 888) = 8.71, p<0.001

<sup>a</sup>CASPer score range is 1-9. <sup>b</sup> REF = reference. <sup>c</sup> After accounting for all other factors in the model, Māori receive 0.89 less points on their CASPer score than non-Māori.





**Figure 9.1 Predicted CASPer score for female applicants with no previous university experience stratified by decile and ethnicity, Māori and non-Māori.**

## 9.4. DISCUSSION

The research presented in this chapter has demonstrated that Māori applicants received significantly lower GPA, STAT, written communication, MMI and CASPer scores. However, there was no statistical difference between Māori and non-Māori in SJT scores. The effect of Māori ethnicity on GPA was not independent of prior university experience. Similarly the impact of ethnicity on written communication was dependent on whether the applicant was first in family to attend university, and on CASPer scores was dependent on the school decile the applicant attended.

The current study also shows that Māori applicants attended lower decile schools and were more likely to be the first in their family to attend university as compared with non-Māori applicants. School decile was associated with GPA, STAT, MMI, and SJT scores, with applicants from lower decile schools receiving significantly lower scores on these tests. Being the first person in their family to attend university was also significantly associated with lower GPA. As such, Māori applicants are likely further disadvantaged in the GPA, STAT, MMI, and SJT assessments because they are more likely to have attended lower decile schools and to be the first in their family to attend university and therefore have the added negative effects of these variables.

The effect of Māori ethnicity on GPA was not independent of prior university experience. Having university experience was associated with an increase in the GPA of both Māori and non-Māori applicants, however the GPA of Māori applicants with prior university study only increased to the level of non-Māori applicants without university experience. For applicants without university experience, Māori received significantly lower GPA than non-Māori. In New Zealand, academic performance in secondary school is related to university performance (Scott, 2008). In a study of Māori students at bachelor level study, Earle (2008) reported that for Māori school leavers, performance in secondary school was highly associated with success in first year university study. Thus, the inequity in secondary school preparation for university of Māori as compared with non-Māori (Curtis, Wikaire, et al., 2015; May et al., 2019; Ministry of Education, 2020a; New Zealand Qualifications Authority, 2020a; Wikaire, 2015), is likely to contribute to the inequity in GPA from the pre-veterinary semester seen between Māori and non-Māori in the present study. The evidence of inequity in secondary school preparation, and the GPA data from the present study, provide further justification of the value of providing support for Māori veterinary applicants both prior to and after matriculation at university. Such support might include activities that have been successful for Indigenous applicants to medicine such as quality pre-matriculation counselling (Chesters et al., 2009), Indigenous recruitment programmes that support academic performance (Bryers et al., 2021), culturally appropriate bridging programmes (Bristowe, 2012; Curtis, Wikaire, Jiang, McMillan, Loto, Fonua, et al., 2015), and holistic academic and pastoral support (Curtis & Reid, 2013). Implementing these types of support for Māori applicants for medicine in New Zealand particularly has shown positive impacts (Crampton et al., 2018; Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015), and may do so for Māori veterinary applicants also.

Māori received lower scores on the STAT test than non-Māori. There are no previous studies exploring the effect of ethnicity and the STAT test, however, it has been shown that minoritised ethnicities in the USA receive lower scores on other standardised tests such as the MCAT for medical student selection (Kreiter, 2013; Lucey & Saguil, 2020) and the GRE for veterinary student selection (Abreu, 2013). In addition, as there was correlation between GPA and STAT scores for Māori ( $r=0.38$ ;  $p<0.01$ ), the inequity in preparation of many Māori for university is also likely to influence the STAT score.

Māori received lower MMI scores than non-Māori, however in contrast SJT scores did not differ by ethnicity. In an assessment such as the MMI or SJT, the score could have been affected by multiple factors such as those related to the applicant (Kyllonen & Kell, 2018), the rater/test administrator (Roberts et al., 2008; Sebok & Syer, 2015; Shavelson & Webb, 1991), and/or the test items or content (Shavelson & Webb, 1991). In this study, the same group of applicants sat both assessments. The MMI and SJT scenarios were developed by many of the same individuals, and the format of the scenarios

was essentially the same, differing only in the precise details in the scenarios. One difference is that in the MMI there is a rater who assesses each individual after direct interaction with them, whereas the SJT responses are machine-marked. Thus, in the MMI, the appearance of the student is known to the assessor in the MMI, whereas it is not in the SJT. Socially assigned ethnicity is the ethnicity that someone is perceived to be by others based on their appearance (Gillon et al., 2019; Harris et al., 2013). As MMI raters see the applicants, socially assigned ethnicity could influence implicit or explicit rater bias. More specifically, whether a rater perceived an applicant to be Māori or not may have influenced the score assigned to the applicant. Several authors have reported that scores on the MMI varied between raters (Roberts et al., 2008; Sebok & Syer, 2015), with one study noting that the greatest source of error in the MMI scores was rater subjectivity (Roberts et al., 2008).

The MMI and SJT scores were significantly correlated for non-Māori ( $r=0.31$ ;  $p<0.001$ ), but were not for Māori ( $r=0.01$ ,  $p>0.5$ ). This was unexpected as the MMI and SJT both utilise bespoke scenarios set in the context of a veterinary student and were planned to assess the same characteristics; so it was anticipated that there would be substantial correlation between their scores. While an element of this difference in correlation between Māori and non-Māori may reflect the smaller numbers of Māori, it may also be related to the visibility of the applicant, and therefore an impact of socially assigned ethnicity and possible bias by some MMI raters. The ethnicity of the MMI raters in this study is unknown, so the influence of rater ethnicity, or rater-applicant ethnic concordance could not be assessed. In the future it would be beneficial to undertake an analysis of the amount of variance in the scores due to the rater, and also to collect rater ethnicity to enable analysis as to whether there were any ethnicity-based inequities or other patterns of concerns across raters.

School decile was significantly associated with GPA, STAT, MMI, SJT and CASPer with applicants from lower decile schools receiving significantly lower scores on these tests. Māori are more likely to attend lower decile schools than non-Māori ( $p=0.002$ ), and as such are likely to be disadvantaged by the effects of decile to a greater level than non-Māori.

Applicants from lower decile schools received lower GPA. While not a perfect indicator, school decile is often used in research in New Zealand as a proxy for socioeconomic position (Curtis et al., 2017; Meehan et al., 2019; Wikaire et al., 2017). Other authors have reported that due to disparities in educational opportunities, medical school applicants from lower socioeconomic backgrounds typically have lower academic attainment than those from high socioeconomic backgrounds (Cleland et al., 2012; Griffin & Hu, 2015; Mian et al., 2019). The impact of socioeconomic position and educational

opportunity may also influence the lower scores in the academic assessments (GPA and STAT) that low decile students received in the present study.

Applicants from lower decile schools received significantly lower scores on the MMI and SJT. The finding of lower MMI scores for applicants from lower socioeconomic background is in contrast to studies of medical applicants by Reiter et al (2012) and Kelly et al. (2014). The reason for the difference in findings between the present study and the studies of Reiter et al (2012) and Kelly et al. (2014) is unclear, but reinforces the need to evaluate the MMI assessment to ascertain whether there are barriers to students from low socioeconomic backgrounds, including Māori. The finding in the present study of lower SJT scores for students from lower socioeconomic backgrounds is supported by Lievens et al. (2016), who reported that the SJT scores of medical applicants from higher socioeconomic groups were significantly higher than the score of applicants from lower socioeconomic groups. However, it was noted that the magnitude of difference in the SJT scores was less than was seen for the difference in academic assessments scores between high and low socioeconomic applicants.

For CASPer scores, the effect of Māori ethnicity was not independent of decile, such that as the decile of the school increased, CASPer scores increased but at a greater magnitude for Māori than non-Māori. Māori applicants were more likely to attend lower decile schools than non-Māori applicants, so the positive effect on CASPer scores of attending a higher decile school would not have been available to all Māori applicants. The findings here of Māori from lower decile schools receiving lower scores on CASPer is supported by the study of (Juster et al., 2019) in which students from minoritised ethnicities and lower socioeconomic groups received lower scores than White or high socioeconomic students.

The effect of Māori ethnicity on the written communication score was not independent of being the first person in their family to attend university. Māori were more likely than non-Māori to be the first in their family to attend university ( $p=0.04$ ), with 44% of Māori applicants identifying as such. This finding is supported by that of Graduate Longitudinal Study New Zealand (GLSNZ) in which it was reported that 48% of Māori were the first in their family to attend university Marie et al. (2008). Being the first person in their family to attend university was significantly associated with lower GPA than those who were not the first person in their family to attend university. This is not surprising as it has been demonstrated that being first in family can lead to challenges in transitioning to the university environment (Theodore et al., 2015), which can negatively impact on academic performance. As Māori applicants are more likely to be the first in their family to attend university, they are further disadvantaged by the systemic impact of this factor. Māori applicants who were the first in their family

to attend university received higher written communication scores than those who were not. This was an unexpected finding, which differed from the results for non-Māori, for whom being first in family to attend university was associated with lower written communication scores. This finding could be in part due to chance, reflecting the small numbers of Māori in the study.

From the multivariate analyses, having prior university experience was significantly associated with an increase in the scores on all the assessments, excluding CASPer. Applicants with prior university experience in the 2017-2019 time period were likely to have applied for selection in the year before, and so would have experienced the selection assessments at least once either in the pilots of the new assessments in 2016 or in live selection in 2017 or 2018. Having previously attempted the assessment, the increase in score could be due to improved performance since the initial attempt or may have reflected a retest effect. A retest effect is when an individual gains higher scores on an assessment on the subsequent attempt in comparison to their initial attempt, without necessarily improving their performance or knowledge (Hausknecht et al., 2007; Scharfen et al., 2018). This retest effect has been demonstrated in the MMI scores of individuals reapplying to an Australian undergraduate medical programme in two consecutive years (Griffin et al., 2008), but wasn't seen when the second application was at a different school Griffin et al. (2019).

The variance explained by the models is low, therefore other factors will also be contributing to the score that are not accounted for in these models such as the applicants' prior academic attainment, amount and efficiency of study in the pre-vet semester, and the impact of events in their personal life. These models would be of limited use for predicting individual future student scores but are valuable for explaining and understanding the association of sociodemographic variables with the scores of past applicants.

## **9.5. SUMMARY**

Māori received lower scores than non-Māori in five of the six selection assessments. There are also negative associations with some selection assessment scores and each of school decile and being first in family to attend university that impact Māori more than non-Māori as Māori are more likely to attend lower decile schools and be the first in their family to attend university. As such, there are structural barriers associated with the selection assessments that affect Māori to a greater level. Additionally, inequity in secondary school preparation, and the GPA data from the present study, provide further evidence for the value of academic and pastoral support for Māori applicants both prior to and after matriculation at university.

The differences seen in selection assessment scores between Māori and non-Māori reinforce the rationale for the existence of an equity pathway for Māori in which they are not compared directly with non-Māori for selection, such as that seen in the equity admission process for admission into medicine (and other health sciences) at the University of Auckland (Curtis et al., 2017). There is also need for future consideration of the value and use of each of these assessments within an equity selection process for Māori.



## Chapter Ten

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### 10. STUDY 4 ACADEMIC OUTCOMES IN THE PROFESSIONAL PHASE

#### 10.1. INTRODUCTION

The previous chapter showed that Māori received lower pre-vet GPA, STAT and MMI scores, and that Māori who attended lower decile high schools received lower CASPer scores than non-Māori. In Chapter 8 it was shown that Māori students were underrepresented in the cohort of students selected into the professional phase of the veterinary programme and had lower mean GPA at selection than non-Māori. These differences between Māori and non-Māori prior to the professional phase raise the question as to whether there are differences in academic outcomes for Māori and non-Māori once in the professional phase.

Academic performance prior to admission has been consistently shown to be the best predictor of academic performance in a medical or veterinary programme (Confer, 1990; Curtis et al., 2017; Prideaux et al., 2011; Salvatori, 2001; Zachary & Schaeffer, 1994). This has reinforced the exclusive or heavy weighting on academic performance in selecting medical and veterinary students in some programmes. However, there is growing recognition of the importance of factors other than academic achievement for success as a veterinary or medical student or practitioner (e.g. Conlon et al., 2012). Thus, as discussed in Chapter 4, many medical programmes now consider more holistic selection processes that include the assessment of non-academic attributes of the applicants.

The veterinary student selection process at Massey University has had two major changes since 2003, with the introduction of an equity pathway for Māori veterinary student selection in 2007, and implementation of non-academic assessments in 2017. In Chapter 8 of this thesis, introduction of the



equity pathway for Māori was shown to reduce the inequity in selection that Māori applicants experienced prior to 2007 (Table 8.5). A common criticism of equity pathways is that they are preferential treatment (Bacchi, 2004) which may allow for admission of substandard students at the expense of more deserving students. These criticisms can be seen in media articles in New Zealand by Johnston (2004), Duff (2018), Hurihanganui (2018), and Miller (2020). Meritocracy in medical or veterinary student selection suggests that those who are the most qualified are selected on the basis of ability, not money or social position (Alon & Tienda, 2007; Cleland et al., 2012; Heller et al., 2014; Razack et al., 2009). However, the privileged socioeconomic backgrounds of those who are selected into medicine contradicts the concept of meritocratic selection (Cleland et al., 2012). Additionally, the assumption of equitable opportunity underpinning meritocracy (Alon & Tienda, 2007) has been shown not to be the case for Māori in education in New Zealand (Bishop et al., 2009; Bolton, 2017; Ministry of Education, 2020a).

Overall academic performance at Massey University is measured by grade point average. In the School of Veterinary Science, veterinary students must pass all of their courses that are offered in each year, in order to be able to progress to the next year of the programme. There is a process of supplementary examination in which a student who does not pass all of their courses on the first attempt may have the opportunity of a second attempt to demonstrate they have met the course outcomes. There is a limit on the number of courses within a year for which a student may have supplementary assessment(s).

It is important to determine whether selection process changes such as implementing the equity pathway for Māori or the introduction of non-academic assessments influence academic outcomes of veterinary students in the professional phase of the programme. It was demonstrated in Chapter 9 that there was a statistically significant difference in pre-vet GPA between Māori and non-Māori, however practically the pre-vet GPA of both were of a high standard. Thus it is hypothesised that there would be little difference in academic outcomes of Māori and non-Māori in the professional phase of the BVSc. Thus, the aim of this study is to determine whether the academic outcomes of students who are selected into the veterinary programme are the same for Māori and non-Māori, and whether the academic outcomes have been influenced by changes to the selection process.

## **10.2. METHODS AND MATERIALS**

This study was conducted with a Kaupapa Māori research positioning (Curtis, 2016; Pihama, 2011; G. Smith, 2012), which “ensures a cultural integrity is maintained when analysing Māori issues” (Pihama,

2010, p. 10). For more detail regarding Kaupapa Māori positioning for this study the reader is directed to sections 2.3 and 2.4 of Chapter 2.

This study was conducted under ethical approval from Massey University Human Ethics Committee Southern B (MUHECB 14-24 and 15-77).

### **10.2.1. Description of data**

Two outcome (dependent) variables were considered in this study. The first variable was GPA in the first semester of the professional phase (range of 0-9), hereafter referred to as 'professional phase GPA'. The second variable was passing all courses in the first semester of the professional phase on the first attempt (yes, no), which will be referred to as 'passing on the first attempt'. These variables were restricted to the first semester of the professional phase, as at the time of data collection the first semester of the professional phase was the only semester for which data for all cohorts from 2003-2019 was available.

The independent variables in this study were time period (2003-2006, 2007-2016, 2017-2019); applicant ethnicity (Māori, non-Māori); gender (female, male); age (continuous); the decile of high school attended (1-10); the type of high school attended (state, state integrated, private, or overseas); prior university experience (yes, no); the pre-vet GPA (0-9); and the STAT score (100-200). School decile is also presented as a categorical variable (low [1-3], medium [4-7] and high [8-10]), for the summary descriptive data in comparing Māori and non-Māori applicants. For clarity, the courses used to calculate the pre-vet GPA are not included in the courses used to calculate the professional phase GPA. The selection assessments written communication, MMI, SJT and CASPer scores were not included in the independent variables as these assessments were not available for all years included in this analysis (2003-2019).

The collection of the data and full description of all the variables utilised in this study are provided in the general materials and methods (Section 6.3).

### **10.2.2. Statistical Analysis**

Data were analysed for descriptive and inferential statistics using R studio software version 1.3.1056 (Rstudio Inc. Boston Massachusetts, USA) and R statistical software version 3.6.6 (R core team, R Foundation for Statistical Computing, Vienna, Austria). The mean and SD of the professional phase GPA stratified by ethnicity (Māori, non-Māori) and other sociodemographic variables were summarised. The number and proportion of individuals who did or did not pass on the first attempt

stratified by ethnicity (Māori, non-Māori) and other sociodemographic variables were also summarised.

To explore the relationship between professional phase GPA and the independent variables (time period, ethnicity, gender, age, the decile of high school attended (1-10), the type of high school attended, prior university experience, pre-vet GPA, and the STAT score), separate univariate linear regression models were produced. Variables associated with professional phase GPA at  $p < 0.25$  were included in a multivariable linear regression model and a method of backward elimination was used to build a multivariable model, as described in Section 9.2.2.2.

To explore the association between passing on the first attempt and the independent variables (as above), separate unmatched univariate logistic regression models were produced. Variables associated with passing on the first attempt at  $p < 0.25$  were included in a multivariable logistic regression model and a method of backward elimination was used to build the multivariable model, as described in Section 8.2.2.1

### 10.3. RESULTS

From 2003 to 2019, 1447 applicants were selected and offered a place in the professional phase of the BVSc degree. Forty-three applicants declined their offer and did not matriculate. Six individuals started the semester but withdrew with permission and without academic penalty, part-way through the semester. As such, these forty-nine individuals did not complete the first semester of the professional phase so are not included in the analyses of post-selection outcomes. In total, 1398 students completed the first semester of the professional phase, of which 62 were Māori, 1333 were non-Māori and 3 were of unknown ethnicity (Figure 10.1).

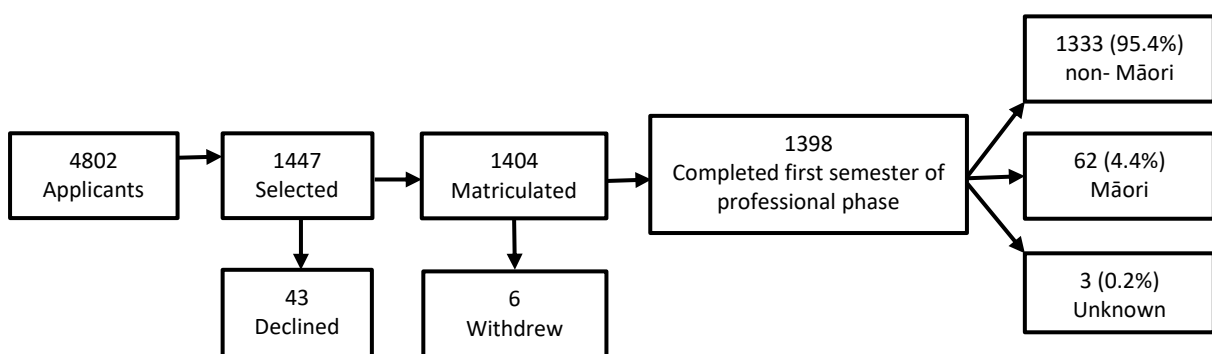


Figure 10.1 The pathway from applicants through to students who completed the first semester of the professional phase, including number at each step.

### 10.3.1. GPA from the professional phase

The mean and standard deviation of professional phase GPA stratified by ethnicity and other sociodemographic variables are shown in Table 10.1. The overall mean professional phase GPA for all students was 5.73 (1.62), and there was no significant difference ( $p=0.19$ ) between Māori students (5.46,  $SD=1.63$ ) and non-Māori students (5.74,  $SD=1.62$ ).

**Table 10.1 Mean and (standard deviation) of GPA in the first semester of the professional phase of selected students in 2003-2019 stratified by ethnicity and sociodemographic factors.**

	Māori n=62 (4.4%)	non-Māori n=1333 (95.6%)	Total n=1395 <sup>a</sup>
<b>Time Period</b>			
2003-2006	4.45 (1.53)	5.21 (1.71)	5.19 (1.71)
2007-2016	5.67 (1.76)	5.87 (1.60)	5.86 (1.61)
2017-2019	5.42 (0.86)	5.96 (1.46)	5.94 (1.44)
<b>Gender</b>			
Female	5.54 (1.58)	5.87 (1.28)	5.86 (1.58)
Male	5.24 (1.81)	5.28 (1.68)	5.28 (1.69)
<b>High School Type</b>			
State	5.23 (1.64)	5.77 (1.63)	5.75 (1.63)
State Integrated	6.46 (1.35)	5.74 (1.59)	5.78 (1.58)
Private	5.45 (1.90)	5.65 (1.64)	5.64 (1.65)
Overseas	4.51 (1.05)	5.71 (1.56)	5.69 (1.56)
Unknown	6.08 (0.59)	5.19 (1.81)	5.28 (1.74)
<b>High School Decile</b>			
Low (1-3)	5.05 (1.47)	6.42 (1.44)	6.26 (1.49)
Medium (4-7)	5.40 (1.74)	5.80 (1.62)	5.77 (1.63)
High (8-10)	5.60 (1.66)	5.68 (1.63)	5.68 (1.63)
Unknown	5.30 (1.14)	5.73 (1.56)	5.72 (1.55)
<b>Prior university experience</b>			
No	5.43 (1.56)	5.58 (1.64)	5.57 (1.64)
Yes	5.48 (1.71)	5.94 (1.58)	5.91 (1.59)

<sup>a</sup> The total number of individuals included in these data (n=1395) is the total number who completed the semester (n=1398) minus the number for whom ethnicity is not known (n=3).

Ethnicity was not associated with professional phase GPA in either the univariate model ( $p=0.19$ ; Table 10.2) or the multivariable model ( $p=0.86$ ; Table 10.3). The highest GPA was observed in female students from lower decile schools with prior university experience selected after 2017 (Table 10.3). The relationship between pre-vet GPA (nonlinear) and professional phase GPA is shown in Figure 10.2. In the multivariable model, age and the type of high school the student attended were not significantly associated with professional phase GPA so were dropped from the model. Additionally, there was no interaction between ethnicity and time period.

**Table 10.2 Univariate linear regression results for the association of sociodemographic variables and selection assessments with grade point average in the first semester of the professional phase (GPA) in 2003-2019, including the mean and (standard deviation) of GPA for each categorical variable.**

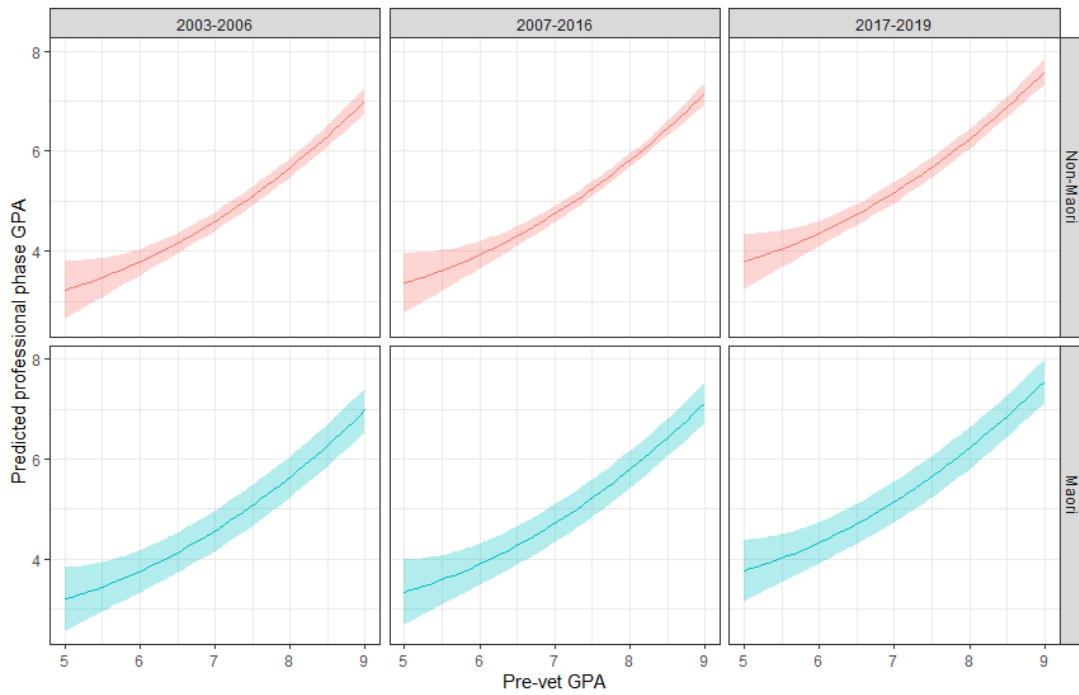
Variables	Mean (SD)	Unadjusted Estimate	SE	t-value	p-value
<b>Ethnicity</b>					
Non-Māori	5.74 (1.62)	REF <sup>a</sup>			
Māori	5.46 (1.63)	-0.28 <sup>b</sup>	0.21	-1.32	0.19
<b>Time Period</b>					
2003-2006	5.18 (1.70)	REF			<0.001
2007-2013	5.85 (1.61)	0.67	0.11	6.21	<0.001
2017-2019	5.94 (1.44)	0.75	0.13	5.77	<0.001
<b>Gender</b>					
Female	5.85 (1.58)	REF			
Male	5.28 (1.69)	-0.57	0.10	-5.53	<0.001
<b>Age (per year)</b>					
	-	0.03	0.01	2.89	0.004
<b>School type</b>					
Private	5.64 (1.65)	REF			0.83
State	5.75 (1.63)	0.10	0.13	0.80	0.42
State Integrated	5.78 (1.58)	0.13	0.16	0.83	0.41
Overseas	5.69 (1.56)	0.05	0.19	0.27	0.79
<b>School Decile (per decile)</b>					
	-	-0.03	0.02	-1.27	0.21
<b>Prior university experience</b>					
No	5.57 (1.64)	REF			
Yes	5.90 (1.59)	0.33	0.09	3.82	<0.001
<b>Pre-vet GPA</b>					
	-	0.93	0.05	20.11	<0.001
<b>STAT score</b>					
	-	-0.005	0.004	-1.10	0.27

<sup>a</sup> REF = reference. <sup>b</sup> There is no significant difference in professional phase GPA between Māori and non-Māori.

**Table 10.3 Multivariable linear regression model for the association of student sociodemographic factors, pre-vet grade point average (GPA) and grade point average in the first semester of the professional phase.**

Variables	Adjusted Estimate	SE	t-value	P
<b>Ethnicity</b>				
Non-Māori	REF <sup>a</sup>			
Māori	-0.03 <sup>b</sup>	0.18	-0.18	0.86
<b>Time Period</b>				
2003-2006	REF			<0.001
2007-2016	0.14	0.10	1.40	0.16
2017-2019	0.57	0.12	4.82	<0.001
<b>Gender</b>				
Female	REF			
Male	-0.55	0.09	-6.00	<0.001
<b>School Decile (per decile)</b>				
	-0.05	0.02	-2.56	0.007
<b>Prior University Experience</b>				
None	REF			
Some	0.79	0.08	9.83	<0.001
<b>Pre-vet GPA</b>				
	-0.87	0.68	-1.28	0.20
<b>Pre-vet GPA squared</b>				
	0.12	0.05	2.72	0.004

Adjusted  $R^2 = 0.33$ ,  $F(9, 1230) = 66.41$ ,  $p < 0.001$ . <sup>a</sup> REF = reference. <sup>b</sup> After accounting for all other factors in the model, the professional phase GPA of Māori and non-Māori are not significantly different.



**Figure 10.2 Prediction of professional phase grade point average (GPA) from pre-vet grade point average (GPA) for a female applicant with no prior university experience stratified by ethnicity and time period.**

### 10.3.2. Passing professional phase courses on the first attempt

Of the 1398 students who matriculated into and completed the first semester of the professional phase, 96 (7%) did not pass all their courses in the first semester of the professional phase on the first attempt. The number and percentage of students who did or did not pass all of their first semester professional phase courses phase on the first attempt stratified by ethnicity and other sociodemographic factors are shown in Table 10.4.

**Table 10.4 Number and percentage (%) or mean and SD of selected students in 2003-2019 (n=1395) who did or did not pass all their courses in the first selection of the professional phase on the first attempt stratified by ethnicity (Māori, non-Māori) and sociodemographic factors.**

	Māori n=62		non-Māori n=1333		Total n=1395 <sup>a</sup>	
	Yes	No	Yes	No	Yes	No
<b>Passing on first attempt</b>	55 (89%)	7 (11%)	1244 (93%)	89 (7%)	1299 (93%)	96 (7%)
<b>Time Period</b>						
2003-2006	6 (75%)	2 (25%)	268 (91%)	27 (9%)	274 (90%)	29 (10%)
2007-2016	38 (90%)	4 (10%)	705 (94%)	47 (6%)	743 (94%)	51 (6%)
2017-2019	11 (92%)	1 (8%)	271 (95%)	15 (5%)	282 (95%)	16 (5%)
<b>Gender</b>						
Female	40 (87%)	6 (13%)	967 (93%)	68 (7%)	292 (93%)	22 (7%)
Male	15 (94%)	1 (6%)	277 (93%)	21 (7%)	1010 (93%)	74 (7%)
<b>Mean Age (SD)</b>	21.7 (5.96)	21.7 (4.19)	20.9 (3.81)	21.7 (4.98)	20.9 (3.93)	21.7 (4.91)
<b>High School Type</b>						
State	36 (90%)	4 (10%)	757 (94%)	51 (6%)	793 (94%)	55 (6%)
State Integrated	9 (90%)	1 (10%)	195 (92%)	17 (8%)	204 (92%)	18 (8%)
Private	6 (86%)	1 (14%)	171 (95%)	9 (5%)	177 (94%)	11 (6%)
Overseas	2 (100%)	0 (%)	105 (91%)	10 (9%)	107 (91%)	10 (9%)
Unknown	2 (100%)	0 (%)	16 (89%)	2 (11%)	21 (91%)	2 (9%)
<b>High School Decile</b>						
Low (1-3)	4 (6%)	0 (0%)	29 (2%)	1 (0%)	33 (2%)	1 (0%)
Medium (4-7)	22 (35%)	3 (5%)	382 (29%)	21 (2%)	404 (29%)	24 (2%)
High (8-10)	25 (40%)	4 (6%)	694 (52%)	55 (4%)	719 (52%)	59 (4%)
Unknown	4 (6%)	0 (0%)	139 (10%)	12 (1%)	143 (10%)	12 (1%)
<b>Prior university experience</b>						
No	25 (93%)	2 (7%)	680 (93%)	49 (7%)	705 (93%)	51 (7%)
Yes	30 (86%)	5 (14%)	564 (93%)	40 (7%)	597 (93%)	45 (7%)
<b>Pre-vet GPA</b>	7.3 (0.98)	6.4 (0.79)	7.7 (0.80)	7.0 (0.76)	7.6 (0.81)	6.9 (0.77)

Note: Percentages may not total 100 due to rounding.

<sup>a</sup> The total number of individuals included in these data (n=1395) is the total number who completed the semester (n=1398) minus the number for whom ethnicity is unknown (n=3).

Ethnicity was not associated with passing on the first attempt in the univariate model ( $p=0.17$ ; table 10.5) or the multivariable model ( $p=0.91$ ; Table 10.6). When all factors are taken into account, each unit increase in pre-vet GPA was associated with just over 3.5 times the odds ( $p<0.001$ ) of students passing on the first attempt. Students selected in 2017-2019 had significantly higher odds of passing all courses in the first semester of the professional phase on the first attempt ( $p=0.008$ ) as compared to students selected in 2003-2006. There was no interaction between ethnicity and time period. The

Hosmer-Lemeshow goodness of fit test was not significant ( $p=0.85$ ), which suggests that the model is not a poor fit for the data. There were a high number of standardised Pearson residuals that exceeded 3 in the group that did not pass on the first attempt. This was not unexpected because of the relatively small number of students that did not pass on the first attempt, however, it does mean that results should be interpreted with caution.

**Table 10.5 Univariate linear regression results for the association of sociodemographic variables and selection assessments with passing all courses in the first semester of the professional phase on the first attempt in 2003-2019.**

Variables	Unadjusted Estimate	SE	Odds Ratio	P
<b>Ethnicity</b>				
Non-Māori			1	
Māori	-0.58	0.42	0.56 (0.26 - 1.39)	0.17
<b>Time Period</b>				
2003-2006			1	
2007-2016	0.43	0.24	1.54 (0.95 - 2.46)	0.08
2017-2019	0.62	0.32	1.86 (1.00 - 3.57)	0.05
<b>Gender</b>				
Female			1	
Male	-0.03	0.25	0.97 (0.60 - 1.63)	0.91
<b>Age (per year)</b>	-0.04	0.02	0.96 (0.92 - 1.01)	0.08
<b>School type</b>				
Private			1	
State	-0.11	0.34	0.89 (0.44 - 1.68)	0.75
State Integrated	-0.35	0.40	0.70 (0.31 - 1.51)	0.38
Overseas	-0.40	0.45	0.66 (0.27 - 1.65)	0.37
<b>School Decile (per decile)</b>	-0.05	0.06	0.95 (0.85 - 1.06)	0.36
<b>Prior university experience</b>				
No			1	
Yes	-0.04	0.21	0.96 (0.63 - 1.46)	0.85
<b>Pre-vet GPA</b>	1.02	0.13	2.78 (2.15 - 3.62)	<0.001
<b>STAT score</b>	-0.002	0.01	1.00 (0.98 - 1.02)	0.84

**Table 10.6 Multivariable logistic regression model for passing all courses in the first semester of the professional phase on the first attempt for students selected in 2003-2019.**

Variables	Adjusted Estimate	SE	Odds Ratio (95%CI)	P
<b>Ethnicity</b>				
Non-Māori	-	-	1	
Māori	0.05	0.45	1.05 (0.46 - 2.74)	0.91 <sup>a</sup>
<b>Time Period</b>				
2003-2006	-	-	1	-
2007-2016	-0.24	0.27	0.79 (0.46 - 1.32)	0.37
2017-2019	0.92	0.35	2.52 (1.30 - 5.09)	0.008
<b>Pre-vet GPA</b>	1.27	0.17	3.56 (2.59 - 4.99)	<0.001

<sup>a</sup> After accounting for all other factors in the model, the odds of passing all courses in the first semester of the professional phase on the first attempt are not significantly different for Māori and non-Māori.



## 10.4. DISCUSSION

This study is the first to quantify the effects of introducing an equity process to support the selection of Māori veterinary applicants and introducing non-academic criteria into the selection process upon the post-selection performance of veterinary students. It is also the first time that the effects of such changes of selection processes upon the academic achievements of veterinary students of Indigenous vs non-Indigenous ethnicities has been reported. This study demonstrated that there were no significant differences in professional phase GPA or the proportion of students passing examinations at the first attempt between Māori and non-Māori. These findings suggest that introducing an equity selection process for Māori and introducing a broad suite of non-academic achievements in the selection process did not impact negatively on the academic performance of Māori compared to non-Māori veterinary students in their professional phase of study. The study also shows that the average GPA ( $p < 0.001$ ) and the odds of passing all examinations at the first attempt ( $p = 0.008$ ) were higher for students selected in the 2017-2019 time period (i.e. after the introduction of non-academic attributes to the selection process) than for students selected in the earlier time periods.

The professional phase GPA ( $p = 0.86$ ) and probability of passing all courses on their first attempt ( $p = 0.91$ ) did not significantly differ between Māori and non-Māori students. Nor was there a significant interaction between ethnicity and the time periods, which suggests that introduction of the equity process for Māori in 2007 did not affect academic outputs. These are important findings as they contradict the criticism that equity processes lead to the inclusion of substandard students. The lack of difference in GPA was supported by the findings of Curtis et al. (2017), who reported on the academic outcomes of students admitted to medicine at the University of Auckland over a 10-year period. In that study, there was an initial difference in Year 2-3 GPA between students selected into medicine through MAPAS (Section 4.4.1) as compared to the General pathway. However, after taking into account prior university experience, admission GPA, and other sociodemographic variables there was no longer a difference in Year 2-3 GPA between students from the two pathways. A difference between the present study and the study of Curtis et al. (2017), is the magnitude of difference in mean GPA prior to selection. The mean GPA of the MAPAS students was almost 2 points lower in comparison to the general pathway students, whereas in the present study the difference in mean pre-vet GPA between Māori and non-Māori was under half a point. The lack of difference in outcomes in this study suggests there may be scope to select Māori veterinary students with a larger difference in pre-vet GPA to non-Māori, whilst still enabling academic success as measured by professional phase GPA between the two groups. Additional support would need to be provided to ensure these students success if such an initiative were undertaken.

In 2017-2019, the professional phase GPA was higher across all students ( $p < 0.001$ ), and the odds of passing all courses on the first attempt was just over 2.5 times greater ( $p = 0.008$ ) as compared with the 2003-2006 time period. When non-academic assessment was introduced into the selection process from 2017, the weighting on academic assessment decreased from 100% to 50% (Section 5.5.3). There was concern that the lower reliance on academic assessment in the selection process might lead to selection of less academically capable students, who might have more difficulty in the professional phase. However, the present data suggest that at least in the first semester of the professional phase, this is not the case. It was intended that consideration of non-academic attributes in the admission process would enable selection of students who had positive personal attributes, such as better communication or interpersonal skills. Mahmud (2014) suggests that students with strong communication skills perform better academically, which may reflect greater confidence to engage and interact in discussion. For students selected from 2017, there was substantial weighting during the selection process on communication, as assessed in the MMI. It is feasible that the selected students had stronger communication skills than in previous time periods when communication was not assessed as part of the selection process, and that having stronger communication skills helped their academic success. It is, of course, not possible presently to determine whether this was the case. However, as these students progress through their studies and undertake courses that specifically address communication skills (courses that are largely identical across selection cohorts), additional data to confirm or refute such a conjecture may become available.

The variable with the greatest effect size on professional phase GPA was pre-vet GPA. Determination of the pre-vet GPA and professional phase GPA are both heavily examination based, and thus it is not unexpected that there was an association between the two as having similar predictive and outcome measures leads to greater predictive validity (S. L. Raidal et al., 2019). Several other studies have also reported that the pre-admission GPA is the best predictor of GPA in veterinary or medical study (Confer, 1990; Curtis et al., 2017; Prideaux et al., 2011; Salvatori, 2001; Zachary & Schaeffer, 1994). In the present study, each one-point increase in pre-vet GPA led to 3.56 times higher odds of passing all professional phase courses on the first attempt. The relationship between higher pre-vet GPA and higher professional phase GPA as well as higher odds of passing all courses on the first attempt demonstrate the importance of supporting students to be as academically prepared as possible prior to selection, as pre-vet GPA influences not only selection outcome but also academic performance in the programme post-selection. Academic support and counselling of students prior to admission (Chesters et al., 2009; Curtis, Wikaire, et al., 2012; Taylor et al., 2019), provision of culturally appropriate recruitment and academic preparation pathways (Bryers et al., 2021; Curtis, Wikaire,

Jiang, McMillan, Loto, Fonua, et al., 2015; Taylor et al., 2019) and academic and pastoral support for students once at university (Curtis, Wikaire, et al., 2012; Paul, 2013) have enabled the success of Indigenous medical students. It is reasonable to consider that such initiatives would also be useful with supporting Indigenous veterinary students to improve their pre-vet GPA.

School decile was significantly associated with professional phase GPA, in that each increase in school decile was associated with a small (0.05 point) but statistically significant decrease in professional phase GPA, such that a decile 1 student (highest level of deprivation) might have a professional phase GPA 0.5 point higher than a student from a decile 10 school (lowest level of deprivation). This was an unexpected finding, in as much as increasing school decile was associated with increased pre-vet GPA (Table 9.4) and was also associated with increased university entrance attainment (Ministry of Education, 2020a) and progression to university (Choat, 1998). However, similar findings have been reported elsewhere. For example, in a study of first year university students in Australia, the authors reported that students from schools of lower socioeconomic status had moderately better performance than students from schools of higher socioeconomic status (Li & Dockery, 2014). In a study of medical students in the UK, Kumwenda et al. (2017) reported that students from state funded schools performed better in medical school than those from independent (privately funded) schools. The authors queried whether this finding could reflect that the state-educated students might have non-academic skills such as resilience and motivation that enabled them to achieve at school, and also enabled them to take better advantage of the opportunities and resources provided in medical school (Kumwenda et al., 2017). This may be a plausible suggestion for the small improvements in professional phase GPA experienced by lower decile students in the present study.

A limitation of this study was that only one semester of professional phase data could be included in the analysis of academic outcomes. These students need to be followed for longer periods of time, and eventually inclusion of graduation data would be recommended. Having said that, it still provides useful initial data for understanding some of the impacts of selection process changes. These data are also restricted to one university, so the findings may not translate to other institutions.

## **10.5. SUMMARY**

While Māori may be selected through an equity process, their academic outcomes and likelihood of success in the professional phase with regard to passing their courses on their first attempt and their first professional phase GPA were not significantly different from students selected through the general pathway in this study. These findings challenge suggestions that Māori students who may be chosen through an equity process are less capable, or academically inferior, to other selected

students. These findings also provide further evidence to support the existence of an equity process to enable access of Māori to veterinary education, which would in turn help to address the inadequate representation of Māori in both the veterinary programme and the veterinary profession. Thus, the introduction of an equity process is positive for both Māori applicants personally and the veterinary programme. Additionally, in this study changing the selection process to include assessment of non-academic criteria from 2017 was associated with an improvement in academic outcomes in the 2017-2019 period. This study is the first to demonstrate that despite the introduction of changes to selection that place lesser weight on academic performance, the GPA and the proportion of students passing examinations on the first attempt were similar or better than prior to these changes.



## Chapter Eleven

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### 11. GENERAL DISCUSSION

The overarching aim of this thesis was to explore how the access of Māori to veterinary education, and by extension, the veterinary workforce, as well as the academic outcomes of Māori once selected into the programme, vary under three separate admission processes taking into account sociodemographic factors. This thesis represents a significant contribution to the international literature on the inclusion of Indigenous peoples in the veterinary profession or the use of an equity selection process to improve their representation, which prior to now has been negligible. Although explored in the context of a single veterinary institution; many of the issues that were identified are applicable to Indigenous applicants to veterinary and medical schools globally.

#### 11.1. A SUMMARY OF FINDINGS

This thesis has demonstrated that Māori do not experience the same level of access to veterinary education as non-Māori. Māori are underrepresented in both the applicant pool (Chapter 7) and selected cohort (Chapter 8) of the veterinary degree programme. Māori experienced more educational barriers than non-Māori applicants (Chapter 7), and prior to 2007, had significantly lower odds of selection than non-Māori (Chapter 8). Introduction of an equity process for Māori student selection in 2007 increased the odds of selection of Māori students to that of non-Māori prior to 2007. Introduction of non-academic criteria into the selection process did not further improve the odds for selection of Māori into the veterinary programme (Chapter 8). Māori received significantly lower scores on five of the six selection assessments (Chapter 9). However, once selected into the veterinary programme, there was no difference in the academic outcomes of Māori and non-Māori (Chapter 10).

Additionally, introduction of an equity process was not associated with a decrease in academic outcomes of the cohort post-selection, and introduction of non-academic criteria into the selection process was associated with an improvement in academic outcomes for the cohort (Chapter 10).

## **11.2. MĀORI ARE UNDERREPRESENTED IN VETERINARY EDUCATION**

Māori are under-represented in the veterinary applicant pool, selected student cohort, and profession in New Zealand. The underrepresentation is concerning and reinforces the evidence of inequitable access of Indigenous peoples to the health professions and expands the evidence base to include the veterinary profession.

Māori veterinary applicants were more likely to have attended lower decile schools, more likely to have attended state than private schools, and were more likely to have been the first in their family to attend university than non-Māori (Chapter 7). All of these factors have been shown to reduce the likelihood of progression to university (Choat, 1998; Marie et al., 2008; New Zealand Qualifications Authority, 2019, 2020a; Theodore et al., 2015) Additionally, for students who aspire to become a veterinarian or a doctor, attaining the minimum requirement of university entrance is inadequate as a higher level of secondary preparation is required for health sciences programmes than for most other university programmes (Wikaire et al., 2016). Thus, the lack of suitably prepared applicants, secondary to the inequity Māori experience in the New Zealand education system (Bolton, 2017), is perhaps the strongest contributor to Māori underrepresentation in veterinary education and in the veterinary profession.

Other factors which have been suggested to account for the lack of ethnic representation in the veterinary applicant pool and therefore selected student cohort in the USA may be relevant in New Zealand. Racism, stereotyping and discrimination (Coffman, 2002; L. M. Greenhill, Nelson, Phillip D., Elmore, R., 2007; Steele & Aronson, 1995), are likely contributors given the evidence of discrimination and inequity in the New Zealand education sector and society more broadly for Māori (Berryman et al., 2012; Jones et al., 2019; Robson et al., 2007; Waitangi Tribunal, 1999). Lack of appropriate role models (Chastain et al., 2007; Elmore, 2004) may be a factor as there are few Māori veterinarians (2%). Financial considerations may be a barrier, given the cost of attending university and the overrepresentation of Māori in lower income brackets (Statistics New Zealand, 2018a), and potentially greater attraction to other health professions that offer higher salaries (Elmore, 2004; L. M. Greenhill, 2007).

Increasing Māori access to higher level educational is an Indigenous right (Jones et al., 2019; United Nations, 2007) that would facilitate individuals, their whānau and communities, to access the financial reward and greater social mobility associated with this level of educational achievement (Curtis, Wikaire, et al., 2015; Tertiary Education Commission, 2019; Theodore et al., 2017). The cost of veterinary education is heavily subsidised by the government, so all ethnic groups, and particularly Māori, should have equitable opportunities to engage in such study.

There would be numerous other benefits from addressing the underrepresentation of Māori in the veterinary applicant pool and eventually the profession. From studies in human medicine, there are numerous reported benefits of more inclusive student cohorts (Hung et al., 2007; Whitla et al., 2003), the graduates of which would be better prepared to meet the needs of all of New Zealand society. Additionally, if there were more Māori veterinary graduates, more Māori clients could experience the potential positive benefits of ethnic concordance (Laveist & Nuru-Deter, 2002) with their veterinarian. Having veterinarians who not only understand, but also hold a Māori worldview could benefit Māori, individually and collectively, and the wider New Zealand community. As New Zealand veterinary applicants, students and the profession are not representative of New Zealand society, the benefits of inclusivity are not being realised.

### ***11.2.1. Early intervention and transition support to increase access to veterinary education***

Early intervention outreach to Māori secondary school students is needed to address the underrepresentation of Māori veterinary applicants and, in turn, selected students. Unfortunately, the secondary school education system does not adequately prepare Indigenous students for selected entry health study (Curtis, Wikaire, et al., 2015; Paul, 2013; Wikaire et al., 2016). Indigenous students may receive inadequate counselling regarding pursuing health profession education as few career advisors are well equipped to appropriately advise Indigenous students about health careers (Chesters et al., 2009). Worse, teachers or career advisors may actively steer Indigenous students away from health careers and the science subjects required to adequately prepare for health profession education (Curtis, Wikaire, et al., 2015; Wikaire et al., 2016). As a result, insufficient numbers of Indigenous students are adequately prepared for embarking on health profession education. Early intervention processes and outreach programmes have been described which facilitate awareness, interest in and preparedness of Indigenous students for tertiary health profession study (Bristowe, 2012; Bryers et al., 2021; Houia-Ashwell, 2020; Mian et al., 2019; Paul, 2013). It is key that outreach programmes facilitate academic preparation rather than just promoting health as an attractive career option (Curtis, Wikaire, et al., 2012). Massey University employs staff to recruit prospective students,



which would include promotion of the veterinary programme, however during the years included in this thesis, there were no Indigenous specific recruitment or support activities for prospective Māori veterinary applicants. If an outreach program was introduced, it would be wise to look to successful programmes developed for human health programs.

Māori veterinary applicants have been shown to be more likely to be first in their family to attend university (Chapter 7), and as such, may need greater support in the transition to university having not had the benefit of parental advice about what to expect at university (Engler, 2010). While some Indigenous students may be prepared to begin bachelor level health profession study, others may need bridging/ foundation level study (Bristowe, 2012; Curtis, Wikaire, Jiang, McMillan, Loto, Fonua, et al., 2015; Houia-Ashwell, 2020; Paul, 2013) or alternate pathways to enable them to gain the pre-requisite knowledge to commence study at this level. An approach that has enabled success in preparing Indigenous students for medical study is a holistic review process to determine the applicants “best starting point” to achieve their study and career goals. To determine the best starting point for an applicant, both non-academic and academic assessments, as well as a review of each applicant’s educational history, are utilised to assess the applicant’s potential to succeed (Curtis, Wikaire, et al., 2015; Paul, 2013). Adopting a similar approach could also benefit Māori veterinary applicants. During the years included in the thesis, there was no Indigenous specific support for prospective Māori students prior to or during the transition to university. Clearly there is need for improvement.

### **11.3. THE EQUITY PROCESS FOR MĀORI IS WORKING BUT NEEDS TO EVOLVE**

Introduction of the equity selection process for Māori student selection in 2007 had a marked impact on improving access to veterinary education for Māori (Table 8.6 Chapter 8). Prior to introduction of the equity selection process Māori were significantly less likely to be selected than non-Māori, which after 2007 no longer existed. However, just ceasing to disadvantage Māori is insufficient given the inequity Māori continue to experience in education and society (Robson et al., 2007), subsequent to the ongoing effects of nearly 200 years of colonial education in which Māori have been systematically oppressed (Simon, 1992). Social justice demands that equitable approaches are utilised. The outcomes of the equity process in this thesis are supported by previous research in medical admission where equity pathways have improved access and inclusion of Indigenous peoples to medicine in New Zealand, Australia, and Canada (Crampton et al., 2018; Curtis, Wikaire, et al., 2015; Mian et al., 2019; Paul, 2013).

At Massey University, during the period of investigation, equity was applied only at the point of selection of veterinary students and was not part of a comprehensive pathway or pipeline approach. The term equity has been used in this thesis to describe the Massey University selection process for Māori veterinary applicants, as well as the Indigenous selection pathways for medicine in New Zealand, Australia, and Canada. However, it should be recognised that these differ from each other in terms of the types and points of intervention provided to the Indigenous students. Once in the veterinary programme Māori students did not have access to additional support beyond that provided for all students. Taylor et al. (2019) suggest that in addition to recruiting Indigenous students into health programmes, it is important to then support them to complete their studies and graduate as health professionals. This sentiment is reinforced and expanded by Curtis, Wikaire, et al. (2012) who note that it is of ethical concern “if institutions actively recruit students into tertiary environments that fail to ensure indigenous student success”. While the Treaty of Waitangi process enabled an important starting place, the absence of formalised culturally appropriate support for students after selection does not align with a culturally appropriate holistic equity approach and as such the Massey University process needs to evolve.

Potential guidance for revision of the Massey University equity selection process into a more comprehensive process could be found in the approaches utilised to improve Indigenous entry to medicine in New Zealand and Australia. The pipeline approach commences with culturally appropriate recruitment processes to increase awareness and knowledge of health careers, and also academic support to better prepare Indigenous students for tertiary health study (Bryers et al., 2021; Curtis, Stokes, et al., 2015; University of Otago, 2021a). There is a focus on determining applicants “best starting point” to achieve their career goals through a culturally framed process using objective testing and an Indigenous specific multiple mini-interview (Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). Some students require further academic preparation through a bespoke bridging/foundation programme (Bristowe, 2012; Curtis & Reid, 2013; Curtis, Wikaire, Jiang, McMillan, Loto, Fonua, et al., 2015), while others are ready to commence bachelor level study. Following year one of bachelor level study, an Indigenous led, standalone admission process for Indigenous Māori and Pacific applicants is utilised to determine who was likely to be successful in their study for admission into the programme (Curtis, Wikaire, et al., 2015). Finally, a suite of culturally appropriate academic and pastoral support is provided to admitted students to facilitate their success and completion of the programme (Curtis, Wikaire, et al., 2015; Lawson et al., 2007; Taylor et al., 2019), including inclusion of Indigenous content in the curriculum (Curtis, Wikaire, et al., 2012; Lawson et al., 2007; Pitama, 2012). All of these initiatives will require an investment in Indigenous staff specifically employed for these purposes.

While direct support of the students is needed, this can only happen with institutional commitment to inclusion. Ultimately changes in the institution are required to provide an environment that is committed to supporting Indigenous student success. Having a strategy, vision or mission statement or strategy regarding Indigenous student success (Curtis, Wikaire, et al., 2012) shows commitment and requires greater action on the part of the institution. Cultural awareness training implementation for both non-Indigenous students and staff is also valuable (Lawson et al., 2007), as is building Indigenous content into the curriculum (Curtis, Wikaire, et al., 2012; Lawson et al., 2007). The same authors also noted that that facilitating pathways for development of Indigenous academics and professional staff is important for greater role modelling, as is having Indigenous faculty in levels of leadership.

### **11.3.1. *Perspectives on equity pathways.***

While equity pathways have been shown to be the most effective strategy to address the underrepresentation of Māori in medicine, there are many hurdles yet to cross before equity pathways for Indigenous selection into either medicine or veterinary science are widely perceived as social justice initiatives (Curtis & Reid, 2013; Jones et al., 2019) rather than preferential treatment. Bacchi (2004) purports that the framing of affirmative action as preferential treatment is challenging as it problematises the recipients, thereby placing the responsibility on them to change to meet the hegemonic standard of what is determined to be meritorious, rather than questioning whether the standard is in fact legitimate. Further, the interpretation of equity pathways as preferential treatment (Radin, 1991) has negative effects for the target groups, such as being perceived as less qualified or less deserving, and in the extreme being seen as privileged for the “special” treatment they are perceived to receive (Bacchi, 2004). This can lead some members of the dominant group to interpret the perceived “preferential treatment” as reverse racism against themselves (Anderson, 2010).

The perception of equity pathways for Indigenous medical selection as reverse racism against Pākehā is highly evident in New Zealand. Multiple news articles demonstrate that many Pākehā continue to have a perspective that Māori or Pacific medical students selected through an equity pathway are only there at the expense of a more deserving Pākehā applicant (Duff, 2018; Fuatai, 2018; Hurihanganui, 2018). This perspective was further evidenced in 2020, when a father of a student who was not selected into the University of Otago medical programme, filed a case against the University over the institution’s equity processes (O’Callaghan, 2020). While the case was eventually withdrawn, it highlights the angst felt by majority members when they feel that there is preferential treatment for Māori.

Many of the objections to Indigenous equity pathways are based on the concept of meritocracy as measured by academic performance. (Razack et al., 2015). It is a reality that some, but not all, Māori students will be selected with lower grade point averages than some general pathway students who will not be selected. However, to focus on academic attainment as the sole indicator of merit is limiting, and fails to acknowledge the value that Indigenous students bring to the programme and profession, the systematic disadvantages to which Māori are subject, and ultimately their Indigenous rights to education (United Nations, 2007). Treating entry to veterinary science or medicine as an individual prize to be won by those with the highest academic performance conflicts with the aim of inclusion and representation, and will continue to favour those already privileged by our selection systems (Cleland et al., 2012).

#### **11.4. THE SELECTION ASSESSMENTS HAVE LIMITED UTILITY FOR MĀORI**

Analysis of all the selection assessments utilised between 2017 and 2019 was undertaken (Chapter 9). The analysis of academic and non-academic selection introduced in 2017 represents the most comprehensive comparison of selection methods that has been undertaken to date. Further, it is the only study to consider the impact of a wide range of methods on the selection of Indigenous applicants.

After consideration of all factors, Māori received lower scores in all the assessments, with the exception of the SJT. As neither the content nor the development of the assessments had a significant Indigenous influence, it cannot be ruled out that these assessments were less relevant or appropriate for Māori. Students from low decile schools received lower scores in all the assessments except written communication. Given that Māori were more likely to come from lower decile schools there is potential for Māori applicants to be doubly disadvantaged in the selection assessments.

It was anticipated that the move away from selection solely upon academic assessment to a blend of academic and non-academic assessment might further enable the access of Māori to veterinary education. However, this did not prove to be the case (Chapter 9). Standard process applicants were ranked in descending order based on their selection score, which had equal weighting on academic and non-academic performance. While a selection score was calculated for Māori applicants through the equity process, they were not ranked and selected using this score. Instead, all applicants through the Māori equity process from 2017, who met the criteria for eligibility for selection into the professional phase and demonstrated sufficient activity in their Māori community, were selected. As, there was no minimum eligibility criteria regarding performance in the non-academic assessments, selection of Māori applicants depended on whether they met the minimum academic eligibility criteria

(i.e. pass all pre-requisite courses and GPA of  $\geq 5.0$ ). As a result, the scores on the written communication assessment and the non-academic assessments did not directly influence the selection outcomes of Māori applicants through the equity process. Had these non-academic assessments played a role in the Māori equity selection process, it is likely fewer Māori applicants would have been selected given that Māori received lower scores on five of the six assessments. It is unlikely that adjusting the weighting of the various selection assessments would have enhanced access for Māori considering the lower scores they received. The finding of inequity in scores on the selection assessments between Māori and non-Māori reinforces the importance of having a separate selection process (inclusive of appropriate selection tools) for Māori in which they are not compared with non-Māori.

It is worthwhile reconsidering the purpose of the selection process. For standard process applicants, there are three to four times the number of applicants than places available, thus a competitive ranking process is required to decrease the number to that which can be accommodated in the programme. In contrast, the number of Māori applying are small, and as such do not need to be 'whittled down'. Given this, perhaps the selection assessments for Māori should have less focus on assessment for ranking and instead focus on assessing the preparedness of the applicant for, and therefore likelihood of success in, the programme and profession and facilitating access for those students.

The data from this thesis raise the question as to which of the selection assessments, if any, are appropriate, or could be adapted to be appropriate, for use in a standalone equity selection process for Māori. The STAT score was not associated with either professional phase GPA or passing all courses in the professional phase on the first attempt and showed bias against Māori. As such there is little evidence to support its use as a selection assessment for Māori. In contrast, pre-vet GPA was significantly associated with both academic outcomes with the largest effect of any predictor variable. While there is still a difference in pre-vet GPA based on a combined effect of the applicants pre-vet GPA and whether they had prior university experience, the strength of prediction of professional phase academic outcomes warrants the continuing use of pre-vet GPA as a measure of academic assessment within Māori. The written communication assessment and GPA were significantly correlated with almost the highest correlation level of any pair of selection assessments. As such, it does not provide substantial additional information above and beyond GPA for academic performance so may also be unnecessary.

With regard to the non-academic assessment, being Māori was associated with lower scores on the MMI and CASPer but not SJT. CASPer is a standardised, externally sourced assessment that has no explicit Indigenous input into its development or marking, and there is no scope for input of Massey University staff into the content. As the relevance of the CASPer assessment to Māori cannot be assured, along with the evidence of bias against Māori, there is little justification to support the use of CASPer in a selection process for Māori. The MMI was also biased against Māori, thus in its current form there is little evidence to support its continued use in the assessment of Māori. There was no difference in the SJT scores between Māori and non-Māori, which would support consideration of its continued use in assessing Māori for veterinary student selection. However, while the SJT produced scores that did not have an ethnic bias, the assessment is highly resource intensive both logistically and financially. Thus, while it has some value, due to the lack of financial feasibility its use was discontinued from 2020. The non-academic assessments are used to assess communication (MMI) and other personal attributes (MMI, SJT and CASPer). Given the smaller cohort size, an assessment of these attributes could be provided by the Indigenous staff employed to implement the pathway, who would interact with the applicants frequently as part of the transition period support. As such, it could be argued that all of these non-academic assessments are unnecessary.

Currently none of the selection assessments enable collection of contextual factors that could inform a holistic assessment of an applicant's likelihood of success in the programme. An Indigenous specific MMI has been effective in assessing the likelihood of success of Indigenous applicants to medicine (Curtis, Wikaire, et al., 2015). An Indigenous led MMI, using Indigenous raters, to gather information regarding contextual factors of veterinary applicants warrants exploration. Such an MMI would also enable a robust method to collect multiple assessments of an applicant's communication skills.

In summary the selection assessments are inappropriate for comparing Māori and non-Māori applicants. Aside from pre-vet GPA, there is little reason to support the use of any of the other selection assessments in their current format in an equity selection process for Māori. Revising the current MMI that is currently used for ranking, to an Indigenous specific MMI for holistic assessment should be considered.

## 11.5. ACADEMIC OUTCOMES DO NOT DIFFER BETWEEN MĀORI & NON-MĀORI

Once selected into the veterinary programme, there is no significant difference in the academic outcomes of Māori and non-Māori (Chapter 10). This finding contradicts the view that Indigenous students selected through an equity process are inferior (Radin, 1991) to students selected through the standard process.

Despite differences in the decile and type of school attended<sup>7</sup> of Māori and non-Māori applicants, these differences did not exist between Māori and non-Māori students in the selected cohort. This raises the possibility that the selection process is a barrier to Māori who do not have similar characteristics to non-Māori. Only 15% of all applicants from low decile schools were selected, while 33% of applicants from high decile schools were selected. Given this fact, and that there are much higher number of applicants from higher decile schools, in the selected cohort across all years, only 2% of students were from low decile schools, compared with 55% from high decile schools (Chapter 8). Nationally, 45% of Māori attend lower decile schools (Ministry of Education, 2016) so it is unsurprising that Māori veterinary applicants were also more likely to have attended low decile schools (Chapter 7). However, this means that the inequity for selection of students from low decile schools is more likely to affect Māori than non-Māori. Given that students from lower decile schools are less likely to attain university entrance (Ministry of Education, 2020a), it follows that they are also less likely to have been adequately prepared for selection into the professional phase of the veterinary programme, as that requires much higher levels of academic attainment than university entrance (Massey University, 2020a).

An opportunity raised by the lack of sociodemographic differences between selected Māori and non-Māori students, as well as the high level of success of selected Māori students, is the possibility that with better support processes there may be scope for selection to be extended to more Māori, perhaps by considering those with a GPA slightly below the minimum cut-off. Whiteford et al. (2013) examined the literature regarding the outcomes of students accepted through processes designed to foster wider participation at university in Australia. The authors concluded that social equity-based admissions do not negatively impact academic outcomes and standards, provided the institution is committed to adequately resourcing appropriate academic support programmes as well as initiatives to enhance student belonging and connectedness to their peers, particularly for those students

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<sup>7</sup> For the entire selected student cohort (2003-2019), first in family status could not be assessed as that data was only available for the 2017-2019 time period.

attending university for the first time. These successful outcomes have been seen where some Indigenous students were selected into a medical programme with GPA below the minimum requirement of the general pathway students (Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015), but still achieve high levels of success in the medical programme (Curtis et al., 2017).

## **11.6. LIMITATIONS OF THESIS**

The data used in the studies in this thesis were all secondary data that were routinely collected for enrolment or selection purposes. The format of the questions used by VCNZ and Massey University to collect the ethnicity data that was used in this thesis is not consistent with the best practice question advised by Statistics New Zealand (2018b) and the Ministry of Health (2017). Kukutai (2004) noted that “reliable and consistent ways to define ...ethnic groups and to identify their members” (pp. 86-87) are needed in order to monitor and ultimately address inequity. In other words, without being able to appropriately measure who is Māori, it is not possible to appropriately identify the areas requiring intervention for Māori and therefore Māori needs (and rights) fail to be addressed. It would also have been ideal to have had secondary school academic attainment data, however that was not available to the researcher. The outcomes data (Chapter 10) was limited to the first semester of the professional phase. It would have been positive to have had more professional phase data, and ideally completion data, to consider for this study. Unfortunately, due to time and resource constraints that was not possible.

## **11.7. SIGNIFICANCE OF THIS THESIS**

This thesis is the first instance of reporting the ethnicity of not only veterinary applicants, but also selected students and the veterinary profession in New Zealand. While it previously appeared that there were few Māori veterinarians or students, it has now been definitively shown that Māori are underrepresented at all levels of the veterinary profession, as applicants, students, and graduated veterinarians. Thus, ethnic inequities are no longer invisible in the veterinary profession.

As there is a single veterinary school for all of New Zealand, these data represent the entire population of veterinary applicants and selected students for all of New Zealand between 2003-2019. This thesis represents the largest body of work on Indigenous veterinary representation both within New Zealand and internationally.

This thesis also represents the most comprehensive comparison of selection tools in a medical or veterinary science programme overall, including comparison of scores across Indigenous and non-



Indigenous applicants. This thesis is also the first to compare the academic outcomes of Indigenous and non-Indigenous students in veterinary science and to demonstrate the lack of difference between them, both within New Zealand and internationally.

Finally, the primary strength of this thesis is that it has incorporated Kaupapa Māori positioning with analysis led by a Māori researcher with provision of senior Kaupapa Māori supervision. As such, this thesis represents a non-victim blaming, non-culturally deficit-based approach that rejects problematising Māori as deficient, incapable, or uninterested in veterinary careers. Kaupapa Māori positioning has ensured centralisation of Māori in the research, thereby allowing for appropriate analysis for Māori. Ultimately it is hoped that this thesis will enable positive and even transformative change for Māori access to the veterinary profession in New Zealand

## Chapter Twelve

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### 12. RECOMMENDATIONS AND CONCLUSIONS

This chapter contains recommendations that arise from the results of this thesis and associated literature review. While the majority of these recommendations are directed to Massey University as the sole provider of veterinary education in New Zealand, recommendations are also provided for the veterinary sector more broadly. The conclusion to this thesis follows these recommendations.

#### 12.1. RECOMMENDATIONS: MASSEY UNIVERSITY / SCHOOL OF VETERINARY SCIENCE

The recommendations for Massey University and the School of Veterinary Science are outlined below. Many of these focus on improving the process, experience, and success of Māori who currently apply, with longer term aims to improve recruitment and the overall environment for Māori students and staff. As a university that describes itself as Tiriti-led, with a focus on Māori student success at all levels of study (Massey University, 2019b), it is hoped that many of these recommendations will be adopted.

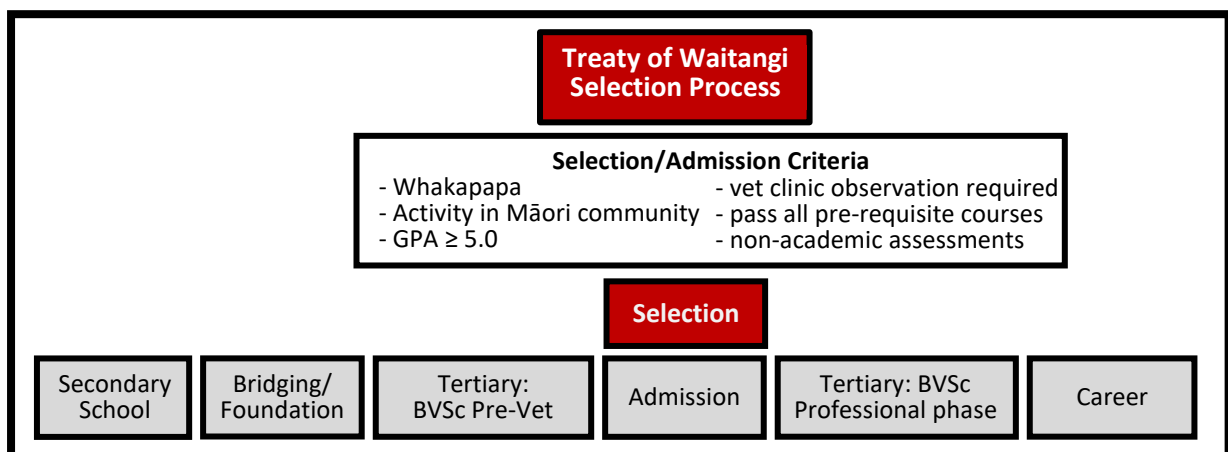
##### 12.1.1. *Appropriate ethnicity data collection, analysis, and reporting*

Massey University and the School of Veterinary Science need to update the questions they used to collect ethnicity data and the methods of data collation, so as to be consistent with best practice as advised by Statistics New Zealand (2018b) and the Ministry of Health (2017). Prior to this thesis there has been no public reporting of veterinary applicant ethnicity and selected student data. It is recommended that Massey University annually report aggregated, deidentified ethnicity data of applicants and selected students each year, ensuring appropriate, non- culture blaming text is used in the reporting.

This thesis represents the first comprehensive quantitative review of the veterinary selection process in New Zealand, since the veterinary programme commenced in the late 1960s. Resources need to be committed to allow ongoing, regular analysis and review of outcomes of the selection process including academic performance in the entirety of the professional phase and completion outcomes. Such ongoing activities will ensure that Māori remain centralised and that there is a means of evaluating the effectiveness of future interventions described below.

### 12.1.2. Pipeline Development

The Treaty of Waitangi selection process was a start to enabling equitable access for Māori to veterinary science, however it is not sufficient and needs to evolve to enable transformative outcomes for Māori. The current Treaty of Waitangi selection process is shown in relation to its timing to various points on the journey from secondary education through to career/employment in Figure 12.1.



**Figure 12.1 Treaty of Waitangi selection process (2007 – 2019)**

To improve the access of Māori to veterinary education, the development of a pipeline approach, including a comprehensive equity pathway is needed to allow for transformative change in the access of Māori to veterinary education. While the university is the key in this process, some engagement with other organisations will be needed. A schematic representation of the proposed pipeline is shown in Figure 12.2.

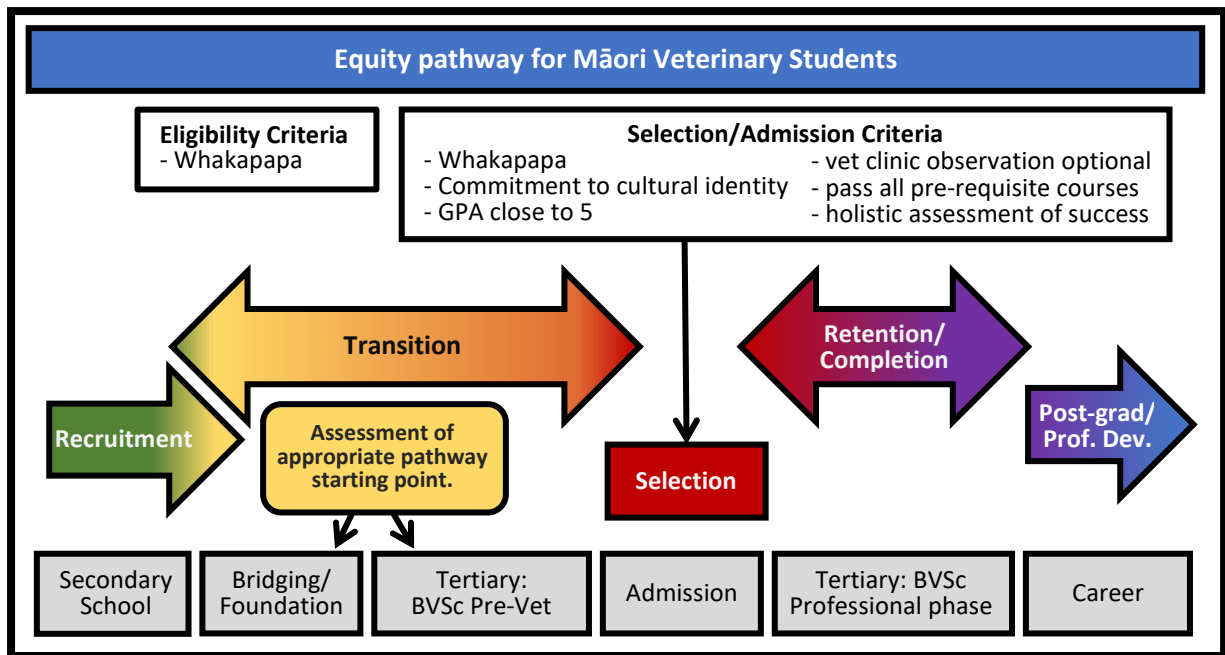


Figure 12.2 Equity pathway to enable access of Māori to veterinary education and the profession.

#### 12.1.2.1. Whakapapa eligibility criteria for access to pathway

Eligibility for the equity pathway should be based on individuals having Māori whakapapa, whether it be for entry to the recruitment processes while in high school or later into tertiary study. This eligibility criteria is predicated upon an Indigenous rights mandate for access to education (Jones et al., 2019; United Nations, 2007), and avoiding cultural essentialism and value-laden judgement regarding “how Māori” an applicant is perceived to be (Curtis & Reid, 2013).

#### 12.1.2.2. Develop a recruitment pathway for engagement with secondary school students

A key longer-term recommendation is the establishment of recruitment pathway that invites and prepares Māori students to consider a career in veterinary science framed within an Indigenous worldview (Curtis, Wikaire, et al., 2012). Such a program will require the University to work with secondary schools and the veterinary profession to facilitate awareness of the veterinary profession and careers, to enable understanding of what preparation is needed to embark on a veterinary career and to support attaining that preparation. Such a substantial undertaking is not possible without additional, appropriate funding. To make a recruitment process feasible, it is recommended that Massey University explore a partnership with Pūhoro STEM Academy (Section 4.4.2.2) who have an existing, extensive network of relationships with Māori secondary students and schools.

### **12.1.2.3. Develop comprehensive transition support for Māori with appropriate resourcing**

The transition to university is difficult. During the years of data collection in this thesis Māori veterinary applicants navigated the transition period without additional support. It is recommended that Massey University implement a programme to support Māori veterinary applicants in the transition to university that is appropriately resourced, staffed and funded, and includes academic, personal, and cultural support initiatives in a culturally appropriate context.

As part of the transition support, it is recommended that Massey University include holistic assessment of each applicant prior to enrolling in university courses, to provide guidance as to the most appropriate starting place to achieve their goals. Initially, this could involve review of their secondary records and a conversation with the applicant to better understand their circumstances and likelihood of success. In time it would be recommended to include a more robust, culturally appropriate interview process.

It is recommended that a pōwhiri (Māori welcoming ceremony) and culturally relevant orientation process are included for all new students (bridging programme or pre-veterinary semester) and their whānau. This would enable the new students and whānau to be appropriately welcomed, to whakawhanaungatanga (process of establishing relationships), and to provide guidance for both students and their whānau as to what to expect at the university.

As the secondary school system is not adequately preparing Māori for university study (Curtis, Wikaire, et al., 2015; Wikaire et al., 2016), a bridging programme is needed to support Māori students to upskill in the sciences and mathematics. Massey university should develop a fit for purpose bridging programme for Māori prospective veterinary applicants built on the evidence of what works for Māori, which includes high levels of culturally appropriate personal and academic support that develop the independent learning skills of students to support their future tertiary success (Bristowe, 2012; Curtis, Townsend, et al., 2012). The programme should also support the development of a cohort and sense of belonging for students under the oversight of Indigenous leadership (Curtis, Townsend, et al., 2012; Houia-Ashwell, 2020).

It is recommended that staff dedicated to supporting Māori applicants are employed, including administrative support and allocation of workload for an Indigenous academic to oversee the process. One or more dedicated professional staff member(s) are needed to coordinate the support initiatives of the pathway. The(se) coordinator(s) would play a substantial role in supporting the transition from secondary school to tertiary study of aspiring Māori veterinary applicants on a day-to-day basis through personal and cultural support and mentoring. The University should also provide academic

support such as funded group or individual tutoring in the science courses (physics, chemistry, and biology). A further recommendation is that dedicated physical space is provided for these students in which they can engage with each other and supportive staff in a culturally safe environment.

Some of the transition recommendations that have arisen as a result of this thesis have been implemented since 2020. A part-time (0.5 FTE) Māori professional staff member ('coordinator') has been employed to provide personal and cultural support, and to facilitate access to academic support. The coordinator assessed each applicant prior to commencing study and provided counselling about their readiness (or otherwise) to commence the pre-veterinary semester and achieve their goal of becoming a veterinarian. A dedicated orientation including mihi whakatau (Māori welcome) for all new students and their whānau was implemented in 2020. Tutoring support is now provided for all the four pre-requisite science courses in the pre-vet phase (physics, chemistry, and biology). A dedicated space for Māori students has been provided in which the staff coordinator is based and there is space to study and eat/share kai. In the first year (2020) of implementation, there have been positive outcomes. Three times more Māori were selected (n=12) than in each of the years 2017-2019 (n=4 for each year) and the pass rates in the courses in the pre-vet semester increased with the majority (80%) passing all their courses, and the remaining 20% passing three of their four courses. No Māori student failed more than one course in the pre-vet semester in 2020, in contrast to 2017-2018, in which 33% failed two to four courses, with almost half of those students failing all four courses. While this data comprises low numbers and does not infer causation, they are positive indicators. Ongoing data monitoring and analysis of these and other yet-to-be implemented initiatives should be undertaken.

#### **12.1.2.4. Develop a holistic, culturally appropriate, standalone selection process for Māori**

The existing Treaty of Waitangi equity process described in this thesis was a sub-process to the standard application process that students of Māori ancestry could choose alongside their standard application. As the number of Māori applicants is currently small, there is no need to rank applicants against each other. However, that need may exist in the future, and changes to the selection process should accommodate for that eventuality. Specifically, a culturally appropriate holistic standalone admission process should be implemented in order to adopt a Kaupapa Māori and Te Tiriti aligned approach for selection of Māori into the professional phase of the veterinary programme. The aim of the selection process should be to enable holistic assessment of each applicant for their likelihood of success in the veterinary programme and in a veterinary career. The selection process should be separate to that of the standard process for non-indigenous students, and under Indigenous control to ensure that its transformative potential is not limited by the oversight of non-Māori.

### ***Revise the selection criteria related to ethnicity***

Eligibility for selection into the professional phase under the Treaty of Waitangi selection process required that students provide evidence of their Māori whakapapa (ancestry) and demonstrate activity in the Māori community. Due to the impacts of colonisation, many Māori may not be strongly connected to their iwi, marae, or a local version of their Māori community. As such, a requirement to demonstrate activity in the Māori community is likely to have been a barrier for some Māori applicants and should be reconsidered. This requirement also promotes a level of cultural essentialism (Hoskins, 2012), which may lead to a victim-blaming approach, where the victims of colonisation are blamed for their lack of Māori community connection and deemed 'less-Māori' than other applicants. The assertion of a Māori rights-based argument for eligibility based on whakapapa (rather than cultural judgment) has been adopted successfully elsewhere (Crampton et al., 2018; Curtis, Wikaire, et al., 2015). As such, it is recommended that Massey University should align with an Indigenous rights perspective by removing the need to demonstrate activity in the Māori community for selection purposes. Instead, a revised requirement that the applicant demonstrate commitment to their cultural identity and future development (as required) should be implemented.

### ***Make the requirement for practical work/observation recommended but optional***

Currently applicants are required to complete 2 weeks of practical work/observation in a veterinary clinic, and failure to do so renders the applicant ineligible for selection. From overseas data, it was shown that it was more difficult for minoritised ethnicities to access veterinary experience hours (Lloyd & Greenhill, 2020). It is possible that the requirement of practical work/ observation in a veterinary clinic may similarly be more difficult for some Māori applicants to complete. It is recommended that the two-week requirement for practical work/observation in a veterinary clinic become a recommendation, rather than an absolute requirement, such that Māori students who are unable to access this experience remain eligible for selection.

### ***Consider some applicants slightly below a GPA of 5.0***

The level of GPA required to be successful in the veterinary degree is estimated to be a minimum of 5.0 (B average), but ultimately the precise level is unknown. As demonstrated in Chapter 10, there is a lack of statistical difference in academic outcomes between Māori and non-Māori once selected into the programme, which was achieved without additional support being provided to any Māori. The inequity in secondary education for Māori, and the lack of additional support for Māori applicants during the period of this PhD may mean that some students who did not meet a GPA of 5.0, may have had the ability to complete the programme, particularly had additional comprehensive support been in place.

It is recommended that once Massey University has more comprehensive support process in place, that some Māori students who are deemed to have the potential to be successful who are close to but have not met the GPA of 5.0 be admitted into the professional phase. These students must be given support to facilitate them to achieve to their potential. There is some risk associated with this approach, as there would initially be some trial and error to determine what GPA level is the minimum below which students are unlikely to be able to successfully complete the course. As such there may be some students admitted who may not be successful, but without trying to create more equitable opportunities it will not be known to what extent it is possible.

***Implement holistic assessment to determine likelihood of success in the programme.***

In this thesis, six selection assessments were analysed. Māori received lower scores than non-Māori on five of the six assessments. These findings reinforce that use of these assessments to compare Māori and non-Māori applicants against each other is inappropriate. In the standard pathway, these assessments are required to rank large numbers of applicants and thereby enable choosing a subset to progress into the professional phase. Whereas the small number of Māori applicants means that selection, and therefore use of the selection assessments, could focus less on assessment for ranking and instead focus on assessing whether applicants are well prepared for success in the programme and profession (Curtis, Wikaire, et al., 2015).

As discussed in Section 11.4, there is no evidence to support the continued use of the STAT test, and limited justification for the written communication assessment, whereas the pre-vet GPA is predictive of academic outcomes once in the programme. It was also discussed that there is little evidence to support the continued use of the CASPer assessment, or the MMI in its present form for assessing the selection of Māori.

It is recommended, that GPA is used to assess academic performance, and that the use of the STAT test and written communication assessment are discontinued. It is also recommended that CASPer, SJT and the MMI (in its current form) are discontinued, and that these non-academic assessments are replaced with an Indigenous specific MMI, and feedback from the pathway coordinator(s).

**12.1.2.5. Implement comprehensive support programme for Māori students once selected**

It is recommended that Massey University implement a comprehensive programme of holistic, culturally appropriate support including academic, cultural, and personal support for students selected into the programme. This support would be similar to that described above for the transition



period in terms of staffing, space allocation, and other components of support such as mentoring and tutoring.

#### **12.1.2.6. Confirm commitment to and funding for the pathway**

It has been noted that funding for some Indigenous pathways or support programmes for health professional programmes is often not secure in the long term (Curtis & Reid, 2013). This is problematic as the lack of certainty and particularly removal of funding would significantly hamper equity pathway activities (Curtis & Reid, 2013; Paul, 2013). It is recommended that Massey University consider the revised equity pathway as a business-as-usual funding requirement which is included in the annual budgeting process, rather than trying to source funding on a year-to-year basis. Along with pathway funding, the university should also strive to develop sustainable scholarship funding (Curtis, Wikaire, et al., 2012; Lawson et al., 2007; Taylor et al., 2019) given the overrepresentation of Māori from low socioeconomic backgrounds.

Currently there is no specific government support for recruitment and retention of Māori in veterinary science. In contrast, the Ministry of Health provides funding support for recruitment of Māori into the health professions and for the bridging programmes (Bristowe, 2012; Bryers et al., 2021; University of Otago, 2021b). Given the critical role veterinarians play in agricultural and animal health and welfare, the most relevant government ministry to veterinary science is the Ministry of Primary Industries. It is recommended that Massey University seek the support of the Ministry of Primary Industries through funding and other support (e.g. internships, mentoring) for the recruitment and retention of Māori into veterinary science.

#### **12.1.3. Improve School culture and climate**

While development of an appropriate pathway for improving access of Indigenous students to veterinary education is needed, it must be recognised that the culture and climate of the institution into which Indigenous students enter will have a significant impact on their success. During the period of this thesis, the veterinary school did not reflect Māori values or perspectives. While not a direct outcome of the research analysis in this thesis, consistent with the Kaupapa Māori positioning of this thesis, recommendations are warranted regarding institutional changes that would facilitate Māori to succeed as Māori (Durie, 2012; G. Smith, 2012; Smith, 2011). Thus, change is needed to enable an improved, culturally safe, climate in the School of Veterinary Science to support Māori success.

Cultural safety is different from cultural competence. While cultural competence is based on acquiring knowledge about another culture, it is foregrounded in difference and runs the risk of the target culture being “othered” (Curtis et al., 2019). In contrast, cultural safety is foregrounded in

understanding societal power differentials and requires “reflective self-assessment of power, privilege and biases” (Curtis et al., 2019, p. 15). Thus cultural safety is a more appropriate aim for individuals and institutions.

#### **12.1.3.1. Include Indigenous success in mission statement**

Improving the success of Māori and Pacific students was introduced as a goal in the School strategic plan in 2019. However, it is not included in the mission statement and it would be recommended that the School introduce an element into the mission statement that reflects a commitment to Indigenous success (Curtis, Wikaire, et al., 2012).

#### **12.1.3.2. Support development of Indigenous staff**

At the time of writing this PhD, the author is the sole member of academic staff in the veterinary school who openly identifies as Māori, which equates to approximately 1% of academic staff. This is below the already low national proportion of Māori academic university staff which varied from 4.2-5.1% between 2012-2017 (McAllister et al., 2019). It is recommended that Massey University commit to raising the proportion of Indigenous staff, ideally to the level of population parity (Jones et al., 2019). This is a long-term recommendation that will require a “grow your own” strategy of encouraging Māori graduates to pursue academic careers. Some initiatives could include encouraging Māori veterinary students to pursue research as students, through research mentorship and provision of funded student research projects, as well as providing post-graduate scholarships for Māori veterinary graduates. It is also recommended that Indigenous academics are developed and promoted into positions of leadership (Curtis, Wikaire, et al., 2012; Jones et al., 2019) where they can influence institution culture, and the policy regarding Indigenous student selection and therefore outcomes.

#### **12.1.3.3. Commit to resourcing and supporting staff development.**

As a School within a university aspiring to be Tiriti led, it is recommended that substantial staff professional development is provided (Curtis, Wikaire, et al., 2012) which could include, for example training with regard to Te Tiriti o Waitangi, cultural safety and understanding university staff responsibilities to Māori. Provision of evidence of engagement in development activities should be built into annual performance reviews and promotion criteria.

#### **12.1.3.4. Introduction of Indigenous content into the curriculum**

It is also recommended that Indigenous content is introduced into the curriculum (Curtis, Wikaire, et al., 2012; Lawson et al., 2007; Paul, 2013). This could start relatively quickly, with regards to education on cultural safety and Te Tiriti of Waitangi. However, true integration of content would be a longer-

term goal requiring curriculum revision. It would also require additional Indigenous expertise than currently exists in the school, so along with the earlier recommendation with regard to developing Indigenous academic staff, external Indigenous expertise is likely to be needed in the interim.

## **12.2. RECOMMENDATIONS: VETERINARY COUNCIL OF NEW ZEALAND (VCNZ)**

Ethnicity data collection by VCNZ is not consistent with best practice as advised by Statistics New Zealand (2018b) and the Ministry of Health (2017). In order to collect the most appropriate and accurate ethnicity data, it is recommended that VCNZ adopt the ethnicity question format recommended by Statistics NZ and data collation and handling outlined in the Ministry of Health Ethnicity Data protocols. It is also recommended that the VCNZ should make publicly available aggregated, deidentified profession ethnicity data in the veterinary profession workforce report, which to date has not been done despite workforce ethnicity data being collected since 2018.

At the time of writing this thesis, a search of the VCNZ website failed to find any references to Māori, inclusion, or societal representation. In contrast, the equivalent regulatory body for veterinarians in the UK, the Royal College of Veterinary Surgeons (RCVS) has a Diversity and Inclusion Group, diversity statement, and recently published their strategy for supporting and promoting diversity in the veterinary profession in the UK (Royal College of Veterinary Surgeons, 2021). As such a recommendation in the short term for the VCNZ is to clarify their position on the inclusion of Māori in the veterinary profession. Then, in line with clause 75b of the Veterinarians Act 2005 (New Zealand Government, 2020) they could liaise with Massey University to support strategy and associated resourcing to support improved representation of Māori in the veterinary profession.

## **12.3. RECOMMENDATIONS: NEW ZEALAND VETERINARY ASSOCIATION**

The New Zealand Veterinary Association (NZVA) is the professional membership association representing New Zealand veterinarians. The NZVA website notes that they are committed to “Ensuring the profession’s contribution to society is the very best it can be” (NZVA, 2019), but has no mention of inclusion or societal representation. The word Māori is mentioned once on the wellbeing page of the website in relation to the concept of hauora (wellbeing). As such, a recommendation for the NZVA is to clarify their position on the inclusion of Māori in the veterinary profession. This should then inform development of a strategy and associated resourcing to support improvement of the representation of Māori in the veterinary profession.

## **12.4. RECOMMENDATIONS: MINISTRY OF PRIMARY INDUSTRIES**

The Ministry of Primary Industries have made a renewed commitment to Māori and te ao Māori through their updated strategy “Fit for a better world” (Ministry of Primary Industries, 2020) which is underpinned by the “Taiao Ora Tangata Ora” report (Primary Industries Council, 2020). Having more Māori veterinarians would align with the objectives of the Ministry. It is recommended that the Ministry of Primary Industries provide funding and other support (e.g. internships, mentoring) to support the recruitment and retention of Māori in veterinary science.

## **12.5. FUTURE RESEARCH**

A strength of this thesis was the Kaupapa Māori positioning, and centralization of Māori in the analysis of access for Māori to veterinary education and academic outcomes in the professional phase. Further research is needed in this area that should continue to maintain Indigenous theorising and Kaupapa Māori positioning. Once data is available from more of the professional phase, analysis will be needed to determine whether the findings in this thesis translate beyond the first semester.

While the results of the quantitative analyses in this thesis have opened the door to the conversation regarding Māori in the veterinary profession, in the future both quantitative and qualitative analyses should be undertaken. They are complementary approaches that will allow a greater richness of data to be collected and analysed. For example, qualitative analysis is needed to more fully understand the experiences of Māori applicants to, and students in, the veterinary programme. It would also be useful to undertake research to understand Māori veterinarians’ experiences in the veterinary profession post-graduation.

As there are recommendations for significant change in this thesis, monitoring and analysis of any changes will be needed. Future research will be needed to assess the ongoing access of Māori to veterinary education, and the impact of implementation of the equity pathway (including recruitment transition, selection, and retention/completion) on Māori access, experiences, and academic outcomes.

Potential research questions that could be approached through quantitative and qualitative approaches could include:

- What secondary school factors helped current veterinary applicants to apply for veterinary science, and what barriers did they face to applying for veterinary science?

- What value, if any, did current Māori veterinary students and graduates find in the practical work/observation time spent in veterinary clinics prior to applying for veterinary science? How easy or difficult did they find it to access the practical work/observation time?
- What are the strengths and weaknesses of the revised secondary engagement and recruitment processes from the standpoint of applicants and their whānau?
- What is the impact of altered selection processes that focus on Māori student readiness, instead of ranking, upon access to and academic outcomes in the BVSc professional phase?
- Do Māori veterinary applicants experience racism in the pre-veterinary phase in relation to their inclusion in an equity pathway and if so how is that manifest?
- What are the experiences of Māori veterinary students in the BVSc programme with respect to discrimination?
- What are the experiences of Māori veterinarians in their professional careers with respect to accessing employment and once employed?

## **12.6. CONCLUSION**

An important outcome of this thesis is that it has brought to light ethnicity in the New Zealand veterinary profession. Māori have been centralised in the research, and the problem of inadequate access of Māori to veterinary education, and the subsequent underrepresentation of Māori in the veterinary profession, has been formally demonstrated. This thesis has also showed that introduction of a selection process for Māori reduced the inequity Māori faced in the selection process, such that Māori were no longer disadvantaged in terms of the odds of being selected. Once selected, the academic outcomes of Māori did not significantly differ from non-Māori.

However, reducing the disadvantages faced by Māori is not sufficient to enable representation of Māori in the veterinary profession to at least a level of population parity. In order to enable the veterinary profession to become more representative, there needs to be a commitment to change from the university, the government/Ministry of Primary Industries, the Veterinary Council of New Zealand (VCNZ), the New Zealand Veterinary Association (NZVA), stakeholders of veterinary education and services, and ultimately individual veterinarians. Whiteford et al. (2013) noted that improved access to higher education for underrepresented students requires multiple stakeholders to work synergistically toward a social inclusion agenda. This depends on a fit for purpose equity pathway for Māori that takes into account not only the eligibility criteria and selection process, but also includes a cohesive, culturally relevant recruitment and academic preparation programme, and a well-developed and substantive programme of academic, cultural, and pastoral support for selected students.

Widespread acknowledgement and transparency of the underrepresentation of Māori in the veterinary profession is essential. Lloyd (2013) outlined that perhaps the most important first step for the veterinary profession in addressing its lack of representation is to “admit there is a problem” (p. 81), and to acknowledge the benefits to the profession of inclusivity, as well as the future risk to the profession should that fail to occur. Admitting that there is a problem is a start, but it is not the endpoint. With acceptance comes the greater responsibility of the veterinary profession, the government, and Massey University to widen access for Māori to veterinary education.

Given the unique situation of New Zealand in having a single veterinary school (Massey University), a single registration body (VCNZ), a single professional association (NZVA), and a substantial proportion of the population involved in primary industries, there is marked scope to collectively address the issues of access and underrepresentation of Māori in the veterinary profession. Lessons can be learned from the University of Otago and the University of Auckland in New Zealand, where actions to widen access for Māori have led to almost population parity level admission of Māori students into medicine. As a university that describes itself as “Tiriti-led” (Massey University, 2019b), Massey University needs to commit to the changes required to improve the inclusion of Māori in veterinary science, including examining university processes for structural barriers, and providing better support in various forms for Māori students both prior to and after selection into the professional phase of the veterinary programme. The Ministry of Primary Industries, New Zealand Veterinary Association and the Veterinary Council of New Zealand also need to commit to improving inclusion of Māori in the veterinary profession. Perhaps more importantly, on an individual level, members of the veterinary profession should reflect on whether their own perspectives support or hinder widening access to the veterinary profession for Māori.



## Chapter Thirteen

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## APPENDIX – RESEARCH OUTPUTS ASSOCIATED WITH THIS THESIS

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### Journal Article

**Jillings, E.K.P.**, Curtis, E., Gardner, D., Parkinson, T., Hecker, K., & Cogger, N. (2021). Widening access to veterinary education: descriptive analysis of ethnicity, societal representation and educational background of applicants to veterinary education in Aotearoa New Zealand. *New Zealand Veterinary Journal*, 69(3), 147-157. . <https://doi.org/10.1080/00480169.2021.1885519>

**This article is equivalent to Chapter 7.**

### Book Chapter

Pelzer, J.M., and **Jillings, E.K.P.** (2017) Student selection, in *Veterinary Medical Education: A Practical Guide*, 1<sup>st</sup> edn (eds J.L. Hodgson and J.M. Pelzer), Wiley-Blackwell, Hoboken, pp.497-510.

### Conference Presentations

**Jillings, EKP** (2021) Rapua te mea ngaro. Exploring the access of Māori to Veterinary Education in Aotearoa New Zealand. *One Health Aotearoa, 7<sup>th</sup> Symposium 2021*, virtual presentation, New Zealand

**Jillings, EKP** (2020) Are the Australian and New Zealand veterinary professions adequately representative of the populations we serve? Keynote Address in *VetEd Down Under Gatton 2020 Conference*, Queensland, Australia

**Jillings, E.K.P.** (2018). Selection – a paradigm shift; the Massey experience. In *Melbourne Academy for Veterinary and Agricultural Science Learning & Teaching Symposium*. Melbourne, Australia

**Jillings, EKP.**, Regnerus, C. (2018) Flipping the paradigm. In *NZVA Conference*. Hamilton, New Zealand.

**Jillings, EKP.**, Erueti BB., Weston JF., Dwyer, C., Burchell, RK., Kachurovski, A., Riley, CB., (2018) Welcome to the Whānau. Engaging underrepresented ethnicities in veterinary education. *VetEd Down Under 2018 Conference*, Adelaide, Australia

