

# Predictors of academic success for Māori, Pacific and non-Māori non-Pacific students in health professional education: a quantitative analysis

Erena Wikaire<sup>1</sup>  · Elana Curtis<sup>1</sup> · Donna Cormack<sup>1</sup> · Yannan Jiang<sup>2</sup> · Louise McMillan<sup>2</sup> · Rob Loto<sup>1</sup> · Papaarangi Reid<sup>1</sup>

Received: 8 July 2016 / Accepted: 30 January 2017 / Published online: 24 February 2017  
© The Author(s) 2017. This article is published with open access at Springerlink.com

**Abstract** Tertiary institutions internationally aim to increase student diversity, however are struggling to achieve equitable academic outcomes for indigenous and ethnic minority students and detailed exploration of factors that impact on success is required. This study explored the predictive effect of admission variables on academic outcomes for health professional students by ethnic grouping. Kaupapa Māori and Pacific research methodologies were used to conduct a quantitative analysis using data for 2686 health professional students [150 Māori, 257 Pacific, 2279, non-Māori non-Pacific (nMnP)]. The predictive effect of admission variables: school decile; attending school in Auckland; type of admission; bridging programme; and first-year bachelor results on academic outcomes: year 2–4 grade point average (GPA); graduating; graduating in the minimum time; and optimal completion for the three ethnic groupings and the full cohort was explored using multiple regression analyses. After adjusting for admission variables, for every point increase in first year bachelor GPA: year 2–4 GPA increased by an average of 0.46 points for Māori ( $p = 0.0002$ , 95% CI 0.22, 0.69), 0.70 points for Pacific ( $p < 0.0001$ , CI 0.52, 0.87), and 0.55 points for nMnP ( $p < 0.0001$ , CI 0.51, 0.58) students. For the total cohort, ethnic grouping was consistently the most significant predictor of academic outcomes. This study demonstrated clear differences in academic outcomes between both Māori and Pacific students when compared to nMnP students. Some (but not all) of the disparities between ethnic groupings could be explained by controlling for admission variables.

**Keywords** Academic success · Ethnic disparities · Health professional · Inequity · Indigenous · Māori · Pacific

---

✉ Elana Curtis  
e.curtis@auckland.ac.nz

<sup>1</sup> Te Kupenga Hauora Māori (Department of Māori Health), Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand

<sup>2</sup> Department of Statistics, Faculty of Science, University of Auckland, Private Bag 92019, Auckland, New Zealand

## Introduction

Tertiary institutions internationally aim to widen participation to ensure graduating cohorts meet the needs of the diverse communities in which they operate (Bowes et al. 2013; The Sullivan Commission 2004; Whiteford et al. 2013). However, tertiary institutions are failing to achieve equitable academic outcomes and show on-going trends of under-achievement for indigenous and ethnic minority students in tertiary programmes (Garvey et al. 2009; Madjar et al. 2010a; The Sullivan Commission 2004; Zorlu 2013). Razack et al. (2015) note that despite strategic commitments to widening participation globally, emphasis on academic performance in determining admission to medical school inevitably excludes those we are aiming to 'include' (Razack et al. 2015). Ethnic disparities are particularly concerning for universities offering health professional programmes that aim to contribute to health equity targets by graduating more workforce-ready ethnic minority health professionals (Curtis et al. 2014b; Kaehne et al. 2014; Ratima et al. 2007). Indigenous and ethnic minority peoples are under-represented within health professions globally and this limits sector ability to provide a culturally safe, competent and appropriate healthcare (Curtis et al. 2012b; Health Workforce Advisory Committee 2003; The Sullivan Commission 2004; Whiteford et al. 2013).

A broad mix of factors that help or hinder academic success for indigenous and ethnic minority students in tertiary health study have been identified internationally: academic preparation (including secondary school academic achievement, exposure to science subjects, meeting tertiary admission prerequisites, and having clear career goals); socioeconomic status; availability of role models and mentors; family support; work/life balance; access to childcare; financial support; clear career information; student support systems; support to transition and first year academic results and environments (Gardner 2005; Jensen 2011; Loftin et al. 2012; Orom et al. 2013). These findings align with literature specific to Māori and Pacific health professional students in New Zealand (Curtis et al. 2012b, 2014b; Morunga 2009; Ratima et al. 2008; Sapoaga et al. 2013; Wikaire and Ratima 2011; Wilson et al. 2011).

Recruitment and retention initiatives have been implemented internationally that aim to identify and address barriers to success for indigenous and ethnic minority health professional students (e.g. scholarships to support financial barriers, admission quotas, provision of pastoral support staff, bridging/foundation programmes to address gaps in academic preparation, additional tutorials, mentoring programmes, provision of indigenous student study space) (Curtis et al. 2012b). However, political and societal backlash that sees these interventions as 'special treatment' and institutional resistance to change has limited both the ability to implement required changes and the effectiveness of interventions (Hesser et al. 1998; Towns et al. 2004). Whilst some promising early results have been reported (i.e. increased enrolment numbers, improved academic performance in year 1 of degree-level study), there is a lack of literature investigating ethnic disparities in programme academic performance and graduation (Curtis et al. 2012b).

Further detailed understanding of which factors influence not only indigenous and ethnic minority student academic success but are also associated with ethnic differences in academic outcomes in tertiary health programmes is necessary to achieve educational and health equity targets. Whilst qualitative studies have offered deeper insight into factors that help and hinder students, there is a need to understand which factors might be operating in different ways (Curtis et al. 2014b). In addition, quantitative analyses in some studies have been limited by small numbers of enrolled students from ethnic minority groups, a focus on

first-year academic outcomes, and a lack of direct comparison between ethnic groups. Quantifying differences in exposure to helping and hindering factors for different ethnic groups is expected to contribute to enhanced targeted support (Curtis et al. 2015a).

Quantitative studies that investigate predictors of academic success for health professional students generally has been completed, however, the majority of international literature in this area has tended to focus on total (predominantly white) student cohorts as indigenous and ethnic minority student numbers are often too small to allow sufficient power for statistical analysis or comparison with other ethnic groups (Andriole and Jeffe 2010; Mills et al. 2009; Utzman et al. 2007). Ethnicity is often positioned as a 'predictor' variable rather than deliberate comparison exploring reasons for disparities between ethnic groups and it is difficult to generalise international findings to both a New Zealand and Māori/Pacific context. In addition, inconsistencies in identification, data collection, definition and grouping of student ethnicity (for example, indigenous status, low-income status, country of birth, self-identified ethnicity, experiences of colonisation) across studies internationally limit generalisation of findings to a local context.

Social accountability of health sectors and tertiary education providers requires particular attention to be focused on understanding the unique needs of indigenous and ethnic minority health professional students in order to better meet their needs and support their academic success. It is timely to complete detailed quantitative analysis of predictive factors to explore how each concept might impact on academic success for different ethnic groups. It is unknown if these reasons for inequities can explain all differences in academic outcomes between ethnic groups.

### **New Zealand context**

In New Zealand (NZ), Māori (the indigenous peoples of NZ) and the Pacific population (made up of more than 40 different ethnic groups that have their own culture, language, history and links to NZ) experience higher health need and yet there is a critical shortage of Māori and Pacific health professionals (Māori make up 14.9% of the population, 3% of doctors, 6% of nurses, 2% of pharmacists and 5% of dentists, Pacific make up 7.4% of the NZ population, 1% of doctors, 0.2% of pharmacists, 0.6% of dentists and 2.2% of nurses) (Cram 2014; Curtis et al. 2012b, 2014a; Ministry of Health 2004, 2011; Statistics New Zealand 2014). Māori and Pacific higher education students show higher attrition rates, lower participation rates and are underrepresented in bachelor level programmes compared to non-Māori students (Education Counts 2010).

The FMHS at the University of Auckland (UoA), New Zealand offers health professional degree-level programmes and is committed to Māori and Pacific health workforce development through its 'Vision 20: 20 programme (The University of Auckland 2014a), providing comprehensive Māori and Pacific student academic and pastoral support (Curtis and Reid 2013). Despite promising increases in recruitment numbers, disparities in academic outcomes between Māori and Pacific, and nMnP students in FMHS remain (e.g. FMHS first year bachelor course completion rates in 2014 were 76.8% for Māori, 61.8% for Pacific and 82.8% for the total cohort) (The University of Auckland 2014b).

This project aimed to investigate predictors of academic success for Māori and Pacific students compared to nMnP enrolled in Bachelor of Health Sciences, Nursing and Pharmacy programmes within the FMHS, UoA. Findings from this study may help to inform medical and other health professional schools internationally that aim to both widen participation and ensure equitable academic outcomes. Findings from this study may offer generalizable findings for international contexts particularly given that indigenous and

ethnic minority health professional students internationally may have experiences. Understanding the reasons for inequities between ethnic groups is important to monitor institutional performance against equity targets and contribute to developing indigenous and ethnic minority student support initiatives.

## Objectives

The main objective of this study was to identify important predictors of academic success (or failure) for Māori, Pacific and nMnP students by:

1. Exploring the predictive effect of FMHS student admission variables and early academic outcome variables on academic results.
2. Investigating how ethnicity is related to student academic outcomes after controlling for the effects of admission process variables.

## Methodology

A Kaupapa Māori Research (KMR) approach, inclusive of Pacific methodology, was utilised for this study (Pihama 2001; Smith 1997, 2012). KMR is an established indigenous research methodology that informs the research question being asked, the methods that are chosen to explore the research question and how the research findings are interpreted (Smith 2012; Smith and Reid 2000). Within this research, the application of Kaupapa Māori and Pacific theoretical principles includes: a commitment to Māori and Pacific leadership and control over the research process to ensure the foregrounding of Māori and Pacific priorities (this includes the need to critique structural power imbalances that may be operating within institutions) (Pihama 2001; Smith 1997, 2012); ensuring positive outcomes for Māori and Pacific research participants and communities (i.e. identifying unique characteristics of Māori students to inform tailoring of educational programmes and support services by institutions to better meet the specific needs of these students), and interpreting findings from a Māori and Pacific worldview (that acknowledges health and educational outcomes for Māori and Pacific students are influenced by broad social, cultural, historical, political and economic contexts) (Smith 1997).

Given this positioning, the authors expect that the analysis and recommendations from this research will require institutional change rather than requiring students to change themselves. The application of Kaupapa Māori Research positioning within a quantitative context can be seen within the project's commitment to maximise 'equal explanatory power' and 'equal analytical power' for data analyses between Māori/Pacific and nMnP participants (e.g. the inclusion of multiple years to enhance sample sizes by ethnicity; use of high quality ethnicity data) (Cormack and Robson 2010; Te Rōpū Rangahau Hauora a Eru Pōmare 2002).

This project has also been informed by Pacific methodological approaches including that of 'talanoa' (Vaiotele 2006). Talanoa is referred to as a Pacific research methodology (similar to Kaupapa Māori), whereby the research is mutually beneficial, upholds Pacific aspirations and ensures researchers are accountable to participants. The input of Pacific Health researchers and methodology of talanoa (Vaiotele 2006) allowed for meaningful exploration of and advocacy for issues amongst both Māori and Pacific students. The

research acknowledges the similar effects of social impacts on health and education for Pacific and Māori peoples (Ministry of Health 2004). Pacific representation within the project team and a project advisory group acknowledges mutual expertise of these parties in Pacific health research and values Pacific knowledge and decision-making contribution (Naepi 2015).

## Methods

### Research setting

This research was located within Te Kupenga Hauora Māori (Department of Māori Health and Office of Tumuaki, UoA, NZ) with senior Māori health researcher leadership. Oversight by an advisory group of Māori, Pacific, academic and administrative faculty staff with expertise pertaining to the research topic.

### Participants

All students enrolled in year two of the BHSc, BNurs, or BPharm programmes within FMHS, UoA (2002–2012) who had had sufficient time to complete the programme. Students who were currently enrolled in 2014 (i.e. still studying towards completion) or for whom the minimum time required to complete their programme had not passed were excluded.

### Study design

An observational study design was used. Secondary individual student demographic, admission and academic results data from 2001 to 2013 was sourced from Student Services Online (SSO) (the UoA web-based centralised student data management system). Multiple regression analysis was used to test: how predictor variables were related to academic outcome variables for each of the Māori, Pacific and nMnP ethnic groupings; and, how ethnicity was related to predictor variables and/or student academic outcomes.

### Ethnicity variable of interest

Student ethnicity was categorised as Māori, Pacific and nMnP ethnic groupings. Self-identified ethnicity was automatically categorised into Māori, Pacific, Asian, European, and Other ethnic groupings within SSO using a prioritisation protocol prior to obtaining the data for the purposes of this study (Education Counts 2012). Prioritisation of Māori ethnicity (as the ethnicity of first priority) when multiple ethnicities are selected ensures representation of all individuals who identify as Māori within analysis outcomes (Cormack and Robson 2010). However, those who may have identified with both Māori and Pacific ethnicity will be counted in the Māori group only—therefore, reducing the Pacific group numbers. The Asian, Other and European ethnicity categories were combined into one nMnP comparator grouping (note that students who self-identified as New Zealander were included within the Other category) given that these ethnicity categories demonstrate similar outcomes within this context. Māori and Pacific ethnic categories remained separate given that different impacts on academic outcomes may be occurring for Pacific and

Māori students. Maintaining separate ethnic categories for Māori and Pacific students aligns with Māori positioning as indigenous peoples and rights as Treaty of Waitangi partners.

### **Predictor variables**

Predictor variables were chosen based on available SSO data and a predictors of success model that foregrounds significant concepts that may impact on indigenous (Māori) and ethnic minority (Pacific) student success (Wikaire et al. 2016). Concepts within the model include: demographic; socioeconomic status; academic preparation; transitioning; early academic results; and, the tertiary environment.

#### *Demographic*

Demographic variables included gender, age at admission and year of admission into year 2 (2002–2012).<sup>1</sup>

#### *Socioeconomic status*

NZ secondary school decile rating categories: low (1–3) (high deprivation), medium (4–7), and high (8–10) (low deprivation) were used to measure/represent socioeconomic status (Mills et al. 2009). High decile represents schools with a high proportion of students who reside in areas of low deprivation (high socioeconomic status). Home schooled or overseas schools were coded as missing.

#### *Academic preparation*

Academic preparation was measured using secondary school results that reflect FMHS bachelor degree entry requirements. With a new system having been introduced in 2005, this data was only available for approximately half of the full student cohort and therefore have been excluded from this analysis. A separate analysis using this data is reported elsewhere (Wikaire 2015).

#### *Transitioning*

Attended school in Auckland (yes, no), type of admission (school leaver, alternative admission) and bridging programme (yes, no) were used to measure transitioning via relocation (moving to live in Auckland for study purposes) or transition via varying pathways between secondary school and FMHS bachelor-level enrolment respectively. School leaver was defined as enrolment in bachelor level FMHS study in the year immediately following secondary school. All other students were classified as alternative admission. Completion of a UoA bridging foundation programme that aims to bridge the 'gap' between secondary and tertiary education contexts was recorded.

---

<sup>1</sup> Year of admission was grouped into 2-year time periods to reduce risk of identification of students via enrolment numbers of <10.

### *Early academic results*

Early academic results were measured using first year bachelor grade point average (GPA) (average 'grade' attained by each student in the first year of bachelor level study across eight courses) (0–9) and passing all courses (i.e. no 'fail' grades) in the first year of bachelor study (yes, no). Early academic results were modelled as being both predicted by admission variables and predictive of longer term programme academic outcomes.

### *Tertiary environment*

Note that there is a lack of measured variables representing tertiary environment factors (e.g. curriculum). Therefore, although the tertiary environment is conceptualised as impacting on student success in the 'predictors of success model', variables measuring these factors were not routinely collected within the SSO system and hence were not included within the analysis in this study.

## **Academic outcome variables**

### *Early academic outcomes*

Early academic outcomes were measured using first year bachelor GPA (0–9) and first year bachelor passed all (eight) courses (yes, no).

### *Programme outcomes*

Programme outcomes included: graduation from the intended programme (i.e. the programme in which students originally enrolled in year 2) (yes, no); graduated in the minimum time (yes, no) (3 years for BHSc and BNurs, 4 years for BPharm); and Year 2–4 programme GPA (0–9) (the average grade achieved over all courses from year two until programme completion).

### *Optimal programme completion*

Ideally, institutions aim for students to achieve optimal academic success via a combination of programme completion, achieving high grades and completing the programme in the minimum time. An optimal completion outcome was developed to explore the combined overall academic success for students using four outcome levels in hierarchical order:

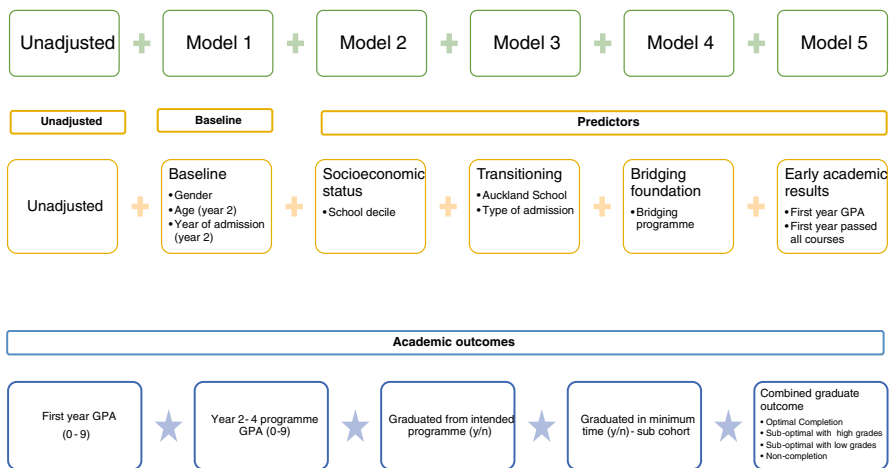
1. *Optimal completion* = graduated from intended programme (yes) and graduated in minimum time (yes) with an overall A grade average (i.e.  $\geq 6.6$ ) across the programme); or
2. *Sub-optimal completion with higher grades* = graduated from intended programme (yes) with an overall B grade average or higher (i.e.  $\geq 3.6$ ); or
3. *Sub-optimal completion with lower grades* = graduated from intended programme (yes) with an overall C grade average (i.e. 1–3.5); or
4. *Non-completion* = those students who for varying reasons did not complete their intended programme.

Category 2 (sub-optimal with high grades) was used as the reference category in the analysis as this was the category with the most students and can thus be taken to represent a ‘typical’ completion outcome.

### Analysis

Statistical analysis was performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). All statistical tests were two-sided at a 5% significance level. A statistical analysis plan was developed a priori that incorporated key predictor and outcome variables of interest using multiple regression models. Continuous variables were summarised descriptively in mean and standard deviation (SD), and the predictive effect of admission variables were tested using linear regression model with an overall F-test, followed by t-tests comparing the mean differences and 95% confidence intervals to the reference level. Binary categorical variables were presented in frequencies and percentages and were tested using logistic regression with a logit link. The optimal completion outcome with four defined categories was tested using nominal logistic regression with a logit link and separate odds ratios were obtained for each comparison category. Odds ratios and 95% confidence intervals were reported with associated *p* values using Chi square tests.

As shown in Fig. 1, pre-defined predictor variables were added to the baseline model (#1) in sequential order (#2–5). Consistent with Kaupapa Māori methodology that locates indigenous peoples at the centre of enquiry, Māori and Pacific ethnic groupings were foregrounded throughout the data analysis (Walter and Andersen 2013). The first stage of analysis involved running separate models for each ethnic grouping to identify the predictive effect of admission variables and early academic outcomes for Māori, Pacific and nMnP student groupings separately. Significant predictors were identified in the model with a *p* value <0.05, and the results on final full model are presented. Regression analyses were next conducted using the total cohort including three ethnic groupings in the same



**Fig. 1** Multiple regression analysis plan that included a baseline (model 1) and the sequential inclusion of additional predictor variables (models 2–5). Predictor variables were predefined. Analysis was completed for the full cohort including three ethnic groupings in the same model so that a group comparison could be carried out that compared Māori/Pacific to nMnP students and repeated for Māori, Pacific and nMnP ethnic groupings separately. The analysis was completed for each of the listed academic outcomes



model to investigate how ethnic disparities were related to admission process and student academic outcomes. Differences in academic outcomes and the change in these differences were observed between ethnic groupings with the sequential addition of predictor variables to each model. The results of unadjusted model, baseline model and full model are reported.

## Ethics

Ethical approval for this project was granted by the UoA Human Participants Ethics Committee (Ref 8110). As per ethics protocols, written informed consent was not required for this research project due to the use of secondary administrative data sources. All secondary data obtained from these datasets were de-identified by an independent research member with no student contact or teaching responsibilities and data analysis occurred via a coding system.

## Results

A total of 2686 students were included in this study including 5.6% Māori ( $n = 150$ ), 9.6% Pacific ( $n = 257$ ) and 84.9% nMnP ( $n = 2279$ ) students. Descriptive summary data are presented in Table 1 for all predictor and academic outcome variables. Differences in unadjusted predictor and academic outcome variables between ethnic groupings have previously been discussed elsewhere (Wikaire et al. 2016). Tables 2, 3 present the analysis results for each of the three ethnic groupings of interest (Māori, Pacific and nMnP) as well as the full cohort which compares the three ethnic groupings in the same model. All models beyond the baseline (#2–5) controlled for age, year of admission and gender (i.e. baseline model #1).

**Table 1** Descriptive summary for all variables by Māori, Pacific, nMnP ethnic groupings and full cohort

Variables	Ethnic grouping						Full cohort ( $n = 2686$ )	
	Māori ( $n = 150$ )		Pacific ( $n = 257$ )		nMnP ( $n = 2279$ )		$n$	%
	$n$	%	$n$	%	$n$	%		
<i>Categorical variables</i>								
Female	108	72.0	182	70.8	1775	77.9	2065	76.9
Year of admission (2nd year) <sup>c</sup>								
2002–3	25	16.7	28	10.9	320	14.0	373	13.9
2004–5	27	18.0	43	16.7	375	16.4	445	16.6
2006–7	23	15.3	54	21.0	428	18.8	505	18.8
2008–9	24	16.0	50	19.4	464	20.3	538	20.0
2010–11	34	22.7	53	20.6	502	22.0	589	21.9
2012	17	11.3	29	11.3	190	8.3	236	8.8
High school decile (8–10)	54	36.0	51	19.8	1275	55.9	1380	51.4
Medium school decile (4–7)	47	31.3	87	33.9	650	28.5	784	29.2
Low school decile (1–3)	41	27.3	85	33.1	125	5.5	251	9.3
Missing school decile	8	5.3	34	13.2	229	10.0	271	10.1

**Table 1** continued

Variables	Ethnic grouping						Full cohort (n = 2686)	
	Māori (n = 150)		Pacific (n = 257)		nMnP (n = 2279)		n	%
	n	%	n	%	n	%		
Attended school in Auckland	81	54.0	211	82.1	1731	76.0	2023	75.3
<i>Missing data</i>	6	4.0	34	13.2	228	10.0	268	10.0
Type of admission (1st year)								
Alternative admission	77	51.3	156	60.7	630	27.6	863	32.1
School Leaver	73	48.7	101	39.3	1649	72.4	1823	67.9
Completed bridging programme	65	43.3	128	49.8	120	5.3	313	11.6
Certificate in Health Sciences	43	28.7	100	38.9	0	0	143	5.3
Bachelor level programme								
Health Sciences <sup>a,b</sup>	99	66.0	185	72.0	696	30.5	980	36.5
Nursing	31	20.67	46	17.9	724	31.8	801	29.8
Pharmacy	26	17.33	39	15.2	917	40.2	982	36.6
First year bachelor passed all courses	91	60.7	105	40.9	1786	78.4	1982	73.8
<i>Missing</i>	0	0.0	0	0.0	1	0.0	1	0.0
Programme passed all courses	86	57.3	102	39.7	1741	76.4	1929	71.8
<i>Missing</i>	1	0.7	0	0.0	0	0.0	1	0.0
Graduated FMHS	106	70.7	184	71.6	1818	79.8	2108	78.5
Graduated intended programme	99	66.0	177	68.9	1783	78.2	2059	76.7
Optimal graduation outcome								
Optimal completion	14	9.3	6	2.3	450	19.7	470	17.5
Suboptimal completion high	72	48.0	110	42.8	1193	52.3	1375	51.2
Suboptimal completion low	20	13.3	68	26.5	175	7.7	263	9.8
Non-completion	44	29.3	73	28.4	461	20.2	578	21.5
Graduated Health Sciences	50	49.0	113	62.1	337	18.6	500	23.9
Graduated Nursing	28	27.4	42	23.1	656	36.2	726	34.6
Graduated Pharmacy	24	23.5	27	14.8	818	45.2	869	41.5
Graduated in minimum time <sup>d</sup>	78	78.8	125	70.6	1533	86.0	1736	84.3
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
<i>Continuous variables</i>								
Age at admission (2nd year)	21.31	4.6	20.8	3.7	20.4	4.1	20.5	4.1
First year bachelor GPA	3.63	1.71	2.83	1.64	4.69	1.94	4.45	1.99
Year 2–4 programme GPA	4.36	1.90	3.48	1.82	5.21	1.69	5.00	1.79

<sup>a</sup> Students may have enrolled in more than one programme within the study duration; students enrolled in multiple programmes were double counted

<sup>b</sup> Students may be double counted if they enrolled in more than one programme

<sup>c</sup> Although there were new enrolments in 2013, we have excluded current students and hence these students are not included in this data i.e. must have completed the minimum number of years required for their programme (i.e. 3 or 4 years)

<sup>d</sup> Only calculated for those graduated intended programme

**Table 2** Multiple regression analysis of predictors of academic outcomes for full cohort and for Māori, Pacific, and nMnP student groupings

Model <sup>a</sup>	Predictor variables (ref)	Comparison	First year bachelor GPA (model #4)			Year 2–4 programme GPA			Graduated from intended programme			Graduated in minimum time		
			Predictor p value	Mean difference	95% CI	Predictor p value	Mean difference	95% CI	Predictor p value	OR	95% CI	Predictor p value	OR	95% CI
<i>Full Cohort (n = 2686)</i>														
Unadj.	Ethnicity grouping (nMnP)	Māori	<0.0001	-1.06	(-1.37, -0.74)	<0.0001	-0.86***	(-1.14, -0.57)	<0.0001	0.54***	(0.38, 0.77)	<0.0001	0.61*	(0.37, 1.00)
		Pacific		-1.86***	(-2.10, -1.61)		-1.73***	(-1.95, -1.51)		0.62***	(0.46, 0.82)		0.39***	(0.28, 0.56)
Baseline	Ethnicity grouping (nMnP)	Māori	<0.0001	-1.07***	(-1.38, -0.75)	<0.0001	-0.84***	(-1.12, -0.56)	<0.0001	0.55**	(0.38, 0.79)	<0.0001	0.59*	(0.35, 0.99)
		Pacific		-1.86***	(-2.10, -1.61)		-1.72***	(-1.93, -1.5)		0.61***	(0.46, 0.81)		0.39***	(0.27, 0.55)
5	Ethnicity grouping (nMnP)	Māori	<0.0001	-0.67***	(-1.01, -0.32)	<0.0001	-0.25	(-0.49, -0.01)	0.0234	0.57**	(0.38, 0.87)	0.7864	1.23	(0.66, 2.30)
		Pacific		-1.35***	(-1.65, -1.05)		-0.57***	(-0.78, -0.36)		0.77	(0.52, 1.12)		1.12	(0.67, 1.87)
		Medium	0.0031	-0.13	(-0.29, 0.04)	0.5672	0.06	(-0.06, 0.18)	0.4855	1.11	(0.88, 1.38)	0.8831	1.07	(0.79, 1.46)
		Low		-0.47***	(-0.74, -0.19)		0.00	(-0.19, 0.19)		1.21	(0.85, 1.73)		0.99	(0.62, 1.58)
		Auckland school (Yes)	0.4398	0.08	(-0.13, 0.29)	0.1811	0.10	(-0.05, 0.24)	0.3598	0.88	(0.67, 1.16)	0.7126	1.08	(0.72, 1.61)
		Type of admission (SL)	0.1969	0.14	(-0.07, 0.34)	0.1661	-0.10	(-0.24, 0.04)	0.1323	0.82	(0.63, 1.06)	0.5482	0.89	(0.61, 1.30)
		Bridging Programme (No)	<0.0001	-0.84***	(-1.12, -0.55)	0.5428	0.06	(-0.14, 0.26)	0.0328	1.49*	(1.03, 2.14)	0.0006	0.43***	(0.26, 0.69)

**Table 2** continued

Model <sup>a</sup> Predictor variables (ref)	Comparison #4)	First year bachelor GPA (model			Year 2–4 programme GPA			Graduated from intended programme			Graduated in minimum time		
		Predictor p value	Mean difference	95% CI	Predictor p value	Mean difference	95% CI	Predictor p value	OR	95% CI	Predictor p value	OR	95% CI
1st year Bach passed all (Yes)	No	-	-	-	0.3001	-0.08	(-0.24, 0.08)	<b>&lt;0.0001</b>	<b>0.49***</b>	(0.36, 0.66)	0.1859	0.77	(0.52, 1.13)
1st year Bach GPA	Per pt increase	-	-	-	<b>&lt;0.0001</b>	<b>0.56***</b>	(0.52, 0.60)	0.4243	1.03	(0.96, 1.11)	<b>&lt;0.0001</b>	<b>1.43***</b>	(1.28, 1.59)
<i>Māori grouping (n = 150)</i>													
5 School decile (High)	Medium	0.1113	-0.23	(-0.94, 0.48)	0.2003	-0.6	(-1.27, 0.06)	0.5023	0.66	(0.23, 1.88)	0.9673	1.25	(0.22, 7.12)
	Low		-0.77	(-1.5, -0.03)		-0.29	(-0.99, 0.41)		1.23	(0.37, 4.08)		1.16	(0.21, 6.37)
Auckland school (Yes)	No	0.1376	-0.45	(-1.06, 0.15)	0.8338	0.06	(-0.51, 0.63)	0.2951	1.64	(0.65, 4.12)	0.0931	0.3	(0.07, 1.22)
Type of admission (SL)	AA	0.8575	0.06	(-0.64, 0.77)	0.2017	-0.43	(-1.09, 0.23)	0.3917	0.64	(0.23, 1.78)	0.8816	1.12	(0.24, 5.25)
Bridging Programme (No)	Yes	<b>0.0165</b>	<b>-0.83*</b>	(-1.5, -0.15)	0.4161	0.26	(-0.38, 0.90)	0.5036	1.41	(0.51, 3.88)	0.2925	0.4	(0.07, 2.20)
1st year Bach passed all (Yes)	No	-	-	-	0.1139	-0.64	(-1.44, 0.16)	0.1934	0.43	(0.12, 1.54)	0.3617	0.39	(0.05, 2.94)
1st year Bach GPA	Per pt increase	-	-	-	<b>0.0002</b>	<b>0.46***</b>	(0.22, 0.69)	0.5800	0.90	(0.61, 1.32)	0.5351	1.26	(0.61, 2.57)
<i>Pacific grouping (n = 257)</i>													
5 School decile (High)	Medium	0.3617	-0.31	(-0.85, 0.22)	0.4631	0.31	(-0.19, 0.80)	0.1307	2.17	(0.90, 5.27)	0.6685	1.22	(0.38, 3.92)
	Low		-0.38	(-0.93, 0.17)		0.27	(-0.23, 0.77)		2.36	(0.97, 5.75)		1.66	(0.52, 5.28)

**Table 2** continued

Model <sup>a</sup> Predictor variables (ref)	Comparison #4)	First year bachelor GPA (model			Year 2–4 programme GPA			Graduated from intended programme			Graduated in minimum time		
		Predictor p value	Mean difference	95% CI	Predictor p value	Mean difference	95% CI	Predictor p value	OR	95% CI	Predictor p value	OR	95% CI
Auckland school (Yes)	No	0.5411	-0.28	(-1.20, 0.63)	0.7176	0.15	(-0.68, 0.98)	0.0983	0.32	(0.08, 1.24)	0.9000	1.15	(0.13, 10.02)
Type of admission (SL)	AA	<b>0.0041</b>	<b>-0.83**</b>	(-1.40, -0.27)	0.2239	-0.33	(-0.85, 0.20)	0.0690	0.4	(0.15, 1.07)	0.7209	1.25	(0.36, 4.32)
Bridging Programme (No)	Yes	0.11258	-0.41	(-0.93, 0.12)	0.6746	-0.10	(-0.58, 0.38)	0.0592	2.37	(0.97, 5.83)	0.0624	0.33	(0.10, 1.06)
1st year Bach passed all (Yes)	No	-	-	-	0.9857	0.01	(-0.55, 0.56)	0.6076	1.30	(0.48, 3.57)	0.2415	0.46	(0.12, 1.70)
1st year Bach GPA	Per pt increase	-	-	-	<b>&lt;0.0001</b>	<b>0.70***</b>	(0.52, 0.87)	<b>0.0079</b>	<b>1.57**</b>	(1.13, 2.19)	0.1340	1.42	(0.09, 2.23)
<i>NMnP grouping (n = 2279)</i>													
5 School decile (High)	Medium	0.0635	-0.10	(-0.28, 0.08)	0.1931	0.09	(-0.03, 0.21)	0.6553	1.11	(0.87, 1.41)	0.4449	1.11	(0.80, 1.56)
	Low		-0.41	(-0.76, -0.05)		-0.09	(-0.32, 0.15)		0.94	(0.60, 1.49)		0.74	(0.41, 1.36)
Auckland school (Yes)	No	0.2607	0.13	(-0.10, 0.37)	0.2216	0.09	(-0.06, 0.25)	0.2069	0.83	(0.62, 1.11)	0.3050	1.27	(0.80, 2.01)
Type of admission (SL)	AA	<b>0.0434</b>	<b>0.24*</b>	(0.01, 0.48)	0.8169	-0.01	(-0.17, 0.14)	0.4978	0.9	(0.67, 1.22)	0.3864	0.83	(0.55, 1.26)
Bridging Programme (No)	Yes	<b>0.0004</b>	<b>-0.73**</b>	(-1.13, -0.32)	0.0842	0.23	(-0.03, 0.50)	0.2282	1.36	(0.82, 2.25)	<b>0.0015</b>	<b>0.35**</b>	(0.18, 0.67)

**Table 2** continued

Model <sup>a</sup> Predictor variables (ref)	Comparison	First year bachelor GPA (model #4)			Year 2–4 programme GPA			Graduated from intended programme			Graduated in minimum time		
		Predictor p value	Mean difference	95% CI	Predictor p value	Mean difference	95% CI	Predictor p value	OR	95% CI	Predictor p value	OR	95% CI
1st year Bach passed all (Yes)	No	-	-	-	0.3345	-0.09	(-0.26, 0.09)	< <b>0.0001</b>	<b>0.42***</b>	(0.30, 0.59)	0.1297	0.71	(0.46, 1.11)
1st year Bach GPA	Per pt increase	-	-	-	< <b>0.0001</b>	<b>0.55***</b>	(0.51, 0.58)	0.8278	0.99	(0.92, 1.07)	< <b>0.0001</b>	<b>1.41***</b>	(1.25, 1.58)

Values of significance <0.05 have been bolded

<sup>a</sup> Linear (for GPA outcomes) and logistic (for Graduation outcomes) regression models have all controlled for year of admission, gender and age at admission. Pre-defined predictors were added to the baseline model in sequential order to estimate their joint effects on the outcome. Model-adjusted estimates of mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated individual p values (in symbols) were reported

\* p value <0.05; \*\* p value <0.01; \*\*\* p value <0.001

**Table 3** Multiple regression analysis on predictors of graduation outcome compared to 'sub-optimal completion with high grades' (reference) for full cohort and for Māori, Pacific, and nMnP student groupings

Model <sup>a</sup>	Predictor variables (ref)	Comparison	Predictor <i>p</i> value	Optimal completion		Sub-optimal completion low grades		Non-completion	
				OR	95% CI	OR	95% CI	OR	95% CI
<i>Full cohort (n = 2686)</i>									
Unadj.	Ethnicity grouping (mMnP)	Māori	<0.0001	<b>0.52*</b>	(0.29, 0.92)	<b>1.89*</b>	(1.13, 3.19)	<b>1.58*</b>	(1.07, 2.34)
		Pacific		<b>0.15***</b>	(0.06, 0.33)	<b>4.21***</b>	(3.00, 5.93)	<b>1.72***</b>	(1.25, 2.35)
Base <sup>a</sup>	Ethnicity grouping (mMnP)	Māori	<0.0001	<b>0.49*</b>	(0.27, 0.88)	<b>1.87*</b>	(1.10, 3.17)	<b>1.55*</b>	(1.04, 2.32)
		Pacific		<b>0.14***</b>	(0.06, 0.32)	<b>4.30***</b>	(3.04, 6.09)	<b>1.71**</b>	(1.24, 2.37)
5	Ethnicity grouping (mMnP)	Māori	<b>0.0288</b>	0.80	(0.41, 1.57)	1.04	(0.54, 1.98)	1.34	(0.85, 2.12)
		Pacific		<b>0.38*</b>	(0.16, 0.92)	<b>1.76*</b>	(1.09, 2.86)	1.29	(0.85, 1.96)
	School decile (High)	Medium	0.7767	1.16	(0.89, 1.53)	1.03	(0.73, 1.45)	0.89	(0.70, 1.13)
		Low		0.99	(0.59, 1.67)	1.03	(0.64, 1.66)	0.85	(0.58, 1.25)
	Auckland school (Yes)	No	0.3302	1.16	(0.83, 1.62)	0.84	(0.53, 1.33)	1.23	(0.91, 1.65)
		AA		1.39	(1.00, 1.94)	1.12	(0.73, 1.72)	1.26	(0.94, 1.69)
	Type of admission (SL)	Yes	0.1432	0.73	(0.40, 1.32)	1.44	(0.88, 2.35)	0.80	(0.54, 1.19)
		Bridging Programme (No)		1.44	(0.85, 2.47)	0.87	(0.56, 1.34)	<b>2.31***</b>	(1.68, 3.17)
	1st year Bach passed all (Yes)	No	<0.0001	<b>1.94***</b>	(1.77, 2.13)	<b>0.54***</b>	(0.47, 0.62)	1.01	(0.93, 1.09)
		1st year Bach GPA							
<i>Māori grouping (n = 150)</i>									
5	School decile (High)	Medium	0.3136	0.52	(0.04, 7.20)	0.56	(0.11, 3.00)	1.48	(0.48, 4.57)
		Low		9.41	(0.74, 119.77)	1.46	(0.30, 7.11)	1.18	(0.33, 4.20)
	Auckland school (Yes)	No	0.3013	4.92	(0.59, 40.95)	0.99	(0.26, 3.83)	0.59	(0.22, 1.63)
		AA		4.54	(0.30, 69.87)	1.11	(0.21, 5.94)	2.12	(0.71, 6.34)
	Bridging Programme (No)	Yes	0.6291	0.30	(0.02, 4.83)	1.9	(0.32, 11.15)	0.73	(0.26, 2.07)
		1st year Bach passed all (Yes)		0.36	(0.01, 14.11)	0.55	(0.08, 3.91)	1.80	(0.48, 6.67)
	1st year Bach GPA	Per point increase	<b>0.0172</b>	<b>*2.85</b>	(1.10, 7.37)	0.39	(0.17, 0.89)	0.90	(0.60, 1.36)

**Table 3** continued

Model <sup>a</sup>	Predictor variables (ref)	Comparison	Predictor <i>p</i> value	Optimal completion		Sub-optimal completion low grades		Non-completion	
				OR	95% CI	OR	95% CI	OR	95% CI
<i>Pacific grouping (n = 257)<sup>b</sup></i>									
5	School decile (High)	Medium	0.1803	-	-	0.83	(0.29, 2.41)	0.42	(0.15, 1.15)
		Low		-	-	1.37	(0.47, 3.98)	0.42	(0.15, 1.17)
	Auckland school (Yes)	No	0.0856	-	-	13.26	(1.04, 168.62)	15.49	(1.34, 179.1)
	Type of admission (SL)	AA	0.4945	-	-	0.9	(0.31, 2.61)	1.76	(0.59, 5.19)
	Bridging Programme (No)	Yes	0.0513	-	-	2.48	(0.93, 6.62)	0.66	(0.25, 1.75)
	1st year Bach passed all (Yes)	No	0.8529	-	-	0.97	(0.32, 2.95)	0.73	(0.24, 2.25)
	1st year Bach GPA	Per point increase	<b>0.0003</b>	-	-	<b>0.57**</b>	(0.38, 0.84)	<b>0.47***</b>	(0.32, 0.70)
<i>NMnP grouping (n = 2279)</i>									
5	School decile (High)	Medium	0.4091	1.19	(0.90, 1.57)	1.15	(0.78, 1.69)	0.88	(0.68, 1.14)
		Low		0.90	(0.50, 1.60)	0.59	(0.26, 1.34)	0.96	(0.59, 1.57)
	Auckland school (Yes)	No	0.1752	1.08	(0.76, 1.53)	0.67	(0.38, 1.19)	1.27	(0.92, 1.75)
	Type of admission (SL)	AA	0.2437	1.43	(1.01, 2.02)	1.13	(0.67, 1.88)	1.10	(0.78, 1.54)
	Bridging Programme (No)	Yes	0.7992	0.96	(0.50, 1.87)	0.82	(0.36, 1.86)	0.77	(0.45, 1.32)
	1st year Bach passed all (Yes)	No	<b>&lt;0.0001</b>	1.42	(0.80, 2.52)	0.84	(0.50, 1.42)	<b>2.75***</b>	(1.92, 3.94)
	1st year Bach GPA	Per point increase	<b>&lt;0.0001</b>	<b>1.95***</b>	(1.77, 2.15)	<b>0.49***</b>	(0.41, 0.58)	1.08	(0.99, 1.18)

Values of significance <0.05 have been bolded

<sup>a</sup> Nominal logistic regression model has controlled for year of admission, gender and age at admission. Pre-defined predictors were added to the baseline model in sequential order to estimate their joint effects on the outcome. Model-adjusted estimates of odds ratios (compared to the reference level), 95% confidence intervals (CI) and associated individual *p* values (in symbols) were reported

<sup>b</sup> Only 6 out of 257 Pacific students attained optimal completion, this category was therefore excluded from the analysis regression model  
 \* *p* value <0.05; \*\* *p* value <0.01; \*\*\* *p* value <0.001



## Total cohort comparison analysis

Table 2 and 3 present the linear and logistic regression analysis results for the full cohort which includes the three ethnic grouping comparison (Māori, Pacific, nMnP). The main variable of interest is 'ethnic grouping' where results are presented comparing 1) Māori to nMnP, and 2) Pacific to nMnP (reference group). Significant differences in first year bachelor GPA, year 2–4 programme GPA and likelihood of graduation are demonstrated between ethnic groupings, even after controlling for all pathway variables. First year bachelor GPA was also a significant predictor of years 2–4 programme GPA and graduation.

### Comparison of Māori to nMnP students

#### *First year bachelor GPA*

When comparing Māori to nMnP student groupings, the mean unadjusted difference in first year bachelor GPA was 1.06 (out of 9) points lower for Māori ( $p < 0.0001$ , CI  $-1.37, -0.74$ ) than nMnP, and remained significantly lower (mean difference  $-0.67$ ,  $p = 0.0002 <$ , CI  $-1.01, -0.32$ ) when controlling for all pathway variables (Table 2, model #4).

#### *Year 2–4 programme GPA*

Year 2–4 programme GPA was on average 0.86 points lower for Māori than nMnP students in the unadjusted model ( $p < 0.0001$ , CI  $-1.14, -0.57$ ) however this difference was accounted for by pathway variables (model #5).

#### *Graduated from intended programme*

The odds of graduating from the intended programme were 43% lower for Māori than nMnP students with adjustment for all pathway variables ( $p = 0.0083$ , OR 0.57, CI 0.38, 0.87) (model #5).

#### *Graduated in minimum time*

The odds of graduating in the minimum time were significantly lower for Māori compared to nMnP in unadjusted and baseline models only however became non-significant when adjusting for pathway variables.

#### *Optimal completion*

In Table 3, the unadjusted model shows that Māori students were less likely to achieve an optimal completion ( $p = 0.0258$ , OR 0.52, CI 0.29, 0.92), whilst more likely to achieve a sub-optimal completion with low grades ( $p = 0.0161$ , OR 1.89, CI 1.13, 3.19) or a non-completion outcome ( $p = 0.0213$ , OR 1.58, CI 1.07, 2.34) relative to achieving a sub-optimal completion with high grades, when compared to nMnP students. After adjusting for first year bachelor results (model #5), the difference in graduation outcomes between Māori and nMnP students was no longer significant. This suggests that the first year of

bachelor study is an important determinant of disparity in overall academic success between Māori and nMnP students.

### Comparison of Pacific to nMnP students

#### *First year bachelor GPA*

In Table 2, model #4, after adjusting for all pathway variables, the difference in mean first year bachelor GPA was 1.35 points lower for Pacific than nMnP students ( $p < 0.0001$ , CI  $-1.65, -1.05$ ).

#### *Year 2–4 programme GPA*

Table 2 shows that Pacific students achieved a year 2–4 programme GPA that was on average 1.73 points lower in the unadjusted model ( $p < 0.0001$ , CI  $-1.95, -1.51$ ) and reduced but remained 0.57 points lower than that of nMnP students in model #5 ( $p < 0.0001$ , CI  $-0.78, -0.36$ ).

#### *Graduated from intended programme/Graduated in minimum time*

In unadjusted models, Pacific students had 38% lower odds of graduating ( $p < 0.0001$ , OR 0.62, CI 0.46, 0.82) and 61% lower odds of graduating in the minimum time ( $p < 0.0001$ , OR 0.39, CI 0.28, 0.56) when compared to nMnP. Differences in likelihood of graduating and graduating in minimum time between Pacific and nMnP students were no longer significant after adjustment for first year bachelor results, bridging programme and type of admission.

#### *Optimal completion*

In the unadjusted model, the odds of achieving an optimal completion were eight times lower ( $p < 0.0001$ , OR 0.15, CI 0.06, 0.33) the odds of achieving a sub-optimal completion with low grades were more than four times higher ( $p < 0.0001$ , OR 4.21, CI 3.00, 5.93) and the odds of non-completion were nearly two times higher ( $p < 0.0001$ , OR 1.72, CI 1.25, 2.35) relative to a sub-optimal completion with high grades for Pacific students when compared to the same outcome for nMnP students (Table 3). After adjustment for all pathway variables, the odds of achieving an optimal completion were lower ( $p = 0.0315$ , OR 0.38, CI 0.16, 0.92) and the chance of achieving a sub-optimal completion with low grades was higher ( $p = 0.0211$ , OR 1.76, CI 1.09, 2.86) relative to a sub-optimal completion with high grades for Pacific students when compared to the same outcome for nMnP students.

### Summary of full cohort comparison

Overall, the disparity in first year bachelor GPA between both Māori and nMnP, and Pacific and nMnP was not explained by pathway variables. Similarly, the disparity between Māori and nMnP in likelihood of graduating and between Pacific and nMnP in year 2–4 programme GPA and chances of optimal completion remained significant after adjusting for pathway variables. Although unadjusted models showed Māori had lower year 2–4

GPA, lower odds of graduating in minimum time and ‘less optimal’ completion than nMnP, these ethnic disparities in academic outcomes were explained by predictor variables indicating the importance of admission variables in determining programme outcome disparities. Overall, these results show that after adjusting for all predictor variables, there was no difference in graduating from intended programme or graduating in the minimum time between Pacific and nMnP students.

## Sub-cohort analysis

### Predictors of academic outcomes for Māori

Bridging programme and first year bachelor GPA were significant predictors of academic outcomes for Māori students.

#### *First year bachelor GPA*

As shown in Table 2 (model #4), after adjusting for pathway variables, Māori students who had completed a bridging programme achieved a first year bachelor GPA that was on average 0.83 points lower than those Māori students who did not ( $p = 0.0165$ , CI  $-1.50, -0.15$ ).<sup>2</sup>

#### *Year 2–4 programme GPA*

Year 2–4 programme GPA was on average 0.46 points higher for every 1 point increase in first year bachelor GPA for Māori students ( $p = 0.0002$ , CI 0.22, 0.69) (model #5) after adjusting for pathway variables.

#### *Graduated from intended programme/Graduated in minimum time*

After adjustment, none of the predictors investigated showed significant effects on graduating or graduating in the minimum time for the Māori student grouping (model #5).

#### *Optimal completion*

For the optimal completion outcome (Table 3), after controlling for all pathway variables, the odds of achieving an optimal programme completion relative to sub-optimal completion with high grades were 2.85 times higher ( $p = 0.0314$ , CI 1.1, 7.37) with every 1-point increase in first year bachelor GPA for Māori students.

### Predictors of academic outcomes for Pacific

Type of admission and first year bachelor GPA were important predictors of Pacific student academic outcomes.

---

<sup>2</sup> Note that bridging programme students often fail to meet the academic prerequisite requirements for direct bachelor level entry. This may explain lower subsequent first year bachelor results given that they enter bridging programmes with known lower levels of academic preparation.

### *First year bachelor GPA*

In Table 2, model #4, after controlling for school decile, attending an Auckland school, and bridging programme participation, alternative admission Pacific students had a first year GPA that was on average 0.8 points lower ( $p = 0.0041$ , CI  $-1.40, -0.27$ ) than Pacific school leavers.

### *Year 2–4 programme GPA*

In model #5, after controlling for all pathway variables, for every 1-point increase in first year GPA Pacific students achieved a year 2–4 programme GPA that was on average 0.7 points higher ( $p < 0.0001$ , CI 0.52, 0.87).

### *Graduated from intended programme*

For every 1 point increase in first year bachelor GPA, Pacific students had 1.57 times higher odds of graduating ( $p = 0.0079$ , OR 1.6, CI 1.13, 2.19).

### *Graduated in minimum time*

None of the investigated predictors had a significant effect on graduating in minimum time for the Pacific student grouping when included in the same model.

### *Optimal completion*

For every 1 point increase in first year bachelor GPA, Pacific students were less likely to achieve sub-optimal completion with low grades (OR 0.57, CI 0.38, 0.84) or non-completion (OR 0.47, CI 0.32, 0.70) than sub-optimal completion with high grades ( $p = 0.0003$  with optimal outcome removed from the dataset due to low numbers of students0010, model #5).

## **Predictors of academic outcomes for nMnP**

For the nMnP student grouping, entering as a school leaver, having completed a bridging programme, and failing to pass all courses in the first year were predictive of ‘lower’ academic outcomes whilst gaining entry via alternative admission and achieving a higher first year bachelor GPA were predictive of ‘higher’ academic outcomes for nMnP students.

### *First year bachelor GPA*

After controlling for pathway variables, nMnP students who entered via alternative admission had a first year GPA that was on average 0.24 points higher ( $p = 0.0434$ , CI 0.01, 0.48) than for school leavers, whilst those who had completed a bridging foundation programme had a first year GPA that was on average 0.73 points lower ( $p = 0.0004$ , CI  $-1.13, -0.32$ ) than those who had not.

### *Year 2–4 programme GPA*

Model #5 shows that, for every 1 point increase in first year bachelor GPA, nMnP students had year 2–4 programme GPA increased by 0.55 points ( $p < 0.0001$ , CI 0.51, 0.58);

### *Graduated from intended programme*

NMnP students who did not pass all courses in their first year of bachelor study were less likely to graduate from their intended programme ( $p < 0.0001$ , OR 0.42, CI 0.30, 0.59) (Table 2, Model #5) than those who did.

### *Graduated in minimum time*

Those nMnP students who had completed a bridging foundation programme had lower odds of graduating in the minimum time ( $p = 0.0015$ , OR 0.35, CI 0.18, 0.67) than those who had not. For every 1 point increase in first year bachelor GPA, nMnP students were more likely to graduate in the minimum time ( $p < 0.0001$ , OR 1.41, CI 1.25, 1.58) (Table 2).

### *Optimal completion*

For every 1 point increase in first year bachelor GPA, nMnP students had higher odds of achieving an optimal programme completion ( $p < 0.0001$ , OR 1.95, CI 1.77, 2.15), and had lower odds of achieving a sub-optimal completion with low grades ( $p < 0.0001$ , OR 0.49, CI 0.41, 0.58) than of achieving a sub-optimal completion with high grades (Table 3). NMnP students who did not pass all courses in their first year of bachelor study were more likely to achieve non-completion relative to sub-optimal completion with high grades ( $p < 0.0001$ , OR 2.75, CI 1.92, 3.94) than those who passed all first year bachelor courses (Table 3).

## **Summary of sub-cohort analysis**

Overall, predictors of achieving a higher first year bachelor GPA were not attending a bridging programme for Māori and entering as a direct school leaver for Pacific students. Achieving a higher first year bachelor GPA was the most significant predictor of achieving a higher year 2–4 programme GPA for both Māori and Pacific students and increased the likelihood of graduating for nMnP. Achieving a higher first year bachelor GPA was also predictive of a higher chance of optimal completion for Māori and nMnP, and lower likelihood of 'less optimal' completion overall, for Pacific and nMnP. Passing all courses in the first year of bachelor study was also important for optimal completion for nMnP students.

## **Discussion**

This study demonstrates that common predictors of academic success operate differently for Māori, Pacific and nMnP student groupings. While most of the predictor variables investigated showed significant predictive effects on academic outcomes for all student

groups in unadjusted models, the impact of school decile (in early models not shown) and bridging programme participation was particularly important for Māori and nMnP students when controlling for other factors. Type of admission was particularly important for Pacific and nMnP students. The first year of bachelor level study was highly predictive of subsequent academic outcomes for all student groups investigated. Variables explored did not explain all of the differences in outcomes between ethnic groupings, thereby foregrounding the need to explore additional tertiary factors that may be operating.

### **Bridging foundation programmes**

Mixed results were found when exploring the association between bridging programme participation and academic outcomes. This is consistent with expectations that our results may reflect both the negative impact of known academic and transitioning gaps that exist for students entering bridging programmes (Benseman et al. 2006), as well as positive effects of the bridging programme itself (i.e. aiming to address these gaps) (Madjar et al. 2010b). Note that completion of the FMHS bridging programme (CertHSc), and higher achievement (CertHSc GPA) within this programme has previously been shown to be positively predictive of achieving a higher first year bachelor GPA in FMHS programmes (Curtis et al. 2015b). The findings suggest that bridging programmes may help to address, but cannot ‘immunise’ Māori and Pacific students from, the impacts of academic and transitioning gaps prior to admission.

### **Daily struggles in tertiary environments—transitioning into racialised ‘climates’**

This study reinforces the importance of the first year of bachelor study as having a significant impact on academic results throughout tertiary health programmes. First year academic results were both *predicted by* pre-tertiary factors, and *predictive of* programme results. This aligns with known literature that discusses how the first year of health study is often an unsafe and daunting experience where students can be culturally isolated, experience racial discrimination, and are submerged in large (often 900+) class sizes in predominantly white institutions (Curtis et al. 2012a, 2014b; Madjar et al. 2010a; Orom et al. 2013) and is noted as a key transitioning point through which Māori and Pacific students must overcome multiple challenges (Madjar et al. 2010b; Sapoaga and Van der Meer 2011; Sapoaga et al. 2013).

Some of the inequities in academic outcomes between Māori or Pacific and nMnP students were explained by investigated predictors. The positioning of these predictor variables prior to or early on in tertiary education contexts does not dismiss the responsibility of the tertiary institution to address factors that may be operating to impact on Māori and Pacific student success throughout later years (year 2 onwards) in health professional study. In addition, some disparities in academic outcomes identified in this study remain unexplained. There is evidence that negative experiences in tertiary health study continue throughout the programme (Curtis et al. 2014b; Garvey et al. 2009), hence even equitable academic outcomes do not guarantee culturally safe and enjoyable experiences through tertiary study (Kaehne et al. 2014; Zorlu 2013). Mayeda et al. (2014) interviewed Māori and Pacific students across UoA who shared examples of both overt and subtle racist remarks often made by nMnP student peers and teaching staff.

## Individual versus institutional focus

Common explanations for why Māori and Pacific students have lower educational outcomes are generally focussed on the individual student (F. Harris 2008) as opposed to the institution (Kasuya et al. 2003; Kay-Lambkin et al. 2002; Rich et al. 2011) citing ‘cultural factors’, institutional or cultural climate as avenues of explanation for disparities (Andriole and Jeffe 2010; Woolf et al. 2013). However, these explanations position the institution, although responsible for ensuring students success, as invisible to critique in the ‘blame’ frame (Bishop and Glynn 1999; Martin-McDonald and McCarthy 2008). Routinely collected data within the UoA take a similar approach meaning individual student-focused variables are more likely to be available for analysis rather than institutional measures.

Hesser, Cregler and Lewis (1998) studied medical school admission for African American students and stated that “*a substantial portion of unexplained variance ... can be attributed to ... static versus changing personal philosophies and commitments held by key institutional figures pertaining to the promotion of, opposition to, or indifference towards racial-ethnic diversity*” (p. 191)). A critical analysis requires measurement of institutional factors that may be predictive of student outcomes (e.g. the proportion of Māori and Pacific staff, culturally relevant course content, interventions that address racial discrimination, effect of class timetabling on part-time employment, and potential for flexible learning).

## Academic preparation

The impact of secondary school results is theorised to have a significant effect on academic outcomes for this cohort however the ability to carry out this work for the full cohort was not possible due to a change in academic achievement systems in 2005 (with school results only available for half of the cohort). A separate analysis using on the cohort for whom school results were available has been completed and have been reported elsewhere (Wikaire 2015).

## Strengths

This study includes a comprehensive quantitative analysis of student data that has not previously been undertaken in a NZ context. The use of Kaupapa Māori methodology, informed by Pasifika methodology, is a particular strength of the project as it foregrounds Māori and Pacific worldviews and allows data analysis in a way that may not otherwise have been completed (Smith 2012; Vaioleti 2006). This has allowed comparison of ethnic groups and exposes racism and privileging of particular ethnic groups over others (Borell et al. 2009). By adopting a non-deficit analysis, this research acknowledges that it is not ‘ethnicity’ that is to blame for academic disparities, but something about the environments created by institutions and the associated experiences that privilege some ethnic groups over others (Harris et al. 2013). This means moving beyond simple description to interrogation of why these experiences are occurring and how these environments manifest such phenomena.

## Limitations

This study was limited by the available data that are routinely collected by the UoA and the way in which they are collected, limiting the ability to analyse and report on student data by ethnicity in various ways (Education Counts 2012). The ability to explore the impact of socioeconomic status using a relevant measure was also limited by available data. Hence, the study used school decile as a proxy for socioeconomic status and acknowledges that this may limit the study findings (Engler 2010).

## Interpretation issues

Pre-prioritisation of the data means that students who identify with both Māori and Pacific ethnic groups will be included in the Māori group only. Considering the importance of the first year of tertiary study as highlighted within relevant literature and the present study findings, this study does not include students who may have entered the first year of bachelor study, but did not continue their academic pathway in year two, therefore eliminated the stories of those students who experienced academic difficulty that led to attrition in year one.

In NZ the UoA FMHS, and Vision 20:20 in many ways is leading innovation and success in Māori and Pacific students in this area (The LIME Network 2013). Given this context, combined with this particular institution, the findings of this study may represent inflated results in some areas. For example, high entry criteria may mean that the students within this sample are likely to represent those school leavers with higher academic achievements than the national average. The Māori and Pacific students in this sample therefore also demonstrate academic outcomes that have been influenced (we assume positively) by the multifaceted recruitment and retention interventions in the FMHS context.

## Conclusion

The findings of this research demonstrate the impact school results and socio-demographic factors have on academic outcomes at tertiary level. Importantly, these factors impact negatively on Māori and Pacific student outcomes to a greater extent than for nMnP students. This research shows that the impact of pre-tertiary and early academic variables extends further than the first year of bachelor level study and that these variables do not fully explain the differences observed in academic outcomes for Māori and Pacific students. This highlights the need for tertiary institutions to extend focus beyond admission and transitioning phases, and provide on-going support for Māori and Pacific students throughout tertiary health programmes. Furthermore, use of new and innovative teaching and learning approaches that cater for students from lower socio-economic and indigenous backgrounds is warranted. Critiquing what role the tertiary institution can play in the elimination of academic inequities for Māori and Pacific students studying towards health professional degrees is necessary.

**Acknowledgements** Erena Wikaire was supported by the Ministry of Education to conduct this research via the provision of a Ngārimu VC 28th Māori Battalion Masters Scholarship. The authors would like to thank members of the Te Hā research project Advisory Group: Dr Teuila Percival; Dr Vili Nosa; Dr Malakai



Ofanoa; Associate Professor Mark Barrow; Lynley Pritchard; James Clark; Dr Peter Carswell and Shaoxun (Carolyn) Huang. We also thank the Tuākana contestable fund and the FMHS postgraduate student association for their support for Erena Wikaire to attend and present these research findings at the Leaders in Indigenous Medical Education (LIME) Connection VI conference in Townsville, Australia 2015. Dr Elana Curtis was supported by Te Kete Hauora, Ministry of Health (New Zealand) to conduct this research via the provision of a Research Fellowship (Contract 414953/337535/00).

**Open Access** This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

## References

- Andriole, D., & Jeffe, D. (2010). Prematriculation variables associated with suboptimal outcomes for the 1994–1999 cohort of US medical school matriculants. *Journal of the American Medical Association*, *304*(11), 1212–1219. doi:10.1001/jama.2010.1321.
- Benseman, J., Coxon, E., Anderson, H., & Anae, M. (2006). Retaining non-traditional students: Lessons learnt from Pasifika students in New Zealand. *Higher Education Research & Development*, *25*(2), 147–162. doi:10.1080/07294360600610388.
- Bishop, R., & Glynn, T. (1999). *Culture counts: Changing power relations in education*. Palmerston North: Dunmore Press.
- Borell, B., Gregory, A., McCreanor, T., & Jensen, V. (2009). “It’s hard at the top but it’s a whole lot easier that being at the bottom”. The role of privilege in understanding disparities in Aotearoa/New Zealand. *Race/Ethnicity: Multidisciplinary Global Perspectives*, *3*(1), 29–50. Retrieved from <https://muse.jhu.edu/article/368755/pdf>
- Bowes, L., Thomas, L., Peck, L., & Nathwani, T. (2013). *International research on the effectiveness of widening participation. Report to HEFCE and OFFA by CFE and Edge Hill University*. United Kingdom: Higher Education Funding Council for England and Office for Fair Access. Retrieved from [http://www.hefce.ac.uk/media/hefce/content/pubs/indirreports/2013/WP\\_international\\_research/2013\\_WPEffectiveness.pdf](http://www.hefce.ac.uk/media/hefce/content/pubs/indirreports/2013/WP_international_research/2013_WPEffectiveness.pdf)
- Cormack, D., & Robson, B. (2010). *Classification and output of multiple ethnicities: Issues for monitoring Māori health*. Wellington: Te Rōpū Rangahau Hauora a Eru Pōmare. Retrieved from <https://www.fmhs.auckland.ac.nz/assets/fmhs/Te%20Kupenga%20Hauora%20M%C4%81ori/docs/classification.pdf>
- Cram, F. (2014). *Improving Māori access to health care: Research report*. Ministry of Health. Retrieved from <http://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvWFpbnxvYXRvYWw0ZHXneDo2YjEzYmVIMGEwYmFhMzg1>
- Curtis, E., & Reid, P. (2013). Indigenous health workforce development: Challenges and successes of the Vision 20: 20 programme. *Australian and New Zealand Journal of Surgery*, *83*(2013), 49–54. doi:10.1111/ans.12030.
- Curtis, E., Reid, P., & Jones, R. (2014a). Decolonising the academy: The process of re-presenting indigenous health tertiary teaching and learning. In F. Cram, H. Phillips, P. Sauni, & C. Tuagalu (Eds.), *Māori and Pasifika higher education horizons (Diversity in Higher Education, Volume 15)* (pp. 147–165). Bingley: Emerald Group Publishing Limited.
- Curtis, E., Townsend, S., & Airini. (2012a). Improving indigenous and ethnic minority student success in foundation health study. *Teaching in Higher Education*. doi:10.1080/13562517.2012.658559.
- Curtis, E., Wikaire, E., Jiang, Y., McMillan, L., Loto, R., Airini, et al. (2015a). A tertiary approach to improving equity in health: Quantitative analysis of the Māori and Pacific admission scheme (MAPAS) process, 2008–2012. *International Journal for Equity in Health*. doi:10.1186/s12939-015-0133-7.
- Curtis, E., Wikaire, E., Jiang, Y., McMillan, L., Loto, R., Fonua, S., et al. (2015b). Open to critique: Predictive effects of academic outcomes from a bridging/foundation programme on first year degree-level study. *Assessment and Evaluation in Higher Education*. doi:10.1080/02602938.2015.1087463.
- Curtis, E., Wikaire, E., Kool, B., Honey, M., Kelly, F., Poole, P., et al. (2014b). What helps and hinders indigenous student success in higher education health programmes: A qualitative study using the Critical Incident Technique. *Higher Education Research & Development*. doi:10.1080/07294360.2014.973378.

- Curtis, E., Wikaire, E., Stokes, K., & Reid, P. (2012b). Addressing indigenous health workforce inequities: A literature review exploring 'best' practice for recruitment into tertiary health programmes. *International Journal for Equity in Health*. doi:10.1186/1475-9276-11-13.
- Education Counts. (2010). Indicators: Tertiary student attrition. Retrieved from <http://www.educationcounts.gov.nz/indicators/main/student-engagement-participation/1959>
- Education Counts. (2012). Data services: Collecting information: Code sets: Ethnic group codes. Retrieved from [http://www.educationcounts.gov.nz/data-services/collecting-information/code\\_sets/ethnic\\_group\\_codes](http://www.educationcounts.gov.nz/data-services/collecting-information/code_sets/ethnic_group_codes)
- Engler, R. (2010). *School leavers' progression to bachelors-level study*. Wellington: Ministry of Education. Retrieved from [http://www.educationcounts.govt.nz/\\_data/assets/pdf\\_file/0006/74148/Schl-leavers-progres-bachelorsFINAL-26032010.pdf](http://www.educationcounts.govt.nz/_data/assets/pdf_file/0006/74148/Schl-leavers-progres-bachelorsFINAL-26032010.pdf)
- Gardner, J. (2005). Barriers influencing the success of racial and ethnic minority students in nursing programs. *Journal of Transcultural Nursing*. doi:10.1177/1043659604273546.
- Garvey, G., Rolfe, I., Pearson, S.-A., & Treloar, C. (2009). Indigenous Australian medical students' perceptions of their medical school training. *Medical Education*. doi:10.1111/j.1365-2923.2009.03519.x.
- Harris, F. (2008). Critical engagement with the historical and contemporary deficit construction of Māori children. *Critical Literacy: Theories and Practices Journal*, 2(1), 43–59. Retrieved from <http://criticalliteracy.freehostia.com/index.php?journal=criticalliteracy&page=article&op=view&path%5B%5D=9&path%5B%5D=1>
- Harris, R., Cormack, D., & Stanley, J. (2013). The relationship between socially-assigned ethnicity, health and experience of racial discrimination for Māori: Analysis of the 2006/07 New Zealand Health Survey. *BMC Public Health*. doi:10.1186/1471-2458-13-844.
- Health Workforce Advisory Committee. (2003). *The New Zealand Health Workforce: Future Directions—Recommendations to the Minister of Health 2003*. Wellington: Ministry of Health. Retrieved from <https://www.health.govt.nz/system/files/documents/publications/hwac-future-directions-recommendations.pdf>
- Hesser, A., Cregler, L. L., & Lewis, L. (1998). Predicting the admission into medical school of African American college students who have participated in summer academic enrichment programs. *Academic Medicine*, 73(2), 187–191. Retrieved from [http://journals.lww.com/academicmedicine/Abstract/2003/05000/USMLE\\_Performances\\_in\\_a\\_Predominantly\\_Asian\\_and.10.aspx](http://journals.lww.com/academicmedicine/Abstract/2003/05000/USMLE_Performances_in_a_Predominantly_Asian_and.10.aspx)
- Jensen, U. (2011). *Factors influencing student retention in higher education. Summary of influential factors in degree attainment and persistence to career or further education for at-risk/high educational need students*. Honolulu, Hawai'i: Pacific Policy Research Center. Kamehameha Schools - Research & Evaluation Division. Retrieved from [http://www.ksbe.edu/\\_assets/spi/pdfs/Retention\\_Brief.pdf](http://www.ksbe.edu/_assets/spi/pdfs/Retention_Brief.pdf)
- Kaehne, A., Maden, M., Thomas, L., Brown, J., & Roe, B. (2014). *Literature review on approaches and impact of interventions to facilitate widening participation in healthcare programmes*. United Kingdom: Edge Hill University. Retrieved from <https://repository.edgehill.ac.uk/6200/1/WPlitrev280514Submitted.pdf>
- Kasuya, R. T., Naguwa, G. S., Guerrero, A. P., Hishinuma, E. S., Lindberg, M. A., & Judd, N. K. (2003). USMLE performances in a predominantly Asian and Pacific Islander population of medical students in a problem-based learning curriculum. *Academic Medicine*, 78(5), 483–490. <http://journals.lww.com/academicmedicine/pages/articleviewer.aspx?year=2003&issue=05000&article=00010&type=abstract>
- Kay-Lambkin, F., Pearson, S.-A., & Rolfe, I. (2002). The influence of admissions variables on first year medical school performance: A study from Newcastle University, Australia. *Medical Education*, 36(2), 154–159. doi:10.1046/j.1365-2923.2002.01071.x.
- Loftin, C., Newman, S., Dumas, B., Gilden, G., & Bond, M. L. (2012). Perceived barriers to success for minority nursing students: An integrative review. *ISRN Nursing*. doi:10.5402/2012/806543.
- Madjar, I., McKinley, E., Deynzer, M., & Merwe, A. (2010). *Beyond the first hurdle: Student persistence beyond the first semester of university study*. Auckland: Starpath Project, The University of Auckland. Retrieved from <https://cdn.auckland.ac.nz/assets/education/about/research/docs/starpath/Beyond%20the%20first%20hurdle%20-%20Student%20persistence%20beyond%20the%20first%20semester%20of%20university%20study.pdf>
- Madjar, I., McKinley, E., Deynzer, M., & van der Merwe, A. (2010). *Stumbling blocks or stepping stones? Students' experience of transition from low-mid decile schools to university*. Auckland: Starpath Project, The University of Auckland. Retrieved from <https://cdn.auckland.ac.nz/assets/education/about/research/docs/starpath/Stumbling-blocks-or-stepping-stones-Research-Report-25-March-2010.pdf>
- Martin-McDonald, K., & McCarthy, A. (2008). 'Marking' the white terrain in indigenous health research: Literature review. *Journal of Advanced Nursing*, 61(2), 126–133. doi:10.1111/j.1365-2648.2007.04438.x.

- Mayeda, D., Keil, M., Dutton, H., & 'Ofamo'oni, I. (2014). "You've gotta set a precedent". Māori and Pacific voices on student success in higher education. *AlterNative*, 10(2), 165–179. Retrieved from [http://www.academia.edu/7491880/\\_Youve\\_gotta\\_set\\_a\\_precedent\\_Maori\\_and\\_Pacific\\_Voices\\_on\\_Student\\_Success\\_in\\_Higher\\_Education](http://www.academia.edu/7491880/_Youve_gotta_set_a_precedent_Maori_and_Pacific_Voices_on_Student_Success_in_Higher_Education)
- Mills, C., Heyworth, J., Rosenwax, L., Carr, S., & Rosenberg, M. (2009). Factors associated with the academic success of first year health science students. *Advances in Health Sciences Education*, 14(2), 205–217. doi:10.1007/s10459-008-9103-9.
- Ministry of Health. (2004). *Pacific health and disability workforce development plan*. Wellington: Ministry of Health. Retrieved from <http://www.moh.govt.nz>
- Ministry of Health. (2011). Monitoring the regulated Māori health workforce. Retrieved from <http://www.health.govt.nz/publication/monitoring-regulated-maori-health-workforce>
- Morunga, E. (2009). Māori student participation in psychology. *MAI Review*, 1, 1–7.
- Naepi, S. (2015). Navigating the currents of Kaupapa Māori and Pan-Pacific research methodologies in Aotearoa New Zealand. *Mai Journal*, 4(1), 71–84. Retrieved from [http://www.journal.mai.ac.nz/sites/default/files/MAIJrnl\\_V4Iss1\\_Naepi.pdf](http://www.journal.mai.ac.nz/sites/default/files/MAIJrnl_V4Iss1_Naepi.pdf)
- Orom, H., Semalulu, T., & Underwood, W. (2013). The social and learning environments experienced by underrepresented minority medical students: A narrative review. *Academic Medicine*, 88(11), 1765–1777. doi:10.1097/ACM.0b013e3182a7a3af.
- Pihama, L. (2001). *Tihei Mauri Ora: Honouring our voices. Mana wahine as a Kaupapa Māori Theoretical framework*. Ph.D., The University of Auckland.
- Ratima, M., Brown, R., Garrett, N., Wikaire, E., Ngawati, R., Aspin, C., et al. (2007). Strengthening Maori participation in the New Zealand health and disability workforce. *Medical Journal of Australia*, 186(10), 541–543. Retrieved from [https://www.mja.com.au/system/files/issues/186\\_10\\_210507/rat10326\\_fm.pdf](https://www.mja.com.au/system/files/issues/186_10_210507/rat10326_fm.pdf)
- Ratima, M., Brown, R., Garrett, N., Wikaire, E., Ngawati, R., Aspin, C., et al. (2008). *Rauringa Raupa: Recruitment and retention of Māori in the health and disability workforce*. Auckland: Taupua Waioara: Division of Public Health and Psychosocial Studies. Faculty of Health and Environmental Sciences: AUT University. Retrieved from [http://www.health.govt.nz/system/files/documents/publications/maori\\_health\\_workforce\\_110708low\\_with\\_cover.pdf](http://www.health.govt.nz/system/files/documents/publications/maori_health_workforce_110708low_with_cover.pdf)
- Razack, S., Hodges, B., Steinert, Y., & Maguire, M. (2015). Seeking inclusion in an exclusive process: Discourses of medical school student selection. *Medical Education*, 49, 36–47. doi:10.1111/medu.12547.
- Rich, A., Ayers, K., Thomson, W., Sinclair, R., Rohan, M., & Seymour, G. (2011). Does performance in selection processes predict performance as a dental student? *European Journal of Dental Education*, 16(2012), 27–34. doi:10.1111/j.1600-0579.2011.00706.x.
- Sapoaga, F., & Van der Meer, J. (2011). Building a Pacific health workforce in New Zealand: Initial findings from a transition project in first year health sciences at university. A practice report. *The International Journal of the First Year in Higher Education*, 2(2), 61–68. Retrieved from <https://fyhejournal.com/article/view/88/93>
- Sapoaga, F., Zaharic, T., Kokaua, J., Ekeroma, A., Murray, G., & van der Meer, J. (2013). Pacific students undertaking the first year of health sciences at the University of Otago, and factors associated with academic performance. *The New Zealand Medical Journal*, 1126(1384), 96–108. Retrieved from [https://www.nzma.org.nz/\\_data/assets/pdf\\_file/0015/34323/content.pdf](https://www.nzma.org.nz/_data/assets/pdf_file/0015/34323/content.pdf)
- Smith, G. (1997). *The development of Kaupapa Māori: Theory and praxis*. Unpublished Ph.D. The University of Auckland, Auckland. Retrieved from <https://researchspace.auckland.ac.nz/handle/2292/623>
- Smith, L. (2012). *Decolonizing methodologies: Research and indigenous peoples* (2nd ed.). London: Zed Books.
- Smith, L., & Reid, P. (2000). *Māori research development. Kaupapa Māori principles and practices: A literature review*. Wellington: Te Puni Kokiri. Retrieved from [http://www.rangahau.co.nz/assets/SmithL/Maori\\_research.pdf](http://www.rangahau.co.nz/assets/SmithL/Maori_research.pdf)
- Statistics New Zealand. (2014). *New Zealand in profile 2014: An overview of New Zealand's people, economy and environment*. Wellington: Statistics New Zealand. Retrieved from [http://www.stats.govt.nz/browse\\_for\\_stats/snapshots-of-nz/nz-in-profile-2014.aspx](http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/nz-in-profile-2014.aspx)
- Te Rōpū Rangahau Hauora a Eru Pōmare. (2002). *Mana Whakamārama—Equal Explanatory Power: Māori and non-Māori sample size in national health surveys*. Wellington: Ministry of Health. Retrieved from [https://www.fmhs.auckland.ac.nz/assets/fmhs/faculty/tkxm/tumuaki/docs/Equal\\_explanatory\\_power.doc](https://www.fmhs.auckland.ac.nz/assets/fmhs/faculty/tkxm/tumuaki/docs/Equal_explanatory_power.doc)
- The LIME Network. (2013). LIMelight awards 2013. Retrieved 10 June 2015, from <http://www.limenetwork.net.au/content/limelight-awards-2013>

- The Sullivan Commission. (2004). *Missing persons: Minorities in the health professions. A report of the Sullivan Commission on diversity in the healthcare workforce*. The Sullivan Commission. Retrieved from <http://www.aacn.nche.edu/media-relations/SullivanReport.pdf>
- The University of Auckland. (2014a). 2015. *The University of Auckland Faculty of Medical and Health Sciences undergraduate prospectus*. Auckland: The University of Auckland. Retrieved from <https://cdn.auckland.ac.nz/assets/fmhs/faculty/handbooks-prospectuses/docs/fmhs-ug-prospectus2015.pdf>
- The University of Auckland. (2014b). *University of Auckland equity profile 2014. Compiled by the statistical consulting centre for the equity office—Te Ara Tautika*. Auckland: The University of Auckland. Retrieved from <https://cdn.auckland.ac.nz/assets/central/about/equal-opportunities/reports-and-plans/UoA%20Equity%20Profile%202014.pdf>
- Towns, C., Watkins, N., Salter, A., Boyd, P., & Parkin, L. (2004). The Orewa Speech: Another threat to Māori health? *The New Zealand Medical Journal*, 117(1205). Retrieved from [https://www.nzma.org.nz/\\_data/assets/pdf\\_file/0004/17950/Vol-117-No-1205-05-November-2004.pdf](https://www.nzma.org.nz/_data/assets/pdf_file/0004/17950/Vol-117-No-1205-05-November-2004.pdf)
- Utzman, R., Riddle, D., & Jewell, D. (2007). Use of demographic and quantitative admissions data to predict performance on the national physical therapy examination. *Physical Therapy*, 87(9), 1181–1193. doi:10.2522/ptj.20060222.
- Vaiotei, T. (2006). Talanoa research methodology: A developing position on Pacific research. *Waikato Journal of Education*, 12, 21–34. Retrieved from <http://whanaouraresearch.co.nz/files/formidable/Vaiotei-Talanoa.pdf>
- Walter, M., & Andersen, C. (2013). *Indigenous statistics: A quantitative research methodology*. California: Left Coast Press Inc.
- Whiteford, G., Shah, M., & Nair, C. (2013). Equity and excellence are not mutually exclusive: A discussion of academic standards in an era of widening participation. *Quality Assurance in Education*, 21(3), 299–310. doi:10.1108/QAE-Apr-2012-0020.
- Wikaire, E. (2015). *Data speaks: Predictors of success in tertiary education health study for Māori and Pacific students*. (Master of Public Health), University of Auckland, Auckland. Retrieved from <https://researchspace.auckland.ac.nz/handle/2292/27046>
- Wikaire, E., Curtis, E., Cormack, D., Jiang, Y., McMillan, L., Loto, R., et al. (2016). Patterns of privilege: A total cohort analysis of admission and academic outcomes for Māori, Pacific and non-Māori non-Pacific health professional students. *BMC Medical Education*, 16(1), 262. doi:10.1186/s12909-016-0782-2.
- Wikaire, E., & Ratima, M. (2011). Māori participation in the physiotherapy workforce. *Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health*, 9(2), 473–495. Retrieved from [http://www.pimatisiwin.com/uploads/jan\\_2011/12WikaireRatima.pdf](http://www.pimatisiwin.com/uploads/jan_2011/12WikaireRatima.pdf)
- Wilson, D., McKinney, C., & Rapata-Hanning, M. (2011). Retention of indigenous nursing students in New Zealand: A cross-sectional survey. *Contemporary Nurse*, 38(1–2), 59–75. doi:10.5172/conu.2011.38.1-2.59.
- Woolf, K., McManus, I., Potts, H., & Dacre, J. (2013). The mediators of minority ethnic underperformance in final medical school examinations. *British Journal of Educational Psychology*, 83(Pt 1), 135–159. doi:10.1111/j.2044-8279.2011.02060.x.
- Zorlu, A. (2013). Ethnic disparities in higher education. *IZA Journal of Migration*, 2(1), 3. doi:10.1186/2193-9039-2-3.