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BHSc   Bachelor of Health Sciences

BNurs   Bachelor of Nursing

BOpt   Bachelor of Optometry

BPharm   Bachelor of Pharmacy

CertHSc   Hikitia te Ora – Certificate in Health Sciences

FMHS   Faculty of Medical and Health Sciences

GP   General Practitioner

GPA   Grade Point Average

NCEA   National Certificate in Educational Achievement

nMnP   Non-Māori non-Pacific

NZ   New Zealand

UoA   The University of Auckland

Research topic

This thesis presents a quantitative analysis of predictors of academic success for Māori and Pacific students enrolled within the Bachelor of Nursing, Bachelor of Pharmacy and Bachelor of Health Sciences degree-level programmes within the Faculty of Medical and Health Sciences at the University of Auckland from 2002 to 2013.

Researcher perspective

Ko Ngāpuhi te iwi, Ko Ngāti Hine te hapū, Ko Hikurangi te maunga, Ko Taumarere te awa, Ko Mōtatau te marae. In secondary school, most of my friends had left by the time I reached my final year. I wanted to study medicine but missed out on the admission criteria by a few points. I did not want to do a bridging programme; it would add an extra year of study that I could not afford to spend away from my whānau. I studied Physiotherapy instead. The programme was shorter; I was given a scholarship, and help to find somewhere to live. At Physio school we started with quite a lot of Māori and Pacific students. By the end, only a few of us graduated. University was different compared to secondary school. We had Māori and Pacific lunches together once a month. That was the day I looked forward to the most. When I could hang out with people like me and feel like I belonged. I did not work as a Physio for long. In that job, I saw the same things that happened at school and university. No one cared about what was important for Māori practitioners or patients, it was not how they had been taught. I could not stay and do nothing, so I left to see if I could help to change things.

Research in health that is grounded in Kaupapa Māori methodology provided for me an approach through which change could occur. Through working in Māori and Indigenous health research, and exposure to leading Māori and indigenous health researchers, I have been privileged to gain knowledge and skills in this area. Through postgraduate study and research work, I was able to gain in-depth knowledge of Māori health, Kaupapa Māori theory and research from an indigenous perspective. As the researcher in this study, my theoretical positioning is located within a Kaupapa Māori paradigm that is built on foundational Kaupapa Māori principles such as tino rangatiratanga, whanaungatanga, Te Tiriti o Waitangi, kaupapa, tikanga, and te reo Māori.

I have seen many of my friends and whānau struggle through the education system, meeting multiple barriers that ultimately make them feel like they want to quit. Some do. In fact many do. They blame themselves, as do their lecturers. Now I see my daughter and our tamariki coming through the system we came through, struggling like we did. This thesis aims to explore and explain some of those struggles and contribute to providing evidence that can be used to create change.

Research overview

Māori are the indigenous peoples of New Zealand and Tagata Pasifika[1] are a heterogeneous composite of peoples with Pacific nation ancestry born and living in New Zealand. Māori and Pacific peoples within New Zealand experience overwhelmingly high health need and are overrepresented across most major mortality and morbidity measures when compared to other ethnic groups. Māori and Pacific health status is a reflection of the ongoing impacts of colonisation and subjugation to western imperialist notions of being, doing and knowing (L. Smith, 2012). Addressing Māori and Pacific health needs reflects both an indigenous rights imperative and Māori rights to equitable health outcomes as tangata whenua and Treaty of Waitangi partners (Robson & Harris, 2007). The New Zealand Government has acknowledged the need to address Māori and Pacific health needs and has prioritised Māori and Pacific health workforce development as a key element in improving Māori and Pacific health outcomes.

Māori and Pacific health workforce development aligns with international efforts to address the needs of indigenous and ethnic minority peoples who display similar trends in health need. Health workforce development aims to increase the proportion of skilled and knowledgeable Māori and Pacific health professionals working across multiple levels and roles within the New Zealand health and disability sector. Ensuring adequate Māori and Pacific representation within health professional roles will contribute to improved cultural concordance (engagement between health practitioner and 'patient' who have similar ethnic backgrounds), quality of care, diversity within the health sector, and the ability of the health workforce to deliver appropriate healthcare to the diverse community it serves (Ministry of Health, 2014a).

Tertiary institutions are responsible for providing high quality health professional education that ensures their students graduate with the knowledge, skills and appropriate qualifications to perform suitably in health professional roles. However, large New Zealand tertiary institutions are built on European traditions of education that promote white ways of teaching and learning and have historically adopted deficit views of Māori and Pacific students who aim to pursue tertiary qualifications (Pihama, 2001e). Whilst maintaining reputations for providing high quality tertiary education and subsequently quality graduates for potential employment, tertiary institutions are failing to ensure adequate recruitment and retention of Māori and Pacific students into and through health professional training. Māori and Pacific students have higher rates of attrition, particularly in the first year of bachelor level study, and show lower pass rates and lower grades overall when compared to predominantly European and Asian students. The failure of tertiary institutions to produce sufficient Māori and Pacific graduates for health sector employment has significant impacts on the ability to address Māori and Pacific health need. Māori and Pacific health workforce development has therefore aimed to explore and address reasons for Māori

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[1] 'Pacific' in this thesis is understood as a heterogeneous composite of peoples with Pacific nation ancestry and/or ethnicity born and living in New Zealand. Pasifika has been defined as "a collective term used to refer to people of Pacific heritage or ancestry who have migrated or been born here in Aotearoa New Zealand" (p. 16). Ministry of Education. (2013). Pasifika Education Plan 2013 - 2017. Wellington: Ministry of Education.

and Pacific underrepresentation across the health workforce. The Faculty of Medical and Health Sciences at the University of Auckland is one example of a tertiary institution that offers health professional education whilst showing a commitment to Māori and Pacific health workforce development and equity in educational outcomes through its Vision 20:20 initiatives.

The Vision 20:20 initiative reflects a commitment to the health workforce development pipeline that extends from pre-tertiary (secondary school) contexts, through transition and admission processes into tertiary contexts and then on to the health workforce. Comprehensive Māori and Pacific specific interventions such as alternative admission pathways, recruitment programmes, bridging foundation programmes, Māori and Pacific leadership within the academy, and academic and pastoral support provision have been developed as methods of addressing the multiple complex barriers that Māori and Pacific students face along this pipeline. 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, Cregler, & Lewis, 1998; Towns, Watkins, Salter, Boyd, & Parkin, 2004). Therefore, despite these interventions, disparities in academic outcomes between Māori and Pacific, and non-Māori non-Pacific students in health professional study remain and there is little evidence to indicate the extent to which individual barriers and/or interventions might be impacting on students along the pipeline to address these disparities (E. Curtis, Wikaire, Stokes, & Reid, 2012). Further, small Māori and Pacific cohort numbers, lack of good quality data, and time delays reflecting lengthy (4 – 6 years) programme duration from enrolment to completion have limited the ability to complete a comprehensive analysis of available quantitative data that might explore these issues.

Research aims

Ensuring Māori and Pacific student success into and through tertiary health study and thereby increasing the Māori and Pacific health workforce is a key element necessary in addressing Māori and Pacific health needs. However, tertiary institutions are struggling to ensure equitable academic outcomes for Māori and Pacific students. Understanding what factors are predictive of Māori and Pacific student academic success in tertiary health programmes will provide new information that informs Māori and Pacific specific support programmes, secondary and tertiary education and health sectors. This project aimed to investigate predictors of academic success or failure for Māori and Pacific students compared to non-Māori non-Pacific, who have entered the undergraduate degree-level Bachelor of Health Sciences, Bachelor or Nursing and Bachelor of Pharmacy programmes within the Faculty of Medical and Health Sciences (FMHS) at the University of Auckland. This research explored the predictors of academic success for Māori and Pacific students enrolled in undergraduate study within the FMHS and whether the Māori and Pacific predictors of academic success differed to other ethnic groups enrolled in undergraduate study within the FMHS.

Thesis outline

Chapter two discusses New Zealand health and education sector contexts that play key roles in determining Māori and Pacific health workforce and Māori and Pacific health outcomes. Relevant background information that contextualises the research topic is provided. The state of Māori and Pacific health and utilisation of health services in New Zealand are described. Political responsibilities and priorities to increase the Māori and Pacific health workforce as a key element necessary in addressing Māori and Pacific health needs are discussed. The role of tertiary institutions within the health workforce development pipeline is described and their failure to ensure equitable Māori and Pacific student academic outcomes in health professional study are foregrounded. Contextual information specific to The University of Auckland (UoA) and its provision of health professional programmes through the Faculty of Medical and Health Sciences (FMHS) is provided. Additional descriptions of the FMHS Māori and Pacific specific academic and pastoral support programme Vision 20:20 that aims to recruit and retain Māori and Pacific students into and through FMHS programmes are made. Rationale for the need to understand the predictors of academic success for Māori and Pacific health professional students through analysis of student data using the current example is discussed.

Chapter three reviews the current literature base available to inform an understanding of the predictors of academic success for Māori and Pacific students within health professional study. National and international literature is reviewed and broad groupings of literature evidence are presented that describe predictors of success for: (1) Māori and Pacific students in tertiary health study; (2) Māori and Pacific students in tertiary study generally; (3) indigenous and ethnic minority groups in tertiary health study internationally; and (4) students in tertiary health study internationally. The chapter concludes with a summary and critique of the available literature.

Chapter four describes the theoretical positioning of the researcher and the research. Kaupapa Māori theory provides a space within which Māori world views, aspirations and ways of being, doing and knowing can be acknowledged and developed (L. Smith, 2012). Kaupapa Māori provides a foundation on which a research methodology can be built that is driven by Kaupapa Māori principles. Kaupapa Māori: locates Māori at the centre of enquiry; prioritises Māori aspirations; ensures the research is of benefit to Māori; takes for granted the validity and legitimacy of Māori world views; and adopts a critical analysis of dominant structures that perpetuate power imbalances. This research is founded on Kaupapa Māori theory that ensures Kaupapa Māori principles are engrained within the research. Explanations of Kaupapa Māori research principles in this context are presented.

Chapter five describes the research methods used to explore the predictive effect of demographic, admission and early academic outcome variables on programme academic outcomes for Māori, Pacific and non-Māori non-Pacific students enrolled in the Bachelor of Health Sciences (BHSc), Nursing (BNurs) and Pharmacy (BPharm) programmes within FMHS between 2002 and 2013. Multiple regression analyses were completed for Māori,

Pacific, and non-Māori non-Pacific student cohorts separately that identified the effect of predictor variables (school decile, Auckland school, type of admission, bridging foundation programme, first year bachelor grade point average (GPA), first year bachelor passed all courses) on academic outcomes (first year bachelor GPA, year 2 – 4 programme GPA, graduated from intended programme, graduated in the minimum time) and a composite completion outcome (optimal completion, sub-optimal completion with high grades, sub-optimal completion with low grades, non-completion). Differences in academic outcomes between ethnic groups were identified and the extent to which predictor variables were explanatory of such differences was explored. Data analysis and interpretation foregrounded Māori world views, located Māori and Pacific at the centre of enquiry and adopted explicit non-victim blame, non-deficit analysis.

Chapter six presents the results of the data analysis which explores the effect of predictor variables on academic outcomes for Māori, Pacific and non-Māori non-Pacific students. Descriptive summaries and multiple logistic and linear regression analysis results for the effect of predictor variables on distinct academic outcome variables and a composite graduation outcome are presented. These results identify differences in distinct and composite academic outcomes between ethnic groupings, and demonstrates how each predictor variable impacts on (or accounts for) those differences.

Chapter seven discusses the research findings in the context of known literature. Similarities and differences between research findings are discussed and the significance of the research findings for key parties is highlighted. These findings are important for tertiary institutions providing health professional programmes and secondary education providers to inform appropriate delivery of education that meets the needs of all students.

Chapter eight presents recommendations for change based on the research findings in the context of the current literature base. Overall conclusions for this project are presented.

Introduction

Māori and Pacific peoples, the Government, and health and education sectors all play important roles in addressing Māori and Pacific health inequities through health workforce development. With a focus on the New Zealand context, this chapter will provide relevant background information to this project's research topic. Māori and Pacific health issues and utilisation of health services will be discussed, and Māori and Pacific rights to health equity and Government commitments to these goals will be outlined. Māori and Pacific health workforce development as a key component in addressing health inequities will then be introduced, with the underrepresentation of Māori and Pacific health professionals foregrounded. The Māori and Pacific health workforce development pipeline will be introduced with a focus on the role of the education sector within this pipeline. Within this pipeline framework, longstanding educational inequities for Māori and Pacific students within secondary and tertiary education sectors will be outlined and their contribution to limiting the potential for improved Māori and Pacific health professional numbers through workforce development discussed. Finally, the institutional context of this research will be explained including descriptions of available health professional programmes and pathways into and through these qualifications, and an outline of Faculty commitments to Māori and Pacific health workforce development and associated initiatives.

Background

The health disparity context

In New Zealand (NZ), Māori (the Indigenous peoples of New Zealand) and Tagata Pasifika experience significant health inequities when compared to non-Māori non-Pacific peoples (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015; Ministry of Health, 2010a; Robson & Harris, 2007). Māori and Pacific peoples have higher mortality and morbidity rates across most major health problems (Robson & Harris, 2007). For example, in 2010–12, Māori male life expectancy (72.8 years) was 7.4 years less than that of non-Māori males (80.2 years) and Māori female life expectancy (76.5 years) was 7.2 years less than that of non-Māori females (83.7 years) (Statistics New Zealand, 2013c). In 2002, after standardisation for age and sex, mortality rates for Māori were twice that of non-Māori overall and death rates from disease were higher for Māori for the top six leading causes of death (Cormack, 2007). In 2006, life expectancy was 6.7 years less for Pacific males and 6.1 years less for Pacific females compared to the total population (Ministry of Health, 2012a). Health inequities between indigenous and ethnic minority (Māori and Pacific), and dominant (non-Māori non-Pacific) peoples are widespread, multilevel and are demonstrated across a wide range of health conditions (Blakely, Ajwani, Robson, Tobias, & Bonne, 2004; Mauri Ora Associates, 2010; Robson & Harris, 2007).

Colonisation, racism and health

Historically, Pākehā / European discourse around Māori health and health inequity has adopted a victim-blame analysis citing Māori 'cultural' factors as possible determinants of disparities between indigenous and ethnic minority and 'majority' populations (McCreanor, 2008; McCreanor & Nairn, 2002). However, this type of analysis fails to highlight, and avoids consideration of, the influences of colonisation and its Pākehā systems and imperialist notions on indigenous and ethnic minority health and education outcomes (Cram, McCreanor, Smith, Nairn, & Johnstone, 2006). Drawing on the work of Jones (2001a), Robson and Reid (2007) provide an understanding of how colonisation operationalises via institutionalised ("differential access to opportunities of society by race"), interpersonal ("prejudice and discrimination according to 'race'") and internalised ("acceptance of negative messages about one's own stigmatised race") racism that contributes to determining health outcomes by determining differential access to the determinants of health (e.g. education, housing, deprivation), differential access to health care, and differences in the quality of care received (p. 6) (Reid & Robson, 2007).

The long term impacts of colonisation are visible; in addition to higher mortality and morbidity rates outlined above, Māori and Pacific peoples suffer health impacts due to broad socioeconomic, cultural, and political determinants of health. For example, Māori have: higher rates of unemployment (13.7% for Māori, 13.1% for Pacific compared to 4.7% for non-Māori in 2011); lower rates of school completion at Level 2 NCEA or higher (43.4% for Māori, 42.3% for Pacific compared to 63.7% for non-Māori); higher rates of exposure to experiences of racial discrimination (R. Harris et al., 2012); and are more likely to live in areas of high deprivation (e.g. 24% Māori, 35.7% for Pacific compared to 7% non-Māori living in NZDep decile 10 (most deprived areas) in 2006). Māori and Pacific peoples also have higher rates of 'health-damaging' behaviours such as smoking (17.3% for Māori, 4.4% non-Māori), and poorer nutrition compared to non-Māori and non-Pacific peoples (Ministry of Health, 2010b, 2012a; Ministry of Social Development, 2010).

Māori and Pacific engagement with the health sector

Despite overwhelmingly high health need, Māori and Pacific utilisation of primary health care providers such as General Practitioners (GP) remains lower than non-Māori non-Pacific, with Māori being less likely to have seen a GP in the last 12 months compared to non-Māori. Māori females are twice as likely as non-Māori females to report unmet need for a GP (RR 2.45, CI 1.96–2.93) (Ministry of Health, 2010a). Similarly, Pacific men reported significantly higher unmet need for a GP compared to total population (Ministry of Health, 2012b). Unsurprisingly, there is overrepresentation of Māori and Pacific peoples' avoidable use of secondary and tertiary health care providers. For example, Māori avoidable hospitalisation rates from 2006 – 2008 were one and a half times higher than non-Māori (RR 1.77, CI 1.76–1.79) and avoidable mortality rates for Māori from 2004 – 2006 were 2.5 times higher than for non-Māori (RR 2.59, CI 2.49–2.70) (Ministry of Health, 2010a). Similarly, the rate for ambulatory-sensitive hospitalisations (hospital admissions that could be avoided by providing adequate

primary healthcare) for Pacific peoples increased between 2001 and 2010 whilst this rate decreased for the total population (Ministry of Health, 2012b).

Health equity rights are government responsibilities

Addressing these health inequities is a priority for Māori and Pacific peoples and the Government and aligns with indigenous rights for Māori as tangata whenua and Treaty partners in New Zealand (Eketone, 2008; Reid & Robson, 2007). Achieving health equity also aligns internationally with the United Nations *Declaration on the Rights of Indigenous Peoples* that supports indigenous rights to health equity and names governments as accountable to these rights (United Nations, 2008). The Ministry of Health is the representative government department that is responsible for ensuring equitable health outcomes for all New Zealanders. The Government's overarching health sector policy frameworks such as The *NZ Health Strategy*[2] (Ministry of Health, 2000), and the Māori and Pacific health strategies *He Korowai Oranga* (Ministry of Health, 2014a) and *Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2014-2018* (Minister of Health & Minister of Pacific Island Affairs, 2010) identified Māori and Pacific health development and addressing Māori and Pacific health disparities as a high priority.

Māori and Pacific health workforce context

The Māori and Pacific health workforce shortage

Key to addressing health disparities for Māori and Pacific peoples is a health sector that is able to deliver culturally appropriate, relevant, safe and effective health care (Ministry of Health, 2000, 2014a). This not only includes a culturally competent health workforce, but also requires a solid capacity of Māori and Pacific health professionals working within and across the health sector. This is particularly worth noting given that some Māori have expressed a preference for doctors who are Māori (M. Ratima et al., 2007), and there is some evidence that cultural concordance (engagement with health professionals of the same ethnic background) increases patient satisfaction and improves health outcomes (Smedley, Stith, & Nelson, 2002). In addition, Māori report a preference for Māori specific health providers and are noted to "*feel more comfortable talking to someone who understands our culture*" (p. 56) (Ministry of Health, 2010b). There are some promising results with one Ministry of Health report showing that of those Māori who are enrolled with a Māori health care provider, 83% reported having seen this provider in the last 12 months (Ministry of Health, 2010b, 2012a). However, the current capacity of Māori and Pacific peoples working in the NZ health sector and therefore, their ability to contribute to meeting Māori health needs, is limited.

There is a critical shortage of Māori and Pacific health professionals in frontline clinical roles, in decision-making roles and working throughout community, secondary and tertiary level health care (Cram, 2014; E. Curtis, Reid, & Jones, 2014; E. Curtis, Wikaire, et al., 2014; E. Curtis et al., 2012; M. Ratima et al., 2007). For example, despite making up 14.9% of the NZ population (Statistics New Zealand, 2013a), and being overrepresented in health

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[2] At the time of writing, the current version of the New Zealand Health Strategy is being updated.

sector utilisation at tertiary care levels, in 2009 Māori made up only 3% of doctors, 6% of nurses, 2% of pharmacists and 5% of dentists (Ministry of Health, 2011a). In the public health workforce, Māori are often concentrated in 'less senior' roles such as community workers, health promotion and education roles (Phoenix Research, 2004). Similarly, Pacific peoples make up 7.4% of the NZ population but only 1% of doctors, 0.2% of pharmacists, 0.6% of dentists and 2.2% of nurses (Ministry of Health, 2004; Statistics New Zealand, 2014; Ussher, 2007). Under-representation of indigenous and ethnic minority peoples within health professions limits health sector ability to provide a culturally safe, competent and appropriate workforce that meets the diverse needs of the community it serves (E. Curtis et al., 2012; Health Workforce Advisory Committee, 2003). This is of particular concern to health professional bodies (e.g. Medical Council of New Zealand, Nursing Council of New Zealand) that aim to ensure that health professions are representative of the diverse populations they serve (Medical Council of New Zealand, 2015; Nursing Council of New Zealand, 2015).

Māori and Pacific health workforce development

Māori health workforce development has been defined as *"the process of strengthening the capacity and capability of the Māori health and disability workforce in order to maximise its contribution to improved health outcomes for Māori" (p. xiii)* (M Ratima et al., 2008). Māori and Pacific health workforce development aims to increase the number of Māori (and Pacific) health professionals working within and across the health and disability sector (E. Curtis & Reid, 2013). Māori and Pacific health workforce development has been prioritised by Māori and the Government as a key element in attempting to address health disparities and improve Māori and Pacific health outcomes (Ministry of Health, 2002, 2011b). *Te Uru Kahikatea – The Public Health Workforce Development Plan 2007-2016* identifies increasing Māori and Pacific participation in the health sector at all levels as a key pathway to improving Māori and Pacific health outcomes (Ministry of Health, 2007). This will increase cultural concordance (noted above to be positive with respect to reducing ethnic health inequities), between Māori and Pacific 'patients' and the health professionals we engage with. In addition, it is hoped that increasing Māori and Pacific health workforce capacity will increase Māori and Pacific representation in decision-making roles, bring Māori and Pacific health priorities to the forefront of health sector operations and reduce the perpetuation of differential access to and through, and quality of, health care (Cram, 2014).

Māori and Pacific health workforce development pipeline

A 'pipeline' framework is a common conceptual way of discussing health workforce development (The Sullivan Commission, 2004). This pipeline operates across primary and secondary education, into tertiary health study and on to the health care workforce, and directs the flow of students through this pathway (E. Curtis et al., 2012; The Sullivan Commission, 2004). Literature discusses how barriers to and facilitators of recruitment and retention can occur at certain 'phases' along the pipeline, and that this model can be used to provide targeted support for students that is appropriate at each phase. Ratima et al. (2008) provide a Māori health and disability workforce development pathway model (Figure 1) that extends through five phases: pre-secondary school; secondary

school and second chance entry; tertiary education; transition to the workforce; and the workforce phase (M Ratima et al., 2008).
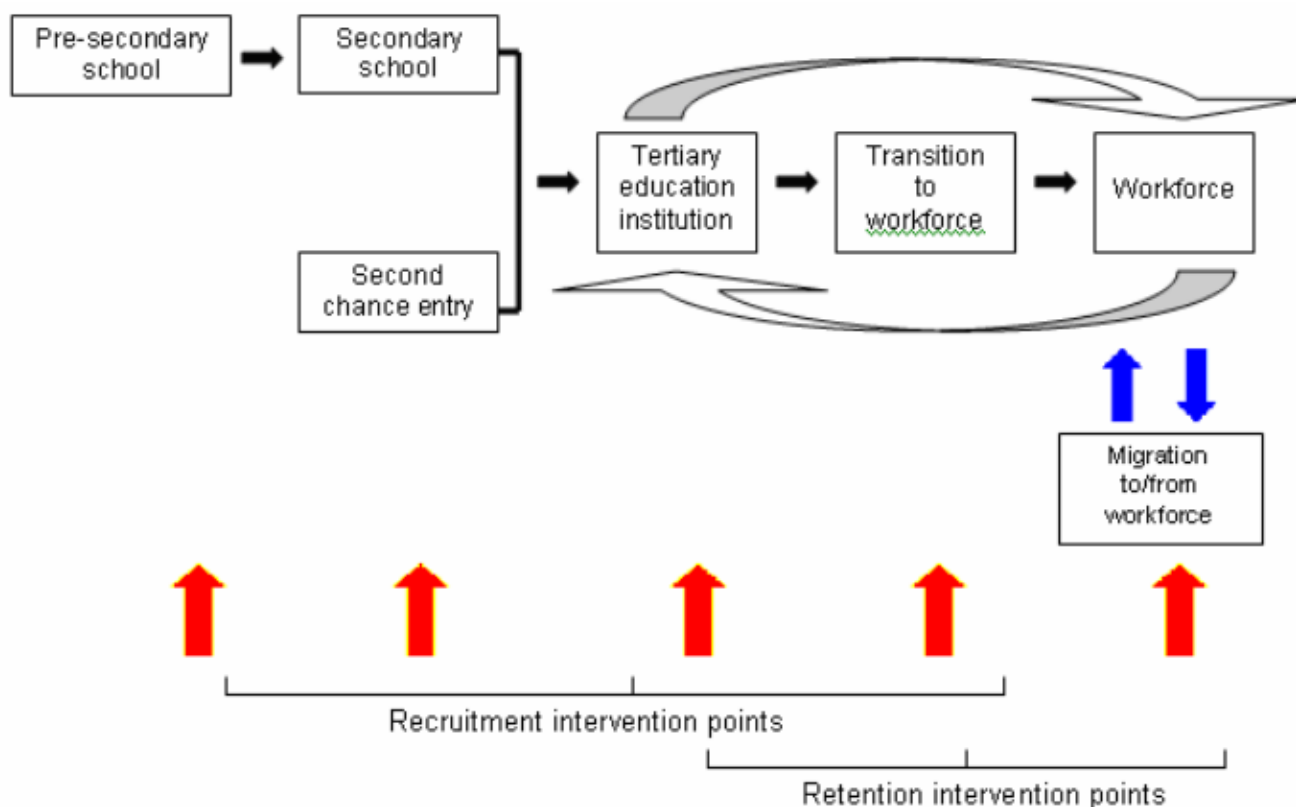
Figure 1: A Māori health and disability workforce development pathway

Source: (p. 160) (M Ratima et al., 2008).

Education sector context

The education sector, in particular secondary and tertiary education providers, play a crucial role within the Māori and Pacific health workforce development pipeline. With the secondary education sector acting as a direct 'feeder' into the tertiary education context, indigenous and ethnic minority health workforce development pathways rely heavily on the ability of secondary education providers to adequately prepare students for entry into tertiary health programmes (E. Curtis et al., 2012). Tertiary institutions are then charged with effectively recruiting, retaining and graduating Māori and Pacific students through health professional tertiary education pathways in order to increase numbers of 'qualified' Māori and Pacific health workers (E. Curtis, Wikaire, et al., 2014; M. Ratima et al., 2007; Whitehead, Shah, & Nair, 2013).

Secondary education context (NCEA)

Internationally, educational institutions set standards and frameworks in order to regulate qualifications. New Zealand has adopted a national qualifications framework similar to the United Kingdom in alignment with government funding of educational qualification delivery and consistency across providers. The intention is that

students will progress from early childhood education, to primary school, intermediate, secondary school, and then tertiary/university and/or employment. During this progression, the publicly funded State system aims to provide sequential educational levels through which a student can progress. I.e. once you pass one level, you can move on to the next level. The New Zealand Qualifications Authority (NZQA) oversees the use of the National Certificate in Educational Attainment (NCEA) qualifications framework within most New Zealand secondary schools with a focus on achievement of NCEA Level 1 (year 11), Level 2 (year 12), and Level 3 (year 13) qualifications prior to leaving secondary school in preparation for tertiary study (or other pathways to employment). NCEA was first introduced in 2002 at NCEA Level 1 (replacing the School Certificate, 6th Form Certificate and University Bursary system), therefore preparing the first cohort of students with NCEA results for entry into tertiary level study in 2005. Although alternative educational options are available within New Zealand (e.g. privately funded schools and Cambridge International Examination or International Baccalaureate qualifications frameworks), this thesis focusses primarily on the most commonly utilised (being government-funded secondary schools and the NCEA qualification) system.

Under the NCEA system, each year students study a number of subjects. The NCEA system uses a combination of internally and externally assessed 'standards' to measure knowledge and skill and to record academic achievement within each school subject. Each standard is worth a certain number of credits (approximately 2 – 6 depending on the standard) and can be gained at achieved, merit, excellence or not achieved levels (in recognition of high (or low) achievement). Students are required to achieve a certain number of credits in order to gain an NCEA certificate at each Level (1 – 3), including recently introduced literacy and numeracy requirements for all levels. New Zealand students follow a general curriculum up until year 11 (aged 15 years) (NCEA level 1) at which time students are then able to choose subjects that align more closely with their intended career path.

Academic preparation for tertiary study

At year 13, students complete NCEA Level 3 and school results from this year are considered when applying to tertiary institutions from school. The minimum requirement for entry into a New Zealand university is *University Entrance* (UE); made up of 10 numeracy credits at Level 1 or above, 10 literacy credits at level 2 or above, and 14 credits each in three level 3 approved subjects. NCEA Rank Score (or entry score) is used by some New Zealand universities as a final weighted score representing overall best Level 3 NCEA results and is incorporated into entry criteria for some tertiary programmes. NCEA rank score is based on a student's best 80 credits at Level 3 or higher using a maximum of five approved subjects, weighted by the level of achievement attained (achieved = 2 points, merit = 3 points, excellence = 4 points) in each set of credits. The rank score is calculated by awarding the following points for up to 24 credits in each approved subject taken at Level 3. The maximum rank score is 320.

From a Māori and Pacific health workforce development perspective, preparation of students pursuing health careers includes ensuring the selection of appropriate prerequisite school subjects (i.e. sciences), achievement to the level of tertiary entry requirements, ensuring students have necessary academic and workload coping skills, provision of clear career information, and facilitation of students as independent learners (E. Curtis et al., 2012). Tertiary institutions generally encourage selection of science subjects (Biology, Chemistry, Physics) alongside literacy and numeracy subjects at NCEA Level 2 and 3 for those students wishing to pursue health professional study. As identified across national and international literature (Acosta & Olsen, 2006; E. Curtis et al., 2012; Drysdale, Faulkner, & Chesters, 2006; Madjar, McKinley, Deynzer, & van der Merwe, 2010b), secondary schools are failing to provide these basic building blocks for indigenous and ethnic minority students and there are well-known longstanding inequities between Māori, Pacific and non-Māori non-Pacific students throughout the New Zealand education system (Ministry of Education, 2002, 2013b, 2014b). Māori and Pacific secondary school students have lower rates of attainment of literacy and numeracy standards, are more likely to leave school with no formal qualification, and have lower rates of university entrance achievement when compared with Pākehā/European and Asian students (Ministry of Education, 2014a). For example, the proportion of Māori (26.8%) and Pacific (36.3%) students leaving school with UE or NCEA Level 3 (i.e. successfully completing the last year of secondary school) was lower than that of Asian (72.2%) and Pākehā/European (53.7%) students (Ministry of Education, 2014a)[3]. Curtis et al. (2015) showed that Māori and Pacific applicants to tertiary health programmes are achieving secondary school results that are well below those required for guaranteed entry to tertiary health programmes (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). Alarmingly, some authors have also highlighted the negative impact of racial discrimination in regard to secondary school careers advice (e.g. careers advisors that guide ethnic minority students away from 'higher level' career options) on ethnic minority students (Drysdale et al., 2006).

Tertiary education context

Internationally, tertiary institution equity objectives aim for equitable academic outcomes for indigenous and ethnic minority students and aim to ensure the retention and success of a diverse student body (Whiteford, Shah, & Nair, 2013). However, rates of Māori and Pacific 'academic success' in tertiary health programmes are far from ideal, and internationally, tertiary institutions are failing to achieve equitable academic outcomes for indigenous and ethnic minority students (Garvey, Rolfe, Pearson, & Treloar, 2009; Madjar, McKinley, Deynzer, & van der Merwe, 2010a). Tertiary institutions show ongoing trends of underrepresentation of indigenous and ethnic minority students participating in and graduating from tertiary programmes. For example, Māori students show highest attrition rates, lower participation rates and are underrepresented in bachelor level programmes compared to non-Māori (Education Counts, 2010a, 2010b). In 2007, level 4 or above qualification completion rates (within 5 years of enrolment) for Māori (62%) and Pacific (58%) students were well below that of the total

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[3] Further information regarding educational gaps between Māori, Pacific and non-Māori non-Pacific students within the education sector generally can be found on the Ministry of Education. *Education Counts* website: https://www.educationcounts.govt.nz/home.

population (74%) (Ministry of Education, 2014b). Universities are struggling to ensure the academic success of Māori and Pacific health professional students and this has direct impacts on health workforce development goals and equity targets.

Government response to education context

The inability of the secondary education sector to adequately prepare students for tertiary education, and demonstrated inequities between Māori, Pacific and non-Māori non-pacific students in the tertiary education sector have significant impacts on the potential for health workforce development. High level policy documents have outlined the Government's commitment to addressing these concerns. The *Ministry of Education* through the *Tertiary Education Commission (TEC)* are responsible for monitoring tertiary institution performance and administering government funding for tertiary education (Tertiary Education Commission, 2014). The *Tertiary Education Strategy 2014-2019* articulates the Government's long-term strategic direction and sets priorities for tertiary education and therefore guides TEC investment (Ministry of Education, 2014b). The *Tertiary Education Strategy 2014-2019*, alongside the Māori education strategy *Ka Hikitia – Accelerating Success 2013-2017* (Ministry of Education, 2013a) and the *Pasifika Education Plan 2013-2017* (Ministry of Education, 2013b) call on tertiary institutions to 'improve outcomes for all' by ensuring more people from priority groups have the transferable skills for employment. The *Tertiary Education Strategy 2014-2019* sets out six key priorities, one of which prioritises boosting Māori and Pasifika achievement by aiming for Māori (p. 13) and Pasifika students (p. 14) to "participate and achieve at all levels on par with other students in tertiary education". These strategies recognise Māori as tangata whenua and Treaty partners and acknowledge the Crown's responsibility to improve Māori achievement, skills and education (Ministry of Education, 2014b).

Institutional context

The Faculty of Medical and Health Sciences, The University of Auckland

The University of Auckland (UoA) offers health professional programmes through its Faculty of Medical and Health Sciences (FMHS). The UoA is the largest university in New Zealand with over 40,000 students and provides a full suite of academic programmes on par with international standards (The University of Auckland, 2015d). The UoA is located within the central Auckland city region in the North Island of New Zealand. Universities that provide health professional education in the North Island are generally located within the Auckland region and, therefore, those students from rural areas are required to re-locate from their hometowns for study purposes (between approximately 2 – 10 hours' drive). Auckland is the largest city in New Zealand with more than 1.42 million people (Statistics New Zealand, 2013b) and accommodation and rental house prices are the highest in the country. It should be noted that in alignment with the UoA's reputation as a high quality university on an international scale, FMHS programmes (and their graduates) are highly regarded in health fields internationally. Hence, competition for 'places' within FMHS programmes is high and attracts a strong calibre of applicants annually. The FMHS has undergone major developments over time; initially operating as a medical school in

1968, the FMHS now offers a range of undergraduate and postgraduate qualifications across multiple health disciplines. Undergraduate degree programmes currently offered within the FMHS include: the *Bachelor of Medicine and Bachelor of Surgery* (MBChB); *Bachelor of Nursing* (BNurs); *Bachelor of Pharmacy* (BPharm); *Bachelor of Health Sciences* (BHSc); and, *Bachelor of Optometry* (BOpt); as well as a Māori and Pacific specific bridging foundation programme - *Hikitia Te Ora Certificate in Health Sciences* (CertHSc) (first offered in 1999) (The University of Auckland, 2014a).

FMHS programmes

The FMHS offers undergraduate degree qualifications that are preferably delivered on campus on a full-time, consecutive-year basis. The length of time required to complete these qualifications ranges from three years for nursing and health sciences, to four years for pharmacy and optometry and six years for medicine. This project focusses on the Bachelor of Health Sciences, Bachelor of Nursing and Bachelor of Pharmacy undergraduate programmes that provide important (non-medical) health professional training. Each programme includes profession (or health discipline) specific content and uses a mixture of non-clinical and / or clinical teaching and learning methods.

The Bachelor of Health Sciences is a non-clinical undergraduate degree and its graduates pursue a broad range of health related careers after gaining an understanding of western medical systems, population health, socioeconomic and behavioural determinants of health and health policy. BHSc students also gain knowledge in epidemiology, public health, Māori and Pacific health, and health systems.

The BPharm is a mixture of non-clinical and clinical teaching that focusses not only on pharmaceuticals, but also develops research skills, provides clinical experience, emphasises critical thinking, ethical practice, and a commitment to patient care for students pursuing a career in pharmacy. After graduation, students are required to undergo a 1-year pre-registration training programme under supervision, after which they are eligible for registration as a pharmacist.

The BNurs includes both clinical and non-clinical teaching methods with a focus on multidisciplinary healthcare systems. BNurs students gain an understanding of a range of topics including mental health nursing, aged care, child and family health, Māori and Pacific health, medical and surgical nursing and management and leadership. The second and third years provide nursing specific content and practical learning.

First-year of FMHS bachelor level study

The first year of bachelor level study within FMHS programmes is a general foundational year that includes biological, physical and social sciences curriculum content. Students generally enrol in a combination of core courses that provide common curriculum content across FMHS programmes, and optional programme specific
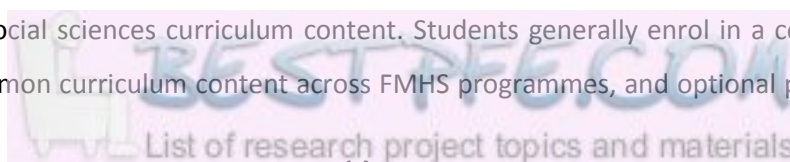
courses that are recommended depending on which FMHS programme (or health profession) a student intends to pursue (The University of Auckland, 2014a). This first year of study includes large class sizes (some involving 900+ students) and creates a highly competitive learning environment given that admission into year 2 of study (particularly in the medical programme) is partially reliant on ranking students based on their first year bachelor grade point average (GPA) (or average grade attained across all first year courses) (The University of Auckland, 2014a). Māori and Pacific students are eligible to apply through the alternative MAPAS admission pathway (with an allocated admission quota) into year 2 of medical study, although year 1 GPA is still taken into consideration for these students.

Entry into FMHS

Direct entry via general admission into the first year of FMHS bachelor level programmes requires school leaver applicants to meet prerequisite criteria for a guaranteed offer of place. Entry criteria is based on achievement of a set NCEA Rank Score (e.g. 250 for BHSc entry) along with selection of and achievement in 'approved' 'Table A' and 'Table B' NCEA level 3 subjects (Table 1).

Table 1: Table A and Table B approved subjects for FMHS programme admission

	Table A	Table B
NCEA Level 3	Classical Studies English Geography History History of Art Te Reo Māori or Te Reo Rangatira	Accounting Biology Chemistry Economics Mathematics Calculus Statistics Physics

Specific entry criteria for individual FMHS programmes are outlined in Appendix A. Note that entry criteria are subject to change on an annual basis and have generally increased annually (The University of Auckland, 2015a, 2015b).

Ethnic inequities in academic outcomes within FMHS

The FMHS is no exception to disparate trends in academic outcomes for its Māori and Pacific students. In alignment with international literature, routinely reported FMHS summary data reported through the equity office shows differences in enrolment numbers and academic outcomes between ethnic groups. Internal data from 2011 – 2015 shows an annual enrolled FMHS headcount of approximately 2000 – 2500 students in undergraduate degree programmes. In 2014, Māori made up 8.4% and Pacific made up 7.2% of FMHS undergraduate equivalent full-time students (EFTS) enrolments (The University of Auckland, 2014b). Undergraduate successful course completions in FMHS for 2014 were 94.6% for Māori, and 86.1% for Pacific compared to 95.2% for the total faculty. Māori successful course completions in FMHS over time have increased

from 78.5% in 2007 to 94.6% in 2014. Pacific successful course completions in FMHS over time have increased from 81.9% in 2007 to 86.6% in 2014. Stage One course completion rates provide information about how well the FMHS teaches and supports new undergraduate students. Stage One course completion rates in 2007 were 74.6% for Māori and 56.5% for Pacific students compared to 80.2% for all FMHS students. These pass rates increased slightly over time with Stage One course completion rates being 76.8% for Māori and 61.8% for Pacific students compared to 82.8% for the total cohort in 2014. New undergraduate retention (i.e. new undergraduates who return the following year) was relatively high for Māori (100%) and Pacific (91.7%) students in FMHS from 2013 to 2014. However, 5-year qualification completion rates (degree level or higher) in 2014 for all UoA students was 55.5% for Māori and 49.2% for Pacific students compared to 65.9% for all students (The University of Auckland, 2014b). This information provides limited summary data that shows inequities in academic outcomes between Māori, Pacific and non-Māori non-Pacific students (i.e. Māori and Pacific students having continued lower rates of course and qualification completions when compared to total cohorts[4]) within FMHS and the UoA.

Māori and Pacific responsiveness

Through long-term development, the FMHS has prioritised achieving Māori and Pacific student equitable outcomes and provides a unique context within which multilevel Māori and Pacific student support initiatives have been developed (The University of Auckland, 2014c). Key to this commitment has been the development of Te Kupenga Hauora Māori (the Department of Māori Health), the office of Tumuaki (Deputy Dean Māori for FMHS), and the Pacific Health Section of the School of Population Health that drive responsiveness through Māori and Pacific leadership within the academy. Initially introducing a simple Māori specific admission quota in 1972, the Faculty response to Māori and Pacific health workforce development, equity and social accountability has developed into a high level strategic statement brought into the Faculty's discourse in the late 1990s that outlines Vision 20:20, an equity focussed initiative that aims to increase Māori and Pacific health professionals to 10% of the NZ health workforce by the year 2020[5] (The University of Auckland, 2014c). Vision 20:20 includes three major initiatives: Whakapiki Ake (Māori specific recruitment programme), Certificate in Health Sciences (the Māori and Pacific specific bridging foundation programme, and the Māori and Pacific Admission Scheme (MAPAS) (academic and pastoral support programme).

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[4] Note that comparing Māori of Pacific student outcomes to the total cohort (made up predominantly of European/Pākehā and Asian students) is likely to underestimate the outcomes specific to European/Pākehā students or non-Māori non-Pacific students (and therefore the 'gap' between ethnic groups) given that Māori and Pacific data are also included in total cohort measures.

[5] More detailed information about Vision 20:20 and its development within FMHS has been described in: Curtis, E., & Reid, P. (2013). Indigenous health workforce development: Challenges and successes of the Vision 20:20 programme. *Australian & New Zealand Journal of Surgery, 83*(2013), 49 – 54 and Curtis, E., Reid, P., & Jones, R. (2014). 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): Emerald Group Publishing Limited.

Whakapiki Ake project (WAP) – Māori recruitment project

The FMHS through Vision 20:20 also provides a Māori specific recruitment programme *Whakapiki Ake.* Established in 2003, the Whakapiki Ake Project is a comprehensive Māori specific recruitment programme targeting Māori secondary school students and their whānau. WAP aims to recruit more Māori students into health careers via FMHS programmes by providing a range of recruitment interventions (e.g. school visits, exposure to tertiary education environments, application assistance, career information, secondary academic enrichment, and support to transition to tertiary study) (E. Curtis et al., 2012).

Hikitia Te Ora – Certificate in Health Sciences – Māori and Pacific bridging foundation programme

The Māori and Pacific admission scheme (MAPAS) admission process provides an alternative entry pathway into bachelor level FMHS programmes for Māori and Pacific applicants who may not meet prerequisite entry criteria via the Certificate in Health Sciences (CertHSc). Initially offered in 1999, the CertHSc is the bridging foundation programme offered by the FMHS that is available to Māori and Pacific FMHS applicants who complete the MAPAS admissions process (explained in further detail below) and are recommended to start their learning journey at the bridging/foundation level as a 'best starting point' for achieving their intended career goal (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). The CertHSc is a one-year full-time programme that delivers science, maths and English rich content in preparation for bachelor level tertiary health programmes. Core course content is combined with development of academic skills, student peer support networks, independence as learners, and Māori and Pacific leadership. Overall the CertHSc aims to 'better' prepare Māori and Pacific students for admission into bachelor level health study by 'bridging' pre-tertiary academic and transitioning gaps (E. Curtis & Reid, 2013; E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). In this way, completion and achievement of a high GPA in the CertHSc programme (4.5 for BHSc, 5.0 for BNurs and BPharm) offers an alternative entry pathway into bachelor level programmes within FMHS.

MAPAS – Māori and Pacific admission, academic and pastoral support

Established in 1972 as a basic quota system for Māori and Pacific applicants into medicine, MAPAS now provides comprehensive academic and pastoral support to Māori and Pacific students studying within FMHS undergraduate (and recently post-graduate) programmes. MAPAS support staff are available to support students with pastoral issues and individually track academic success throughout the year. MAPAS also deliver cohort cohesiveness activities such as student wānanga, cohort lunches, MAPAS tutorials, as well as Māori and Pacific leadership, advocacy and representation on academic boards and within the university infrastructure (E. Curtis & Reid, 2013; E. Curtis, Wikaire, et al., 2014).

The MAPAS admission scheme also provides a Māori and Pacific specific admissions process to assess suitability of entry into health study that takes into account a broad range of cognitive and non-cognitive factors that may impact on success. The MAPAS admissions process aims to provide an alternative admission process into FMHS

for applicants with Māori or Pacific ancestry and takes into account a broad perspective of the student including academic and non-academic considerations in a Māori and Pacific specific context that values Māori and Pacific realities and priorities. Interviewees complete a *Multiple Mini Interview* (MMI) consisting of four stations: academic preparation (prior academic achievement and relevance of subject content); career aspirations (knowledge of intended health career and pathways to achieving this goal); student information (balancing study and work, family, financial, life commitments); and whānau support (availability of whānau support and influence on study); MAPAS specific Maths and English tests. Final recommendations for the 'best starting point' (Bachelor, CertHSc, Not FMHS) for that student depending on intended career are made in January when NCEA Level 3 school results are released from the previous year (Curtis et al., 2015).

Curriculum responsiveness

In alignment with the Faculty commitment to Māori and Pacific health, FMHS programmes also aim to increase responsiveness to Māori and Pacific health through inclusion of specific curriculum content that addresses relevant issues. For example, the Māori health content within one of the year one foundational courses has been strengthened; and, all year 2 medical, nursing and pharmacy students undertake an inter-professional teaching programme known as *Māori Health Intensive* over four consecutive days. The *Te Ara: Graduate profile in Hauora Māori for undergraduate programmes of the Faculty of Medical and Health Sciences* booklet (The University of Auckland, 2009) provides further detail that prescribes how FMHS programmes 'should' deliver teaching and learning that is comprehensive and responsive to Māori health. However, much work is needed to ensure implementation of this approach across FMHS (The University of Auckland, 2009).

Chapter summary

This chapter has described important contextual information necessary for understanding the research topic, including overviewing health inequities experienced by Māori and Pacific peoples, and Māori and Pacific health workforce development as a key element in activities to address health inequities. In addition, the broad education sector context has been discussed, as well as a more detailed outline of the specific context within the FMHS at the University of Auckland. In the following chapter, the available literature on predictors of academic success for Māori and Pacific students in health professional study will be reviewed.

Introduction

This chapter reviews the current literature available to inform an understanding of the predictors of academic success for Māori and Pacific students within health professional study. National and international literature were reviewed to explore the current knowledge base for predictors of academic success in tertiary health professional programmes in general, and where possible, specific to Māori and Pacific students. Broad groupings of literature evidence are presented that describe predictors of success for: (1) Māori and Pacific students in tertiary health study; (2) Māori and Pacific students in tertiary study generally; (3) indigenous and ethnic minority groups in tertiary health study internationally; and (4) students in tertiary health study internationally. The chapter concludes with a summary and critique of the available literature.

Literature review methods overview

This research aimed to review a broad range of relevant literature to appropriately inform the research. A 'formal' literature review was not intended. Major health databases such as Medline (OvidSP), Pubmed, and Google Scholar were searched for relevant literature. Search terms included: 'Māori', 'Pacific', 'Indigenous', 'Aboriginal', 'Ethnic', 'Race', 'Minority', 'Black', 'Native', 'Underrepresented', 'health science', 'med*', 'pharm*', 'nurs*', 'dent*', 'physical therapy', 'predict*', 'select*' 'success', 'academic', 'achievement', 'student'. Literature searches were refined and repeated between March 2014 and May 2015 as the project evolved to ensure current literature were included.

Research was included if it met the following criteria: relevant to the research topic; indigenous or ethnic minority student success was the main focus of the research. Literature was also limited, for practical reasons to literature where the full text version was available online and published in English language. With known limitations in the available literature specifically for Māori and Pacific students in a New Zealand context, the literature review was expanded to include international indigenous ethnic minority groups (acknowledged as experiencing similar impacts of colonisation as underrepresented health professional students and as overrepresented in health problem statistics)[6].

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[6] Other indigenous and ethnic minority groups considered within this project are focussed on indigenous groups (e.g. Aboriginal and Torres Strait Islander, Native American, African American, Native Alaskan, Inuit, Hispanic). For the purposes of this research, Asian ethnic groups were not considered in minority groups. This reflects the New Zealand context where Asian students experience similar or better academic outcomes in comparison to non-Māori non-Pacific.

Literature review findings

Predictors of success for Māori and Pacific students in tertiary health study

A building body of research has investigated factors that may predict success of Māori and Pacific students in tertiary health study (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015; E. Curtis et al., 2012; Morunga, 2009; M Ratima et al., 2008; F Sopoaga et al., 2013; Wikaire & Ratima, 2011; Wilson, McKinney, & Rapata-Hanning, 2011). Collectively, these studies used both quantitative and qualitative research methods and included Māori and / or Pacific participants from tertiary education and health workforce contexts within medicine, nursing, pharmacy, health sciences, physiotherapy, psychology and other health professions in New Zealand. Key themes of factors that predict success for Māori and Pacific students in health professional study identified from these studies are described in more detail below.

Academic preparation

The New Zealand literature identified academic preparation for tertiary health study as a key factor in determining success for Māori and Pacific students, (E. Curtis et al., 2012; M Ratima et al., 2008; Wikaire & Ratima, 2011). With a focus on Māori in a New Zealand context, Curtis, Wikaire, Stokes and Reid (2012) completed an international literature review exploring 'best practice' for recruitment of indigenous students into tertiary health programmes. This study used a Kaupapa Māori research methodology and reviewed 70 articles that discussed recruitment activities operating across a recruitment 'pipeline'. This review identified that Māori and Pacific students were experiencing lower secondary school retention rates and lower rates of achieving university entrance criteria compared to non-Māori non-Pacific students (E. Curtis et al., 2012). Another study completed ten key informant interviews to explore barriers to and facilitators of Māori participation in the physiotherapy workforce and noted that the secondary education sector is failing to ensure academic success of Māori students, and that this results in Māori students being inadequately prepared to meet prerequisite entry criteria for tertiary health study (Wikaire & Ratima, 2011). In 2008, the *Rauringa Raupa* report outlined findings from two nationwide surveys that included 285 Māori tertiary health students and 449 Māori working in the health sector; as well as 30 key informant and ten ex-workforce interviews to explore barriers to and facilitators of recruitment and retention of Māori into the Health and Disability workforce. Findings from both the surveys and interviews were combined and presented together. These studies also described how entry criteria into health study (often requiring high achievement in science-rich subjects), acts as a major barrier to Māori and Pacific student entry into tertiary health study (E. Curtis et al., 2012; M Ratima et al., 2008).

Sapoaga et al. (2013) used quantitative data to explore factors associated with academic performance of 275 Pacific students in the first-year of health sciences from 2007 – 2011 at the University of Otago. Data for school results (NCEA Level 3 results overall and for science and maths subjects) and semester 1 Grade Point Average (GPA) was compared with non-Pacific students. Curtis et al. (2015) used multiple regression analysis to explore the predictive effect of admission variables used in the MAPAS admission process on final MAPAS

recommendations for the 'best starting point' for pursuing an intended health career for 918 Māori and Pacific applicants between 2008 – 2012 to FMHS. Although Curtis et al. (2015) identified that Māori and Pacific applicants with higher NCEA Rank Scores, exposure to at least 2 science subjects and higher Maths test scores were more likely to be recommended for direct entry into health study at a bachelor level (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015), both of these studies acknowledged that it is considerably more difficult for Māori and Pacific students to meet bachelor level health study entry requirements considering these students were shown to achieve lower school results (i.e. NCEA subject scores and NCEA Rank Score) than what was required (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015; Sapoaga et al., 2013). In association with these findings, in the study of MAPAS applicants, nearly half of the applicants assessed via the MAPAS admissions process between 2008 and 2012 were recommended to start tertiary health study at a bridging foundation programme level in order to address gaps in academic preparation (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015).

Career information

Provision of clear career information was seen as a major factor impacting student success (E. Curtis et al., 2012; Morunga, 2009; M Ratima et al., 2008; Wikaire & Ratima, 2011; Wilson et al., 2011). The previously mentioned studies also documented how poor access to quality health career information for Māori was detrimental to recruitment and retention in the health sector (M Ratima et al., 2008; Wikaire & Ratima, 2011). Specifically, the *Rauringa Raupa* report described a lack of provision of sufficient information to students to build clear career pathways (M Ratima et al., 2008) and was supported by Wikaire and Ratima (2001) who noted inadequate information regarding necessary prerequisite qualifications for entry and a lack of encouragement to pursue careers in health for Māori (Wikaire & Ratima, 2011). Similarly, another study explained how a reliance on careers advisors who divert Māori and Pacific students away from health careers and adopt a deficit discourse with lower expectations of indigenous/URM students also hindered student journeys through the recruitment pipeline (E. Curtis et al., 2012). In the Māori and Pacific specific (MAPAS) admission process, 'some or major concerns' in Multiple Mini Interview (MMI) testing about whether a student has a clear career pathway has been shown to be predictive of being recommended to pursue study pathways outside FMHS (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). This was supported by a small study interviewing five key informants regarding Māori participation in psychology (Morunga, 2009) and other studies that noted how career planning issues were compounded by low Māori participation in the health sector that meant a low presence of, lack of access to, and limited opportunities to work with, indigenous health professionals as role models and mentors (Morunga, 2009; M Ratima et al., 2008; Wikaire & Ratima, 2011; Wilson et al., 2011). Alternatively, the literature review described previously, found that whānau and community involvement in providing career advice and exposure to role models were positive factors that were identified as increasing student motivation and confidence to apply for admission to health programmes (E. Curtis et al., 2012).

Whānau support

Availability of and access to whānau support was an important factor for Māori and Pacific students identified in the New Zealand research (E. Curtis et al., 2012; Morunga, 2009; M Ratima et al., 2008; Wikaire & Ratima, 2011; Wilson et al., 2011). Studies described how transitioning into tertiary health study often provided a mixture of challenges that impacted on whānau support for students. For example, the high cost of tertiary education and distant location of tertiary providers often required students to move away from families and community support systems to study (E. Curtis et al., 2012; Morunga, 2009; M Ratima et al., 2008; Wikaire & Ratima, 2011; Wilson et al., 2011). Wilson, McKinney and Rapata-Hanning (2011) surveyed Māori nursing students using a cross-sectional survey about their experience of nursing education. This study provided additional detail that described how Māori students reported experiencing increased financial hardship, difficulties accessing childcare, and balancing whānau and study commitments (Wilson et al., 2011). Curtis et al., (2015) also showed that students with 'some or major concerns' around whānau support and student information (i.e. work life balance) were less likely to be recommended for admission to FMHS health programmes (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015).

Tertiary transitioning

The transition into tertiary health study was also identified as a significant factor for Māori and Pacific students (E. Curtis, Wikaire, et al., 2014; E. Curtis et al., 2012; Morunga, 2009; M Ratima et al., 2008; Wikaire & Ratima, 2011). Curtis et al. (2014) completed 41 individual interviews with Māori students in the Medicine (n=17), Pharmacy (n=3), Nursing (n=7) and Health Sciences (n=14) programmes at the University of Auckland. A total of 1346 critical incidents were identified that helped or hindered Maori student success in these programmes. This study along with other research noted a lack of support for Māori students to transition into university (Morunga, 2009; Wikaire & Ratima, 2011) and highlighted experiences that impacted negatively on students included: entering 'foreign' non-indigenous tertiary health environments with large class sizes; experiencing cultural alienation; institutional racism; and experiences of discrimination and stigma towards Māori (E. Curtis, Wikaire, et al., 2014; E. Curtis et al., 2012; M Ratima et al., 2008).

Alternatively, one study noted how bridging foundation programmes could be beneficial in supporting students during this transition phase (academically and pastorally), whilst gaining necessary academic skills for further tertiary study. Importantly, this research explained how bridging programmes provided opportunities to address gaps in educational achievement and prepared students for academic success (E. Curtis et al., 2012). The literature review findings emphasised the need to continue indigenous/URM specific support after enrolment because these students were more likely to show lower first year success rates and have higher first year attrition rates (E. Curtis et al., 2012). This was also demonstrated in the Pacific cohort studied at Otago University who achieved lower first semester GPA scores compared to non-Pacific students (Faafetai Sopoaga et al., 2013). To ensure retention, literature suggested the provision of: culturally specific tutorials to address lack of academic

preparation; provision of learning resources; supportive peer relationships; supportive teaching and learning environments; indigenous content in curricula that values Māori and Pacific culture; Māori and Pacific support staff; and opportunities for work experience with Māori and Pacific health professionals (E. Curtis, Wikaire, et al., 2014; Wilson et al., 2011).

Socioeconomic status

Socioeconomic status and its influences on students was seen as a major factor in determining academic success in a number of studies (M Ratima et al., 2008; Faafetai Sopoaga et al., 2013; Wilson et al., 2011). One study discussed the impact of the lower socio-economic position of Māori (M Ratima et al., 2008) and another study described how lack of institutional flexibility around broad socioeconomic influences created ongoing challenges for Māori nursing students and made retention and completion difficult (Wilson et al., 2011). These issues are likely to impact Māori and Pacific students significantly with some evidence of higher proportions of these students coming from lower socioeconomic backgrounds. For example, 42% of Pacific students in the first year of health science at Otago had attended low decile schools compared with 10% of non-Pacific students (Faafetai Sopoaga et al., 2013).

Summary

Overall, literature specific to Māori and Pacific student success within tertiary health study provides identification of broad factors that impact on students. Evidence highlights the importance of pre-tertiary factors such as 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, whanau support, work/life balance, access to childcare, financial support, clear career information, support systems, support to transition and first year academic results and environments.

Predictors of success for Māori and Pacific students in tertiary study generally

There is a related body of literature that focuses on predictors of success for Māori and Pacific students in tertiary study in general. Key findings are similar and included literature is discussed below, organised similarly to the themes identified in the first section of this chapter.

Academic preparation

A New Zealand study explored how transition into tertiary study is influenced by prior knowledge and experience gained through social and educational environments. A key issue identified for Māori and Pacific students included the impact of secondary school results (and lower numbers of Māori and Pacific students attaining University Entrance and academic prerequisite qualifications) which prevents tertiary enrolment (Madjar et al., 2010b). Engler (2010) analysed data for a national cohort of school leavers born between 1985 and 1991 and found that Māori and Pacific school leavers had lower rates of achieving University Entrance and progressing

directly to tertiary study (Engler, 2010b). Another study linking school to tertiary results showed that NCEA Level 3 results were highly correlated to passing all first year degree level courses for students generally (Scott, 2008). However, Māori and Pacific students were less likely to pass all courses in first year and were more likely to 'drop out' of degree study in the first year. Their results showed Māori and Pacific NCEA Level 3 results were less strongly correlated to first year results compared to that of non-Māori non-Pacific students, indicating that other factors may be operating on determining first year outcomes over and above that of school results (Scott, 2008). Lack of academic preparation was also shown to impact on first and second year tertiary results (Madjar et al., 2010b). Factors influencing success during this time include: social transition; lack of clear orientation information; knowledge of academic programme and prior preparation; large class sizes; availability of academic and pastoral support; and the hidden curriculum combined with tertiary environments that are more conducive of Pākehā student success (Madjar et al., 2010b). Scott (2008) notes the importance of increasing numbers of Māori students attaining UE in order to increase those graduating from bachelor degrees (Scott, 2008). This is particularly concerning given that entry into bachelor-level health programmes generally requires prior academic achievement that is well over and above 'University Entrance' criteria. For example, University Entrance equates to an NCEA Rank Score of 160 out of a possible 320, however BHSc entry requires an NCEA Rank Score of 250.

Whānau role

Leach and Zepke (2005) reviewed New Zealand and international literature investigating student decision-making for prospective tertiary students. With a focus on what have been referred to as 'non-traditional' students (i.e. from low socioeconomic backgrounds and of non-dominant ethnic groups), this study emphasised that choosing to study is often a decision driven by the aspiration to enhance one's community (Leach & Zepke, 2005). Parents play a key role in decision-making whilst schools also influence decisions and are responsible for providing clear career information. Financial support is also necessary. For Pacific students, family and employment commitments coupled with freedom and personal responsibility seemed to impact student success on top of impacts of academic preparation and achievement. Other factors included availability of Pacific role models, teaching staff and Pacific specific support; Pacific specific teaching pedagogies and accurate and timely information (Madjar et al., 2010b). These findings were reiterated in a Wellington based study by Toumu'a and Laban (2014) who described a university wide response to Pacific student needs and identified the need for Pacific specific space, support to access financial aid, importance of Pacific staff, and clear information provision (Toumu'a & Laban, 2014).

School decile

In their literature review described above, Leach and Zepke indicate that socioeconomic status is the strongest predictor of determining if students enter tertiary study (Leach & Zepke, 2005). Engler (2010) highlights how school decile is important in explaining student outcomes and is based on socio-economic characteristics of communities from which schools draw their pupils (although not all individual pupils represent this

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socioeconomic status). School decile is therefore likely a marker for school characteristics that determine likelihood of choosing tertiary study (Engler, 2010b). Shulruf, Li, McKimm, and Smith (2012) aimed to explore the predictive effect of demographic factors and secondary school results (particularly number of credits and GPA in science subjects) on first year GPA for all students admitted in 2005 (n=245) to the nursing, pharmacy and health sciences programmes at the University of Auckland. Their findings indicated no significant impact of any demographic variables (gender, ethnicity, school decile) on overall cohort first year results (note small Māori (n=6) and Pacific (n=19) sample size) (Shulruf, Li, McKimm, & Smith, 2012). Alternatively, Engler (2010b) found that ethnic group, achievement score (a composite score derived from NCEA school results for the purposes of the study), school decile, time off and University Entrance were all significant predictors of tertiary study at bachelor level for the total cohort. This study also found that lower proportions of New Zealand school leavers identifying solely with Māori (40%) or Pasifika (52%) ethnic groups went on to tertiary study at bachelor level compared to 72% of European. For Māori and Pacific students who attend low decile schools, even if they achieve highly in NCEA, their odds of studying at bachelor level remained low (Engler, 2010b). In two related research studies, Yuan, Turnery and Irving (2010) noted that the impact of school decile for Māori and Pacific students is significantly greater than that for Asian and European students (Yuan, Turner, & Irving, 2010) and that Māori and Pacific student success at secondary school increases with availability of and number of attempted achievement standards, whilst lower decile schools may be limiting the available number of achievement standards to Māori and Pacific students (Turner, Irving, Li, & Yuan, 2010).

Predictors of success for indigenous and ethnic minority groups in tertiary health study internationally

Further insight can be gained into factors that are likely to predict success for Māori and Pacific students in health professional study by exploring literature that describes similar issues for indigenous and ethnic (or underrepresented) minority[7] (URM) student success in tertiary health study internationally. The studies described below were predominantly completed in the United States of America or Australia with a focus on medical or nursing education, and also highlight similar findings to those already identified for Māori and Pacific students.

Experiences of tertiary environments

A paper published online by the *Kamehameha Schools - Research & Evaluation Division* based in Hawai'i presented a review of theories and research on factors that impact on retention and persistence in higher education with a focus on indigenous (Hawai'ian) and other ethnic minority students. A major determinant of retention was academic, social and cultural integration for students. Factors influencing retention were presented at the individual, institutional and social and external level. Individual factors included academic

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[7] Under-represented minority is a term used in these research studies predominantly in the USA to refer to students belonging to ethnic groups that are not represented within their student cohort in the same proportion to their representation in the population. URM generally includes ethnic groups such as African American, Native Alaskan, American Indian (Native American), Hispanic, Pacific Island and Asian.

performance (GPA, credits earned, work ethic), attitudes, and satisfaction (sense of belonging and social connectedness). One institutional level factor included academic engagement, and social and external level factors included social and family support (Jensen, 2011). Another USA based study completed a literature review and identified: lack of financial, emotional and moral support; isolation; discrimination; and lack of academic support and mentoring as barriers to nursing programme completion for URM students (Loftin, Newman, Dumas, Gilden, & Bond, 2012).

Similarly, Gardner (2005) interviewed 15 ethnic minority nursing students in Australia and identified themes of isolation, 'differentness', being discriminated against and a lack of acknowledgement and valuing of cultural differences from peers and staff as barriers (Gardner, 2005). A literature review of 28 studies exploring the experiences of URM students in medical schools internationally described how these students experienced less supportive social environments, are subject to discrimination and racial harassment and that these experiences negatively impact on academic outcomes. The authors indicated that these adverse climates in tertiary health environments decrease the attractiveness of careers in health for URM students (Orom, Semalulu, & Underwood, 2013).

Bridging foundation and support programmes

An American study exploring the predictive effect of results in a pre-admission programme on application to, acceptance into and graduation from medical school for 371 URM (90% African American, 9% Native American, 0.3% Hispanic) students in North Carolina, USA between 1984 and 1989. The nine-week intensive academic programme was provided to URM and economically disadvantaged students who had met medical school prerequisites. Students with higher mean science and total GPA and MCAT scores, who had attended colleges with higher MCAT scores were more likely to be accepted into medical school. Those URM students who achieved highly in the bridging foundation programme and were 'highly recommended' for medical school had higher odds of graduating compared to those not recommended. Overall, higher results in the bridging foundation programme resulted in greater likelihood of applying to, being accepted into and graduating from medical school when compared to URM applicants who did not complete the bridging foundation programme. These results indicate that performance in bridging foundation programmes can be predictive of academic outcomes in medical school for URM students (Strayhorn, 2000). In addition, a higher 'ranking' within this bridging foundation programme was predictive of subsequent academic performance in the same cohort (Strayhorn, 1999).

Another large American study explored the impact of a 9-week summer pre-medical pipeline programme on successful completion of medical school for disadvantaged students (Keith & Hollar, 2012). This longitudinal study gathered student data between 1974 – 2001 for students who completed the pre-medicine programme, their pathways into and through medical schools. A total of 801 of the 935 who completed the programme gained a medical degree. Disadvantaged students showed lower pre-med measures such as lower MCAT scores, lower

undergraduate GPA and undergraduate science GPA than total applicants. Rates of matriculation and completion by ethnic group were similar for those students who completed the pre-medical pipeline programme. Caucasian students in this programme represented 8% (n=43) compared to 82% African American (n=303) and admission for 'disadvantaged' students was based on lower family annual income and barriers to education. These findings suggest that disadvantaged 'white' students may respond positively alongside indigenous and ethnic minority students who participate in targeted equity initiatives. Importantly, the authors found no significant differences between student matriculation by race, however, this sample did not include 'non-disadvantaged' white students, and therefore the findings suggest that indigenous and ethnic minority student outcomes were similar to disadvantaged white students (not white students overall) (Keith & Hollar, 2012).

One study explored the impact of participation in the 'ARMS' programme (equity targeted mentoring and academic tracking) for minority students studying nursing (n=64) over three years in U.S.A on the NCLEX-RN (nursing licensure exam) (Sutherland, Hamilton, & Goodman, 2007). This study found that the odds of passing the NCLEX-RN were 2.9 times higher for 'white/anglo' students compared with other ethnic groups generally, however, for those students who participated in the ARMs programme, there was no difference in odds between 'white/anglo' and other students for passing the NCLEX-RAN. These findings indicate that targeted mentoring and academic tracking can help address ethnic differences in academic outcomes. This study included a relatively small sample size, was carried out in U.S.A and completed analysis using a combined Hispanic, Asian Pacific, and African American student cohort group (Sutherland et al., 2007).

Admission testing

An Hawaiian study looked at the predictive effect of *Medical College Admission Test* (MCAT) scores on medical licensure exam outcomes for various ethnic student groups at one medical school (Kasuya et al., 2003). For students graduating between 1996 and 2000, (n=258), demographic, MCAT and undergraduate science GPA were used to predict medical licensure exam outcomes. Ethnic groups included 'Caucasian', 'Hawaiian or Pacific Island', as well as Chinese, Filipino, Japanese, and Asian. Hawaiian and Pacific Island students (by ancestry) achieved lower MCAT scores than 'Caucasian' students however the ethnic groups studied did not differ in licensure exam outcomes. These results are mixed, are limited by small sample sizes and the authors caution interpretation. Their findings do however indicate that whilst MCAT and science GPA were good predictors of licensure exam outcomes overall, ethnic differences exist in predictive effect (Kasuya et al., 2003).

These studies provide a broad range of information from which we can draw insights into predictors of success for Māori and Pacific students. In addition to New Zealand literature, this research explores admission tools such as MCAT and shows promising results from early intervention programmes that aim to prepare students for health professional study.

Predictors of success for students in tertiary health study internationally

In addition to the limited literature that specifically focuses on predictors of success for indigenous and ethnic minority students, there is a larger body of research that has looked at predictor variables and their effect on academic outcomes for total student cohorts in tertiary health study in New Zealand and internationally. These studies generally include 'ethnicity' as a predictor variable (rather than the cohort group of interest), and student cohorts in these studies are generally made up of predominantly 'white'/European students from USA, the United Kingdom, Australia and New Zealand.

Rich et al. (2011) completed a longitudinal review of admissions variables for 411 dental students at Otago University between 2004 and 2009 and compared these variables to academic performance through the dental programme. The full cohort was predominantly made up of NZ European (31.87%) and other ethnic groups while Māori and Pacific ethnic groups combined represented 2.7%. NZ European ethnicity (y/n) was included as a predictor variable and was the strongest predictor of higher class placement in the final year (Rich et al., 2011). Similarly, Kay-Lambkin, Pearson and Rolfe (2002), explored the relationship between admission variables and first semester assessment results for 278 first year medical students in Australia between 1994 and 1997. With 'indigenous status' as a predictor, the study showed that the relative risk of obtaining a 'not satisfactory' result was 3.1 ($p<0.05$) for Aboriginal and Torres Strait Islander students compared to those who were not. Again this indicates a less desirable academic result for indigenous students indicating differences in experiences between ethnic groups.

Similar results were found in other studies. A multiple regression study of first year health science students in Western Australia (n=381) between 2000 and 2005 with 3.4% (n=13) Aboriginal and Torres Strait Islander (ASTI) students found that students with 'ATSI status' achieved on average a 'weighted average mark' that was 12 points lower in first year than non-ATSI students ($p<0.01$) (Mills, Heyworth, Rosenwax, Carr, & Rosenberg, 2009). Utzman, Riddle and Jewell (2007) found that non-white ('Black', Hispanic and Asian/Pacific Islander) physical therapy students in 20 U.S programmes had higher odds (OR=2.766, CI: 2.06, 3.72) of academic difficulty compared to white students (Utzman et al., 2007). Seago and Spetz (2005) explored disparities in success rates in California between 1994 – 2001 for diverse students and identified predictors of on-time completion rates, attrition rates, and 'Nursing licensing exam' first time pass rates for all nursing students. Their sample (N = not stated) included a mixture of African American, Asian, Filipino, Hispanic, Native American, and White nursing graduates and included 'ethnicity' as a predictor. The authors found mixed results, however, findings suggested that minority students had lower on-time completion and graduation rates, and those universities with lower proportions of ethnic minority students had higher completion and lower attrition rates (Seago & Spetz, 2005).

A large U.S based study using national data for 97445 medical school matriculants' between 1994 – 2009 also found that URM (Black, Hispanic, American Indian/Alaska Native) (n=12505) students had higher odds of

graduating without passing on first attempt (OR=2.30, 95% CI: 2.13, 2.48) and academic withdrawal/dismissal (OR=2.96, 95% CI: 2.48, 3.54) when compared with students of white ethnicity (Andriole & Jeffe, 2010).

Chapter summary and critique of literature

This chapter has reviewed a broad range of national and international literature to explore the current knowledge base around predictors of academic success for Māori and Pacific students within health professional study. A summary of the literature was presented in broad groupings that described predictors of success for: (1) Māori and Pacific students in tertiary health study; (2) Māori and Pacific students in tertiary study generally; (3) indigenous and ethnic minority groups in tertiary health study internationally; and (4) students in tertiary health study internationally. A limited body of research that is specific to Māori and Pacific students has provided insight into a broad range of academic and non-academic factors that may impact on academic success in tertiary health study. In a broader New Zealand context, additional literature for Māori and Pacific students in all types of tertiary study document similar experiences, barriers to and facilitators of academic success. An expanded review of broad international literature has highlighted similar factors that impact other indigenous and ethnic minority students in health professional study. International findings generally document the consistency of academic difficulty that is experienced by indigenous and URM students in tertiary health study settings.

Whilst some insight is provided into factors that may predict student success through tertiary health programmes for Māori and Pacific students, these findings tend to focus on successful admission and / or first year tertiary results however lack detailed analysis of how these factors might predict longer term academic outcomes such as programme completion. In addition, quantitative analysis in some studies has been limited by small ethnic minority student numbers. New Zealand based research also focusses predominantly on experiences for Māori students, and although some information specific to Pacific students is available, it would be mutually beneficial to build what is known for both Māori and Pacific student cohorts. The majority of international literature in this review has tended to focus on total (predominantly white) student cohorts and it is therefore difficult to generalise their findings to both a New Zealand and Māori/Pacific context. Careful attention should also be paid to how ethnic groups are grouped and compared. It is therefore timely to carry out research that completes analysis for ethnic groups individually, and determines to what extent important predictive factors impact on academic performance throughout tertiary health study.

The following chapters will describe the methodology and methods used within this research to contribute to the knowledge base around predictors of academic success in health professional study for Māori and Pacific students. A conceptual 'predictors of academic success model' will be presented that is informed by the reviewed literature, and Faculty of Medical and Health Sciences context to inform the research methods within Chapter five.

Introduction

This chapter outlines the theoretical positioning of the research by describing Kaupapa Māori methodology within this research context. Kaupapa Māori theory and research will be discussed and key Kaupapa Māori principles will be explained in relation to their implications within this research. Explanation as to the significance of Kaupapa Pasifika research methodologies within this context is also provided.

Kaupapa Māori theoretical perspective

This research (and the researcher) is clearly positioned from a Kaupapa Māori theoretical perspective. Kaupapa Māori provides the theoretical foundations, 'themes', values, assumptions and beliefs of a Māori world view (Pihama, 2001d; L. Smith, 1999; Walker, 1996). Kaupapa Māori is distinctively Māori, was developed in practice in the community and has its theoretical foundations firmly grounded in ancient Māori knowledge (Pihama, 2001c). Kaupapa Māori theoretical foundations ultimately provide the basis on which to build Kaupapa Māori Research (KMR) methodology.

Kaupapa Māori is now a well-established research paradigm, particularly utilised in health and education sectors, with an increasing body of literature applying kaupapa Māori methodology in both qualitative and quantitative contexts (Ahuriri-Driscoll, Hudson, Bishara, Milne, & Stewart, 2012; E. Curtis & Wikaire, 2012; E. H. Curtis, M; Riddell, T; Robson, B; Harris, R; Mills, C; Reid, P, 2010; S. Edwards, McManus, McCreanor, & Whariki Research Group, 2005; R. Harris et al., 2012; R. Jones, Crengle, & McCreanor, 2006; R. Jones et al., 2010; Robson & Harris, 2007). Kaupapa Māori research validates and legitimises traditional and contemporary Māori theory, knowledge, philosophy and ways of being and doing. As a research approach, kaupapa Māori research critically challenges 'white' assumptions of normality and carves out space for Māori to research and define ourselves (Pihama, 2001d; G. Smith, 1997; L. Smith, 1999). Hence, Kaupapa Māori creates theoretical space for critical analysis and critique of Pākehā hegemonies, colonisation processes, and unequal power-relations. It also promotes action that is transformative, empowering and liberatory (Walker, 1996). Kaupapa Māori exists as a theoretical framework that develops, re-shapes and evolves through a continued process of critique and reflection (Pihama, 2001b; Walker, 1996).

Kaupapa Māori methodology

This research utilises a Kaupapa Māori Research (KMR) methodology; a valid approach that contributes to scientific knowledge that does not require justification by Western scientific standards (L. Smith, 1999). This methodology aligns with a Māori inquiry paradigm and provides the theoretical foundations on which to develop and design the research methods, data analysis and outcomes (M Ratima et al., 2008). The present study

acknowledges and operates by Kaupapa Māori principles and essential elements such as: tino rangatiratanga (self-determination); taonga tuku iho (cultural aspirations); ako Māori (culturally preferred pedagogy); kia piki ake I ngā raruraru o te kainga (socio-economic mediation); whānau (extended family); kaupapa (collective philosophy); te reo me ōna tikanga; Te Tiriti o Waitangi (the Treaty of Waitangi); āta (growing respectful relationships); and whakapapa (relational framework to tea o Māori) (Pihama, 2001a; G. Smith, 1997; L. Smith, 1999)[8]. Kaupapa Māori principles and research processes that are particularly relevant to this research topic and context are explained in further detail below.

In the context of this research study Kaupapa Māori means:

Operating from a Māori worldview that takes into account Māori realities

This means the research acknowledges that health and educational outcomes for Māori and Pacific students (and peoples) are influenced by broad social, cultural, historical, political and economic contexts (G. Smith, 1997). Therefore, project planning, analysis and interpretation acknowledges the diverse realities Māori and Pacific peoples experience in contemporary New Zealand.

Commitment to Māori leadership and control over the research

This commitment relates to *tino rangatiratanga*; ensuring Māori sovereignty and control over the research. By ensuring the research is led and developed by Māori health researchers using Kaupapa Māori methodology, we ensure that Māori priorities are foregrounded, disparities between Māori/Pacific and non-Māori non-Pacific students are identified, and research is carried out in a way that ensures benefit to Māori and Pacific peoples from the research (L. Smith & Reid, 2000).

That the researcher/researched relationship is mutually beneficial

Kaupapa Māori prioritises both the professional development of the researcher and benefit to Māori and participants. This principle ensures a reciprocal relationship between researcher and 'researched' by valuing the contribution, partnership and decision-making role of the 'research participants'. Locating the research within the institution that delivers the health professional programmes allows the researchers to understand context-

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[8] Further detailed discussion of Kaupapa Māori principles has been published elsewhere:
Kaupapa Māori.com. (2015). Kaupapa Māori. Retrieved from: http://www.kaupapamaori.com/.
Pihama, L. (2001). Kaupapa Māori Theory - Identifying elements. Chapter 5 in 'Tihei Mauri Ora: Honouring our voices. Mana Wahine as a Kaupapa Māori Theoretical Framework. Unpublished PhD Thesis Auckland: The University of Auckland.
Smith, G. (1997). *The development of Kaupapa Māori: Theory and praxis. Unpublished PhD.* The University of Auckland, Auckland.

specific experiences for students, and facilitates analysis and interpretation of the research findings. In addition, as part of larger ongoing research and development of Māori and Pacific recruitment and retention programmes, this research is able to inform real time changes to institutional support programmes. This ensures acknowledgement of students as people and linked with a non-deficit approach, aims to ensure the research is of benefit to them.

Commitment to Māori researcher professional development

This principle acknowledges the mutually beneficial nature of research, which is to develop and grow more Māori and Pacific researchers whilst also ensuring that the research findings are of benefit to the research participants. Through this project, development of research skills, exposure to Kaupapa Māori research, theory and methodology learnings was prioritised for the researcher. This research promotes the development of new statistical and quantitative research skills for the researcher.

That the research will be of benefit to Māori

This principle relates to positioning of Māori and Pacific peoples at the centre of enquiry. This ensures Māori and Pacific peoples are foregrounded and prioritised in this research, and no longer marginalised. This principle also exists in response to historical outcomes of research that have marginalised Māori and resulted in negative outcomes for Māori (Consedine & Consedine, 2005; L. Smith, 2005). Kaupapa Māori researchers have identified that prior quantitative research has often been done in ways that fail to explore issues specific to Māori aspirations, noting that "In the bulk of the literature, disparities are either ignored (the data not collected or not analysed by ethnicity) or are merely observed and documented" (p. 4) (Te Rōpū Rangahau Hauora a Eru, 2002). In response, this research uses quantitative methods to foreground disparities between Māori (and Pacific) and dominant ethnic groups.

Explicit rejection of findings that suggest the culture or genetics of Māori or Pacific students are to blame for their educational failures

This research seeks to review and critique the available literature relevant to the research question. Kaupapa Māori rejects findings, analysis or explanations that suggest that Māori or Pacific student 'culture' is to blame for educational disparities. The analysis will also reject conclusions that identify 'cultural' or 'genetic' differences as causes of educational outcome differences. This aligns with our own data analysis and conclusions that take a non-deficit, non-victim blaming approach (R. Bishop, 1998; E. Curtis et al., 2012; R. Jones et al., 2006).

That the research will critique structural power imbalances; that analysis and recommendations will require institutional change rather than requiring students to change themselves

Similar to a critical theory approach to research, Kaupapa Māori seeks to critique how power imbalances might be operating within tertiary institutions. Critical theory focusses on critiquing and challenging the 'power-holder' (R. Bishop & Glynn, 1999) which, in this context, is the tertiary institution. Critical theory is of the position that outcomes (and inequities in outcomes) are the product of an institution that privileges one type of person over others, and hence produces 'better' outcomes for those privileged groups (Borell, Gregory, McCreanor, & Jensen, 2009; Hooks, 1992; Mahuika, 2008). Critical theory therefore seeks to address disparities by creating change at the level of the institution. In alignments with KMR principles, the research analysis will take a non-deficit, non-victim blame approach (Cram et al., 2006; L. Smith, 1999). This approach ensures that control and therefore obligation to change is located with the structural power holder. Hence, the research analysis requires researchers to make conclusions requiring institutional *adaptation* to student needs rather than student *integration* into institutional climates (Zepke & Leach, 2005).

That the research meets Māori participant/community determined quality assessment standards

The researchers own that there is a clear responsibility to carry out and disseminate the research in ways that align with the expectations of Māori and Pacific communities (R. Jones et al., 2006). Research planning, analysis and conclusions will therefore align with Māori and Pacific aspirations. For example, the research ensures that the advisory group is involved at crucial research decision-making stages and as well as ensuring dissemination of research findings in a way that meets Māori and Pacific community expectations.

Interpretation and conclusions are mana enhancing for Māori participants and communities

All research outputs will ensure discourse does not reinforce negative Māori stereotypes and that terms and language used are consistent with Kaupapa Māori research re-presentation of Māori from a Māori worldview (Moewaka Barnes et al., 2012). Research will be presented in such a way that exposes disparities between Māori and non-Māori in relation to equity objectives. Where possible, raw numbers will also be made available so that the significance of disparities can be interpreted accurately (Blakely et al., 2005).

That the research is consistent with Kaupapa Pasifika methodology

This study aims to ensure the research processes are consistent with Kaupapa Pasifika research methodology and that the research is of benefit to Pacific peoples (Vaioleti, 2006). It is acknowledged that the research is primarily positioned from a Kaupapa Māori world view, and that caution needs to be taken when including Pacific

students within this project. However, the aim of this research is to provide critique of the dominant power holder that is the institution from an indigenous and ethnic minority perspective. Hence, this research acknowledges the similar experiences of students of Pacific descent in that Pacific peoples experience similar effects of social impacts on health and education to Māori (Ministry of Health, 2004). Ensuring Pacific representation within the project team and advisory group acknowledges mutual expertise of these parties in Pacific health research and values Pacific knowledge and decision-making contribution (Naepi, 2015). Advisory group meetings therefore allowed sharing of research perspectives between Māori and Pacific researchers and facilitated discussion that informed further research direction.

Chapter summary

This chapter has discussed how the research has its theoretical foundations within Kaupapa Māori theory that is used to inform Kaupapa Māori methodology and research methods. Kaupapa Māori principles with particular relevance to this research have been explained with examples where appropriate. Appropriate acknowledgement of the significance of Kaupapa Pasifika research methodology and Pacific peoples in this research context has also been made. The following chapter will describe the research methods used within this research that are informed by the previous background context, literature review, and this methodology chapter.

Introduction

This chapter provides relevant information regarding the Kaupapa Māori research environment and associated research processes. The research aim, questions and objectives are presented and the research methods used within this research discussed. Explanation of the importance of ethnicity within this research is also provided. A conceptual model of predictors of success for Māori and Pacific students is presented that was informed by relevant literature and the research context. Details are provided on the student cohort included in this study and the process of data sourcing and cleaning. All variables are defined and explained and the multiple regression analysis model is outlined.

Kaupapa Māori research environment

This research was located within the Tōmaiora Māori health research unit, Te Kupenga Hauora Māori (the Department of Māori Health), that sits within the Faculty of Medical and Health Sciences (FMHS) at the University of Auckland. Tōmaiora is a Māori health research group, led by senior Māori health researchers who are at the forefront of research and knowledge in their chosen areas of interest (E. Curtis & Reid, 2013; E. Curtis, Reid, et al., 2014; E. Curtis, Wikaire, et al., 2014; Fu, Exeter, & Anderson, 2014; Harwood et al., 2012; R Jones et al., 2010; McLellan, McCann, Worrall, & Harwood, 2013). Location of the research within Tōmaiora allowed the researcher to access ongoing support (in particular around Kaupapa Māori) from Tōmaiora members as appropriate. The research also formally operates in alignment with Tōmaiora research protocols and processes as an appropriate Kaupapa Māori research framework (The University of Auckland, 2015c).

This research was completed as a smaller sub-project of a larger project entitled *Te Hā - Vision 20:20: Exploring predictors of success* that aims to conduct quantitative data analysis exploring predictors of success within the FMHS. Ethics approval was granted by the University of Auckland Human Participants Ethics Committee (Ref 8110) for a period of three years (starting May 2012) and was extended for a further three years until May 2018. The larger *Te Hā* project operates using a core Māori-led project team under guidance from an advisory group who provide high level direction and advice regarding research processes. Advisory group members consist of FMHS staff members with Māori and Pacific health research, academic and administrative expertise within tertiary health education. Situating this smaller sub-project within the larger context enabled high level guidance from the advisory group and project team as is consistent with Kaupapa Māori research practices used by other projects (E. Curtis et al., 2010; R. Jones et al., 2006). Supervision of the researcher (Masters student) was provided by two Māori health researchers, Dr Elana Curtis and Dr Donna Cormack, who have expertise in qualitative and quantitative Kaupapa Māori research, and leadership experience in tertiary academic environments (including the University of Auckland and the University of Otago).

Whilst supported by this Kaupapa Māori research context, the researcher (Masters student) was responsible for all major project tasks including, for example: project planning and proposal development; contribution to the larger project ethics application; project management; liaison with administrators to obtain data; analysis planning; liaison with statistical support staff to direct data analysis; and interpretation and writing of research findings.

Research aims and objectives

This project aimed to investigate predictors of academic success or failure for Māori and Pacific students, compared to non-Māori non-Pacific students, who entered the undergraduate degree-level programmes within the Faculty of Medical and Health Sciences (FMHS) at the University of Auckland[9].

Research questions

1. What are the predictors of academic success for Māori and Pacific students enrolled in undergraduate study within the FMHS?

2. Do Māori and Pacific predictors of academic success differ to other ethnic groups enrolled in undergraduate study within the FMHS?

Research objectives

1. Provide a detailed description of FMHS students at the point of admission using quantitative data.

2. Identify predictors of academic success or failure for FMHS students by:

    (a) Exploring the predictive effect of FMHS student admission variables and early academic outcome variables on academic results.

    (b) Conducting multivariable regression analysis to test how ethnicity is related to admission process outcomes and/or student academic outcomes.

3. Providing recommendations to the FMHS regarding any actions that can be taken to better support Māori and Pacific students following the identification of predictors of success or failure.

Conceptual 'predictors of academic success' model

Predictors are defined in this study as those factors that are likely to influence the outcome of interest. A 'predictors of academic success' model was developed based on the Māori and Pacific health workforce development pipeline, reviewed literature, and experience within the FMHS context, that foregrounds significant

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[9] Note that the Bachelor of Optometry FMHS programme was excluded from this study in relation to its relatively recent addition to the FMHS suite of undergraduate programmes. The Bachelor of Medicine and Bachelor of Surgery programme was also excluded from this study due to the lack of available data specific to this programme at the time of data sourcing.

concepts that may impact on Māori and Pacific student success (Figure 2). Key concepts in this model include: demographics (e.g. age, gender), socioeconomic status (e.g. economic status, poverty, housing, access to education), academic preparation (e.g. school results), transitioning (e.g. bridging foundation programmes, whānau support), and early academic results (e.g. first year academic results). Each concept aims to group together a range of similar interacting factors that collectively may impact on student success as discussed in depth in Chapter Two. For example, the concept of academic preparation aims to include factors such as: academic achievement at school; exposure to science subjects; access to career information; and knowledge of required pre-requisites for entry, whereas the concept of early academic results aims to include factors such as: academic achievement in the first year of bachelor study; response to first year tertiary environments; and transitioning issues during this time.
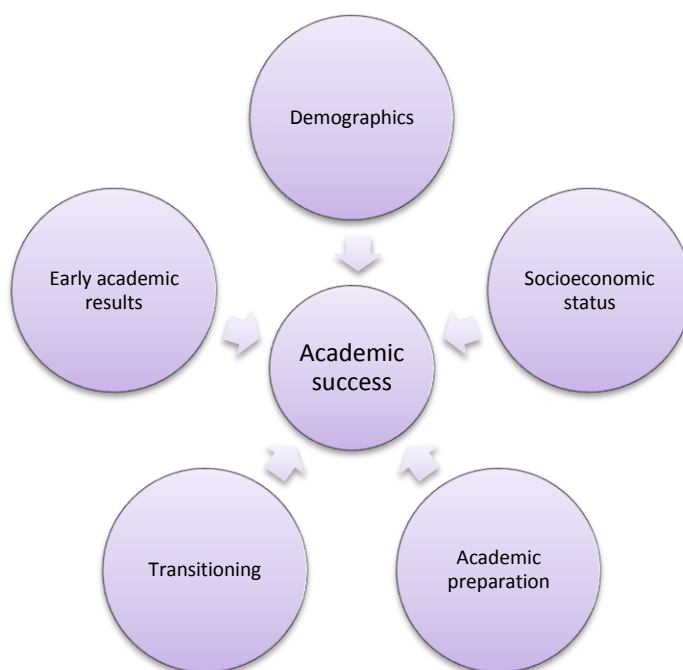
Figure 2: Conceptual model of predictors of academic success

Methods

This research used Kaupapa Māori quantitative research methods (E. Curtis et al., 2010; E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015; R. Harris, Cormack, & Stanley, 2013). Quantitative research methods provide powerful analytical tools for knowledge development and gaining new insights into data patterns and relationships between variables (Walter & Andersen, 2013). Indigenous research using quantitative methods is relatively rare but has the potential to contribute in powerful ways to what is already known through qualitative findings (Walter, 2005).

Data sourcing

Retrospective secondary student data from 2001 – 2013 was sourced from *Student Services Online* (SSO) (the UoA web-based centralised student data management system) and included demographic, admission and

academic results at the individual student level. Availability of data was limited to those variables that are routinely collected within the SSO system and by the quality of the data collected. Data was imported into SAS (Statistical Analysis Software), de-identified and cleaned to ensure data quality and consistency. Statistical support (e.g. data coding and analysis) was provided by the Department of Statistics, UoA and directed by the researcher to ensure maintenance of the principle of tino rangatiratanga (i.e. Māori leadership and control over the research) (G. Smith, 1997).

Participants

All students who enrolled in year two of the Bachelor of Health Sciences (BHSc), Bachelor of Nursing (BNurs), or Bachelor of Pharmacy (BPhar) programmes at the FMHS between 2002 and 2013 were included in this study. Enrolment into year two was defined as evidence of enrolment (i.e. having a grade awarded) in at least one 'stage 2 core course' (e.g. NURSING 201) for the BHSc, BNurs, or BPhar programmes. Year two was chosen as the point of identification of enrolment within specific FMHS programmes given the overlapping nature of the first year programmes and the high tendency for students to change from one programme to another between year one and year two. Students who had recently enrolled in programmes (i.e. were still studying as current students as determined by evidence of enrolment in courses in 2012 or 2013) and for whom the minimum time required to complete their programme of enrolment had not passed were excluded from the study given that they had not yet achieved programme outcomes. Students who were enrolled in conjoint degrees were also excluded from the study given the complex nature of their progress through programmes.

Data variables

Data variables included in this study were limited by quality and availability of retrospective data that is routinely collected within the UoA SSO database. With consideration of the project and knowledge base context, variables that most closely represented the concepts of importance as identified in the predictors of academic success model (above) were derived from raw SSO data. A list of derived data variables and their code sets are presented in Table 2.

Variable of interest - Ethnicity and ethnic grouping

Ethnicity is defined by Statistics New Zealand as *"the ethnic group or groups that people identify with or feel they belong to. Ethnicity is a measure of cultural affiliation, as opposed to race, ancestry, nationality or citizenship. … people can belong to more than one ethnic group"* (p. 1) (Statistics New Zealand, 2005). Ethnicity in this context refers to the self-identified ethnic group with which students identify, whilst also acknowledging that ethnicity may act as an indicator of different social experiences determined by society. Dr Camara Jones (2001) notes how *"race is a social classification in our race-conscious society that conditions most aspects of our daily life experiences and results in profound differences in life chances"* (p. 300) (C. Jones, 2001b). Literature suggests that environments in which peoples with self-identified or socially assigned ethnicity that is different from the

dominant norm are exposed to different experiences that are driven by identifying with that ethnicity (R. Harris et al., 2013).

Table 2: List of baseline, predictor and academic outcome variables

Variable name	Code set	
Variable of interest		
Ethnic grouping	Māori, Pacific, Non-Māori non-Pacific	
Demographic variables		
Age at admission	YYYY (age in years)	
Gender	Male, Female	
Year of admission (year II)	2002-3, 2004-5, 2006-7, 2008-9, 2010-11, 2012	
Socioeconomic status		
School Decile	High (8-10), Medium (4-6), Low (1-3)	
Academic preparation		
NCEA Rank Score	0 – 320	*Predictor variables*
Table A max credits	NN	
Table B max credits	NN	
Table B science max	NN	
Table B Maths max	NN	
Transitioning		
Auckland School	Yes, No	
Type of admission	School leaver, Alternative admission	
Bridging foundation programme		
Bridging programme	Yes, No	
Early academic results		
First year bachelor GPA	0 – 9	
First year bachelor passed all	Yes, No	
Academic success		*Outcome variables*
First year bachelor GPA	0 – 9	
Year 2 – 4 programme GPA	0 – 9	
Graduated intended programme	Yes, No	
Graduated minimum time	Yes, No	
Composite graduation	Optimal completion, Sub-optimal completion with high grades, Sub-optimal completion with low grades, Non-completion	

Ethnicity data collection and analysis protocols

Collection and analysis of ethnicity data is a key area of importance for research involving Māori (Simmonds, Robson, Cram, & Purdie, 2008). Statistics New Zealand (2009) provide detailed guidelines for ethnicity data collection and analysis and recommend a 'total' ethnicity categorisation method[10]. Student Services Online (SSO) however, utilise a 'prioritisation' protocol for reporting student data by ethnicity as dictated by the Ministry of Education (accessible via the 'Education Counts' website) (Education Counts, 2012). Students are able to self-

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[10] Note that Statistics New Zealand recommends using 'total' ethnicity categorisation which ensures that all individuals who identify with an ethnic group are counted within that group. The Ministry of Education however, uses prioritisation recommendations and this process is carried through to secondary and tertiary education institutions who's reporting and collection processes align with this recommendation and therefore Ministry of Education requirements.

select up to three ethnic groups (e.g. Italian, Niuean, Filipino) at Level 3 (offering 32 options) and SSO automatically prioritises these selections to collapse into one ethnic group (e.g. Pasifika) at Level 1 (offering five options) based on this protocol. A list of ethnic groups at levels 1-3 is provided in Appendix B. Ethnicity data obtained from SSO was automatically prioritised at Level 1 into Māori, Pacific, Asian, Other[11], and Pākehā/European groupings. Research has shown that prioritisation of Māori ethnicity (as the ethnicity of first priority) when multiple ethnicities are selected ensures accurate representation of Māori within analysis outcomes (Cormack & Robson, 2010; Robson & Harris, 2007). However, the prioritisation approach impacts on the Pacific ethnic group (i.e. those who identify with both Māori and Pacific ethnicity are only counted in the Māori group – therefore reducing the Pacific group in terms of numbers). This is not ideal in this research context and is acknowledged as a limitation.

Ethnic grouping

Students were grouped into Māori, Pacific and non-Māori non-Pacific (combined Asian, Other and Pākehā/European) ethnic groupings[12]. Māori and Pacific categories remained separate given that different impacts on academic outcomes may be occurring for Pacific and Māori students. The Asian, Other, Pākehā/European and missing ethnic groupings were combined together as a comparator non-Māori non-Pacific ethnic grouping.

Predictor variables

Demographic variables

Gender, *age at admission* and *year of admission* were included as control variables. Gender is recorded as Male or Female; age is calculated from date of birth and is defined as the age in years on the 1st March in the year of admission into year two; year of admission is defined as the earliest year in which a student enrolled in a core stage two course for the BHSc, BNurs or BPharm programmes and is recorded for years 2002 to 2012. For presentation purposes, year of admission was grouped into two-year blocks (e.g. 2002 – 3, 2004 – 5) to ensure student data was presented in a way that did not allow identification of individual students given some small sample sizes in individual years.

Socioeconomic status

Socioeconomic status was identified as a key factor that may impact on Māori and Pacific student academic success. A specific measure of socioeconomic status (based on student home address as used by Statistics New Zealand for Census data purposes) was not available due to the changing nature of student addresses whilst studying. Therefore, secondary school decile rating was used as a measure of socioeconomic status in this study

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[11] 'Other' includes the Middle Eastern, Latin American, African (MELAA) Ethnic group.
[12] This project acknowledges that 'Pacific' is not a recognised ethnic 'group', but rather an aggregate category made up of smaller specific ethnic groups (e.g. Tonga, Samoan). Ethnicity categories are therefore herein referred to as ethnic groupings.

as recommended by the advisory group. School decile is a rating out of 10 representing the proportion of students who live in areas of high deprivation and is calculated using five socio-economic indicators (household income, occupation, household crowding, educational qualifications, and income support) (Ministry of Education, 2015). School decile has been used previously as an indicator of socioeconomic status in higher education contexts (Mills et al., 2009). The decile rating of the 'last secondary school attended' by the student prior to enrolment at UoA was used. School decile ratings 1 – 10 were grouped into three categories: low (1 – 3), medium (4 – 7), and high (8 – 10). These groupings are consistent with groupings of school decile used by the New Zealand Education Review Office. A school decile rating of 0 was recorded for those students who had attended school through correspondence (home schooled) or who had attended school outside of New Zealand (overseas) and were coded as missing.

Transitioning

Transitioning is conceptualised as the movement of a student from a secondary school education context into health professional study within a tertiary institution. Transitioning includes consideration of the changes and challenges faced during this transition and how well prepared a student (and their situation) are to accommodate these changes. Transitioning may include notions of career preparation, whānau support, arranging suitable accommodation and possibly relocating, balancing study, work and life commitments, levels of maturity in decision making and career planning, and may take into account prior tertiary study, making life changes and choices.

Transitioning was measured in this study by identifying if the student had attended secondary school inside, or outside of the Auckland region according to the Ministry of Education school region categories. Auckland school is recorded as 'yes' (last secondary school attended was in the Auckland region) or 'no' (all other regions including: Waikato; Bay of Plenty; Wellington; Canterbury; Northland; Hawkes Bay; Manawatu-Wanganui; Taranaki; Gisborne; Otago; Nelson; Southland; Marlborough; Tasman; and West Coast). Unknown, overseas or missing school region information was categorised as 'missing'.

Transitioning that involved varying pathways between secondary school and bachelor level admission were measured using type of admission (e.g. school leaver or alternative admission). School leaver (SL) is defined as enrolment in secondary school in the year immediately prior to enrolment in the first year of bachelor degree level study within FMHS. Alternative admission (AA) is defined as anyone else who is not classified as a school leaver (including students who may have been transitioning directly from secondary school into a bridging foundation programme, and then on to first year bachelor level study).

Bridging foundation programmes

Bridging foundation is conceptualised here as exposure to and completion of an academic programme that aims to bridge the 'gap' between secondary and tertiary education contexts. Students were classified as either having completed a UoA specific bridging foundation programme 'yes' (I.e. CertHSc, Tertiary Foundation Certificate, or New Start) prior to enrolment in the first year of bachelor level study within FMHS, or 'no', having no record of enrolment in a UoA bridging foundation programme (no). Note that students may have completed bridging programmes offered by other tertiary providers prior to admission; however, these data were not available.

Academic preparation

Prior academic preparation was identified as potentially having a significant impact on student academic outcomes. Academic preparation was measured in this study using variables derived from secondary school NCEA Level 3 results that reflect FMHS bachelor degree entry requirements (described previously in chapter 2). Those students with missing school results or those with non-NCEA qualifications (e.g. Cambridge International Exam) were categorised as having missing data for these variables.

NCEA Rank Score

NCEA Rank Score is likely to indicate overall academic preparation that includes concepts of work ethic, academic skills and ability to meet prescribed educational assessment demands. NCEA Rank Score data were available from 2005 to 2013 given that this was when the NCEA system was introduced in New Zealand secondary schools. Note that this means a large proportion of the original dataset is recorded as having missing data for NCEA (i.e. those students with school results prior to the introduction of NCEA). NCEA Rank Score is automatically calculated within SSO and is presented as a continuous variable ranging from 0 – 320.

Prior achievement in English, Maths and Science subjects

Entry into FMHS bachelor degree programmes requires a minimum number of credits in one Table A subject and one Table B subject (as described previously in Chapter Two). Subjects listed in Table A are generally considered to be English-rich subjects whilst Table B subjects generally include maths and science focussed subjects. Achieving a high number of credits is likely to indicate successful knowledge and skill in a specific subject area. High achievement in English, maths and science subjects also aligns with recommendations for preparation for health professional study. Table A max was defined as the highest number of credits attained at Level 3 in one Table A subject. Table B Maths max was defined as the highest number of credits attained at Level 3 in one Table B Maths subject (accounting, calculus, economics, or statistics). Table B Science max was defined as the highest number of credits attained at Level 3 in one Table B science subject (biology, chemistry, or physics). Students who did not have NCEA data or those who did not enrol in a Table A or B subject were coded as 'missing'.

Evidence suggests that the first year of bachelor study is crucial in terms of determining retention (continuation) or attrition (drop-out) of students in tertiary health programmes. Early academic results were measured using first year bachelor GPA and passing all courses in the first year of bachelor study. First year bachelor GPA was defined as the average 'grade' attained by each student in the first year of bachelor level study within the FMHS across eight courses (representing full-time study). For each course, students are awarded a pass grade usually ranging from A+ to C- which corresponds to a number ranging from 9-0 (A+ = 9, A = 8, A- = 7, B+ = 6, B = 5, B- = 4, C+ = 3, C = 2, C- = 1). Fail grades such as D+, D, D-, W (withdrawn), DNS (did not sit), DNC (did not complete), F (fail) are recorded as 0 (zero) and are included in GPA calculations. Other grades such as P (pass), CP (conceded pass), NA (not available pending result) and NAX (not available pending academic dishonesty investigation) are excluded from GPA calculations.

Passing all courses in the first year of bachelor study was defined as having no 'fail' grades for any courses taken in the year of admission at bachelor degree level. Hence, first year passed all 'yes' was defined as the absence of any grades that were categorised as a fail (e.g. D+, F, DNC), (i.e. all courses taken achieved a passing grade). First year passed all 'no' was defined as the presence of at least one fail grade. First year bachelor academic results (GPA and passed all courses) are included as both 'early' academic outcomes and predictors of 'programme' academic outcomes.

Outcome variables

Academic success was explored using a range of academic outcome measures that collectively produce a multi-faceted view of success (or failure). Successful completion of a health professional bachelor degree qualification was measured by determining if the student had graduated from intended programme (yes/no). Of those that had graduated, the time taken to reach graduation (i.e. time to completion) was assessed by measuring if the student had completed in the minimum time (yes/no). Indications of academic difficulty (or not) in the first year, and combined subsequent years of undergraduate study, were assessed using *first year bachelor grade point average* (GPA) and *year 2 – 4 programme GPA.* A composite measure of academic success was developed that combined each individual measure into an overall *completion outcome* that included four levels of success (optimal completion, sub-optimal completion with high grades, sub-optimal completion with low grades, non-completion).

One key academic outcome is successful graduation from a student's intended programme. Successful graduation from the intended programme 'yes' was defined as having completed the requirements for graduation from any of the BHSc, BNurs, or BPharm programmes. All other students were categorised as 'no' for graduated intended programme. Note that not having graduated from an intended programme is likely to

indicate student attrition or dropout given that current students, or those who had had less than the minimum time pass for programme completion, were excluded from the analysis. Students who originally enrolled in one of the BHSc, BNurs, or BPharm programmes and then changed to another programme, and then graduated with a different bachelor degree were recorded as 'no' given that their programme of graduation was not the same as original enrolment. The assumption here is that the original enrolment indicates student intention to complete this same qualification.

Time to completion

It is important to identify students that are completing tertiary health programmes within the minimum time (seen as a form of academic success) and who are not (seen as a sign of experiences of academic difficulty). Graduated in the minimum time is recorded as 'yes' or 'no' for the subset of students who did graduate from their intended programme. Graduated in minimum time is defined as completion of the FMHS programme in the minimum number of years (e.g. 3 years for BHSc and BNurs, 4 years for BPharm).

Academic grades

A more detailed assessment of student academic success can be informed by academic grades. A grade is awarded as an indicator of how well a student has met the assessment criteria (e.g. A-). Achievement of high academic grades is linked to potential employment and study opportunities post-graduation. A commonly used measure of academic success is grade point average (GPA) which is an overall average of all individual course grades. GPA not only gives an indication of academic performance through a programme, it will also be affected if a student is experiencing 'academic difficulty' (e.g. if a student fails a course, their grade for that course will be recorded as zero and this will therefore reduce the overall GPA score considerably). Year 2 – 4 programme GPA (0 – 9) was defined as the average grade achieved over all courses from year two until the final year of study in a specific programme, and excludes courses taken in the first year of study. First year bachelor GPA was defined as the average grade attained by each student in the first year of bachelor level study within the FMHS across eight courses (as described previously when discussing predictor variables).

Composite completion outcome

It is helpful to consider how academic outcomes might operate together to produce overall student graduation outcomes.

Optimal completion

'Ideally', tertiary institutions aim to produce 'high calibre' graduates with high 'employability'. Thus, 'optimal completion' in this context is defined as successful completion of the originally intended programme (yes), completion in the minimum time (yes), and achieving at least an A grade average (i.e. > 6.6) across the entire programme.

Sub-optimal completion with high grades is likely to include those students who have completed the intended qualification, however did not reach an optimal outcome through completion in more than the minimum time, or achieving on average B grades, or both. Sub-optimal completion with high grades was defined as successful completion of the originally intended programme (yes), completion in the minimum time (yes or no), and achieving at least an A or B grade average (i.e. > 6.6) across the entire programme, and not already included in the optimal completion category.

Sub-optimal completion with low grades

Sub-optimal completion with low grades is likely to represent those students who gained programme completion but experienced a level of academic difficulty in doing so. Sub-optimal completion with low grades was defined as successful completion of the originally intended programme (yes), completion in the minimum time (yes or no), and achieving at least a C grade average (i.e. 1 – 3.5) across the entire programme.

Non-completion

All other students were categorised as not achieving programme completion and this is likely to represent those students who for varying reasons did not complete their intended programme and did not continue to work towards completion.

Analysis

Descriptive summary

Descriptive information was provided on all demographic, predictor and academic outcome variables for each of the Māori, Pacific and non-Māori non-Pacific student cohorts. Continuous variables were summarised as numbers of observed and missing values, means, and standard deviations. Categorical variables were described as numbers of observed and missing values, and percentages. Distribution of the data for ethnic grouping was also reviewed.

Multiple regression analysis

Multiple regression analysis was used to test: how predictor variables are related to academic outcome variables for each ethnic grouping, and, how ethnicity is related to predictor variables and/or student academic outcomes. The researcher and project supervisors met to discuss and plan the multiple regression analysis. Each variable was discussed and debated in terms of what it may be representing or measuring in relation to the research question and predictor of academic success concepts, and how other variables may operate in association. An analysis plan flow diagram was developed that built on the original predictors of academic success model (explained earlier) and incorporated key predictor and outcome variables of interest (Figure 3). Predictor

variables were sequentially added to the analysis model in relation to their impact on students over the pipeline. The analysis model includes a baseline model (#1), and sequential models 2, 3, 4, 5, 6.

Māori and Pacific ethnic groupings were foregrounded throughout the data analysis. The first stage of regression analysis involved running the statistical models separately for each ethnic grouping. This approach aligns with the project objectives that aim to identify if each variable is having a predictive effect, and if those variables differ between ethnic groups. Multiple regression analysis was then repeated including all ethnic groupings in the same model and sequentially adding predictor variables. A group comparison was carried out that compared Māori to non-Māori non-Pacific and Pacific to non-Māori non-Pacific. Differences in academic outcomes and the change in these differences with the sequential addition of predictor variables were observed. Statistical analysis was performed using SAS version 9.3. All statistical tests were two-sided and maintained at a 5% significance level.

The multiple regression analysis was originally completed using the full study cohort whilst excluding Model #5 (i.e. academic preparation) – therefore including Models 1, 2, 3, 4, and 6. Model #5 was excluded from this original analysis given that NCEA data were only available for approximately half of the study cohort and therefore would have limited study findings. The results of this full analysis are presented in the results chapter.

This original analysis was repeated for a sub-cohort of students who had NCEA data available. This NCEA sub-cohort analysis included all models (#1 – 6). This analysis resulted in similar findings when compared with the full cohort analysis. Additional NCEA specific results are discussed within the results chapter with tables included in Appendix C where additional information is relevant to the overall research findings.

Chapter summary

This chapter described how location of the research within a Māori health research centre facilitated research guidance and support for the researcher. The research aims and objectives were outlined and a conceptual model of predictors of academic success was introduced. A description of the research methods and variables used in this study was provided. Explanation of the multiple regression analysis plan was outlined and presented via a flow diagram. The next chapter presents the findings of the research. Data analysis findings including descriptive summaries and multiple regression analysis results will be presented.

Figure 3: Total cohort analysis multiple regression analysis plan.

| Model 1 | + | Model 2 | + | Model 3 | + | Model 4 | + | Model 5 | + | Model 6 |

| Control | | Predictors |

Baseline
- Gender
- Age (year 2)
- Year of admission (year 2)

Socioeconomic status
- School decile

Transitioning
- Auckland School
- Type of admission

Bridging foundation
- Bridging programme

Academic preparation
- Rank Score -cont
- Table A max - cont
- Table B Sci Max
- Table B Maths max

Early academic results
- First year GPA
- First year passed all courses

Outcomes
- Grad intended prog (y/n)
- Graduate GPA (continuous 0-9)
- Grad min time (y/n) - sub cohort
- Graduate outcome (4 levels - Optimal Completion, Sub-optimal with high grades, Sub-optimal with low grades, Non-completion)

Full cohort
- Māori only
- Pacific only
- nMnP only
- Group comparison
- Models 1 - 4 + 6

NCEA cohort
- Māori only
- Pacific only
- nMnP only
- Group comparison
- Models 1 - 6

Introduction

This chapter presents the results of the data analysis that explores the effect of predictor variables on academic outcomes for Māori, Pacific and non-Māori non-Pacific students (nMnP) who enrolled in the Bachelor of Health Sciences (BHSc), Bachelor of Nursing (BNurs) and Bachelor of Pharmacy (BPharm) programmes at the University of Auckland (UoA) between 2002 and 2012. Results are presented for the BHSc, BNurs and BPharm programmes as a combined total. Descriptive summaries (numbers, percentages, means, and standard deviations) are presented that describe the student cohort by Māori, Pacific, and non-Māori non-Pacific 'ethnic groupings' using demographic, admission, and academic outcome data. Statistically significant differences in the distribution of variables of interest between ethnic groups are presented within the descriptive summary tables. This chapter also presents the multiple logistic and linear regression analysis results for the effect of predictor variables (school decile, Auckland school, type of admission, bridging programme, first year bachelor GPA and first year passed all courses) on distinct academic outcome variables (first year GPA, year 2 – 4 programme GPA, graduated from intended programme, graduated in the minimum time) and a 'composite' graduation outcome made up of four levels of achievement: optimal completion; sub-optimal completion with high grades; sub-optimal completion with low grades; and non-completion. Multiple regression analysis is first presented separately for each individual ethnic group (Māori, Pacific, and non-Māori non-Pacific) for distinct and composite academic outcomes. These results identify within-group predictors of academic success for each ethnic category. The multiple regression analysis results are then presented for the total cohort and include a comparison between ethnic groupings (Māori versus nMnP, Pacific versus nMnP). These results identify differences in distinct and composite academic outcomes between ethnic groupings, and then, by sequentially adding each variable to the same statistical model, explore how each predictor variable impacts on (or accounts for) those differences. Multiple regression analysis controlled for gender, age and year of admission.

Descriptive summary

Demographic and predictor variables

Table 3 provides a summary of descriptive demographic and admission variables for Māori, Pacific, and nMnP student groupings. As outlined in the methods chapter, chi-square and ANOVA tests were used to identify significant differences in the distribution of variables of interest (gender, age, school decile, type of admission, bridging programme, and school results) between Māori and nMnP, and between Pacific and nMnP ethnic groupings.

Enrolment numbers

A total of 2686 students were identified as having enrolled in a BHSc, BNurs or BPharm programme within the Faculty of Medical and Health Sciences (FMHS) between 2002 and 2012. Non-Māori non-Pacific students made up the majority of the student cohort (84.8%, n=2279), Pacific students accounted for just under 10% (9.6%, n=257) and Māori students represented 5.6% (n=150) of the student cohort. Proportions of ethnic groups at admission remained relatively constant between 2002 and 2012 with Māori students making up less than 7%; Pacific students ranging between 7% and 15%; and non-Māori non-Pacific students representing more than 80% of the student cohort in each time period considered.

Programme of enrolment

Thirty-six percent of the total cohort was enrolled in each of the health sciences and pharmacy programmes, with 30% enrolled in nursing. Two thirds of the Māori students in this cohort were enrolled in the BHSc programme, followed by 21% in BNurs and 17% in BPharm. Nearly three quarters of Pacific students were enrolled in the BHSc followed by 18% and 15% in BNurs and BPharm respectively. Non-Māori non-Pacific students were more evenly spread across the three programmes with 30%, 32% and 40% enrolled in BHSc, BNurs, and BPharm respectively (Table 3).

Demographic variables

Approximately three quarters of all three ethnic groupings were made up of female students, with Pacific students having a higher proportion of male student enrolments (29%) compared to nMnP male students (22%) (p= 0.0105) (Table 3). The mean age for the total cohort at admission to year 2 of FMHS programmes was 20 years, with Māori students being slightly older at admission compared to nMnP (21.3 years compared with 20.5 years, p= 0.0061).

Transition and admission variables

A significantly higher proportion of nMnP students (72%) had enrolled in bachelor level study within FMHS as direct school leavers compared to less than half of Māori students (p< 0.0001) and just over one third of Pacific students (p< 0.0001). Similarly, significantly less nMnP students had completed bridging foundations programmes (5%) compared to half of Pacific students (50%, p< 0.0001) and two fifths (43%) of Māori students (p< 0.0001). This is not surprising given the large proportion of the Māori (n=43, 29%) and Pacific (n=100, 39%) students in this study who had completed the Certificate in Health Sciences (CertHSc) (a bridging foundation programme offered within FMHS that is only available to Māori and Pacific students). A significantly higher proportion of Pacific students (94.6%, p< 0.0001), and a significantly lower proportion of Māori students (56.3%,

p< 0.0001), had attended secondary school in Auckland compared with three quarters of nMnP students[13] (Table 3).

Table 3: Predictor variables for Māori, Pacific and non-Māori non-Pacific students (n=2686).

Demographic and admission variables	Ethnic grouping									
	Māori			Pacific			nMnP (ref)		Total	
	n	%	p value	n	%	p value	n	%	n	%
Total cohort	150	100.0		257	100.0		2279	100.0	2686	100.0
Categorical variables										
Gender										
Female	108	72.0		182	70.8		1775	77.9	2065	76.9
Male	42	28.0	0.0944	75	29.2	0.0105	504	22.1	621	23.1
Year of admission (2nd yr.) ‡§										
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
School Decile										
High (8-10)	54	38.0		51	22.9		1275	62.2	1380	57.1
Medium (4-7)	47	33.1		87	39.0		650	31.7	784	32.5
Low (1-3)	41	28.9	<0.0001	85	38.1	<0.0001	125	6.1	251	10.4
Auckland School										
No	63	43.8		12	5.4		320	15.6	395	16.3
Yes	81	56.3	<0.0001	211	94.6	<0.0001	1731	84.4	2023	83.7
Type of admission (1st yr.)										
Alternative admission	77	51.3		156	60.7		630	27.6	863	32.1
School Leaver	73	48.7	<0.0001	101	39.3	<0.0001	1649	72.4	1823	67.9
Bridging programme										
No	85	56.7		129	50.2		2159	94.7	2373	88.3
Yes	65	43.3	<0.0001	128	49.8	<0.0001	120	5.3	313	11.6
Certificate in Health Sciences										
No	107	71.3		157	61.1		2270	100	2543	94.7
Yes	43	28.7	-	100	38.9	-	0	0	143	5.3
Programme enrolled§										
Health Sciences	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
Continuous variables	*Mean*	*SD*	*p value*	*Mean*	*SD*	*p value*	*Mean*	*SD*	*Mean*	*SD*
Age at admission (2nd yr.)	21.31	4.6	0.0061	20.8	3.7	0.1346	20.4	4.1	20.5	4.1
School results										
NCEA Rank Score	196.9	46.6	<0.0001	178.3	45.3	<0.0001	231.0	39.7	224.3	43.9
Table A Max	19.0	4.1	0.0008	18.4	5.1	<0.0001	20.7	3.8	20.4	4.0
Table B Max	22.8	6.6	0.0081	21.3	7.4	<0.0001	24.7	5.6	24.3	5.9
Table B Maths Max	21.5	6.1	0.0076	20.3	8.2	<0.0001	23.9	6.4	23.4	6.7
Table B Science Max	19.9	6.0	0.0157	16.9	5.5	<0.0001	21.4	4.4	20.9	4.8

‡Note that 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 one year. § Results are presented for those variables that were tested.

School results

The average NCEA Rank Score attained was 196.9 (SD 46.6) for Māori and 178.3 (SD 45.28) for Pacific students out of a maximum attainable score of 320. Both Māori and Pacific students' average Rank Scores were significantly lower (p<0.0001) than the average of 231 (SD 39.73) achieved by nMnP students[14]. The maximum number of credits achieved in Table A, Table B, Table B Science subjects and Table B Maths subjects on average were all significantly lower for both Māori and Pacific student cohorts when compared to nMnP students. One

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[13] Note that the higher proportion of Māori students who attended school outside of Auckland compared to other ethnic groupings may be reflective of Whakapiki Ake (the Māori student recruitment programme) targeting Māori students both within and outside Auckland to attend FMHS.

[14] Note that direct guaranteed entry to the BHSc programme requires an NCEA Rank Score of 250 combined with at least 18 Level 3 NCEA credits in one subject in each of Table A and Table B.

example shows that for science subjects (Table B Science max) Māori students achieved on average 1.47 credits less (mean 19.9, SD 6.04, p=0.0157), and Pacific students achieved on average 4.46 credits less (mean 16.91, SD 5.47, p<0.0001) than nMnP students (mean 21.37, SD 4.45).

School decile was distributed significantly differently for both Māori and Pacific students when compared to the nMnP cohort (p<0.0001) (Table 3, Figure 4). The majority of nMnP students had attended high (62.2%) and medium (31.7%) decile schools, leaving just 6.1% of nMnP having attended low decile schools. In contrast, the majority of Māori and Pacific students (62.0% of Māori, 77.1% of Pacific) had attended low or medium decile schools. Figure 4 provides an infographic depicting the distribution of Māori, Pacific and non-Māori non-Pacific students in this study cohort across the high, medium and low decile schools they attended prior to admission. Of particular note is the proportion of non-Māori non-Pacific students from low decile (red) schools compared to much larger proportions of low decile (red) for Māori and Pacific student groups.

Figure 4: Infographic representing proportion of students by school decile and ethnic grouping
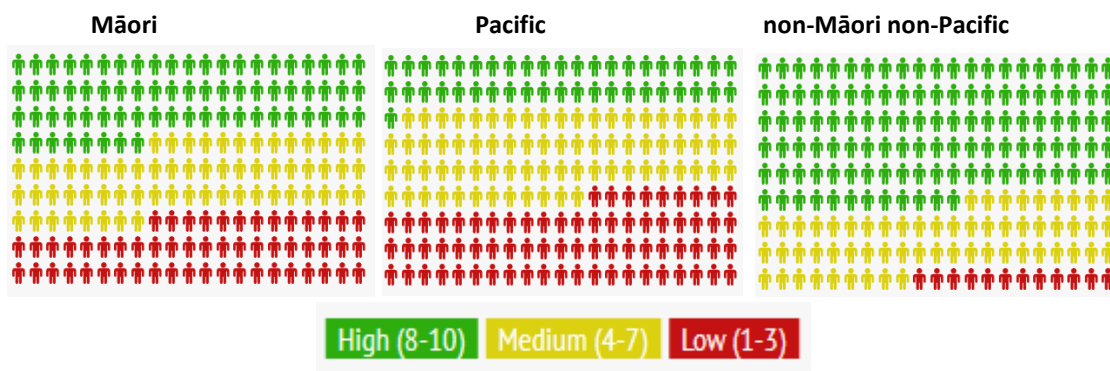
Academic outcome variables

Table 4 presents student academic outcomes for the first year of Bachelor level study and for programme overall outcomes for Māori, Pacific, and non-Māori non-Pacific student groupings. Chi-square and ANOVA tests were used to identify significant differences in the distribution of variables of interest (first year bachelor passed all, programme passed all, graduated FMHS, graduated intended programme, graduated in minimum time, first year bachelor GPA, and year 2–4 programme GPA) between Māori and nMnP, and between Pacific and nMnP ethnic groupings.

First year bachelor GPA and first year passing all courses

Māori or Pacific students were less likely (p<0.0001 for Māori, p<0.0001 for Pacific) to have passed all courses (at first attempt) in their first year of bachelor study when compared with nMnP students. Whilst 78% of nMnP students passed all courses in their first year, Māori and Pacific students in comparison had 61% and 41% pass rates respectively. Māori and Pacific students also had an average GPA in the first year of bachelor study that was significantly lower (mean GPA=3.63, SD=1.71, p<0.0001 for Māori, mean GPA=2.83, SD=1.64, p<0.0001 for Pacific) when compared to nMnP students (mean GPA=4.69, SD=1.94) (Table 4).

Table 4: Academic outcomes for Māori, Pacific and non-Māori non-Pacific students (n=2686)

Academic outcome variables	Ethnic grouping									
	Māori			Pacific			nMnP		Total	
Categorical variables	*n*	*%*	*P value*	*N*	*%*	*P value*	*n*	*%*	*n*	*%*
First year bachelors passed all										
No	59	39.3		152	59.1		492	21.6	703	26.2
Yes	91	60.7	<0.0001	105	40.9	<0.0001	1786	78.4	1982	73.8
Programme passed all										
No	63	42.3		155	60.3		538	23.6	756	28.1
Yes	86	57.7	<0.0001	102	39.7	<0.0001	1741	76.4	1929	71.8
Graduated FMHS										
No	44	29.3		73	28.4		461	20.2	578	21.5
Yes	106	70.7	0.0078	184	71.6	0.0023	1818	79.8	2108	78.5
Graduated intended programme										
No	51	34.0		80	31.1		496	21.8	627	23.3
Yes	99	66.0	-	177	68.9	-	1783	78.2	2059	76.7
Composite 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
Programme graduated from										
BHSc	50	49.0		113	62.1		337	18.6	500	23.9
BNurs	28	27.4		42	23.1		656	36.2	726	34.6
BPharm	24	23.5	-	27	14.8	-	818	45.2	869	41.5
Graduated in minimum time										
No	24	23.5		57	31.3		278	15.3	359	17.1
Yes	78	76.5	0.0275	125	68.7	<0.0001	1533	84.6	1736	82.9
Continuous variables	*Mean*	*SD*	*P value*	*Mean*	*SD*	*P value*	*Mean*	*SD*	*Mean*	*SD*
First year bachelor GPA	3.63	1.71	<0.0001	2.83	1.64	<0.0001	4.69	1.94	4.45	1.99
Year 2 – 4 programme GPA	4.36	1.90	<0.0001	3.48	1.82	<0.0001	5.21	1.69	5.00	1.79
Year 1 – 4 programme GPA	4.05	1.63	-	3.21	1.56	-	4.95	1.59	4.73	1.68

Note that students may be double counted if they have graduated from more than one programme. Results are presented for those variables that were tested for significant differences between ethnic groupings.

Year 2 – 4 programme GPA, passing all courses, and graduation

The proportion of non-Māori non-Pacific students who passed all courses within the BHSc, BNurs or BPharm programmes from year 2 onwards (at first attempt) was 76% compared to 57% for Māori and 40% for Pacific students. The average GPA from year 2 to completion was significantly lower for Māori (mean= 4.36, p<0.0001) and Pacific (mean= 3.48, p<0.0001) students compared to nMnP students (mean= 5.21). When combining the GPA gained across all years of bachelor level study (year 1 – year 3 (BNurs/BHSc) or 4 (BPharm), Māori students had an average GPA of 4.05 (equating to a B- grade), Pacific students had an average GPA of 3.21 (equating to a C+ grade), and nMnP students had an average GPA of 4.95 (equating to B grade). A higher proportion of nMnP students (80%) graduated from the FMHS compared to 71% of Māori (p=0.0078) and 71% of Pacific (p=0.0023) students. A lower proportion of Māori (66%) and Pacific students (69%) graduated from their intended programme (i.e. the programme they originally enrolled in) when compared to 78% of nMnP students (Table 4).

Composite graduation outcome

For the composite graduation outcome, clear disparities were evident. Whilst 20% of nMnP students achieved optimal completion (e.g. graduating from intended programme in the minimal time with an A grade average), less than 10% of Māori and less than 3% of Pacific students achieved this outcome. Approximately half of Māori

(48%) and nMnP (52%) students achieved suboptimal completion with high grades compared to only two fifths of Pacific students. Less than 10% of nMnP students gained suboptimal programme completion with low grades compared to 15% of Māori and nearly one third of Pacific students. A large proportion of Māori and Pacific students for the composite graduation outcome had not completed a Bachelor level programme within FMHS, with nearly one third being categorised as achieving non-completion. One in four nMnP students had not completed an FMHS programme[15]. Non-completion is likely to represent drop-out or attrition from the programme given that current students with evidence of continued enrolment have been excluded from this sample. Of those that completed an FMHS programme, the majority of Māori (49%) and Pacific (62%) students had completed the BHSc programme; almost half of nMnP students completed the BPharm; and, 85% percent of nMnP students had completed their programmes within the minimum time compared to three quarters of Māori students (75%) and just over two thirds of Pacific students (68.7%).

Multiple regression analysis results

Sub-group analysis – academic outcomes

Table 5 presents the multiple regression analysis results for each of the three ethnic groupings of interest (Māori, Pacific, non-Māori non-Pacific). Results are presented for the estimated effect of predictor variables (school decile, Auckland school, type of admission, bridging/foundation programme, first year bachelor GPA and first year bachelor passed all courses) on academic outcomes (first year bachelor GPA (0-9), year 2–4 programme GPA (0-9), graduated from intended programme (yes/no), graduated in the minimum time (yes/no)). Predictor variables were sequentially added to the model as per the analysis plan flow diagram (Figure 3). All models (2-6) controlled for age, year of admission and gender (i.e. baseline model #1).

Predictors of academic outcomes for Māori

School decile, bridging programme, first year bachelor GPA, and Auckland school were all important predictors of academic outcomes for Māori (Table 5). These predictors are discussed in further detail below in relation to each academic outcome considered.

First year bachelor GPA

In Model #2, school decile was predictive of first year bachelor GPA whereby Māori students from low decile schools had an average first year bachelor GPA that was 1.16 points lower than those Māori students who attended high decile schools (p=0.0014, CI: -1.87, -0.46). After controlling for admission type and Auckland school (model #3), this reduced to 1.07 points lower, but remained a significant predictor of mean first year GPA for Māori students (p=0.0035, CI: -1.77, -0.36). Model #4 shows that Māori students who had completed a bridging

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[15] Note that currently enrolled students have been excluded from this sample, therefore a non-completion is likely to indicate 'drop-out' or attrition from the programme and / or the faculty with no evidence of enrolment in any courses in the last 2 years after the 'minimum time' required for completion.

programme achieved a first year bachelor GPA that was on average 0.83 points lower than those who did not (p=0.0165, CI: -1.50, -0.15)[16]. With the inclusion of bridging programme as a predictor, the effect of school decile on first year bachelor GPA was no longer significant at the p<0.05 level. Overall, school decile and bridging programme were important in determining first year bachelor GPA such that those Māori students who attended low decile schools and had completed a bridging programme achieved lower first year bachelor GPA results than Māori students who attended schools with high decile and did not complete bridging programmes.

Year 2–4 programme GPA

When considering a longer term year 2 – 4 programme GPA academic outcome, school decile and first year bachelor GPA are important determinants for Māori students. Attending a low (estimate -0.88, CI: -1.62, -0.15, p=0.0193) or medium (estimate -0.80, CI: -1.56, -0.05, p=0.0375) decile school was also a predictor of lower mean year 2 – 4 GPA for Māori (model #2), however, this difference became non-significant after other variables were introduced into model #3 and #4. Despite levels of significance dropping for school decile with inclusion of other explanatory variables, all point estimates for the effect of school decile low and medium compared with high decile are negative indicating that overall, attendance at low or medium decile schools may have a negative effect on year 2–4 programme GPA. Model #6 shows that after controlling for all other variables, early academic outcomes such as first year bachelor GPA are predictive of year 2 – 4 programme GPA, i.e. for every point increase in first year bachelor GPA, Māori students achieved a year 2 – 4 programme GPA that was 0.46 points higher (p=0.0002, CI: 0.22, 0.69). These findings indicate that attending a low decile school is associated with achieving a lower first year bachelor GPA, whilst achieving a higher first year bachelor GPA is beneficial to year 2 – 4 programme GPA for Māori students.

Graduated from intended programme

None of the variables of interest had a significant predictive effect on the academic outcome of graduating from intended programme for Māori students at the level of p<0.05.

Graduated in the minimum time

For those Māori students who had graduated from their intended programme (n=99), when adjusting for baseline variables, school decile and type of admission (model #3), those who had attended school outside of Auckland had lower odds of graduating in the minimum time compared to those who attended school in the Auckland region (OR 0.25, CI: 0.07, 0.91, p=0.0362). However, once bridging foundation programme was included in the same model (#4), Auckland school was no longer significant a significant predictor of graduating in the

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[16] 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.

minimum time. No other pathway variables showed significant predictive effect on graduating in the minimum time for Māori students at the level of $p<0.05$.

Overall, school decile, bridging programme, first year bachelor GPA, and Auckland school were all important predictors of academic outcomes for Māori. Māori students who attended low decile schools and had completed a bridging programme achieved lower first year bachelor GPA results than those Māori students who attended high decile schools and did not complete bridging programmes. Attending a low decile school is negatively associated with the academic outcomes examined, whilst achieving a higher first year bachelor GPA is beneficial to year 2 – 4 programme GPA for Māori students. Type of admission was not a significant predictor of academic outcomes for Māori students. For those Māori students who graduated, attending an Auckland school had a positive effect on graduating in the minimum time, however this effect did not maintain levels of significance at $p<0.05$ when adjusting for all other variables in Model #6.

Predictors of academic outcomes for Pacific students

School decile, type of admission, bridging programme and first year bachelor GPA were important predictors of Pacific student academic outcomes (Table 5). These predictors are discussed in further detail below in relation to each academic outcome considered.

First year bachelor GPA

Similar to Māori, school decile was predictive of Pacific student early academic outcomes with low school decile associated with Pacific students achieving a first year bachelor GPA that was 0.57 points lower than Pacific students who attended high decile schools ($p=0.0478$, CI: -1.14, -0.01) (model #2). However, after adjusting for Auckland school and type of admission (model #3), school decile was no longer significant as a predictor for first year bachelor GPA. Although Auckland school did not reach levels of significance, type of admission for Pacific students was important for predicting first year bachelor GPA, year 2 – 4 programme GPA and intended programme. Alternative admission students achieved a first year bachelor GPA that was on average 1.09 points lower ($p<0.0001$, CI: -1.55, -0.63) than Pacific students who were school leavers on admission. In model #4, after controlling for 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

Type of admission for Pacific students was important for predicting year 2 – 4 programme GPA. Pacific alternative admission students achieved a year 2 – 4 programme GPA that was on average 1.15 points lower ($p<0.0001$, CI: -1.67, -0.63) than Pacific students who were school leavers on admission. In model #4, after controlling for bridging programme participation, alternative admission Pacific students had a year 2 – 4 programme GPA that was on average 0.9 points lower ($p=0.0063$, CI: -1.55, -0.26) than Pacific school leavers. In model #6, after

controlling for all other variables, for every 1 point increase in first year GPA, Pacific students achieved a programme GPA that was on average 0.7 points higher (p<0.0001, CI: 0.52, 0.87).

Given that 60% of Pacific students gain entry as alternative admission students, including 50% who completed bridging programmes, these results indicate that Pacific students who gain entry to bachelor level study as school leavers achieve higher first year bachelor and year 2 – 4 programme GPA results and are more likely to graduate from their intended programme than alternative admission Pacific students. In addition, participation in a bridging foundation programme for Pacific students may reduce the difference in first year bachelor GPA and year 2 – 4 programme GPA between school leaver and alternative admission Pacific students.

Graduated from intended programme

In Model #6, after controlling for all other variables, for every 1 point increase in first year bachelor GPA, the odds of graduating from the intended programme increased by 1.6 times for Pacific students (CI: 1.13, 2.19, p=0.0079)

Graduated in the minimum time

Pacific students who completed a bridging foundation programme had a lower odds of graduating in the minimum time (OR=0.27, p=0.0187, CI: 0.09, 0.81) than those who did not (model #4). However, when adjusting for first year results in the same model (#6), this predictor was no longer significant. Therefore, after controlling for all pathway variables in the same model, none of the variables of interest had a predictive effect on graduating in the minimum time for Pacific students (Model #6).

Overall, those Pacific students who had attended low decile schools and entered via alternative admission achieved first year bachelor GPA results that were lower than those that attended high decile schools and entered as direct school leavers. Achieving a higher first year bachelor GPA and gaining entry as a school leaver was then predictive of achieving a higher year 2 – 4 programme GPA and graduating from the intended programme. Bridging programme had some effect on graduating in the minimum time, however did not reach levels of significance when adjusting for all other variables in the same model (#6). Auckland school and passing all courses in first year were not significant predictors for Pacific students.

Predictors of academic outcomes for non-Māori non-Pacific

School decile, type of admission, bridging programme, passing all courses in 1st year and first year bachelor GPA were all important predictors of academic outcomes for students who were nMnP (Table 5).

First year bachelor GPA

Model #2 shows that nMnP students from low decile schools had a first year GPA that was 0.43 points lower (p=0.0183, CI: -0.78, -0.07) when compared to nMnP students from high decile schools. These differences remained after controlling for Auckland school, type of admission and bridging foundation programme (model #4). Non-Māori non-Pacific 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), whilst those who had completed a bridging foundation programme had a first year GPA that was on average 0.7 points lower (p=0.0004, CI: -1.13, -0.32) than nMnP school leavers and those who did not complete a bridging foundation programme respectively.

Year 2 – 4 programme GPA

Model #2 shows that nMnP students from low decile schools had a year 2 – 4 programme GPA that was 0.31 points lower (p=0.0476, CI: -0.61, 0.00) compared to nMnP students from high decile schools. These differences remained after controlling for Auckland school, type of admission and bridging foundation programme (model #4). Model #6A shows that for every 1 point increase in first year bachelor GPA, nMnP students had a year 2 – 4 programme GPA increase of 0.55 points (p<0.0001, CI: 0.51, 0.58) and were 1.4 times more likely to graduate in the minimum time (p<0.0001, CI: 1.25, 1.58).

Graduated from intended programme

Non-Māori non-Pacific students who did not pass all courses in their first year of bachelor study had lower odds of graduating from their intended programme (OR=0.42, p<0.0001, CI: 0.30, 0.59) than those who passed all first year bachelor courses.

Graduated in the minimum time

Those non-Māori non-Pacific students who completed bridging foundation programmes had lower odds of graduating in the minimum time than those who did not complete a bridging foundation programme (OR= 0.35, CI: 0.18, 0.67, p= 0.0015).

Overall, attending low decile schools, completing 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.

Table 5: Multiple regression analysis on predictors of academic outcomes for Māori (n=150), Pacific (n=257), and non-Māori non-Pacific students (n=2279)

Model*	Predictor variables (ref)	Comparison	First year bachelor GPA				Year 2–4 programme GPA				Graduated from intended programme				Graduated in minimum time			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Māori																	n-99	
2	School decile (High)	Medium	-0.59	-1.27	0.10	0.0912	**-0.88**	-1.62	-0.15	**0.0193**	0.80	0.31	2.06	0.6430	0.56	0.13	2.44	0.4405
		Low	**-1.16****	-1.87	-0.46	**0.0014**	**-0.80**	-1.56	-0.05	**0.0375**	1.49	0.52	4.31	0.4600	0.64	0.16	2.55	0.5256
3	School decile (High)	Medium	-0.43	-1.13	0.28	0.2307	-0.79	-1.56	-0.02	0.0442	0.70	0.26	1.89	0.4777	0.92	0.19	4.41	0.9156
		Low	**-1.07***	-1.77	-0.36	**0.0035**	-0.74	-1.50	0.03	0.0583	1.42	0.48	4.20	0.5312	0.80	0.19	3.47	0.7667
	Auckland school (Yes)	No	-0.50	-1.12	0.11	0.1057	-0.25	-0.92	0.41	0.4491	1.53	0.62	3.79	0.3552	**0.25**	0.07	0.91	**0.0362**
	Type of admission (SL)	AA	-0.23	-0.91	0.44	0.4951	-0.41	-1.13	0.32	0.2721	0.76	0.29	1.99	0.5810	0.80	0.20	3.29	0.7602
4	School decile (High)	Medium	-0.23	-0.94	0.48	0.5183	-0.75	-1.53	0.04	0.0630	0.64	0.23	1.80	0.3929	1.28	0.23	7.03	0.7780
		Low	-0.77	-1.50	-0.03	0.0410	-0.67	-1.48	0.14	0.1048	1.25	0.40	3.92	0.7079	1.13	0.23	5.49	0.8819
	Auckland school (Yes)	No	-0.45	-1.06	0.15	0.1376	-0.24	-0.91	0.43	0.4760	1.51	0.61	3.74	0.3730	0.27	0.07	1.01	0.0521
	Type of admission (SL)	AA	0.06	-0.64	0.77	0.8575	-0.34	-1.12	0.45	0.3967	0.69	0.25	1.88	0.4632	1.08	0.24	4.95	0.9210
	Bridging Programme (No)	Yes	**-0.83***	-1.50	-0.15	**0.0165**	-0.19	-0.94	0.55	0.6121	1.40	0.53	3.73	0.4998	0.40	0.08	2.00	0.2649
6	School decile (High)	Medium					-0.60	-1.27	0.06	0.0737	0.66	0.23	1.88	0.4301	1.25	0.22	7.12	0.7984
		Low					-0.29	-0.99	0.41	0.4095	1.23	0.37	4.08	0.7332	1.16	0.21	6.37	0.8657
	Auckland school (Yes)	No					0.06	-0.51	0.63	0.8338	1.64	0.65	4.12	0.2951	0.30	0.07	1.22	0.0931
	Type of admission (SL)	AA					-0.43	-1.09	0.23	0.2017	0.64	0.23	1.78	0.3917	1.12	0.24	5.25	0.8816
	Bridging Programme (No)	Yes					0.26	-0.38	0.90	0.4161	1.41	0.51	3.88	0.5036	0.40	0.07	2.20	0.2925
	1st Yr. Bach passed all (Yes)	No					-0.64	-1.44	0.16	0.1139	0.43	0.12	1.54	0.1934	0.39	0.05	2.94	0.3617
	1st Yr. Bach GPA	per point increase					**0.46**	0.22	0.69	**0.0002**	0.90	0.61	1.32	0.5800	1.26	0.61	2.57	0.5351
Pacific																	n=177	
2	School decile (High)	Medium	-0.42	-0.98	0.14	0.1406	-0.02	-0.65	0.62	0.9620	1.71	0.76	3.84	0.1925	1.39	0.49	3.96	0.5390
		Low	-0.57	-1.14	-0.01	0.0478	-0.21	-0.85	0.43	0.5216	1.82	0.81	4.12	0.1484	1.24	0.44	3.52	0.6840
3	School decile (High)	Medium	-0.33	-0.87	0.21	0.2307	0.07	-0.54	0.69	0.8138	1.96	0.85	4.54	0.1146	1.37	0.47	3.98	0.5595
		Low	-0.37	-0.92	0.17	0.1797	0.01	-0.61	0.64	0.9698	2.01	0.86	4.71	0.1088	1.42	0.48	4.14	0.5260
	Auckland school (Yes)	No	-0.31	-1.22	0.61	0.5084	-0.07	-1.11	0.98	0.8987	0.33	0.09	1.20	0.0913	0.98	0.13	7.49	0.9810
	Type of admission (SL)	AA	**-1.09****	-1.55	-0.63	**<.0001**	**-1.15**	-1.67	-0.63	**<.0001**	0.50	0.24	1.04	0.0623	0.48	0.20	1.19	0.1133
4	School decile (High)	Medium	-0.31	-0.85	0.22	0.2489	0.09	-0.53	0.70	0.7824	1.89	0.81	4.40	0.1387	1.21	0.40	3.59	0.7377
		Low	-0.38	-0.93	0.17	0.1716	0.01	-0.62	0.63	0.9838	2.04	0.86	4.81	0.1055	1.29	0.43	3.88	0.6498
	Auckland school (Yes)	No	-0.28	-1.20	0.63	0.5411	-0.04	-1.09	1.00	0.9329	0.31	0.09	1.14	0.0780	0.97	0.12	7.58	0.9739
	Type of admission (SL)	AA	**-0.83****	-1.40	-0.27	**0.0041**	**-0.90**	-1.55	-0.26	**0.0063**	**0.32**	0.13	0.82	**0.0178**	1.11	0.36	3.49	0.8538
	Bridging Programme (No)	Yes	-0.41	-0.93	0.12	0.1258	-0.38	-0.98	0.21	0.2043	1.91	0.83	4.40	0.1285	**0.27**	0.09	0.81	**0.0187**
6	School decile (High)	Medium					0.31	-0.19	0.80	0.2217	2.17	0.90	5.27	0.0865	1.22	0.38	3.92	0.7430
		Low					0.27	-0.23	0.77	0.2861	2.36	0.97	5.75	0.0598	1.66	0.52	5.28	0.3944
	Auckland school (Yes)	No					0.15	-0.68	0.98	0.7176	0.32	0.08	1.24	0.0983	1.15	0.13	10.02	0.9000
	Type of admission (SL)	AA					-0.33	-0.85	0.20	0.2239	0.40	0.15	1.07	0.0690	1.25	0.36	4.32	0.7209
	Bridging Programme (No)	Yes					-0.10	-0.58	0.38	0.6746	2.37	0.97	5.83	0.0592	0.33	0.10	1.06	0.0624
	1st Yr. Bach passed all (Yes)	No					0.01	-0.55	0.56	0.9857	1.30	0.48	3.57	0.6076	0.46	0.12	1.70	0.2415
	1st Yr. Bach GPA	per point increase					**0.70**	0.52	0.87	**<.0001**	**1.57**	1.13	2.19	**0.0079**	1.42	0.90	2.23	0.1340

Table 5 continued: Multiple regression analysis on predictors of academic outcomes for Māori (n=150), Pacific (n=257), and non-Māori non-Pacific students (n=2279)

Model	Predictor variables (ref)	Comparison	First year bachelor GPA				Year 2–4 Programme GPA				Graduated from intended programme				Graduated in minimum time			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
	Non-Māori non-Pacific														n=1783			
2	**School decile (High)**	Medium	-0.08	-0.26	0.10	0.3746	0.06	-0.10	0.21	0.4841	1.09	0.86	1.38	0.4973	1.07	0.78	1.48	0.6820
		Low	-0.43	-0.78	-0.07	0.0183	-0.31	-0.61	0.00	0.0476	0.94	0.60	1.47	0.7829	0.64	0.37	1.11	0.1130
3	**School decile (High)**	Medium	-0.10	-0.28	0.08	0.2868	0.04	-0.12	0.19	0.6416	1.11	0.87	1.41	0.4043	1.06	0.77	1.46	0.7327
		Low	**-0.44***	-0.80	-0.09	**0.0142**	-0.32	-0.62	-0.01	0.0408	0.95	0.61	1.49	0.8269	0.64	0.37	1.12	0.1196
	Auckland school (Yes)	No	0.12	-0.11	0.36	0.2996	0.17	-0.03	0.37	0.1043	0.83	0.62	1.11	0.2113	1.24	0.80	1.92	0.3465
	Type of admission (SL)	AA	0.19	-0.04	0.43	0.1046	0.11	-0.09	0.31	0.2944	0.91	0.68	1.23	0.5503	0.79	0.53	1.16	0.2259
4	**School decile (High)**	Medium	-0.10	-0.28	0.08	0.2908	0.04	-0.12	0.19	0.6391	1.11	0.87	1.41	0.4059	1.04	0.75	1.45	0.7970
		Low	-0.41	-0.76	-0.05	0.0244	-0.31	-0.61	0.00	0.0475	0.95	0.60	1.48	0.8086	0.70	0.40	1.24	0.2228
	Auckland school (Yes)	No	0.13	-0.10	0.37	0.2607	0.17	-0.03	0.37	0.0992	0.83	0.62	1.11	0.2084	1.31	0.84	2.04	0.2394
	Type of admission (SL)	AA	**0.24***	0.01	0.48	**0.0434**	0.12	-0.08	0.32	0.2458	0.91	0.67	1.23	0.5264	0.92	0.61	1.37	0.6746
	Bridging Programme (No)	Yes	**-0.73****	-1.13	-0.32	**0.0004**	-0.18	-0.53	0.16	0.2968	1.10	0.67	1.79	0.7151	**0.23**	0.12	0.42	**<.0001**
6	**School decile (High)**	Medium					0.09	-0.03	0.21	0.1321	1.11	0.87	1.41	0.4127	1.11	0.80	1.56	0.5320
		Low					-0.09	-0.32	0.15	0.4691	0.94	0.60	1.49	0.7933	0.74	0.41	1.36	0.3315
	Auckland school (Yes)	No					0.09	-0.06	0.25	0.2216	0.83	0.62	1.11	0.2069	1.27	0.80	2.01	0.3050
	Type of admission (SL)	AA					-0.01	-0.17	0.14	0.8619	0.90	0.67	1.22	0.4978	0.83	0.55	1.26	0.3864
	Bridging Programme (No)	Yes					0.23	-0.03	0.50	0.0842	1.36	0.82	2.25	0.2282	**0.35**	0.18	0.67	**0.0015**
	1st Yr. Bach passed all (Yes)	No					-0.09	-0.26	0.09	0.3345	**0.42**	0.30	0.59	**<.0001**	0.71	0.46	1.11	0.1297
	1st Yr. Bach GPA	per point increase					**0.55**	0.51	0.58	**<.0001**	0.99	0.92	1.07	0.8278	**1.41**	1.25	1.58	**<.0001**

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear and 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Sub-group analysis – composite outcome

Table 6 presents the multiple regression analysis results for each of the three ethnic groupings of interest (Māori, Pacific, non-Māori non-Pacific). Results are presented for the estimated effect of predictor variables (school decile, Auckland school, type of admission, bridging/foundation programme, first year GPA and first year passed all courses) on the composite graduation outcome with four outcome levels (optimal completion, sub-optimal completion with high grades, sub-optimal completion with low grades, non-completion). Sub-optimal completion with high grades was used as the reference level against which the odds ratio of achieving each of the other levels was calculated. Predictor variables were sequentially added to the model as per the analysis plan flow diagram (Figure 3). All models (2 – 6) controlled for age, year of admission and gender (i.e. baseline model 1).

Predictors of academic success for Māori

After controlling for all other variables, for every 1 point increase in first year bachelor GPA, the odds of achieving an optimal programme completion relative to sub-optimal completion with high grades increased by 2.85 times (p=0.0314) for Māori students. None of the variables of interest were predictive of achieving a sub-optimal completion with low grades or non-completion relative to sub-optimal completion with high grades for Māori students. Overall, those Māori students who achieved higher first year bachelor GPA scores were more likely to achieve optimal graduation outcomes than their counterparts.

Predictors of academic success for Pacific

In model #3, when controlling for baseline variables (age, gender, year of admission), school decile, and Auckland school, alternative admission Pacific students were more likely to achieve a sub-optimal completion with low grades than a sub-optimal completion with high grades (OR= 2.41, p=0.0318, CI: 1.08, 5.38) when compared to Pacific school leavers. However, when adjusting for bridging programme participation in the same model (#4), this difference became non-significant. In model #6 when controlling for all other variables, Pacific students were less likely to achieve a sub-optimal completion with low grades (OR=0.57, p=0.0046, CI: 0.38, 0.84) and less likely to achieve non-completion (OR=0.47, CI: 0.32, 0.70, p=0.0002) than to achieve a suboptimal completion with high grades. Note that the value of ">999.999" for estimates and confidence intervals for optimal completion indicates insufficient data available for regression estimates. This also highlights the low numbers of Pacific students achieving optimal completion. Overall, Pacific students who gained higher first year bachelor GPA scores and attended school in Auckland were less likely to achieve lower level sub-optimal completion outcomes than those Pacific students who did not.

Predictors of academic success for non-Māori non-Pacific

For nMnP students, after adjusting for all other variables (model #6), for every 1 point increase in first year bachelor GPA, the odds of achieving an optimal programme completion increased by 1.95 times (p< 0.0001, CI: 1.77, 2.15), and the odds of achieving a sub-optimal completion with low grades decreased (OR= 0.49, CI: 0.41,

0.58, p<0.0001) relative to achieving a sub-optimal completion with high grades. In the same model (#6), those nMnP students who did not pass all first year bachelor courses were more likely to achieve non-completion relative to sub-optimal completion with high grades than those nMnP students who passed all first year bachelor courses (OR= 2.75, CI: 1.92, 3.94, p<0.0001).

NCEA sub-cohort relevant findings[17]

For the NCEA sub-cohort of nMnP students, additional predictive effects were raised that are worth noting (Appendix C, Table 8). Similar to the full cohort, after controlling for all other variables, for every 1 point increase in first year bachelor GPA, nMnP NCEA students were more likely to achieve an optimal completion outcome (OR= 2.1, CI: 1.7, 2.5, p<0.0001) and less likely to achieve sub-optimal completion with low grades (OR=0.54, CI: 0.40, 0.73, p<0.0001) relative to achieving sub-optimal completion with high grades. As well, those nMnP NCEA students who did not pass all courses in the first year of bachelor study had higher odds of non-completion rather than sub-optimal completion with high grades (OR=2.2, CI: 1.28, 3.67, p= 0.0039) when compared to those nMnP NCEA students who did pass all courses in the first year of bachelor study.

In addition, Auckland school, NCEA Rank Score and Table A max were significant predictors of optimal completion outcomes for nMnP NCEA students. Those nMnP NCEA students who did not attend school in Auckland were more likely to achieve optimal completion relative to sub-optimal completion with high grades (OR= 2.2, CI: 1.27, 3.79, p=0.0047) than those who did attend school in Auckland. For every 20 point increase in NCEA Rank score, the odds ratio for achieving an optimal completion outcome relative to a sub-optimal completion with high grades was 1.2 (CI: 1.00, 1.37, p=0.0495). For every 1 point increase in Table A max (number of credits achieved in one Table A subject), the odds ratio for achieving an optimal completion outcome relative to a sub-optimal completion with high grades increased by 1.1 (CI: 1.01, 1.16, p=0.0164).

Overall, both the full cohort and NCEA sub-cohort of non-Māori non-Pacific students who achieved higher first year bachelor GPA scores, or passed all courses in the first year of bachelor study, were more likely to achieve optimal programme outcomes or less likely to achieve sub-optimal programme outcomes. In addition, attending school outside of Auckland, achieving higher NCEA Rank Score or higher Table A max credits were predictive of higher odds of achieving optimal completion outcomes for nMnP NCEA students. No additional NCEA results were significantly predictive for the Māori or Pacific student NCEA sub-cohorts.

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[17] As noted in previously, the multiple regression analysis was repeated using only those students with NCEA data (approximately half of the original study cohort). This NCEA sub-cohort analysis additionally included NCEA school results are predictors at Model #5 within the multiple regression analysis plan flow diagram.

Table 6: Multiple regression analysis on predictors of graduation outcome compared to 'sub-optimal completion with high grades' (reference) for Māori (n= 150), Pacific (n= 257), and non-Māori non-Pacific students (n= 2279)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Māori														
2	School decile (High)	Medium	0.43	0.09	2.17	0.3062	0.91	0.20	4.12	0.8969	1.33	0.49	3.63	0.5732
		Low	1.12	0.23	5.53	0.8912	2.45	0.65	9.24	0.1852	1.17	0.39	3.54	0.7818
3	School decile (High)	Medium	0.33	0.06	1.90	0.1796	0.80	0.17	3.79	0.3192	1.49	0.52	4.30	0.5137
		Low	0.99	0.19	5.19	0.4883	2.60	0.66	10.19	0.0867	1.20	0.38	3.76	0.9742
	Auckland school (Yes)	No	2.03	0.45	9.16	0.3581	1.85	0.54	6.39	0.3302	0.73	0.28	1.87	0.5078
	Type of admission (SL)	AA	1.80	0.30	10.81	0.5204	1.65	0.42	6.45	0.4711	1.83	0.67	4.99	0.2386
4	School decile (High)	Medium	0.64	0.10	4.24	0.3388	0.63	0.12	3.21	0.2931	1.53	0.52	4.54	0.5112
		Low	2.03	0.29	14.26	0.2811	1.81	0.42	7.80	0.2026	1.26	0.38	4.21	0.9743
	Auckland school (Yes)	No	1.91	0.39	9.26	0.4230	1.60	0.45	5.75	0.4715	0.72	0.28	1.87	0.5043
	Type of admission (SL)	AA	6.14	0.61	62.20	0.1246	1.17	0.27	5.11	0.8399	1.98	0.68	5.72	0.2092
	Bridging Programme (No)	Yes	0.10	0.01	0.92	0.0426	2.59	0.53	12.81	0.2420	0.81	0.29	2.25	0.6842
6	School decile (High)	Medium	0.52	0.04	7.20	0.1391	0.56	0.11	3.00	0.3119	1.48	0.48	4.57	0.5268
		Low	9.41	0.74	119.77	0.0273	1.46	0.30	7.11	0.3537	1.18	0.33	4.20	0.9583
	Auckland school (Yes)	No	4.92	0.59	40.95	0.1404	0.99	0.26	3.83	0.9900	0.59	0.22	1.63	0.3092
	Type of admission (SL)	AA	4.54	0.30	69.87	0.2778	1.11	0.21	5.94	0.8997	2.12	0.71	6.34	0.1796
	Bridging Programme (No)	Yes	0.30	0.02	4.83	0.3964	1.90	0.32	11.15	0.4780	0.73	0.26	2.07	0.5524
	1st Yr. Bach passed all (Yes)	No	0.36	0.01	14.11	0.5875	0.55	0.08	3.91	0.5475	1.80	0.48	6.67	0.3822
	1st Yr. Bach GPA*	per point increase	**2.85**	1.10	7.37	**0.0314**	0.39	0.17	0.89	0.0248	0.90	0.60	1.36	0.6260
Pacific														
2	School decile (High)	Medium	0.45	0.05	3.94	0.4705	1.18	0.45	3.06	0.7367	0.64	0.27	1.55	0.3254
		Low	0.22	0.02	2.92	0.2500	1.93	0.75	4.99	0.1742	0.64	0.26	1.60	0.3399
3	School decile (High)	Medium	0.56	0.03	10.42	0.9592	1.04	0.39	2.82	0.4985	0.54	0.21	1.34	0.3456
		Low	0.35	0.02	7.39	0.5793	1.83	0.68	4.92	0.1285	0.59	0.23	1.52	0.5802
	Auckland school (Yes)	No	>999.999	0.37	>999.999	0.0787	10.15	0.99	103.89	0.0509	10.03	1.02	98.72	0.0482
	Type of admission (SL)*	AA	<0.001	<0.001	4.04	0.0861	**2.41**	1.08	5.38	**0.0318**	2.10	0.93	4.74	0.0738
4	School decile (High)	Medium	0.42	0.02	8.54	0.7790	1.05	0.38	2.89	0.4675	0.55	0.22	1.39	0.3934
		Low	0.39	0.02	7.68	0.7014	1.95	0.71	5.36	0.0986	0.59	0.23	1.53	0.5542
	Auckland school (Yes)	No	>999.999	<0.001	>999.999	0.8531	9.61	0.92	100.33	0.0586	10.26	1.04	100.84	0.0458
	Type of admission (SL)	AA	0.00	<0.001	>999.999	0.3474	1.31	0.49	3.49	0.5900	2.45	0.91	6.57	0.0757
	Bridging Programme (No)	Yes	<0.001	<0.001	>999.999	0.8833	2.72	1.08	6.90	0.0346	0.78	0.32	1.91	0.5900
6	School decile (High)	Medium	0.00	<0.001	>999.999	0.9213	0.83	0.29	2.41	0.4021	0.42	0.15	1.15	0.2969
		Low	0.57	<0.001	>999.999	0.9707	1.37	0.47	3.98	0.3260	0.42	0.15	1.17	0.3039
	Auckland school (Yes)	No	>999.999	<0.001	>999.999	0.7671	13.26	1.04	168.62	0.0464	15.49	1.34	179.10	0.0282
	Type of admission (SL)	AA	<0.001	<0.001	>999.999	0.8798	0.90	0.31	2.61	0.8523	1.76	0.59	5.19	0.3086
	Bridging Programme (No)	Yes	<0.001	<0.001	>999.999	0.7610	2.48	0.93	6.62	0.0707	0.66	0.25	1.75	0.3976
	1st Yr. Bach passed all (Yes)	No	>999.999	<0.001	>999.999	0.7640	0.97	0.32	2.95	0.9604	0.73	0.24	2.25	0.5887
	1st Yr. Bach GPA**	per point increase	>999.999	<0.001	>999.999	0.7219	**0.57**	0.38	0.84	**0.0046**	**0.47**	0.32	0.70	**0.0002**

Table 6 continued: Multiple regression analysis on predictors of graduation outcome compared to 'sub-optimal completion with high grades' (reference) for Māori (n= 150), Pacific (n= 257), and non-Māori non-Pacific students (n= 2279)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Non-Māori non-Pacific														
2	School decile (High)	Medium	1.06	0.82	1.37	0.6497	1.12	0.78	1.61	0.5368	0.90	0.70	1.16	0.4149
		Low	0.74	0.44	1.25	0.2566	0.78	0.36	1.68	0.5168	0.94	0.58	1.53	0.8121
3	School decile (High)	Medium	1.03	0.80	1.34	0.2350	1.15	0.80	1.65	0.2828	0.88	0.68	1.13	0.5491
		Low	0.71	0.42	1.20	0.1795	0.78	0.36	1.68	0.4076	0.93	0.58	1.51	0.9853
	Auckland school (Yes)	No	1.14	0.83	1.57	0.4284	0.61	0.35	1.07	0.0846	1.29	0.94	1.77	0.1157
	Type of admission (SL)	AA	1.52	1.11	2.07	0.0087	1.10	0.68	1.77	0.7059	1.10	0.79	1.53	0.5907
4	School decile (High)	Medium	1.03	0.80	1.34	0.2418	1.15	0.80	1.66	0.2596	0.88	0.68	1.13	0.5442
		Low	0.72	0.43	1.21	0.1875	0.76	0.35	1.64	0.3740	0.93	0.58	1.51	0.9946
	Auckland school (Yes)	No	1.14	0.83	1.57	0.4210	0.61	0.35	1.06	0.0787	1.29	0.94	1.77	0.1148
	Type of admission (SL)	AA	1.53	1.12	2.10	0.0075	1.06	0.65	1.71	0.8294	1.10	0.79	1.54	0.5784
	Bridging Programme (No)	Yes	0.83	0.46	1.51	0.5377	1.57	0.74	3.31	0.2412	0.95	0.56	1.62	0.8534
6	School decile (High)	Medium	1.19	0.90	1.57	0.2269	1.15	0.78	1.69	0.1258	0.88	0.68	1.14	0.5111
		Low	0.90	0.50	1.60	0.5013	0.59	0.26	1.34	0.1479	0.96	0.59	1.57	0.9254
	Auckland school (Yes)	No	1.08	0.76	1.53	0.6864	0.67	0.38	1.19	0.1717	1.27	0.92	1.75	0.1397
	Type of admission (SL)	AA	1.43	1.01	2.02	0.0425	1.13	0.67	1.88	0.6527	1.10	0.78	1.54	0.5872
	Bridging Programme (No)	Yes	0.96	0.50	1.87	0.9122	0.82	0.36	1.86	0.6283	0.77	0.45	1.32	0.3414
	1st Yr. Bach passed all (Yes)*	No	1.42	0.80	2.52	0.2317	0.84	0.50	1.42	0.5180	**2.75**	1.92	3.94	**<.0001**
	1st Yr. Bach GPA*	per point increase	**1.95**	1.77	2.15	**<.0001**	**0.49**	0.41	0.58	**<.0001**	1.08	0.99	1.18	0.0793

* 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 p-values were reported.

Total cohort comparison analysis – academic outcomes

Table 7 presents the linear and logistic regression analysis results for the three group comparison (Māori, Pacific, non-Māori non-Pacific). The main variable of interest is 'ethnic grouping' where results are presented comparing 1) Māori to non-Māori non-Pacific (reference group) and 2) Pacific to non-Māori non-Pacific (reference group). All models (#2 – 6) controlled for age, year of admission and gender (i.e. baseline model #1).

Comparison of Māori to non-Māori non-Pacific students

First year bachelor GPA

In the unadjusted model, Māori students achieved a mean first year bachelor GPA that was on average 1.06 points lower than that for non-Māori non-Pacific students ($p<0.0001$, CI: -1.37, -0.74). After adjusting sequentially for pathway variables through models #1 (baseline) – #4 , the difference in mean first year bachelor GPA between Māori and non-Māori non-Pacific students reduced to 0.67 points lower for Māori than non-Māori non-Pacific ($p=0.0002$, CI: -1.01, -0.32). Approximately 12% of the original difference in first year bachelor GPA between Māori and nMnP students was explained by school decile and approximately another 24% of this difference was reduced by adjusting for bridging foundation programme, leaving approximately 64% of this difference unexplained.

In the NCEA sub-cohort analysis (Appendix C, Table 9), similar findings were present with the difference in mean first year bachelor GPA being 0.87 points lower for Māori compared to nMnP students in the unadjusted model. Similarly, adjustment for baseline variables accounted for approximately 6% of this difference, school decile accounted for 10% of this difference and bridging foundation programme accounted for an additional 24% of this difference. In addition, inclusion of NCEA results in the multiple regression model explained a further 44% of this difference. The difference between Māori and nMnP student first year bachelor GPA was therefore no longer significantly different once controlling for NCEA results in the NCEA sub-cohort.

Year 2 – 4 programme GPA

Māori students achieved a year 2 – 4 programme GPA that was on average 0.86 points lower than non-Māori non-Pacific students in the unadjusted model ($p<0.0001$, CI: -1.14, -0.57). After adjusting for baseline variables, school decile, Auckland School, type of admission and bridging foundation programme (model #4), Māori students achieved a mean year 2 – 4 programme GPA that was on average 0.63 points lower than that of non-Māori non-Pacific students ($p<0.0001$, CI: -0.94, -0.32). After including first year bachelor results in the same model, the difference in mean year 2 – 4 programme GPA between Māori and non-Māori non-Pacific students was no longer significant.

The NCEA sub-cohort analysis (Appendix C, Table 9) showed similar results with year 2 – 4 programme GPA on average being 0.5 points lower for Māori NCEA students than that of nMnP NCEA students when adjusting for baseline variables (p=0.0276, CI: -0.90, -0.05). The difference between Māori and nMnP student year 2 – 4 programme GPA for NCEA students was no longer significant when adjusting for school decile in model #2.

Graduated from intended programme

In the unadjusted model, for Māori students, the odds of graduating from the intended programme were lower than the odds of graduating from intended programme for non-Māori non-Pacific students (OR=0.54, p=0.0013, CI: 0.38, 0.79). Although slightly reduced with adjustment for all other pathway variables, this difference in odds remained (OR=0.57, p=0.0083, CI: 0.38, 0.87) in Model #6.

In the NCEA sub-cohort analysis (Appendix C, Table 10), there was no significant difference in the odds of graduating from the intended programme between Māori and nMnP NCEA students at baseline.

Graduated in the minimum time

Of those students that graduated, in the unadjusted model, the odds of Māori students graduating in the minimum time were lower than that of non-Māori non-Pacific students (OR= 0.41, p=0.0494, CI: 0.37, 1.00). After including school decile in the same model (#2), the difference in odds of graduating in the minimum time between Māori and non-Māori non-Pacific students was no longer significant.

In the NCEA sub-cohort analysis (Appendix C, Table 10), there was no significant difference in the odds of graduating in the minimum time between Māori and nMnP NCEA students at baseline.

Comparison of Pacific to non-Māori non-Pacific students

First year bachelor GPA

In the unadjusted model and baseline models, Pacific students achieved a mean first year bachelor GPA that was on average 1.86 points lower than that of non-Māori non-Pacific students (p<0.0001, CI: -2.10, -1.61). In model #2, the mean difference in first year bachelor GPA reduced but was still 1.67 points lower for Pacific students indicating that school decile accounted for 10.2% of this mean difference (p<0.0001, CI: -1.95, -1.39). With adjustment for Auckland School and type of admission (model #3), the mean difference between Pacific and nMnP first year bachelor GPA reduced further to 1.66 points lower for Pacific (p<0.0001, CI: -1.94, -1.38). After adjusting for all pathway variables, the difference in mean first year bachelor GPA between Pacific and non-Māori non-Pacific students reduced to 1.35 points lower for Pacific than non-Māori non-Pacific (p=<0.0001, CI: -1.65, -1.05). Overall, 10.2% of the mean difference was explained by school decile, 0% by baseline variables, 0.5% by Auckland school and type of admission, and 10.7% by bridging programme, leaving a remaining 72.6% of the difference unexplained.

When the same analysis was repeated for the NCEA sub-cohort (Appendix C, Table 9), similar results were seen. The unadjusted difference between Pacific and nMnP student first year bachelor GPA was 1.73 points lower for Pacific compared to nMnP. Baseline variables accounted for 4.6% of this mean difference, school decile accounted for 12.1%, Auckland school and type of admission 0.6%, and bridging programme 14.4%, leaving 68.3% of the mean difference in first year bachelor GPA between Pacific and nMnP students in the NCEA cohort unexplained. Of interest however, was the inclusion of NCEA school results which further reduced the mean difference in first year bachelor GPA from 1.17 to only 0.47 points lower for Pacific compared to nMnP in model #5 accounting for a further 41.0% of the mean difference and leaving only 27.2% of the mean difference unexplained by the predictors of interest.

Year 2 – 4 programme GPA

Pacific students achieved a year 2–4 programme GPA that was on average 1.73 points lower than non-Māori non-Pacific students in the unadjusted model ($p<0.0001$, CI: -1.95, -1.51). After adjusting for all pathway variables (i.e. baseline variables, school decile, Auckland School, type of admission, bridging foundation programme, and first year bachelor results) (model #6), Pacific students achieved a mean year 2 – 4 programme GPA that was on average 0.57 points lower than that of non-Māori non-Pacific students ($p<0.0001$, CI: -0.78, -0.36). Showing similar patterns to first year bachelor GPA; 0.6% of the mean difference in year 2 – 4 programme GPA between Pacific and nMnP students was explained by baseline variables, 9.8% explained by school decile, 2.9% by Auckland school and type of admission, 9.2% by bridging programme, and 44.5% was explained by first year bachelor results; leaving 33% unexplained by predictor variables in this analysis.

When the same analysis was repeated for the NCEA cohort only (Appendix C, Table 9), the difference in year 2 – 4 programme GPA between Pacific and nMnP students was no longer significant in model #5 ($p=0.0754$) with NCEA school results accounting for a further 18.1% of the mean difference (model #5, see Appendix C, Table 10).

Overall, considering both full and NCEA student cohort results; school results accounted for a large portion of the disparity in first year bachelor GPA and year 2 – 4 programme GPA between Pacific and nMnP students, followed by bridging programme and school decile. Auckland school and baseline variables had minimal effect. Further, first year bachelor results then become important for predicting disparities in academic performance in GPA between Pacific and nMnP students in subsequent years.

Graduated from intended programme

In the unadjusted model, the odds for Pacific students of graduating from their intended programme were lower than that of non-Māori non-Pacific students (OR=0.62 $p=0.0007$, CI: 0.46, 0.82). With adjustment for baseline and pathway variables (model #4), this difference in odds remained (OR= 0.41, $p=0.0103$, CI: 0.42, 0.89). After

adjusting for first year bachelor results in the same model (#6), the difference in odds between Pacific and non-Māori non-Pacific students was no longer significant.

In the NCEA sub-cohort analysis (Appendix C, Table 10), there was no significant difference in the odds of graduating from the intended programme between Pacific and nMnP NCEA students at baseline.

Graduated in the minimum time

Of those students that graduated, in the unadjusted model, the odds of Pacific students graduating in the minimum time were lower than that of non-Māori non-Pacific students (OR= 0.39, p<0.0001, CI: 0.27, 0.55). After adjusting for baseline variables, school decile, Auckland school and type of admission (Model #3), this difference reduced slightly (OR= 0.45, p=0.0002, CI: 0.29, 0.69). After including bridging foundation programme in the same model (#4), the difference in odds of graduating in the minimum time between Pacific and non-Māori non-Pacific students was no longer significant.

The NCEA sub-cohort analysis (Appendix C, Table 10), showed similar results with the odds of graduating in the minimum time being lower for Pacific NCEA students than nMnP NCEA students when adjusting for baseline variables (OR= 0.43, p=0.0024, CI: 0.25, 0.74). There was no longer a significant difference in the odds of graduating in the minimum time between Pacific and nMnP NCEA students after adjusting for Auckland school and type of admission (model #3).

Table 7: Multiple regression analysis on predictors of academic outcomes for full cohort (n=2686).

Model	Predictor variables (ref)	Comparison	First year Bachelor GPA				Year 2 – 4 programme GPA				Graduated from intended programme				Graduated in minimum time (n=2059)			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Unadjusted	Ethnicity grouping (nMnP)	Māori	-1.06	-1.37	-0.74	<.0001	-0.86	-1.14	-0.57	<.0001	0.54	0.38	0.77	0.0006	0.61	0.37	1.00	0.0494
		Pacific	-1.86	-2.10	-1.61	<.0001	-1.73	-1.95	-1.51	<.0001	0.62	0.46	0.82	0.0007	0.39	0.28	0.56	<.0001
Baseline	Ethnicity grouping (nMnP)	Māori	-1.07	-1.38	-0.75	<.0001	-0.84	-1.12	-0.56	<.0001	0.55	0.38	0.79	0.0013	0.59	0.35	0.99	0.0438
		Pacific	-1.86	-2.10	-1.61	<.0001	-1.72	-1.93	-1.50	<.0001	0.61	0.46	0.81	0.0008	0.39	0.27	0.55	<.0001
2	Ethnicity grouping (nMnP)	Māori	-0.93	-1.26	-0.60	<.0001	-0.75	-1.05	-0.46	<.0001	0.54	0.37	0.80	0.0019	0.62	0.36	1.06	0.0804
		Pacific	-1.67	-1.95	-1.39	<.0001	-1.55	-1.79	-1.30	<.0001	0.64	0.46	0.90	0.0108	0.41	0.27	0.62	<.0001
	School decile (High)	Medium	-0.13	-0.30	0.04	0.1218	-0.01	-0.16	0.14	0.9306	1.08	0.87	1.34	0.4839	1.02	0.76	1.37	0.8877
		Low	-0.53	-0.81	-0.26	0.0001	-0.31	-0.55	-0.07	0.0129	1.15	0.81	1.62	0.4430	0.75	0.48	1.15	0.1799
3	Ethnicity grouping (nMnP)	Māori	-0.94	-1.28	-0.61	<.0001	-0.77	-1.07	-0.47	<.0001	0.57	0.39	0.85	0.0056	0.64	0.37	1.10	0.1080
		Pacific	-1.66	-1.95	-1.38	<.0001	-1.50	-1.76	-1.25	<.0001	0.67	0.47	0.94	0.0220	0.45	0.29	0.69	0.0002
	School decile (High)	Medium	-0.14	-0.31	0.03	0.1078	-0.02	-0.17	0.13	0.8225	1.10	0.88	1.37	0.3959	1.02	0.76	1.37	0.8891
		Low	-0.53	-0.81	-0.26	0.0001	-0.30	-0.54	-0.06	0.0161	1.17	0.83	1.66	0.3745	0.77	0.50	1.18	0.2272
	Auckland school (Yes)	No	0.07	-0.15	0.28	0.5440	0.14	-0.05	0.32	0.1570	0.88	0.68	1.15	0.3563	1.05	0.72	1.54	0.7871
	Type of admission (SL)	AA	0.00	-0.21	0.20	0.9732	-0.10	-0.28	0.09	0.3010	0.86	0.66	1.11	0.2314	0.75	0.54	1.04	0.0842
4	Ethnicity grouping (nMnP)	Māori	-0.67	-1.01	-0.32	0.0002	-0.63	-0.94	-0.32	<.0001	0.53	0.36	0.81	0.0027	1.01	0.56	1.85	0.9632
		Pacific	-1.35	-1.65	-1.05	<.0001	-1.34	-1.61	-1.07	<.0001	0.61	0.42	0.89	0.0103	0.73	0.45	1.19	0.2091
	School decile (High)	Medium	-0.13	-0.29	0.04	0.1419	-0.01	-0.16	0.14	0.8856	1.10	0.88	1.36	0.4206	1.02	0.76	1.37	0.9156
		Low	-0.47	-0.74	-0.19	0.0008	-0.26	-0.51	-0.02	0.0339	1.15	0.81	1.63	0.4347	0.84	0.54	1.32	0.4511
	Auckland school (Yes)	No	0.08	-0.13	0.29	0.4398	0.15	-0.04	0.33	0.1301	0.88	0.67	1.15	0.3409	1.10	0.75	1.62	0.6183
	Type of admission (SL)	AA	0.14	-0.07	0.34	0.1969	-0.02	-0.21	0.16	0.8016	0.82	0.63	1.07	0.1481	0.97	0.68	1.38	0.8547
	Bridging Programme (No)	Yes	-0.84	-1.12	-0.55	<.0001	-0.43	-0.68	-0.17	0.0011	1.24	0.87	1.77	0.2397	0.30	0.19	0.48	<.0001
6	Ethnicity grouping (nMnP)	Māori					-0.25	-0.49	-0.01	0.0383	0.57	0.38	0.87	0.0083	1.23	0.66	2.30	0.5200
		Pacific					-0.57	-0.78	-0.36	<.0001	0.77	0.52	1.12	0.1733	1.12	0.67	1.87	0.6637
	School decile (High)	Medium					0.06	-0.06	0.18	0.3050	1.11	0.88	1.38	0.3810	1.07	0.79	1.46	0.6466
		Low					0.00	-0.19	0.19	0.9979	1.21	0.85	1.73	0.2998	0.99	0.62	1.58	0.9633
	Auckland school (Yes)	No					0.10	-0.05	0.24	0.1811	0.88	0.67	1.16	0.3598	1.08	0.72	1.61	0.7126
	Type of admission (SL)	AA					-0.10	-0.24	0.04	0.1661	0.82	0.63	1.06	0.1323	0.89	0.61	1.30	0.5482
	Bridging Programme (No)	Yes					0.06	-0.14	0.26	0.5428	1.49	1.03	2.14	0.0328	0.43	0.26	0.69	0.0006
	1st Yr. Bach passed all (Yes)	No					-0.08	-0.24	0.08	0.3001	0.49	0.36	0.66	<.0001	0.77	0.52	1.13	0.1859
	1st Yr. Bach GPA	per pt increase					0.56	0.52	0.60	<.0001	1.03	0.96	1.11	0.4243	1.43	1.28	1.59	<.0001

Linear 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 mean difference (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Total cohort comparison analysis – composite outcome

Table 8 presents the logistic regression analysis results for sequentially adjusted models comparing three groups (Māori compared to nMnP, Pacific compared to non-Māori non-Pacific) for the odds of achieving a composite graduation outcome of optimal completion, sub-optimal completion with low grades, or non-completion compared to the odds of achieving a sub-optimal completion with high grades.

Comparison of Māori to non-Māori non-Pacific

The unadjusted model shows that the odds of Māori students achieving an optimal completion were lower (OR=0.52, p=0.0258, CI: 0.29, 0.92), whilst the odds of achieving a sub-optimal completion with low grades (OR=1.89, p=0.0161, CI: 1.13, 3.19) or a non-completion outcome, were higher (OR=1.58, p=0.0213, CI: 1.07, 2.34) relative to achieving a suboptimal completion with high grades when compared to the odds of achieving the same results for non-Māori non-Pacific students. After adjusting for baseline and pathway variables (model #4) the odds of Māori students achieving an optimal completion outcome rather than a sub-optimal completion with high grades was still lower than that of non-Māori non-Pacific students (OR=0.49, p=0.0329, CI: 0.26, 0.94). After adjusting for first year bachelor results in the same model, the difference in graduation outcomes was no longer significantly different between Māori and non-Māori non-Pacific students. This suggests that the first year of bachelor study is an important determinant of disparity in overall academic success between Māori and nMnP students. In the NCEA sub-cohort analysis (Appendix C, Table 11), there was no significant difference in the odds of achieving optimal completion outcomes between Māori and nMnP NCEA students at baseline.

Comparison of Pacific to non-Māori non-Pacific

The unadjusted model shows that the odds of Pacific students achieving optimal completion were lower (OR=0.15, p<0.001, CI: 0.06, 0.33), whilst the odds of achieving a sub-optimal completion with low grades (OR=4.21, p<0.0001, CI: 3.00, 5.93) or non-completion were higher (OR=1.72, p=0.0008, CI: 1.25, 2.35) relative to achieving a suboptimal completion with high grades when compared to the odds of achieving the same results for non-Māori non-Pacific students. Sequential inclusion of pathway variables school decile, Auckland school, type of admission, bridging foundation programme and first year bachelor results accounted partially for this difference in odds between Pacific and non-Māori non-Pacific students. However, after controlling for all pathway variables (model #6), the odds of achieving an optimal completion rather than a sub-optimal was still lower for Pacific students than that of non-Māori non-Pacific students (OR=0.38, p=0.0315, CI: 0.16, 0.92). In Model #6, the odds ratio of achieving a sub-optimal completion with low grades relative to a sub-optimal completion with high grades was 1.76 (p=0.0211, CI: 1.09, 2.86) for Pacific students when compared to non-Māori non-Pacific students.

In the NCEA sub-cohort analysis (Appendix C, Table 11), similar results were seen with the odds of Pacific NCEA students achieving an optimal completion relative to sub-optimal completion with high grades remaining lower

in the unadjusted model (OR = 0.15, CI: 0.05, 0.49, p= 0.0017) and Model #4 (OR = 0.18, CI: 0.05, 0.62, p= 0.0062), when compared to the odds of achieving the same result for nMnP NCEA students. The difference in odds of achieving an optimal completion outcome between Pacific and nMnP NCEA students was no longer significant with further adjustment for NCEA results in model #5. This indicates that NCEA school results are important predictors of the disparity between Pacific and nMnP student overall academic success for those students with NCEA results.

Table 8: Multiple regression analysis on predictors of graduation outcome compared to 'sub-optimal completion with high grades' (reference) for full cohort (n=2686)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Unadjusted	Ethnicity grouping (nMnP)	Māori	**0.52**	0.29	0.92	**0.0258**	**1.89**	1.13	3.19	**0.0161**	**1.58**	1.07	2.34	**0.0213**
		Pacific	**0.15**	0.06	0.33	**<.0001**	**4.21**	3.00	5.93	**<.0001**	**1.72**	1.25	2.35	**0.0008**
Baseline*	Ethnicity grouping (nMnP)	Māori	**0.49**	0.27	0.88	**0.0174**	**1.87**	1.10	3.17	**0.0200**	**1.55**	1.04	2.32	**0.0334**
		Pacific	**0.14**	0.06	0.32	**<.0001**	**4.30**	3.04	6.09	**<.0001**	**1.71**	1.24	2.37	**0.0011**
2	Ethnicity grouping (nMnP)	Māori	**0.47**	0.25	0.87	**0.0162**	1.57	0.90	2.75	0.1148	1.48	0.96	2.26	0.0732
		Pacific	**0.16**	0.07	0.38	**<.0001**	**3.86**	2.60	5.75	**<.0001**	**1.55**	1.06	2.25	**0.0232**
	School decile (High)	Medium	1.04	0.82	1.34	0.7366	1.11	0.80	1.53	0.5393	0.91	0.72	1.16	0.4554
		Low	0.79	0.50	1.27	0.3364	1.42	0.91	2.21	0.1262	0.90	0.62	1.31	0.5852
3	Ethnicity grouping (nMnP)	Māori	**0.42**	0.22	0.78	**0.0066**	1.55	0.87	2.75	0.1336	1.36	0.88	2.10	0.1674
		Pacific	**0.15**	0.06	0.35	**<.0001**	**3.43**	2.26	5.19	**<.0001**	**1.49**	1.01	2.20	**0.0435**
	School decile (High)	Medium	1.01	0.79	1.30	0.9411	1.11	0.80	1.54	0.5386	0.89	0.70	1.13	0.3320
		Low	0.76	0.48	1.23	0.2647	1.36	0.87	2.13	0.1812	0.88	0.60	1.28	0.4924
	Auckland school (Yes)	No	1.21	0.89	1.64	0.2244	0.84	0.55	1.31	0.4451	1.24	0.93	1.65	0.1522
	Type of admission (SL)	AA	**1.47**	1.09	1.98	**0.0123**	1.43	0.99	2.05	0.0580	1.24	0.93	1.65	0.1387
4	Ethnicity grouping (nMnP)	Māori	**0.49**	0.26	0.94	**0.0329**	1.16	0.63	2.14	0.6305	1.38	0.88	2.17	0.1588
		Pacific	**0.18**	0.08	0.43	**0.0001**	**2.59**	1.64	4.09	**<.0001**	**1.52**	1.01	2.29	**0.0430**
	School decile (High)	Medium	1.01	0.79	1.30	0.9159	1.10	0.79	1.52	0.5901	0.89	0.70	1.13	0.3406
		Low	0.78	0.49	1.26	0.3154	1.28	0.81	2.01	0.2941	0.88	0.60	1.29	0.5029
	Auckland school (Yes)	No	1.22	0.90	1.66	0.2043	0.82	0.53	1.27	0.3717	1.24	0.93	1.66	0.1488
	Type of admission (SL)	AA	**1.51**	1.12	2.05	**0.0073**	1.15	0.78	1.71	0.4831	1.26	0.94	1.68	0.1264
	Bridging Programme (No)	Yes	0.59	0.34	1.03	0.0639	**2.15**	1.36	3.40	**0.0011**	0.94	0.64	1.39	0.7709
6A	Ethnicity grouping (nMnP)	Māori	0.80	0.41	1.57	0.5148	1.04	0.54	1.98	0.9177	1.34	0.85	2.12	0.2120
		Pacific	**0.38**	0.16	0.92	**0.0315**	**1.76**	1.09	2.86	**0.0211**	1.29	0.85	1.96	0.2323
	School decile (High)	Medium	1.16	0.89	1.53	0.2789	1.03	0.73	1.45	0.8821	0.89	0.70	1.13	0.3327
		Low	0.99	0.59	1.67	0.9778	1.03	0.64	1.66	0.8978	0.85	0.58	1.25	0.4088
	Auckland school (Yes)	No	1.16	0.83	1.62	0.3829	0.84	0.53	1.33	0.4443	1.23	0.91	1.65	0.1740
	Type of admission (SL)	AA	1.39	1.00	1.94	0.0521	1.12	0.73	1.72	0.5959	1.26	0.94	1.69	0.1237
	Bridging Programme (No)	Yes	0.73	0.40	1.32	0.2990	1.44	0.88	2.35	0.1503	0.80	0.54	1.19	0.2748
	1st Yr. Bach passed all (Yes)	No	1.44	0.85	2.47	0.1797	0.87	0.56	1.34	0.5213	**2.31**	1.68	3.17	**<.0001**
	1st Yr. Bach GPA	per point increase	**1.94**	1.77	2.13	**<.0001**	**0.54**	0.47	0.62	**<.0001**	1.01	0.93	1.09	0.8663

* Cumulative 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 p-values were reported.

Summary of findings

This research explored the predictive effects of select predictor variables on academic outcomes in the BHSc, BNurs, and BPharm programmes at the University of Auckland for Māori, Pacific, and non-Māori non-Pacific student ethnic groupings.

Description of Māori, Pacific and non-Māori non-Pacific student cohorts

Clear differences were identified between nMnP and the Māori or Pacific student ethnic groups for all variables explored. Māori and Pacific students are more likely to have attended lower decile schools, gain admission via bridging foundation programmes, and have lower secondary school qualifications including lower achievement in science subjects. Māori students are more likely to move to Auckland to study and have a higher mean age at admission. Differences in academic outcomes were highlighted between Māori and Pacific, and nMnP students. Non-Māori non-Pacific students had higher rates of graduation, had a higher proportion of students who completed their programme of study in the minimum time, and achieved higher first year and year 2 – 4 programme GPA scores compared to Māori and Pacific student groups. Non-Māori non-Pacific students also had a higher proportion of students who achieved optimal outcomes, and a lower proportion of students who failed to complete their tertiary health programme, or achieved sub-optimal completion with low grades when compared to Māori or Pacific students.

Predictors of academic outcomes for Māori students

School decile, bridging programme, first year bachelor GPA and Auckland school were all important predictors of academic outcomes for Māori students. Māori students who attended low decile schools and had completed a bridging programme achieved lower first year bachelor GPA results than those Māori students who attended high decile schools and did not complete bridging programmes. Attending a low decile school was detrimental, whilst achieving a higher first year bachelor GPA was beneficial to year 2 – 4 programme GPA for Māori students. Type of admission was not a significant predictor of academic outcomes for Māori students. None of the predictor variables of interest reached significance levels for graduated from intended programme.

Predictors of academic outcomes for Pacific students

School decile, type of admission, bridging programme and first year bachelor GPA were important predictors of academic outcomes for Pacific students. Pacific students who had attended low decile schools or had gained entry via alternative admission achieved first year bachelor GPA results that were lower than those Pacific students who attended high decile schools or gained entry as direct school leavers. Achieving a higher first year bachelor GPA and gaining entry as a school leaver was then predictive of achieving a higher year 2–4 programme GPA and graduating from the intended programme. Bridging programme had some effect on 'graduating in the minimum time', however did not reach levels of significance at p<0.05 when adjusting for all other variables.

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Auckland school and passing all courses in first year were not significant predictors for Pacific student academic outcomes.

Predictors of academic outcomes for non-Maori non-Pacific students

School decile, type of admission, bridging programme, passing all courses in 1st year and first year bachelor GPA were all important predictors of academic outcomes for nMnP students. Those non-Māori non-Pacific student who completed bridging foundation programmes achieved lower first year bachelor GPA scores compared to those nMnP students who did not complete bridging programmes whilst those nMnP students who gained entry via alternative admission achieved higher first year bachelor GPA scores compared with those nMnP school leavers. Non-Māori non-Pacific students who achieved higher first year GPA scores were more likely to achieve a higher year 2 – 4 programme GPA whilst those nMnP students who passed all courses in the first year of bachelor level study had higher odds of graduating from their intended programme.

Predictors of academic outcomes for the total cohort with ethnicity as a predictor

Clear differences in academic outcomes were demonstrated between both Māori and Pacific student ethnic groupings when compared to non-Māori non-Pacific students. Some of the disparities between ethnic groupings were explained by controlling for other predictor variables (school decile, Auckland school, type of admission, bridging programme, first year bachelor GPA, first year passed all courses) in the same analysis model. Importantly, not all of the disparate outcomes were explained by adjusting for the predictor variables of interest. For example, both Māori and Pacific student groups achieved a significantly lower first year bachelor GPA compared to nMnP after controlling for school decile, Auckland school, type of admission, and bridging programme.

Chapter summary

This chapter has presented the findings of this research. Descriptive summaries were provided for Māori, Pacific and non-Māori non-Pacific student groupings. Multiple regression analysis results were presented that identified predictors of success for Māori, Pacific and non-Māori non-Pacific student groupings. The relationship between predictor variables and disparities in academic outcomes between ethnic groupings were explored. Additional findings of relevance within the additional NCEA sub-group analysis were presented with supporting information located in Appendix C. The next chapter will provide discussion pertaining to the research findings in the context of current literature with interpretation from a Kaupapa Māori world view.

Introduction

The findings of this research provide valuable quantitative data that depict student profiles by ethnic grouping and reveal the academic inequities (re)produced within the FMHS. In general, these findings show that Māori and Pacific students gain entry to FMHS bachelor level programmes with pre-tertiary, admission, and early academic characteristics that provide significant barriers to academic success within health study. The implications of these barriers are demonstrated in the disparate academic outcomes identified within this study. Contrary to this, non-Māori non-Pacific students have significantly fewer barriers to academic success, or rather, FMHS programmes are provided in a way where the characteristics of nMnP students are beneficial rather than hindering to academic success. Whilst some barriers are explained or mediated by the predictor variables examined, some disparities in academic achievement between ethnic groups remain. These findings are important for tertiary institutions providing health professional programmes to inform appropriate delivery of education that meets the needs of all students. In this chapter, important points foregrounded by the research findings will be discussed within the context of the available literature. Strengths and limitations of the research, and other points of interpretation of the data, will then be outlined.

Discussion points

Know your cohort - acknowledging fundamental differences between student cohorts

The findings of this research identify fundamental differences between student ethnic group cohorts, for example, Māori and Pacific students are more likely to have attended lower decile schools, gain admission via bridging foundation programmes, have lower secondary school qualifications including lower achievement in science subjects, and Māori students are more likely to be older and have attended school outside Auckland, when compared with nMnP students. The finding that Māori students are slightly older at admission is consistent with literature in this area (Future Workforce DHBNZ, 2009) and is likely to reflect participation in bridging foundation programmes or other pathways prior to entry that increase the amount of time between leaving school and bachelor level programme admission. These research findings indicate that each student ethnic grouping (in particular Māori and Pacific students) is likely to experience a different mix of barriers to academic success depending on the tertiary environment and its responsiveness to such socio-demographic factors (E. Curtis, Wikaire, et al., 2014; Future Workforce DHBNZ, 2009; M Ratima et al., 2008). Institutions therefore need to consider the contextual realities of all students they serve and ensure delivery of programme content and institutional environments in a way that aims to address such barriers in a comprehensive manner (E. Curtis, Reid, et al., 2014; E. Curtis et al., 2012).

In this thesis, detailed descriptions of each of the Māori, Pacific and nMnP student ethnic groupings are presented. These data provide valuable information that extends beyond simply reporting indigenous and/or minority student enrolment numbers (Usher, Lindsay, & Mackay, 2005; Wadenya & Lopez, 2008) to describe pre-tertiary socio-demographic and academic achievement characteristics for each ethnic grouping (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). Specific values (e.g. average NCEA Rank score) and proportions (e.g. 95% of Pacific students attended school in Auckland) are presented that were previously unknown for this student cohort. While some national data are available that show rates of achievement of University Entrance by ethnic group for New Zealand school leavers, higher or more detailed academic data such as average NCEA Rank score or subject results for school leavers are not routinely provided or published (Education Counts, 2014). It is therefore difficult to know whether the findings of this research align with national data. The findings of this research subsequently provide novel and useful data that can inform secondary and tertiary education sectors.

Māori and Pacific together or separately?

Our findings clearly show both similarities and differences between Māori and Pacific student groups. The critical Kaupapa Māori lens of this research aimed to expose differences between dominant (nMnP) and non-dominant (Māori and Pacific) student groups, providing a critique of structural inequities that might perpetuate academic disparities between these groups. This research has shown many differences between these two groups, highlighting not only lower levels of academic success for Māori and Pacific students, but also overrepresentation, and higher levels of academic success and privileging of the nMnP student grouping. It is important to shift the focus from minority to majority groups, to expose the inevitable opposite of what happens at the margins of society (R. Bishop, 2003; L. Smith, 2012). In addition, we must also acknowledge the difference in findings between Māori and Pacific students. There are both benefits and disadvantages of presenting results either combined or separately for Māori and Pacific student groups. Combined, Māori and Pacific data may increase analytical power, and provide clear binary differences between the indigenous/ethnic minority groups of interest and dominant ethnic groupings. Separately, this research provides much needed information for both Māori and Pacific student groups, and acknowledges the specific experiences and needs of both of these groups. However, when presented separately, there is also risk of interpretation that again focusses on comparing minorities (Māori versus Pacific) as opposed to exposing power struggles. Caution in interpretation of these findings must be taken to ensure a default position from an institutional perspective is not taken whereby the single ethnic group with the highest degree of academic difficulty (e.g. Pacific students) is targeted as the 'problem area' whilst other groups also experiencing academic difficulty to a slightly lesser extent (e.g. Māori students) are inevitably side-lined as being 'less critical'. Focus should therefore remain on addressing disparities between dominant and non-dominant student ethnic groups as this ensures all non-dominant ethnic group needs are addressed.

Lifting above expectations – what academic preparation for health study really means

The findings of this study show that a significant proportion of disparate academic outcomes in tertiary health programmes can be attributed to inadequate academic preparation and secondary school achievement prior to admission. These findings align with Engler (2010b) who found that Māori and Pacific students had lower levels of achievement in NCEA, and therefore, were less well prepared for tertiary study (Engler, 2010b). Whilst inadequate academic preparation for tertiary study has been acknowledged previously (E. Curtis et al., 2012; Engler, 2010b; Madjar et al., 2010b; M Ratima et al., 2008; Scott, 2008; Wikaire & Ratima, 2011), this study's findings show that entry into tertiary study in health professional programmes demands entry prerequisites that are far over and above those required for other tertiary education programmes (The University of Auckland, 2014a, 2015e; University of Otago, 2015). Secondary school students are taught to aim for achieving University Entrance (as the minimum requirement for tertiary education entry) (Madjar et al., 2010b); however, FMHS programmes require secondary school qualifications that far exceed this level of education (The University of Auckland, 2014a). Secondary schools often fail to produce a cohort of Māori and Pacific students that a) are able to meet these high academic prerequisites and b) include sufficient numbers for selection (Madjar et al., 2010b; Yuan et al., 2010).

The extent to which these high entry requirements impact on the characteristics of the student cohort chosen for admission are demonstrated by the low number of nMnP students from low decile schools who gain entry into FMHS programmes, indicating that such entry requirements privilege those students from medium and high decile schools. This high entry criteria puts added pressure on Māori and Pacific students to meet these additional admission requirements in a secondary education context where their retention until year 13 and taking science subjects is limited (Ministry of Health, 2014b).

The context of these research findings necessitates discussion about the meaning of *preparation* for bachelor level health study. It seems that academic preparation required for FMHS study is not simply meeting high prerequisite qualifications, but also obtaining a mixture of specific knowledge, skills, and experiences that boost readiness for bachelor level study (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015). This includes a combination of factors associated with tertiary learning environments in general (e.g. knowledge of course content, exposure to learning environments, readiness for student life), and insider knowledge specific to health study contexts (e.g. heavy science content and high workload expectations) (E. Curtis, Wikaire, Jiang, McMillan, Loto, Airini, et al., 2015; E. Curtis et al., 2012). Tertiary institutions often rely on parents and families to share such information through their own past experiences, however Māori and Pacific students are more likely to be the first in their family to have attended university and hence are less likely to have role models or whānau to share this career information with them (Future Workforce DHBNZ, 2009). A future workforce report by District Health Boards New Zealand noted that *"Māori first-generation tertiary students can be faced with greater challenges, as they are settling into an environment with which their whānau is unfamiliar"* (p. 9) (Future

Workforce DHBNZ, 2009). This inevitably leaves students reliant on career advisors who have been noted to take a deficit analysis and provide inadequate career information to minority students (Chesters et al., 2009).

It seems there are clear gaps between the level of academic preparation achieved (or not) by secondary schools (often limited to university entrance), and the level expected by tertiary institutions (Engler, 2010a; Ministry of Education, 2009). It is therefore important to monitor this issue over time to ensure narrowing of these gaps.

Bridging foundation programmes

Given these large gaps in academic preparation, it is no surprise that nearly half of each of the Māori and Pacific student cohorts in this study completed bridging foundation programmes prior to bachelor level entry compared to only 5% of nMnP students. For these students, bridging foundation programmes provide a valuable pathway through which bachelor level health study can be accessed for those students who do not meet bachelor level direct entry criteria.

The current study findings showed mixed results when exploring the effects of bridging programme participation on 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, Coxon, Anderson, & Anae, 2006), as well as positive effects of the bridging programme itself (i.e. aiming to address these gaps) (Madjar et al., 2010b). For example, participation in a bridging programme in this study was predictive of achieving a lower first year GPA for Māori and non-Māori student groups. Note that the majority of those Māori and Pacific students who completed a bridging programme in this study had completed the Certificate in Health Sciences programme, 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 (E. Curtis, Wikaire, Jiang, McMillan, Loto, Fonua, et al., 2015). Therefore, the findings of this study may be a reflection of gaps in academic preparation prior to bridging foundation programme entry, rather than a reflection of the bridging programme itself.

Conversely, given that participation in a bridging foundation programme was not a significant predictor of likelihood to graduate and graduating in the minimum time for Māori, Pacific or non-Māori non-Pacific student groups, this may mean a degree of levelling has occurred between bridging foundation programme students and direct entry students. These findings are consistent with other studies that showed participation in bridging programmes was predictive of higher rates of admission and programme completion when compared to similar students who did not complete bridging programmes (Strayhorn, 1999, 2000; Sutherland et al., 2007).

Overall, 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. Within a broader New

Zealand context however, it is important to consider additional risks that participation in bridging foundation programmes may pose in a policy context. For example, policy moves to 'time restrict' access to education, loans and allowances in New Zealand are detrimental to Māori and Pacific students who are likely to require this extra bridging foundation year of tertiary study (ONE News, 2015; Studylink, 2014).

Daily struggles in tertiary environments – transitioning into racialised 'climates'

The findings of this study reinforce the importance of the first year of bachelor study as having a significant impact on academic results throughout tertiary health programmes. These results show that first year academic results are 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 a key transitioning point through which Māori and Pacific students must meet and overcome multiple challenges (Madjar et al., 2010b; Sapoaga et al., 2013; Scott, 2008). As described previously, the first year of tertiary 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 (E. Curtis, Wikaire, et al., 2014; E. Curtis et al., 2012; Madjar et al., 2010b; Orom et al., 2013; M Ratima et al., 2008). Although support for transitioning students from secondary school into bridging foundation programmes and / or to gain entry into bachelor programmes is essentially a wrap-around intervention (E. Curtis & Reid, 2013), particular attention is required throughout the first (and subsequent) year(s) of bachelor level study to ensure retention of Māori and Pacific students once admitted.

The findings of this study demonstrate that after adjusting for predictor variables, some of the inequities in academic outcomes between Māori or Pacific and non-Māori non-Pacific students are no longer statistically significant. The positioning of these predictor variables prior to or early on in tertiary education context 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 (E. Curtis, Wikaire, et al., 2014; Garvey et al., 2009), hence even equitable academic outcomes do not guarantee culturally safe and enjoyable experiences through tertiary study. Mayeda (2014) interviewed Māori and Pacific students across University of Auckland faculties about their experiences within the institution. These students shared many examples of both overt and subtle racist remarks often made by non-Māori non-Pacific student peers and teaching staff (Mayeda, Keil, Dutton, & 'Ofamo'oni, 2014). In the FMHS context, Burgess also highlights the importance of supporting transition, and re-establishing cohort connections between years 1 and 2 of study, with year 1 operating as a key access point for students to pursue study in specific programmes such as pharmacy and medicine. Hence, initially established Māori and Pacific student networks in year 1 may be subject to separation, and require re-connection with slightly different 'sub-cohorts' in year 2 (Burgess, 2014).

The role of the university

In the context of the pipeline framework for Māori and Pacific health workforce development (Acosta & Olsen, 2006; Alexander, Chen, & Grumbach, 2009; E. Curtis et al., 2012), the scrutiny of responsibility for ensuring student success at secondary school (and preparation for tertiary study) has focussed on the secondary education sector (F Sopoaga et al., 2013; Ussher, 2008). The tertiary sector however, surely has a key role to play in facilitating this success (Drysdale et al., 2006; The Sullivan Commission, 2004). The current approach of the health faculty has been to set high entry requirements, enabling selection of the most qualified students (largely those from high decile schools) from the available pool (although the MAPAS admission process has provided an alternative entry pathway for admission through the CertHSc for those Māori and Pacific students not meeting general entry criteria). This approach has been fuelled by high demand for places within programmes (D. Edwards, Friedman, & Pearce, 2013; Poole, Moriarty, Wearn, Wilkinson, & Weller, 2009). In the FMHS context, this approach may have allowed the institution to set the teaching and learning curriculum at a high standard generally, and therefore perhaps inadvertently eliminated the need to address the educational needs of those students who may not have attended high decile schools. Given that detailed data reporting is rarely broken down by ethnic group, opportunity to monitor and critique the institution has also been limited. This approach might also be seen as a way of maintaining and facilitating elitism, that is, those students who are more likely to succeed academically are also those more likely to come from higher socioeconomic backgrounds, a trend that has been identified internationally (Social Mobility & Child Poverty Commission, 2013).

An international report exploring widening participation in European universities noted that *"There has been no improvement in participation at the most selective universities among the least advantaged young people … and the most advantaged young people are seven times more likely to attend the most selective universities as the most disadvantaged"* (P. 5) (Social Mobility & Child Poverty Commission, 2013). Social accountability however demands that widening access to health programmes and therefore increasing health workforce diversity is a priority (Prideaux et al., 2011; Whiteford et al., 2013). These findings highlight the need for tertiary institutions to critique the way in which they select and admit all students for tertiary health programmes (Poole et al., 2009; Whiteford et al., 2013). Social accountability obligations of tertiary institutions demand a greater responsibility to reach out to primary and secondary education sectors and facilitate change (Whiteford et al., 2013). In light of secondary education sector failures, tertiary institutions need to acknowledge their responsibility to assist in improving retention and academic achievement for Māori and Pacific students at secondary school, and make institutional change that reflects the realistic needs, skills and abilities of the diverse body of applicants.

Individual versus institutional focus

Common explanations for why Māori and Pacific students have lower educational outcomes are generally focussed on the student (F. Harris, 2008). The findings and the focus of literature generally foregrounds predictor

variables at the individual level of the student as opposed to the institution (Kasuya et al., 2003; Kay-Lambkin, Pearson, & Rolfe, 2002; Rich et al., 2011). Some literature tends to take a rather soft approach to describing explanatory ideas; citing cultural factors, or institutional or cultural climate as avenues of explanation for disparities (Andriole & Jeffe, 2010; Woolf, McManus, Potts, & Dacre, 2013). Essentially, this makes both the educational institution and the non-Māori non Pacific students invisible to critique (Martin-McDonald & McCarthy, 2008). Routinely collected data within the University of Auckland take a similar approach meaning individual student-focussed variables are more likely to be available for analysis rather than institutional measures.

Whilst many explanations focus on factors that operate at the individual, family, or community level; the institution that is controlling and providing the educational qualification, and hence holds the responsibility for ensuring students successfully complete their intended programme is left invisible in the 'blame' frame (R. Bishop & Glynn, 1999). In 1998, Hesser, Cregler and Lewis 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) (Hesser et al., 1998). A critical analysis requires measurement and reporting 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).

Strengths

This study carried out a comprehensive quantitative analysis of student data that has not previously been undertaken in a New Zealand context. The value of these research results will be important in both national and international contexts where there are large gaps data reporting in this level of detail that compares dominant to non-dominant ethnic groups. Additionally in the New Zealand context, this research provides clear accounts of the gaps between secondary school achievement and tertiary education expectations that can be measured and monitored on an ongoing basis. The dataset created for this research is also valuable in itself given that other related research can be completed using the data used for this study. 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 realities and allows data analysis in a way that may not otherwise have been completed (L. Smith, 2012; Vaioleti, 2006). This adds to the necessary literature base driven by Kaupapa Māori methodology. This research approach 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 (R. 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. Although ideas and concepts around factors that influence academic success are difficult to measure and quantify, quantitative analysis provides a way by which ideas can be tested and explored further. For example, measurement of institutional racism is far from specific, however, identification of variables that may act as a proxy to this concept (e.g. ethnicity, school decile), and then the analysis of these variables can provide new knowledge to inform research objectives. Location of the study within the institution and within a Māori health research centre strengthened the research by providing an insider view of the research (i.e. access to internal institutional information that contributed to knowledge and understanding of the research context), and by providing a culturally safe space within which Kaupapa Māori research could be carried out) (L. Smith, 2012).

Limitations

This study was limited by the available data that are routinely collected by the University and the way in which they are collected (Education Counts, 2012). Specifically, the way in which information is collected within the SSO University central database limits the ability to analyse and report on student data by ethnicity in various ways. The scope of available data also limited the ability to analyse other 'unmeasured' factors that may have predicted success in this cohort group. For example, institutional factors are not routinely measured; rather, data collection has an overwhelming focus at the level of the individual student as opposed to the institution. The ability to accurately measure socioeconomic status was also limited by available data. Although student home address was available and could have been matched to the New Zealand Census mesh block data (available from Statistics New Zealand), as has been done in previous studies (R. Harris et al., 2013), the advisory group acknowledged that this method may have been less reliable given students often use a 'temporary' address (e.g. student hostel) whilst studying, and that this data is self-administered by students and may have changed over time. Hence, the study used school decile as a proxy for socioeconomic status and acknowledges that this may limit the study findings (Engler, 2010b).

Interpretation issues

Care should be taken when interpreting these findings for the Pacific and nMnP student groupings. Due to pre-prioritisation of the data prior to analysis, we know that students who identify with both Māori and Pacific ethnic groups will be included in the Māori group only. Therefore, the Pacific ethnic grouping includes some but not all of the students who identified with a Pacific ethnicity. It is assumed therefore that this cohort is slightly reduced. The nMnP student grouping also includes all other ethnic groups, including students of Asian ethnicity and 'other'.

Note also that this study cohort included students who had successfully enrolled in year 2 of bachelor level study. 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 for varying reasons did not continue their academic pathway in year two. Exclusion of these students from the analysis therefore eliminated the stories of those students who experienced academic difficulty that led to attrition in year one.

This research used data from health science, pharmacy and nursing programmes within a faculty that also provides a medical programme. These are important findings to document student data in non-medical settings. With limited numbers of Māori and Pacific students in the nursing and pharmacy programmes, we were unable to provide programme specific findings, however, we feel that a faculty wide response to these findings is necessary.

Consideration needs to be given the context in which this research has been carried out and the implications of these findings in other settings. In New Zealand, the University of Auckland, FMHS, and Vision 20:20 present a model for supporting Māori and Pacific students into and through health professional programmes that in many ways is leading innovation and success in this area (The LIME Network, 2013). Given the comprehensive nature of the support interventions delivered to students within this context, combined with the highly regarded nature of this particular Faculty, 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. Similarly, the multifaceted recruitment and retention interventions in the FMHS context (e.g. a Māori and Pacific bridging foundation programme, a Māori specific recruitment programme, additional MAPAS tutorials, a MAPAS admission process, MAPAS academic tracking and support, Māori and Pacific leadership within the Faculty) may not be available in other institutional contexts. The Māori and Pacific students in this sample therefore also demonstrate academic outcomes that have been influenced (assumingly positively) by these interventions.

Chapter summary

This chapter has foregrounded important issues related to the research findings within the context of tertiary institutions, health workforce development and related literature. Recommendations for change and overall research conclusions informed by this research will be made in the following chapter.

Introduction

This chapter outlines wider contextual implications of the research findings. Recommendations for change are made and overall conclusions for this project are presented.

Implications

This research adds valuable information to the literature base that informs Māori and Pacific health workforce development, health and education sectors. Specifically, this research provides clear information for tertiary institutions aiming to widen participation and improve academic outcomes for indigenous and ethnic minority students in health professional study. Clear differences between ethnic groups have been described that are similar to minority student profiles in other settings. These findings reinforce the need to accurately identify the characteristics of student cohorts by ethnic group in order to 'best' address their specific needs. For example, in the New Zealand context, the limited number of tertiary providers that offer health professional programmes requires students to relocate for study purposes and impose additional challenges around geographical disconnection from whānau support networks. Context specific variables should therefore be explored in other tertiary contexts when aiming to identify factors that might impact on student success.

The findings of this research demonstrate the important 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 non-Māori non-Pacific. For example, Māori and Pacific students face significant financial barriers to study, and yet institutions continue to demand ever increasing tertiary fees, require students to attend classes in central city locations daily, and prevent part-time employment by requiring students to meet high workloads. This research shows that the impact of pre-tertiary and early academic variables extends further than the first year of bachelor level study. This highlights the need for tertiary institutions to extend focus beyond admission and transitioning phases, and provide ongoing support for Māori and Pacific students throughout tertiary health programmes. Addressing barriers posed by these factors requires serious attention from tertiary institutions. A new critique of the institution is required that explores ways through which barriers to education for Māori and Pacific students can be minimised. Institutions should capitalise on opportunities to do this through technological advances and refreshed approaches to teaching and learning.

Recommendations

The following recommendations encourage actions that are informed by the research findings and the wider project context and should be undertaken in order to facilitate change.

1. ***The University of Auckland***
    o   Improve the routine collection, management and reporting of student data by ethnic group within the University of Auckland in order to inform decision-making and action by:
        ▪   Ensuring the collection, management and reporting of student data by ethnic group aligns with Statistics New Zealand recommendations for ethnicity data (Statistics New Zealand, 2005). This may require institutional changes to centralised student data collection and management within the University of Auckland.
        ▪   Committing to annual reporting of FMHS student data by ethnic group in order to provide detailed information regarding demographic and academic preparation trends.
        ▪   Using ethnic-specific data to evaluate institutional performance against equity objectives to inform the targeted delivery of support and teaching and learning to Māori and Pacific students in ways that meets their needs and realities.
        ▪   Ensuring that routine recording and reporting on academic outcomes be established that exposes disparities between dominant and non-dominant ethnic student groups.
    o   Increasing focus and support for transitioning into and through the first year of bachelor level study for Māori and Pacific students by:
        ▪   Understanding the realistic academic achievement levels of secondary school leavers from all socioeconomic backgrounds within New Zealand and tailor admission criteria, programme delivery and curriculum content (and learning level) accordingly.
        ▪   Maintaining a focus on supporting both Māori and Pacific student groups (as a collective indigenous/ethnic minority) (not one or the other), whilst also recognising and addressing the unique needs of Māori and Pacific students within FMHS.
    o   Continue to develop and integrate bridging foundation programmes such as the Certificate in Health sciences with secondary and tertiary education contexts by:
        ▪   Ensuring that undergraduate degree level programme content, delivery and expectations are aligned with (and flexible in relation to) bridging foundation programmes.
    o   Ensure delivery of programme content and institutional environments in a way that considers the contextual realities of all students and aims to address such barriers in a comprehensive manner by:
        ▪   Providing targeted support for Māori and Pacific students that actively addresses additional challenges imposed by wider socioeconomic factors.
        ▪   Providing additional support for Māori and Pacific students who have moved away from whānau and community support to Auckland to study.

List of research project topics and materials

- Sharing research findings with Faculty staff that exposes disparities in academic outcomes between ethnic minority (Māori and Pacific) and dominant (non-Māori non-Pacific) students consistently produced through FMHS programmes.

o Increase engagement with the secondary education sector in order to reduce gaps between secondary school outcomes and tertiary health programme expectations and requirements by:

- Providing clear information about entry requirements and career pathways to secondary schools that targets Māori and Pacific students in culturally responsive ways.

- Increase the provision of detailed knowledge of the building blocks required (e.g. whānau support, exposure to tertiary learning environments, career planning) for academic success within tertiary health study to secondary schools and their Māori and Pacific students.

2. *The secondary education sector*

o Increase the level of academic preparation of Māori and Pacific school leavers aiming to enter tertiary health programmes by:

- Actively discouraging staff attitudes that adopt a deficit analysis towards Māori and Pacific students.

- Ensuring that school subjects and achievement standards that align with tertiary health programme entry criteria are available to Māori and Pacific students.

- Delivering additional culturally specific academic support to Māori and Pacific secondary school students that encourages NCEA Level 3 achievement at levels over and above University Entrance (i.e. aligns with tertiary health study entry requirements).

- Ensure Māori and Pacific school leavers are equipped with academic skills required for entry into and completion of tertiary health study.

o Provide additional non-academic building blocks for Māori and Pacific secondary school students in preparation for transitioning into tertiary health study.

- Provide clear career information including knowledge of pre-requisite entry criteria, study pathway and admission options.

- Provide additional information required for tertiary study preparation (e.g. opportunities for exposure to tertiary learning environments and Māori and Pacific health role models, information about tertiary study demands, information about financial support and accommodation options).

3. *National New Zealand policy makers*

o Extend time-limited Government funding for student loans, allowances and support for those students undertaking learning pathways that bridge entry (i.e. bridging foundation programmes) into tertiary study.

- o Improve routine data reporting of national NCEA achievement at levels above University Entrance, in individual subjects and overall (e.g. NCEA Rank Score) by ethnic group.
- o Establish requirements for secondary and tertiary education providers to routinely report academic outcomes by ethnic group in a way that exposes disparities between dominant and non-dominant student cohorts.
- o Monitor and work towards narrowing the gap between achievement levels of Māori and Pacific school leavers and tertiary health programme entry requirements nationally.

4. ***Further research***

- o Support and encourage further research that contributes to the knowledge base for exploring solutions for equitable outcomes for Māori and Pacific students using Kaupapa Māori and Kaupapa Pasifika methodologies.
    - Develop further research that explores predictors of academic success for all Māori and Pacific students entering the first year of bachelor level study within FMHS.
    - Carry out further exploration of the impact of bridging foundation programme participation on academic outcomes.
    - Explore reasons for disparities in tertiary health programmes that involve a focus on institutional factors rather than individual student factors.
    - Further develop Kaupapa Pasifika research in health workforce development.
    - Carry out additional research that explores predictors of academic success for Māori and Pacific students studying medicine within FMHS.
    - Develop research (and measures) that focus on factors that facilitate success for Māori and Pacific students (e.g. the impact of interventions such as academic and pastoral support).

Conclusions

This research aimed to explore the effect of predictor variables on academic outcomes for Māori and Pacific students within FMHS undergraduate programmes. Demographic, pre-tertiary, admission and early academic outcome factors impose significant barriers on Māori and Pacific students and yet do not explain all of the disparities in academic outcomes between Māori/Pacific and non-Māori non-Pacific student groupings produced within FMHS programmes. Implications of these findings require educational institutions to identify and understand the realities and challenges faced by Māori and Pacific students in pursuit of health careers and ensure provision of tertiary programmes and environments in ways that meet the needs of all students. Demonstrated disparities in academic outcomes between ethnic groupings should be alarming to tertiary institution and programme staff.

Given that this study includes more than a decade of student data, these long standing inequitable outcomes should not be tolerated further. Tertiary health programme providers present themselves more as slow moving snails, rather than the innovative and front running trailblazers they like to think of themselves as. This research brings forth the transparency of the need for institutions to find equity-focused solutions that are realistic and accomplishable. If institutions are serious about achieving real equitable outcomes for Māori and Pacific students, major institutional changes are necessary. These changes should shift from a narrow lens focus at the margins where Māori and Pacific 'cultural' factors, or individual level characteristics are blamed, to an interrogation of the institutional 'culture' that celebrates 'normalising' what are really 'European' ideas about education, learning, teaching and success. Open minded critical reflection and critical consciousness needs to occur at multiple institutional levels. Whilst further research in this area is needed, this should not stop institutions from acting on these obligations now.

How do you get in?

Admission from New Zealand secondary school qualifications in 2015

To be admitted to the University, school leavers must have a university entrance qualification based on NCEA, CIE, IB or another recognised, equivalent qualification. You must also meet the admission requirements and be selected into your programme of study in the Faculty of Medical and Health Sciences.

Guaranteed entry scores

The table below shows the entry scores for school leavers who are seeking admission into the Faculty of Medical and Health Sciences undergraduate programmes. If you achieve the required score and other requirements for your programme you will be offered a place. Please note that NCEA, CIE and IB use different scales and scores. For Table A and B see pg 16.

Note: From 2016 the University will introduce an academic English language requirement for entry into all undergraduate programmes. For more information please see www.auckland.ac.nz.

2015 Faculty of Medical and Health Sciences undergraduate guaranteed entry scores for school leavers who are citizens or permanent residents of New Zealand or Australia

Programme	NCEA Level 3	CIE*	IB	Special Entry
Bachelor of Health Sciences (BHSc)	250 with a minimum of 18 credits in one subject from Table A and minimum of 18 credits in one subject from Table B	300 with one subject from Table A and one full A Level subject from Table B	33	MAPAS INTL
Bachelor of Medicine and Bachelor of Surgery (MBChB)	Not available to school-leavers. You must first complete Year 1 of either the BHSc or the BSc in Biomedical Science, or have completed another degree approved by the Faculty of Medical and Health Sciences. See alternative admissions.			
Bachelor of Nursing (BNurs)	220 with a minimum of 16 credits in one subject from Table A and minimum of 16 credits from one of Biology, Chemistry or Physics	260 with one subject from Table A and one of Biology, Chemistry or Physics at full A Level	29	MAPAS INTL
Bachelor of Optometry (BOptom)	Not available to school-leavers. See 'Alternative admission schemes' on page opposite.			
Bachelor of Pharmacy (BPharm)	Not available to school-leavers. See 'Alternative admission schemes' on page opposite.			
Bachelor of Science (BSc) in Biomedical Science	280	310	37	MAPAS INTL

Source: (p. 14) (The University of Auckland, 2015e)

For the purposes of Ministry of Education statistical returns, students must be reported in one ethnic group only. To determine which ethnic group to report for a particular student, start at the top of the list on the left-hand side and find the first ethnicity that applies to this student. Then look to the right-hand column to choose the ethnic group for this student, which is where they will be recorded in the roll return tables.

Code at School Level		Ethnic Group to be used in ECE child and staff return (RS61) and in school roll returns (tables J5, J6, & J8)	Ethnic Group to be used for School Leavers (SL1, SL2)
In schools SMS a student can have up to three ethnic affiliations		*Report students in one group only*	*Report students in one group only*
Level 3		**Level 2**	**Level 1**
Code	**Meaning**	To determine which ethnic group to report for a particular student, start at the top of the list and use the first ethnicity that applies to this student	
211	Māori	Māori	Māori
351	Tokelauan	Tokelauan	Pacific peoples
361	Fijian	Fijian	
341	Niuean	Niuean	
331	Tongan	Tongan	
321	Cook Islands Māori	Cook Islands Māori	
311	Samoan	Samoan	
371	Other Pacific Peoples	Other Pacific Peoples	
411	Filipino	Southeast Asian	Asian
412	Cambodian		
413	Vietnamese		
414	Other Southeast Asian		
431	Indian	Indian	
421	Chinese	Chinese	
441	Sri Lankan	Other Asian	
442	Japanese		
443	Korean		
444	Other Asian		
511	Middle Eastern	Middle Eastern	MELAA
521	Latin American	Latin American	
531	African	African	
611	Other Ethnicity	Other	Other
999	Not Stated		
128	Australian	Other European	NZ European/Pākehā/Other European
121	British /Irish		
127	German		
122	Dutch		
123	Greek		
124	Polish		
125	South Slav		
126	Italian		
129	Other European		
111	NZ European/Pākehā	NZ European/Pākehā	

Descriptive summary tables

Table 1: Predictor variables for Māori, Pacific, and non-Māori non-Pacific NCEA students (n=1288)

Demographic and admission variables	Ethnic grouping								
	Māori		Pacific		nMnP		Total		
Categorical variables	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	
Gender									
Female	46	73.02	94	77.05	896	81.23	1036	80.43	
Male	17	26.98	28	22.95	207	18.77	252	19.57	
Year of admission (2nd yr.)									
2006-7	11	5.4	19	6.3	272	90	302	100	
2008-9	15	4.0	41	10.96	318	85.06	374	100	
2010-11	26	5.96	36	8.26	374	85.78	436	100	
2012	11	6.63	26	15.66	139	83.73	166	100	
School Decile †*									
High (8-10)	26	41.27	23	18.85	663	60.11	712	55.28	
Medium (4-7)	19	30.16	45	36.89	354	32.09	418	32.45	
Low (1-3)	17	26.98	50	40.98	80	7.25	147	11.41	
Missing	1	1.59	4	3.28	6	0.54	11	0.85	
Auckland School? †*									
No	28	44.44	7	5.74	173	15.68	208	16.15	
Yes	34	53.97	111	90.98	924	83.77	1069	83	
Missing	1	1.59	4	3.28	6	0.54	11	0.85	
Type of admission (1st yr.) †*									
Alternative admission	28	44.44	71	58.2	154	13.96	253	19.64	
School Leaver	35	55.56	51	41.8	949	86.04	1035	80.36	
Bridging programme †*									
No	32	50.79	48	39.34	1030	93.38	1110	86.18	
Yes	31	49.21	74	60.66	73	6.62	178	13.82	
Programme enrolled									
Health Sciences	39	61.9	92	75.41	363	32.91	494	38.35	
Nursing	14	22.22	18	14.75	315	28.56	347	26.94	
Pharmacy	12	19.05	12	9.84	444	40.25	468	36.34	
Continuous variables	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Age at admission (2nd yr.) †*	19.57	0.86	19.69	1.01	19.16	0.91	19.23	0.93	
School results									
NCEA Rank Score †*	196.9	46.64	178.35	45.28	230.99	39.73	224.34	43.86	
Table A Max	18.96	4.15	18.41	5.06	20.67	3.78	20.37	4.00	
Table B Max	22.77	6.58	21.34	7.36	24.75	5.63	24.34	5.95	
Table B Maths Max	21.54	6.14	20.34	8.19	23.87	6.41	23.43	6.67	
Table B Science Max	19.9	6.04	16.91	5.47	21.37	4.45	20.89	4.81	

† (Māori) * (Pacific) indicates a statistically significant difference in distribution, compared to non-Māori non-Pacific students (P<0.05). Note that although there were new enrolments in 2013, we have excluded current students and hence these students are not included in this data.

Table 2: Academic outcomes for Māori, Pacific and non-Māori non-Pacific NCEA students (n=1288)

Academic outcomes	Ethnic grouping							
	Māori		Pacific		nMnP		Total	
Categorical variables	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
First year bachelors passed all†*								
No	28	44.44	81	66.39	268	24.3	377	29.27
Yes	35	55.56	41	33.61	834	75.61	910	70.65
Missing	.	.	.	.	1	0.09	1	0.08
Programme passed all†*								
No	23	36.51	73	59.84	269	24.39	365	28.34
Yes	40	63.49	49	40.16	834	75.61	923	71.66
Graduated FMHS?								
No	13	20.63	32	26.23	227	20.58	272	21.12
Yes	50	79.37	90	73.77	876	79.42	1016	78.88
Graduated intended programme								
No	14	22.22	32	26.23	235	21.31	281	21.82
Yes	49	77.78	90	73.77	868	78.69	1007	78.18
Gradation Outcome								
Optimal completion	8	12.7	3	2.46	209	18.95	220	17.08
Suboptimal completion high	33	52.38	55	45.08	587	53.22	675	52.41
Suboptimal completion low	9	14.29	32	26.23	80	7.25	121	9.39
Non-completion	13	20.63	32	26.23	227	20.58	272	21.12
Programme graduated from								
BHSC	25	50	63	70	204	23.26	292	28.71
BNURS	13	26	16	17.78	288	32.84	317	31.17
BPHAR	12	24	11	12.22	385	43.9	408	40.12
Graduated in min time*								
No	1	2	.	.	7	0.8	8	0.79
Yes	49	98	90	100	868	98.97	1007	99.02
Continuous variables	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
First year bachelor GPA †*	3.61	1.60	2.75	1.59	4.48	1.83	4.27	1.87
Year 2 – 4 programme GPA†*	4.62	1.92	3.54	1.8	5.14	1.65	4.97	1.74
Year 1 – 4 programme GPA	4.19	1.63	3.26	1.56	4.85	1.54	4.67	1.62

Note that students may be double counted if they have graduated from more than one programme. Note that not all variables were tested for significant differences between ethnic groups. Results are presented for those that were tested.

NCEA sub-cohort multiple regression analysis results tables

Table 3: Multiple regression analysis on predictors of academic outcomes for Māori students with NCEA data (n=63)

Model	Predictor variables (ref)	Comparison	1st Year Bachelor GPA				Year 2-4 Programme GPA				Graduated from intended programme				Graduated in minimum time			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
2	**School decile (High)**	Medium	**-1.26**	-2.25	-0.28	**0.0130**	**-2.10**	-3.21	-1.00	**0.0003**	0.65	0.11	3.93	0.6390	>999.999	<0.001	>999.999	0.8820
		Low	**-1.40**	-2.41	-0.40	**0.0071**	**-1.22**	-2.34	-0.09	**0.0343**	1.74	0.20	15.54	0.6199	<0.001	<0.001	>999.999	0.8310
3	**School decile (High)**	Medium	**-1.26**	-2.30	-0.22	**0.0188**	**-2.29**	-3.40	-1.18	**0.0001**	0.72	0.11	4.90	0.7404	>999.999	<0.001	>999.999	0.7054
		Low	**-1.40**	-2.43	-0.38	**0.0083**	**-1.23**	-2.32	-0.14	**0.0280**	1.89	0.20	17.49	0.5751	<0.001	<0.001	>999.999	0.6612
	Auckland school (Yes)	No	-0.07	-0.98	0.84	0.8735	0.09	-0.88	1.06	0.8527	0.72	0.13	3.91	0.7059	<0.001	<0.001	>999.999	0.6293
	Type of admission (SL)	AA	-0.06	-1.20	1.07	0.9108	**-1.33**	-2.53	-0.12	**0.0324**	0.80	0.09	7.11	0.8376	<0.001	<0.001	>999.999	0.5910
4	**School decile (High)**	Medium	-1.05	-2.13	0.03	0.0557	**-2.19**	-3.35	-1.02	**0.0004**	1.01	0.13	7.73	0.9958	>999.999	<0.001	>999.999	0.6036
		Low	**-1.17**	-2.25	-0.09	**0.0348**	-1.11	-2.28	0.06	0.0618	2.76	0.24	31.42	0.4140	17.21	<0.001	>999.999	0.9736
	Auckland school (Yes)	No	-0.08	-0.99	0.83	0.8608	0.09	-0.89	1.07	0.8592	0.63	0.11	3.50	0.5932	<0.001	<0.001	>999.999	0.7128
	Type of admission (SL)	AA	0.18	-1.01	1.37	0.7616	-1.20	-2.48	0.08	0.0662	0.89	0.09	8.66	0.9227	<0.001	<0.001	>999.999	0.9520
	Bridging Programme (No)	Yes	-0.64	-1.62	0.35	0.1985	-0.33	-1.39	0.73	0.5380	0.42	0.07	2.46	0.3368	<0.001	<0.001	>999.999	0.8481
5	**School decile (High)**	Medium	-0.50	-1.66	0.67	0.3925	**-1.69**	-2.98	-0.40	**0.0119**	1.06	0.06	17.93	0.7899	134.97	<0.001	>999.999	0.9732
		Low	-0.74	-1.98	0.50	0.2354	**-0.54**	-1.92	0.84	0.4317	3.14	0.07	139.85	-	>999.999	<0.001	>999.999	0.9505
	Auckland school (Yes)	No	-0.35	-1.36	0.66	0.4899	-0.07	-1.19	1.05	0.8966	0.22	0.01	3.26	0.2688	<0.001	<0.001	>999.999	0.9203
	Type of admission (SL)	AA	0.51	-1.07	2.08	0.5190	-0.51	-2.27	1.24	0.5566	0.36	0.01	26.58	0.6403	>999.999	<0.001	>999.999	0.9072
	Bridging Programme (No)	Yes	-0.36	-1.46	0.74	0.5148	-0.16	-1.38	1.06	0.7954	0.68	0.08	6.18	0.7333	<0.001	<0.001	>999.999	0.8743
	NCEA Rank Score	per point increase	0.02	-0.01	0.04	0.1400	0.02	-0.01	0.05	0.1126	1.03	0.98	1.08	0.2799	1.05	0.00	471.16	0.9877
	Table A Max credits	per point increase	-0.03	-0.16	0.10	0.6700	0.03	-0.12	0.18	0.6932	1.13	0.74	1.74	0.5752	6.05	<0.001	>999.999	0.8732
	Table B Maths Max credits	per point increase	-0.04	-0.14	0.07	0.4655	-0.06	-0.17	0.06	0.3199	0.97	0.73	1.29	0.8343	0.46	<0.001	>999.999	0.9267
	Table B Science Max credits	per point increase	0.01	-0.09	0.11	0.8536	-0.01	-0.12	0.11	0.8907	**0.72**	0.53	0.98	**0.0336**	1.40	<0.001	>999.999	0.9686
6	**School decile (High)**	Medium					**-1.31**	-2.46	-0.17	**0.0256**	2.50	0.03	197.26	0.6815	8.47	<0.001	>999.999	0.9898
		Low					-0.18	-1.41	1.04	0.7636	2.72	0.01	926.18	0.7362	9.82	<0.001	>999.999	0.9901
	Auckland school (Yes)	No					0.10	-0.88	1.08	0.8384	0.08	<0.001	7.89	0.2798	0.00	<0.001	>999.999	0.9636
	Type of admission (SL)	AA					-0.95	-2.49	0.60	0.2216	0.04	<0.001	74.69	0.3956	>999.999	<0.001	>999.999	0.8348
	Bridging Programme (No)	Yes					0.06	-1.00	1.13	0.9068	1.72	0.06	46.47	0.7468	0.03	<0.001	>999.999	0.9832
	NCEA Rank Score	per point increase					0.01	-0.01	0.03	0.3154	1.04	0.95	1.13	0.4321	1.19	<0.001	>999.999	0.9736
	Table A Max credits	per point increase					0.06	-0.07	0.19	0.3666	1.25	0.67	2.30	0.4824	1.11	<0.001	>999.999	0.9978
	Table B Maths Max credits	per point increase					-0.05	-0.15	0.05	0.3498	0.91	0.61	1.34	0.6227	0.47	<0.001	>999.999	0.9415
	Table B Science Max credits	per point increase					-0.03	-0.13	0.07	0.5710	0.58	0.33	1.01	0.0560	2.48	<0.001	>999.999	0.9518
	1st Yr Bach passed all (Yes)	No					-0.85	-2.20	0.51	0.2117	0.00	<0.001	1.07	0.0529	>999.999	<0.001	>999.999	0.9626
	1st Yr Bach GPA	per point increase					0.38	-0.06	0.82	0.0906	0.37	0.05	2.59	0.3170	99.18	<0.001	>999.999	0.9290

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear and 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 4: Multiple regression analysis on predictors of graduation outcome for Maori students with NCEA (n=63)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
2	School decile (High)	Medium	0.05	0.00	2.02	0.1131	1.40	0.12	15.81	0.7875	2.06	0.23	18.34	0.5179
		Low	0.29	0.02	3.38	0.3199	0.83	0.09	8.05	0.8695	0.49	0.04	6.50	0.5845
3	School decile (High)	Medium	0.00	<0.001	0.70	0.0565	0.11	0.00	10.94	0.3110	1.33	0.10	17.70	0.6105
		Low	0.09	0.00	2.65	0.8028	1.27	0.06	27.04	0.4354	0.55	0.04	7.59	0.5260
	Auckland school (Yes)	No	38.24	0.82	>999.999	0.0631	0.33	0.01	8.59	0.5030	1.97	0.19	20.26	0.5688
	Type of admission (SL)	AA	0.88	0.03	27.87	0.9399	>999.999	<0.001	>999.999	0.7058	0.54	0.04	7.38	0.6459
4	School decile (High)	Medium	0.01	<0.001	2.54	0.0964	0.10	0.00	7.50	0.3960	0.99	0.07	13.79	0.7193
		Low	0.51	0.01	37.29	0.4486	0.41	0.01	17.56	0.8972	0.43	0.03	6.86	0.4893
	Auckland school (Yes)	No	93.55	0.83	>999.999	0.0600	0.13	0.00	8.10	0.3347	2.55	0.26	25.46	0.4249
	Type of admission (SL)	AA	3.86	0.03	458.86	0.5792	>999.999	<0.001	>999.999	0.8093	0.47	0.03	7.73	0.5981
	Bridging Programme (No)	Yes	0.06	<0.001	8.17	0.2622	16.98	0.05	>999.999	0.3432	2.70	0.37	19.56	0.3265
5	School decile (High)	Medium	<0.001	<0.001	>999.999	0.8253	<0.001	<0.001	>999.999	0.9565	15.99	<0.001	>999.999	0.6344
		Low	>999.999	<0.001	>999.999	0.8882	<0.001	<0.001	>999.999	0.7842	>999.999	<0.001	>999.999	0.5340
	Auckland school (Yes)	No	>999.999	<0.001	>999.999	0.8568	0.00	<0.001	>999.999	0.8887	0.96	<0.001	>999.999	0.9973
	Type of admission (SL)	AA	54.85	<0.001	>999.999	0.9584	>999.999	<0.001	>999.999	0.8505	<0.001	<0.001	>999.999	0.3980
	Bridging Programme (No)	Yes	>999.999	<0.001	>999.999	0.9514	>999.999	<0.001	>999.999	0.6673	>999.999	<0.001	>999.999	0.4304
	NCEA Rank Score	per point increase	2.03	0.06	66.32	0.6901	1.09	0.14	8.75	0.9382	1.06	0.84	1.33	0.6491
	Table A Max credits	per point increase	0.37	<0.001	>999.999	0.9415	0.12	<0.001	>999.999	0.6482	0.03	<0.001	537.02	0.4677
	Table B Maths Max credits	per point increase	1.75	<0.001	>999.999	0.9653	6.46	<0.001	>999.999	0.8205	3.06	0.14	67.84	0.4799
	Table B Science Max credits	per point increase	0.01	<0.001	>999.999	0.6351	0.38	<0.001	>999.999	0.9106	0.85	0.23	3.16	0.8033
6	School decile (High)	Medium	0.00	<0.001	>999.999	0.9506	1.38	<0.001	>999.999	0.9315	0.08	<0.001	>999.999	0.9552
		Low	>999.999	<0.001	>999.999	0.9380	<0.001	<0.001	>999.999	0.8860	1.81	<0.001	>999.999	0.9760
	Auckland school (Yes)	No	>999.999	<0.001	>999.999	0.8466	0.05	<0.001	>999.999	0.9670	>999.999	<0.001	>999.999	0.8156
	Type of admission (SL)	AA	>999.999	<0.001	>999.999	0.9627	>999.999	<0.001	>999.999	0.9404	>999.999	<0.001	>999.999	0.9157
	Bridging Programme (No)	Yes	>999.999	<0.001	>999.999	0.9157	>999.999	<0.001	>999.999	0.9295	6.33	<0.001	>999.999	0.9823
	NCEA Rank Score	per point increase	1.54	0.01	231.18	0.8668	1.24	0.04	43.43	0.9067	1.15	0.20	6.68	0.8771
	Table A Max credits	per point increase	1.13	<0.001	>999.999	0.9929	0.21	<0.001	>999.999	0.8903	0.76	<0.001	>999.999	0.9761
	Table B Maths Max credits	per point increase	2.88	<0.001	>999.999	0.9285	2.77	<0.001	>999.999	0.9196	5.63	<0.001	>999.999	0.7969
	Table B Science Max credits	per point increase	0.28	<0.001	>999.999	0.9371	0.31	<0.001	>999.999	0.8882	0.95	<0.001	>999.999	0.9972
	1st Yr Bach passed all (Yes)	No	>999.999	<0.001	>999.999	0.9152	4.86	<0.001	>999.999	0.9857	>999.999	<0.001	>999.999	0.6891
	1st Yr Bach GPA	per point increase	>999.999	<0.001	>999.999	0.8330	0.12	<0.001	>999.999	0.9464	>999.999	<0.001	>999.999	0.7857

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear and 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 5: Multiple regression analysis on predictors of academic outcomes for Pacific students (n=122) with NCEA

Model	Predictor variables (ref)	Comparison	1st Year Bachelor GPA				Year 2-4 Programme GPA				Graduated from intended programme				Graduated in minimum time (n=90)			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
2	School decile (High)	Medium	-0.26	-1.05	0.53	0.5137	0.40	-0.49	1.30	0.3701	1.00	0.30	3.29	0.9951	2.96	0.58	15.04	0.1905
		Low	-0.29	-1.09	0.52	0.4808	0.35	-0.56	1.26	0.4448	1.76	0.49	6.29	0.3831	3.71	0.78	17.71	0.1008
3	School decile (High)	Medium	-0.25	-1.07	0.56	0.5411	0.42	-0.48	1.32	0.3596	1.34	0.37	4.88	0.6550	5.03	0.85	29.93	0.0759
		Low	-0.31	-1.11	0.50	0.4544	0.31	-0.58	1.20	0.4919	1.66	0.46	6.06	0.4420	5.77	1.06	31.41	0.0427
	Auckland school (Yes)	No	-0.14	-1.40	1.12	0.8283	-0.28	-1.67	1.11	0.6885	0.18	0.03	1.09	0.0619	0.30	0.01	12.11	0.5238
	Type of admission (SL)	AA	-0.50	-1.32	0.32	0.2321	**-1.11**	-2.02	-0.20	**0.0167**	0.36	0.09	1.42	0.1437	0.12	0.02	1.01	0.0506
4	School decile (High)	Medium	-0.25	-1.07	0.58	0.5547	0.40	-0.51	1.30	0.3883	1.41	0.38	5.20	0.6057	4.60	0.74	28.47	0.1005
		Low	-0.30	-1.11	0.52	0.4701	0.28	-0.62	1.18	0.5326	1.78	0.48	6.59	0.3889	5.11	0.92	28.58	0.0631
	Auckland school (Yes)	No	-0.14	-1.41	1.12	0.8241	-0.27	-1.67	1.13	0.7042	0.17	0.03	1.04	0.0558	0.30	0.01	11.87	0.5225
	Type of admission (SL)	AA	-0.54	-1.47	0.39	0.2494	-0.96	-1.98	0.06	0.0650	0.26	0.05	1.20	0.0844	0.22	0.02	2.33	0.2063
	Bridging Programme (No)	Yes	0.08	-0.72	0.89	0.8359	-0.28	-1.18	0.61	0.5300	1.95	0.50	7.67	0.3376	0.40	0.07	2.36	0.3095
5	School decile (High)	Medium	-0.16	-1.07	0.76	0.7340	0.43	-0.61	1.47	0.4104	0.80	0.15	4.12	0.7851	**15.51**	1.03	234.61	**0.0479**
		Low	-0.33	-1.21	0.55	0.4576	0.10	-0.90	1.10	0.8449	1.92	0.37	10.09	0.4417	4.21	0.53	33.14	0.1724
	Auckland school (Yes)	No	0.04	-1.42	1.49	0.9567	-0.17	-1.82	1.49	0.8397	0.24	0.03	2.36	0.2217	>999.999	<0.001	>999.999	0.9885
	Type of admission (SL)	AA	0.89	-0.32	2.10	0.1478	0.37	-1.01	1.75	0.5994	1.11	0.10	12.72	0.9311	0.44	0.02	11.45	0.6246
	Bridging Programme (No)	Yes	0.31	-0.58	1.19	0.4893	-0.19	-1.20	0.82	0.7050	2.50	0.45	13.87	0.2952	0.37	0.04	3.32	0.3721
	NCEA Rank Score	per point increase	**0.02**	0.01	0.04	**0.0054**	**0.02**	0.00	0.03	**0.0469**	1.03	1.00	1.05	0.0893	1.01	0.97	1.05	0.6804
	Table A Max credits	per point increase	-0.03	-0.11	0.06	0.5409	0.00	-0.10	0.10	0.9894	0.94	0.81	1.09	0.4183	1.03	0.81	1.32	0.7952
	Table B Maths Max credits	per point increase	0.00	-0.05	0.05	0.9482	0.00	-0.06	0.06	0.9876	0.98	0.89	1.08	0.6680	1.01	0.88	1.15	0.8902
	Table B Science Max credits	per point increase	0.04	-0.03	0.11	0.2908	0.04	-0.04	0.12	0.3396	1.01	0.89	1.14	0.9206	1.12	0.95	1.32	0.1956
6	School decile (High)	Medium					0.53	-0.28	1.34	0.1950	0.85	0.13	5.61	0.8629	36.60	0.80	>999.999	0.0646
		Low					0.32	-0.46	1.10	0.4185	6.56	0.68	63.75	0.1050	10.80	0.75	156.17	0.0808
	Auckland school (Yes)	No					-0.22	-1.51	1.07	0.7351	0.13	0.01	2.28	0.1631	>999.999	<0.001	>999.999	0.9890
	Type of admission (SL)	AA					-0.31	-1.40	0.78	0.5723	1.19	0.05	30.36	0.9166	0.13	0.00	9.10	0.3415
	Bridging Programme (No)	Yes					-0.43	-1.22	0.35	0.2776	1.19	0.14	10.18	0.8724	0.18	0.01	4.51	0.2927
	NCEA Rank Score	per point increase					0.00	-0.01	0.01	0.8432	1.02	0.98	1.06	0.3319	0.99	0.94	1.04	0.5732
	Table A Max credits	per point increase					0.02	-0.05	0.10	0.5748	0.95	0.78	1.17	0.6581	1.09	0.80	1.48	0.6031
	Table B Maths Max credits	per point increase					0.00	-0.04	0.04	0.9924	0.93	0.83	1.05	0.2300	1.06	0.90	1.24	0.5113
	Table B Science Max credits	per point increase					0.01	-0.05	0.07	0.7831	0.97	0.84	1.12	0.6580	1.06	0.86	1.31	0.5816
	1st Yr Bach passed all (Yes)	No					-0.24	-1.03	0.54	0.5375	2.50	0.34	18.19	0.3649	0.24	0.01	4.41	0.3359
	1st Yr Bach GPA	per point increase					**0.68**	0.42	0.94	**<.0001**	**4.88**	1.85	12.86	**0.0013**	2.42	0.72	8.19	0.1548

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear and 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 6: Multiple regression analysis on predictors of graduation outcome for Pacific students with NCEA (n=122)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
2	School decile (High)	Medium	0.21	0.01	5.63	0.3494	0.62	0.15	2.65	0.5183	0.82	0.22	3.05	0.7639
		Low	0.37	0.02	9.30	0.5453	0.77	0.19	3.17	0.7171	0.51	0.13	2.01	0.3334
3	School decile (High)	Medium	0.27	0.01	8.89	0.6589	0.53	0.12	2.36	0.3777	0.57	0.14	2.35	0.6712
		Low	0.28	0.01	11.80	0.7085	0.77	0.19	3.20	0.9069	0.52	0.13	2.11	0.5039
	Auckland school (Yes)	No	2.46	<0.001	>999.999	0.9983	5.06	0.31	82.24	0.2542	12.11	1.00	146.59	0.0500
	Type of admission (SL)	AA	<0.001	<0.001	>999.999	0.9219	1.68	0.40	7.06	0.4758	2.92	0.66	12.86	0.1561
4	School decile (High)	Medium	0.33	0.01	11.97	0.7408	0.55	0.12	2.52	0.3956	0.54	0.13	2.28	0.6572
		Low	0.30	0.01	12.43	0.6915	0.83	0.20	3.51	0.8361	0.49	0.12	2.01	0.4581
	Auckland school (Yes)	No	4.05	<0.001	>999.999	0.9973	4.83	0.30	79.07	0.2697	**12.56**	1.03	152.53	**0.0470**
	Type of admission (SL)	AA	<0.001	<0.001	>999.999	0.9252	1.17	0.22	6.19	0.8496	3.75	0.73	19.13	0.1123
	Bridging Programme (No)	Yes	<0.001	<0.001	>999.999	0.9344	1.91	0.44	8.33	0.3915	0.59	0.14	2.38	0.4543
5	School decile (High)	Medium	0.02	<0.001	>999.999	0.9475	0.26	0.03	2.06	0.1229	1.02	0.18	5.80	0.5903
		Low	5.06	<0.001	>999.999	0.9383	0.99	0.19	5.19	0.3288	0.49	0.09	2.74	0.2998
	Auckland school (Yes)	No	0.03	<0.001	>999.999	0.9901	7.91	0.25	254.32	0.2429	7.10	0.47	106.94	0.1567
	Type of admission (SL)	AA	<0.001	<0.001	>999.999	0.7329	1.10	0.11	11.57	0.9339	0.78	0.06	9.64	0.8455
	Bridging Programme (No)	Yes	11.40	<0.001	>999.999	0.9891	2.15	0.36	13.01	0.4055	0.45	0.08	2.54	0.3659
	NCEA Rank Score	per point increase	1.51	0.07	32.34	0.7907	1.00	0.97	1.03	0.7605	0.97	0.95	1.00	0.0799
	Table A Max credits	per point increase	27.24	<0.001	>999.999	0.7727	0.95	0.80	1.13	0.5656	1.04	0.88	1.24	0.6348
	Table B Maths Max credits	per point increase	0.14	<0.001	>999.999	0.7724	0.98	0.88	1.09	0.6701	1.02	0.93	1.13	0.6545
	Table B Science Max credits	per point increase	6.32	<0.001	>999.999	0.8266	0.98	0.86	1.11	0.7213	1.01	0.88	1.16	0.8746
6	School decile (High)	Medium	0.00	<0.001	>999.999	0.9523	1.38	<0.001	>999.999	0.1410	0.08	<0.001	>999.999	0.3086
		Low	>999.999	<0.001	>999.999	0.9534	<0.001	<0.001	>999.999	0.7916	**1.81**	<0.001	>999.999	**0.0433**
	Auckland school (Yes)	No	>999.999	<0.001	>999.999	0.9292	0.05	<0.001	>999.999	0.0904	**>999.999**	<0.001	>999.999	**0.0444**
	Type of admission (SL)	AA	>999.999	<0.001	>999.999	0.8860	>999.999	<0.001	>999.999	0.5626	>999.999	<0.001	>999.999	0.9847
	Bridging Programme (No)	Yes	>999.999	<0.001	>999.999	0.9822	>999.999	<0.001	>999.999	0.2338	6.33	<0.001	>999.999	0.8862
	NCEA Rank Score	per point increase	1.54	0.01	231.18	0.9007	1.24	0.04	43.43	0.6387	1.15	0.20	6.68	0.3983
	Table A Max credits	per point increase	1.13	<0.001	>999.999	0.9884	0.21	<0.001	>999.999	0.6131	0.76	<0.001	>999.999	0.7761
	Table B Maths Max credits	per point increase	2.88	<0.001	>999.999	0.9930	2.77	<0.001	>999.999	0.7134	5.63	<0.001	>999.999	0.2795
	Table B Science Max credits	per point increase	0.28	<0.001	>999.999	0.9094	0.31	<0.001	>999.999	0.9036	0.95	<0.001	>999.999	0.5277
	1st Yr Bach passed all (Yes)	No	>999.999	<0.001	>999.999	0.8362	4.86	<0.001	>999.999	0.9617	>999.999	<0.001	>999.999	0.4215
	1st Yr Bach GPA	per point increase	>999.999	<0.001	>999.999	0.7556	**0.12**	<0.001	>999.999	**0.0282**	**>999.999**	<0.001	>999.999	**0.0005**

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear and 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 7: Multiple regression analysis on predictors of academic outcomes for non-Māori non-Pacific students with NCEA (n=1103)

Model	Predictor variables (ref)	Comparison	1st Year Bachelor GPA				Year 2-4 Programme GPA				Graduated from intended programme				Graduated in minimum time (n=868)			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
2	School decile (High)	Medium	0.0185	-0.2172	0.2542	0.8776	0.1133	-0.0965	0.3231	0.2896	1.169	0.843	1.620	0.3489	1.269	0.811	1.986	0.2974
		Low	-0.3621	-0.7894	0.0652	0.0966	**-0.4116**	-0.7920	-0.0313	**0.0339**	0.786	0.457	1.352	0.3843	0.634	0.309	1.301	0.2140
3	School decile (High)	Medium	0.0087	-0.2286	0.2460	0.9427	0.0941	-0.1166	0.3048	0.3809	1.182	0.851	1.643	0.3177	1.291	0.822	2.028	0.2681
		Low	-0.3714	-0.7996	0.0567	0.0890	**-0.3984**	-0.7785	-0.0183	**0.0400**	0.777	0.451	1.339	0.3634	0.631	0.307	1.297	0.2104
	Auckland school (Yes)	No	0.0721	-0.2284	0.3726	0.6377	**0.3018**	0.0350	0.5685	**0.0266**	0.845	0.568	1.255	0.4038	1.036	0.579	1.853	0.9046
	Type of admission (SL)	AA	0.1409	-0.2371	0.5188	0.4648	-0.2558	-0.5913	0.0797	0.1349	1.199	0.703	2.046	0.5044	0.568	0.305	1.057	0.0742
4	School decile (High)	Medium	0.0136	-0.2230	0.2502	0.9104	0.0950	-0.1158	0.3058	0.3766	1.187	0.854	1.650	0.3069	1.257	0.799	1.980	0.3225
		Low	-0.3175	-0.7460	0.1109	0.1462	**-0.3885**	-0.7702	-0.0069	**0.0460**	0.797	0.461	1.377	0.4156	0.713	0.341	1.491	0.3692
	Auckland school (Yes)	No	0.0926	-0.2073	0.3925	0.5448	0.3055	0.0384	0.5726	0.0250	0.851	0.572	1.265	0.4255	1.142	0.631	2.070	0.6605
	Type of admission (SL)	AA	0.2023	-0.1769	0.5814	0.2955	-0.2446	-0.5823	0.0932	0.1556	1.232	0.720	2.111	0.4467	0.652	0.344	1.233	0.1880
	Bridging Programme (No)	Yes	**-0.6411**	-1.0884	-0.1937	**0.0050**	-0.1169	-0.5154	0.2816	0.5650	0.773	0.441	1.354	0.3684	**0.330**	0.157	0.694	**0.0035**
5	School decile (High)	Medium	**0.2996**	0.0850	0.5143	**0.0063**	0.2711	0.0589	0.4832	0.3766	1.244	0.872	1.774	0.2276	1.153	0.694	1.915	0.5817
		Low	0.3600	-0.0282	0.7482	0.0691	**0.1256**	-0.2581	0.5094	**0.0460**	0.962	0.525	1.762	0.9005	0.826	0.357	1.912	0.6545
	Auckland school (Yes)	No	-0.1399	-0.4165	0.1367	0.3211	0.2058	-0.0676	0.4792	0.1400	0.827	0.536	1.278	0.3925	0.915	0.467	1.792	0.7950
	Type of admission (SL)	AA	**1.1587**	0.7869	1.5305	**<.0001**	**0.3946**	0.0271	0.7622	**0.0354**	1.382	0.736	2.595	0.3143	1.048	0.459	2.393	0.9120
	Bridging Programme (No)	Yes	-0.0013	-0.4130	0.4104	0.9951	0.2036	-0.2034	0.6105	0.3266	1.047	0.558	1.966	0.8858	**0.357**	0.153	0.835	**0.0175**
	NCEA Rank Score	per point increase	**0.0268**	0.0235	0.0302	**<.0001**	**0.0162**	0.0129	0.0195	**<.0001**	**1.008**	1.002	1.014	**0.0050**	1.008	1.000	1.016	0.0505
	Table A Max credits	per point increase	**0.0303**	0.0018	0.0588	**0.0374**	**0.0503**	0.0221	0.0785	**0.0005**	**0.953**	0.908	0.999	**0.0441**	1.046	0.982	1.114	0.1639
	Table B Maths Max credits	per point increase	-0.0043	-0.0209	0.0122	0.6083	**-0.0185**	-0.0349	-0.0021	**0.0267**	0.996	0.970	1.022	0.7485	0.996	0.957	1.038	0.8586
	Table B Science Max credits	per point increase	**0.0467**	0.0220	0.0715	**0.0002**	**0.0265**	0.0020	0.0509	**0.0341**	1.024	0.983	1.066	0.2585	1.027	0.972	1.085	0.3415
6	School decile (High)	Medium					0.1090	-0.0694	0.2875	0.2307	1.175	0.820	1.682	0.3802	1.009	0.591	1.723	0.9739
		Low					-0.0773	-0.3996	0.2450	0.6379	0.864	0.467	1.596	0.6398	0.526	0.216	1.284	0.1581
	Auckland school (Yes)	No					**0.2922**	0.0623	0.5221	**0.0128**	0.886	0.571	1.377	0.5918	1.141	0.554	2.349	0.7201
	Type of admission (SL)	AA					-0.2385	-0.5528	0.0757	0.1367	1.062	0.562	2.004	0.8539	0.461	0.195	1.092	0.0785
	Bridging Programme (No)	Yes					0.2336	-0.1112	0.5785	0.1840	1.157	0.608	2.203	0.6563	0.473	0.188	1.190	0.1116
	NCEA Rank Score	per point increase					0.0020	-0.0012	0.0051	0.2221	1.004	0.998	1.011	0.1971	0.992	0.982	1.002	0.1182
	Table A Max credits	per point increase					**0.0343**	0.0106	0.0580	**0.0046**	0.948	0.904	0.995	0.0303	1.024	0.959	1.092	0.4785
	Table B Maths Max credits	per point increase					**-0.0168**	-0.0305	-0.0030	**0.0170**	0.994	0.967	1.021	0.6433	0.999	0.958	1.042	0.9644
	Table B Science Max credits	per point increase					0.0004	-0.0203	0.0211	0.9691	1.011	0.971	1.054	0.5899	0.994	0.938	1.053	0.8307
	1st Yr Bach passed all (Yes)	No					-0.1461	-0.4062	0.1140	0.2707	**0.573**	0.349	0.942	**0.0281**	0.885	0.440	1.779	0.7320
	1st Yr Bach GPA	per point increase					**0.5161**	0.4470	0.5852	**<.0001**	1.090	0.947	1.256	0.2296	**1.976**	1.538	2.540	**<.0001**

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear and 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 8: Multiple regression analysis on predictors of graduation outcome for non-Maori non-Pacific students with NCEA (n=1103)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
2	School decile (High)	Medium	1.12	0.80	1.58	0.5167	1.08	0.65	1.81	0.7611	0.85	0.60	1.20	0.3552
		Low	0.63	0.30	1.30	0.2062	1.08	0.43	2.71	0.8646	1.20	0.68	2.13	0.5300
3	School decile (High)	Medium	1.07	0.76	1.52	0.1937	1.10	0.66	1.84	0.8382	0.83	0.58	1.18	0.1670
		Low	0.63	0.30	1.31	0.1744	1.07	0.43	2.68	0.9705	1.22	0.69	2.16	0.3140
	Auckland school (Yes)	No	**1.61**	1.06	2.45	**0.0251**	0.57	0.25	1.29	0.1746	1.41	0.92	2.15	0.1166
	Type of admission (SL)	AA	0.84	0.48	1.48	0.5470	1.27	0.60	2.66	0.5345	0.79	0.44	1.40	0.4128
4	School decile (High)	Medium	1.08	0.76	1.52	0.1954	1.10	0.66	1.84	0.7842	0.82	0.58	1.17	0.1818
		Low	0.63	0.30	1.31	0.1783	1.02	0.40	2.57	0.9504	1.18	0.67	2.11	0.3594
	Auckland school (Yes)	No	**1.62**	1.06	2.46	**0.0245**	0.55	0.24	1.26	0.1581	1.39	0.91	2.13	0.1274
	Type of admission (SL)	AA	0.85	0.48	1.49	0.5722	1.20	0.57	2.56	0.6341	0.76	0.43	1.36	0.3600
	Bridging Programme (No)	Yes	0.87	0.43	1.77	0.7037	1.62	0.65	4.00	0.2990	1.34	0.73	2.45	0.3450
5	School decile (High)	Medium	1.58	1.05	2.38	0.1322	0.91	0.50	1.65	0.9450	0.83	0.57	1.22	0.2627
		Low	1.09	0.44	2.69	0.7529	0.79	0.29	2.14	0.7015	1.14	0.60	2.14	0.4848
	Auckland school (Yes)	No	**2.05**	1.24	3.37	**0.0049**	0.66	0.25	1.75	0.3978	1.48	0.93	2.37	0.1001
	Type of admission (SL)	AA	1.52	0.74	3.13	0.2550	0.54	0.19	1.51	0.2394	0.76	0.39	1.49	0.4187
	Bridging Programme (No)	Yes	0.59	0.23	1.54	0.2816	0.95	0.33	2.76	0.9234	1.00	0.51	1.94	0.9887
	NCEA Rank Score	per point increase	**1.03**	1.02	1.03	**<.0001**	**0.98**	0.97	0.99	**0.0003**	1.00	0.99	1.00	0.3501
	Table A Max credits	per point increase	**1.11**	1.04	1.18	**0.0008**	1.05	0.97	1.13	0.2553	**1.06**	1.01	1.12	**0.0165**
	Table B Maths Max credits	per point increase	0.98	0.95	1.01	0.1847	1.01	0.97	1.06	0.6925	1.00	0.97	1.03	0.9782
	Table B Science Max credits	per point increase	0.99	0.94	1.04	0.6800	0.99	0.93	1.06	0.7672	0.96	0.92	1.01	0.1051
6	School decile (High)	Medium	1.39	0.90	2.16	0.2008	0.98	0.53	1.82	0.9373	0.86	0.58	1.26	0.2378
		Low	0.91	0.35	2.37	0.5877	1.01	0.36	2.87	0.9629	1.25	0.66	2.38	0.3457
	Auckland school (Yes)	No	**2.20**	1.27	3.80	**0.0047**	0.50	0.18	1.38	0.1826	1.34	0.83	2.16	0.2287
	Type of admission (SL)	AA	0.82	0.36	1.86	0.6355	1.18	0.43	3.26	0.7483	0.91	0.46	1.81	0.7912
	Bridging Programme (No)	Yes	0.53	0.19	1.46	0.2195	0.62	0.20	1.96	0.4178	0.85	0.43	1.68	0.6390
	NCEA Rank Score	per point increase	**1.01**	1.00	1.02	**0.0495**	0.99	0.98	1.00	0.0696	1.00	0.99	1.01	0.5800
	Table A Max credits	per point increase	**1.09**	1.02	1.16	**0.0164**	1.06	0.98	1.14	0.1864	**1.07**	1.01	1.12	**0.0146**
	Table B Maths Max credits	per point increase	0.97	0.94	1.01	0.1311	1.01	0.96	1.06	0.6954	1.00	0.98	1.03	0.7728
	Table B Science Max credits	per point increase	0.96	0.90	1.02	0.1449	1.03	0.96	1.09	0.4375	0.98	0.93	1.02	0.2649
	1st Yr Bach passed all (Yes)	No	1.21	0.49	2.99	0.6747	1.42	0.63	3.19	0.4004	**2.17**	1.28	3.67	**0.0039**
	1st Yr Bach GPA	per point increase	**2.09**	1.74	2.51	**<.0001**	**0.54**	0.40	0.73	**<.0001**	1.03	0.88	1.20	0.7568

* Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

NCEA group comparison multiple regression analysis results tables

Table 9: Multiple regression analysis on predictors of average GPA in the 1st year, and years 2-4 of bachelor level study (n=1288) for students with NCEA

Model	Predictor variables (ref)	Comparison	1st Year Bachelor GPA				Year 2-4 Programme GPA			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Unadjusted	Ethnicity grouping (nMnP)	Māori	**-0.87**	-1.33	-0.41	**0.0002**	**-0.53**	-0.96	-0.10	**0.0150**
		Pacific	**-1.73**	-2.07	-1.40	**<.0001**	**-1.60**	-1.92	-1.29	**<.0001**
Baseline*	Ethnicity grouping (nMnP)	Māori	**-0.82**	-1.28	-0.37	**0.0004**	**-0.47**	-0.90	-0.05	**0.0276**
		Pacific	**-1.65**	-1.99	-1.31	**<.0001**	**-1.55**	-1.86	-1.24	**<.0001**
2	Ethnicity grouping (nMnP)	Māori	**-0.73**	-1.20	-0.27	**0.0020**	-0.39	-0.82	0.04	0.0759
		Pacific	**-1.44**	-1.81	-1.08	**<.0001**	**-1.39**	-1.73	-1.05	**<.0001**
	School decile (High)	Medium	-0.06	-0.28	0.16	0.5829	0.01	-0.19	0.21	0.8909
		Low	**-0.45**	-0.79	-0.10	**0.0105**	**-0.36**	-0.68	-0.05	**0.0240**
3	Ethnicity grouping (nMnP)	Māori	**-0.74**	-1.22	-0.27	**0.0022**	-0.37	-0.80	0.07	0.1014
		Pacific	**-1.43**	-1.81	-1.06	**<.0001**	**-1.21**	-1.56	-0.87	**<.0001**
	School decile (High)	Medium	-0.06	-0.28	0.15	0.5612	0.00	-0.20	0.20	0.9902
		Low	**-0.45**	-0.79	-0.10	**0.0109**	**-0.33**	-0.64	-0.01	**0.0417**
	Auckland school (Yes)	No	0.04	-0.23	0.32	0.7547	0.25	0.00	0.50	0.0508
	Type of admission (SL)	AA	-0.01	-0.33	0.32	0.9593	**-0.49**	-0.79	-0.19	**0.0014**
4	Ethnicity grouping (nMnP)	Māori	**-0.53**	-1.01	-0.04	**0.0347**	-0.23	-0.68	0.22	0.3157
		Pacific	**-1.18**	-1.58	-0.77	**<.0001**	**-1.05**	-1.42	-0.68	**<.0001**
	School decile (High)	Medium	-0.05	-0.27	0.16	0.6270	0.01	-0.20	0.21	0.9574
		Low	**-0.38**	-0.72	-0.03	**0.0309**	-0.29	-0.60	0.03	0.0767
	Auckland school (Yes)	No	0.06	-0.21	0.33	0.6647	**0.26**	0.01	0.51	**0.0418**
	Type of admission (SL)	AA	0.13	-0.20	0.47	0.4310	**-0.40**	-0.71	-0.09	**0.0105**
	Bridging Programme (No)	Yes	**-0.66**	-1.01	-0.31	**0.0002**	**-0.41**	-0.73	-0.08	**0.0136**
5	Ethnicity grouping (nMnP)	Māori	-0.09	-0.53	0.35	0.6771	0.03	-0.42	0.47	0.8988
		Pacific	**-0.47**	-0.85	-0.10	**0.0139**	**-0.58**	-0.96	-0.20	**0.0027**
	School decile (High)	Medium	0.02	0.04	0.45	0.0198	0.18	-0.02	0.39	0.0773
		Low	**0.80**	-0.28	0.36	**0.8033**	0.06	-0.26	0.39	0.7021
	Auckland school (Yes)	No	-0.13	-0.38	0.13	0.3305	0.18	-0.08	0.44	0.1805
	Type of admission (SL)	AA	**1.13**	0.80	1.47	**<.0001**	0.29	-0.05	0.62	0.0955
	Bridging Programme (No)	Yes	-0.16	-0.49	0.17	0.3309	-0.15	-0.48	0.18	0.3869
	NCEA Rank Score	per point increase	**0.03**	0.02	0.03	**<.0001**	**0.02**	0.01	0.02	**<.0001**
	Table A Max credits	per point increase	0.03	0.00	0.05	0.0576	**0.05**	0.02	0.07	**0.0005**
	Table B Maths Max credits	per point increase	0.00	-0.02	0.01	0.5835	**-0.02**	-0.03	0.00	**0.0351**
	Table B Science Max credits	per point increase	**0.04**	0.02	0.06	**0.0003**	0.02	0.00	0.04	0.0685
6	Ethnicity grouping (nMnP)	Māori					0.08	-0.29	0.45	0.6695
		Pacific					-0.29	-0.61	0.03	0.0754
	School decile (High)	Medium					0.05	-0.12	0.22	0.5637
		Low					0.03	-0.24	0.30	0.8162
	Auckland school (Yes)	No					**0.26**	0.04	0.47	**0.0193**
	Type of admission (SL)	AA					**-0.36**	-0.64	-0.07	**0.0153**
	Bridging Programme (No)	Yes					-0.03	-0.31	0.24	0.8062
	NCEA Rank Score	per point increase					0.00	0.00	0.01	0.1195
	Table A Max credits	per point increase					**0.03**	0.01	0.05	**0.0033**
	Table B Maths Max credits	per point increase					**-0.01**	-0.03	0.00	**0.0248**
	Table B Science Max credits	per point increase					0.00	-0.02	0.02	0.7215
	1st Yr Bach passed all (Yes)	No					-0.17	-0.41	0.07	0.1578
	1st Yr Bach GPA	per point increase					**0.53**	0.46	0.59	**<.0001**

Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. Linear 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 10: Multiple regression analysis on predictors of graduating from the intended programme (n=1288) and graduating in the minimum time (n=1007) for students with NCEA

Model	Predictor variables (ref)	Comparison	Graduated from intended programme				Graduated in minimum time			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Unadjusted	Ethnicity grouping (nMnP)	Māori	0.95	0.51	1.75	0.8629	1.13	0.47	2.71	0.7882
		Pacific	0.76	0.50	1.17	0.2123	**0.46**	0.28	0.77	**0.0028**
Baseline*	Ethnicity grouping (nMnP)	Māori	0.94	0.50	1.75	0.8321	1.12	0.46	2.75	0.8037
		Pacific	0.81	0.52	1.26	0.3409	**0.43**	0.25	0.74	**0.0024**
2	Ethnicity grouping (nMnP)	Māori	1.00	0.52	1.91	0.9911	1.23	0.49	3.07	0.6574
		Pacific	0.86	0.53	1.40	0.5336	**0.48**	0.26	0.86	**0.0142**
	School decile (High)	Medium	1.09	0.80	1.47	0.5880	1.23	0.81	1.86	0.3341
		Low	1.05	0.66	1.68	0.8287	0.77	0.43	1.39	0.3867
3	Ethnicity grouping (nMnP)	Māori	1.07	0.55	2.07	0.8452	1.40	0.54	3.60	0.4854
		Pacific	0.85	0.51	1.40	0.5153	0.56	0.30	1.04	0.0650
	School decile (High)	Medium	1.12	0.82	1.51	0.4868	1.25	0.82	1.90	0.2968
		Low	1.06	0.66	1.69	0.8215	0.79	0.44	1.43	0.4370
	Auckland school (Yes)	No	0.80	0.56	1.16	0.2422	0.99	0.58	1.69	0.9611
	Type of admission (SL)	AA	0.95	0.61	1.49	0.8287	**0.55**	0.32	0.95	**0.0305**
4	Ethnicity grouping (nMnP)	Māori	1.17	0.59	2.31	0.6534	2.10	0.77	5.74	0.1462
		Pacific	0.94	0.55	1.62	0.8277	0.92	0.45	1.85	0.8039
	School decile (High)	Medium	1.12	0.83	1.53	0.4596	1.23	0.81	1.87	0.3376
		Low	1.09	0.68	1.75	0.7327	0.91	0.49	1.68	0.7654
	Auckland school (Yes)	No	0.81	0.56	1.17	0.2536	1.09	0.63	1.89	0.7569
	Type of admission (SL)	AA	1.01	0.64	1.61	0.9605	0.72	0.40	1.30	0.2720
	Bridging Programme (No)	Yes	0.76	0.48	1.21	0.2478	**0.31**	0.17	0.58	**0.0002**
5	Ethnicity grouping (nMnP)	Māori	1.29	0.62	2.68	0.5012	2.65	0.88	7.98	0.0833
		Pacific	1.19	0.65	2.18	0.5796	1.09	0.50	2.39	0.8289
	School decile (High)	Medium	1.17	0.84	1.63	0.3668	1.22	0.76	1.98	0.4075
		Low	1.27	0.75	2.16	0.3743	0.85	0.43	1.67	0.6317
	Auckland school (Yes)	No	0.79	0.53	1.17	0.2388	0.94	0.50	1.76	0.8471
	Type of admission (SL)	AA	1.23	0.70	2.15	0.4688	1.20	0.56	2.57	0.6486
	Bridging Programme (No)	Yes	1.04	0.62	1.74	0.8815	**0.34**	0.17	0.68	**0.0024**
	NCEA Rank Score	per point increase	**1.01**	1.00	1.01	**0.0012**	**1.01**	1.00	1.02	**0.0237**
	Table A Max credits	per point increase	0.96	0.92	1.00	0.0671	1.04	0.98	1.10	0.1642
	Table B Maths Max credits	per point increase	1.00	0.97	1.02	0.8823	0.99	0.96	1.03	0.6777
	Table B Science Max credits	per point increase	1.01	0.98	1.05	0.5171	1.03	0.98	1.09	0.2080
6	Ethnicity grouping (nMnP)	Māori	1.34	0.64	2.83	0.4416	3.10	0.98	9.82	0.0552
		Pacific	1.45	0.78	2.69	0.2434	1.31	0.56	3.07	0.5334
	School decile (High)	Medium	1.11	0.79	1.55	0.5552	1.11	0.67	1.85	0.6745
		Low	1.22	0.71	2.08	0.4713	0.76	0.37	1.59	0.4696
	Auckland school (Yes)	No	0.84	0.56	1.26	0.3931	1.12	0.57	2.19	0.7380
	Type of admission (SL)	AA	0.92	0.52	1.62	0.7763	0.52	0.24	1.14	0.1042
	Bridging Programme (No)	Yes	1.13	0.67	1.91	0.6491	**0.40**	0.19	0.84	**0.0155**
	NCEA Rank Score	per point increase	1.01	1.00	1.01	0.1214	0.99	0.99	1.00	0.2219
	Table A Max credits	per point increase	**0.96**	0.92	1.00	**0.0459**	1.03	0.97	1.09	0.3425
	Table B Maths Max credits	per point increase	1.00	0.97	1.02	0.8001	1.00	0.96	1.04	0.8813
	Table B Science Max credits	per point increase	1.00	0.96	1.04	0.9562	1.00	0.95	1.06	0.9585
	1st Yr Bach passed all (Yes)	No	**0.59**	0.37	0.93	**0.0232**	0.89	0.47	1.67	0.7157
	1st Yr Bach GPA	per point increase	1.12	0.98	1.28	0.0905	**1.94**	1.54	2.43	**<.0001**

Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

Table 11: Multiple regression analysis on predictors of graduation outcome for students with NCEA (n=1288)

Model	Predictor variables (ref)	Comparison	Optimal completion				Sub-optimal completion low grades				Non-completion			
			Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value	Estimate	95% LCI	95% UCI	p-value
Unadjusted	Ethnicity grouping (nMnP)	Māori	0.68	0.31	1.50	0.3393	2.00	0.92	4.34	0.0787	1.02	0.53	1.97	0.9561
		Pacific	**0.15**	0.05	0.50	**0.0017**	**4.27**	2.60	7.00	**<.0001**	1.51	0.95	2.39	0.0831
Baseline*	Ethnicity grouping (nMnP)	Māori	0.61	0.28	1.36	0.2296	1.75	0.80	3.86	0.1639	0.97	0.50	1.91	0.9362
		Pacific	**0.13**	0.04	0.43	**0.0007**	**3.80**	2.26	6.37	**<.0001**	1.34	0.83	2.16	0.2382
2	Ethnicity grouping (nMnP)	Māori	0.63	0.28	1.41	0.2625	1.62	0.72	3.63	0.2407	0.89	0.44	1.80	0.7526
		Pacific	**0.15**	0.04	0.48	**0.0016**	**3.55**	2.02	6.26	**<.0001**	1.25	0.74	2.10	0.4068
	School decile (High)	Medium	1.09	0.78	1.53	0.6011	1.07	0.67	1.69	0.7836	0.92	0.67	1.27	0.6098
		Low	0.72	0.38	1.35	0.3064	1.27	0.69	2.36	0.4434	0.99	0.60	1.62	0.9536
3	Ethnicity grouping (nMnP)	Māori	0.55	0.24	1.26	0.1585	1.68	0.72	3.91	0.2286	0.78	0.38	1.61	0.5062
		Pacific	**0.16**	0.05	0.54	**0.0030**	**2.97**	1.63	5.41	**0.0004**	1.28	0.75	2.20	0.3662
	School decile (High)	Medium	1.04	0.74	1.46	0.8316	1.09	0.69	1.73	0.7125	0.88	0.63	1.22	0.4475
		Low	0.73	0.39	1.37	0.3230	1.20	0.64	2.24	0.5673	0.98	0.60	1.61	0.9410
	Auckland school (Yes)	No	**1.69**	1.13	2.53	**0.0106**	0.61	0.31	1.21	0.1590	**1.49**	1.01	2.22	**0.0463**
	Type of admission (SL)	AA	0.84	0.49	1.44	0.5327	1.65	0.91	2.99	0.1004	1.08	0.67	1.75	0.7492
4	Ethnicity grouping (nMnP)	Māori	0.61	0.26	1.42	0.2524	1.27	0.52	3.09	0.6032	0.69	0.33	1.44	0.3215
		Pacific	**0.18**	0.05	0.62	**0.0062**	**2.19**	1.13	4.26	**0.0207**	1.12	0.63	1.98	0.7042
	School decile (High)	Medium	1.04	0.74	1.46	0.8099	1.08	0.68	1.71	0.7584	0.87	0.63	1.21	0.4138
		Low	0.74	0.39	1.40	0.3582	1.10	0.58	2.07	0.7704	0.94	0.57	1.55	0.8148
	Auckland school (Yes)	No	**1.70**	1.14	2.54	**0.0099**	0.59	0.30	1.16	0.1265	1.48	1.00	2.20	0.0520
	Type of admission (SL)	AA	0.86	0.50	1.47	0.5835	1.34	0.71	2.53	0.3640	0.99	0.60	1.63	0.9744
	Bridging Programme (No)	Yes	0.73	0.38	1.42	0.3558	**2.15**	1.13	4.06	**0.0192**	1.49	0.91	2.43	0.1148
5	Ethnicity grouping (nMnP)	Māori	1.05	0.40	2.76	0.9147	1.29	0.49	3.38	0.6068	0.65	0.29	1.44	0.2890
		Pacific	0.41	0.12	1.49	0.1769	1.99	0.96	4.12	0.0649	0.95	0.50	1.80	0.8755
	School decile (High)	Medium	**1.54**	1.03	2.29	**0.0337**	0.91	0.53	1.55	0.7153	0.89	0.62	1.27	0.5165
		Low	1.33	0.63	2.85	0.4555	1.03	0.52	2.06	0.9240	0.91	0.52	1.58	0.7288
	Auckland school (Yes)	No	2.05	1.27	3.30	**0.0031**	0.58	0.26	1.32	0.1962	**1.58**	1.02	2.43	**0.0391**
	Type of admission (SL)	AA	1.55	0.79	3.05	0.2050	0.77	0.34	1.75	0.5286	0.91	0.51	1.65	0.7657
	Bridging Programme (No)	Yes	0.56	0.24	1.28	0.1666	1.73	0.85	3.51	0.1312	1.12	0.65	1.93	0.6881
	NCEA Rank Score	per point increase	1.03	1.02	1.03	**<.0001**	0.99	0.98	1.00	**0.0020**	1.00	0.99	1.00	0.2102
	Table A Max credits	per point increase	**1.11**	1.05	1.18	**0.0004**	1.01	0.95	1.08	0.7260	1.05	1.00	1.10	0.0512
	Table B Maths Max credits	per point increase	0.99	0.96	1.02	0.4101	1.01	0.98	1.05	0.4960	1.00	0.97	1.03	0.9779
	Table B Science Max credits	per point increase	0.99	0.94	1.04	0.5854	0.96	0.95	1.05	0.6325	0.98	0.94	1.02	0.2151
6	Ethnicity grouping (nMnP)	Māori	1.12	0.41	3.04	0.8292	1.33	0.49	3.66	0.5774	0.62	0.28	1.40	0.2526
		Pacific	0.46	0.12	1.71	0.2470	1.48	0.67	3.24	0.3294	0.79	0.41	1.52	0.4849
	School decile (High)	Medium	1.38	0.90	2.12	0.1460	0.93	0.53	1.63	0.8050	0.92	0.64	1.32	0.6427
		Low	1.30	0.58	2.89	0.5263	1.01	0.49	2.09	0.9878	0.95	0.54	1.68	0.8689
	Auckland school (Yes)	No	**2.21**	1.32	3.70	**0.0027**	0.47	0.20	1.10	0.0820	1.43	0.92	2.22	0.1132
	Type of admission (SL)	AA	0.81	0.37	1.74	0.5855	1.43	0.62	3.29	0.4023	1.18	0.64	2.14	0.5988
	Bridging Programme (No)	Yes	0.57	0.24	1.37	0.2101	1.45	0.68	3.10	0.3384	1.02	0.58	1.78	0.9566
	NCEA Rank Score	per point increase	**1.01**	1.00	1.02	**0.0295**	1.00	0.99	1.00	0.2608	1.00	0.99	1.01	0.6142
	Table A Max credits	per point increase	**1.08**	1.02	1.15	**0.0107**	1.01	0.95	1.08	0.6776	**1.05**	1.00	1.10	**0.0457**
	Table B Maths Max credits	per point increase	0.98	0.95	1.02	0.3599	1.01	0.97	1.05	0.5329	1.00	0.98	1.03	0.8601
	Table B Science Max credits	per point increase	0.96	0.91	1.01	0.1299	1.03	0.98	1.09	0.2637	0.99	0.95	1.03	0.6025
	1st Yr Bach passed all (Yes)	No	1.31	0.57	2.99	0.5217	1.31	0.66	2.60	0.4402	**2.04**	1.26	3.29	**0.0035**
	1st Yr Bach GPA	per point increase	**2.05**	1.72	2.45	**<.0001**	**0.56**	0.44	0.72	**<.0001**	0.97	0.84	1.12	0.6522

Statistical model number as explained in the analysis diagram. E.g. Model #2 includes adjustment for baseline variables (gender, age and year of admission) and school decile. Models #2-6 adds sequential predictor variables into the same model. 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 mean difference or odds ratio (compared to the reference level), 95% confidence intervals (CI) and associated p-values were reported.

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