

Cross-Sectional Survey of Cardiovascular Risk Factors among Adolescents in Christchurch

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This project evolved from a concern that Pacific peoples' burden from non-communicable diseases - such as diabetes, hypertension and heart disease - appeared to be increasing at an alarming rate. One way to address these types of non-communicable disease is by intervening at a young age to facilitate change. However, there has been a lack of evidence in order to inform intervention work.

This survey provides some of the evidence needed, in order to carry out an intervention that will hopefully address the rate of these diseases in the adult population. The success of this survey was dependent on all ethnic communities within every region of Christchurch and the nine schools that were involved.

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Abstract

In New Zealand, cardiovascular disease is higher among Maori and Pacific peoples than other ethnic group.

Researchers in Cardiology documented that CVD begins early in a person's life and that a person's risk of cardiovascular disease is determined by risk factors that contribute to a form of CVD over time.

This thesis, "The Cardiovascular Risk Factors in Adolescents of Christchurch: A Cross-Sectional Survey (CRFAC)", is the first of its kind in the South Island, and was designed to estimate the prevalence of risk factors for cardiovascular disease for adolescent high school students in New Zealand. The aims of the study were to determine cardiovascular risk factor levels between, Pacific, Asian, Maori, and European students, with the Pacific communities including (Samoan, Cook Islands, Tongan, and Niuean). The CRFAC was a school-based cross-sectional survey of 1051 adolescent students, across nine Christchurch High Schools.

The study specifically aimed to determine ethnic-specific differences in lifestyle and intermediate variables that have been established as cardiovascular risks. Variables included: smoking, alcohol consumption, leisure-time physical activity (LTPA), television exposure, and sun exposure, and body mass index (BMI). Demographic variables analyzed included: form (level of education), gender, ethnic group, and socio-economic status.

In regards to smoking and alcohol consumption, Maori had the highest rates overall 77% and 88%, respectfully. As for LTPA, the type of activity that was participated in varied between sex and ethnicity. For instance, netball was played predominately more for females than males, and rugby was played more so by European/Pakehas than compared to Asians. Maori and Pacific also had a higher proportion 43.4% and 33.7%, respectively, who watched TV four or more hours per week day on average compared to the other ethnicities. Sun exposure varied strongly with ethnicity, with Asian students having a smaller proportion 20.1% in the high daily sun exposure category compared with Maori 40.8 % daily ($p < 0.001$).

The CRFAC study results showed that demographic variables were associated with the intermediate variables: lifestyle and BMI. The findings showed that there were substantive ethnic variations between the four main ethnic groups (Pacific, Maori, Asian and European) in risk factors for cardiovascular disease.

The CRFAC study was able to identify contributing factors, for which gave the investigator clarity to possible reasons for ethnic differences in BMI. The CRFAC study results showed that Pacific participants had the highest BMI levels of all the ethnic groups, followed by Maori.

GLOSSARY

1. **CVD**- or Cardiovascular Disease is the class of diseases that involve the heart or blood vessels.
2. **CRFAC**- stands for *Christchurch Risk Factors for Adolescents of Christchurch*. This study was the cross-sectional research performed for this thesis.
3. **Rheumatic Heart Disease**- damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria.
4. **Peripheral Arterial Disease**- disease of blood vessels supplying the arms and legs.
5. **Deep Vein Thrombosis & Pulmonary Embolism**- blood clots in the leg veins, which can dislodge and move to the heart and lungs.
6. **Cerebrovascular Disease**- disease of the blood vessels supplying the brain.
7. **Coronary Heart Disease**- disease of the blood vessels supplying the heart muscle.
8. **Congenital Heart Disease**- malformations of heart structure existing at birth.
9. **Obesity**- is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems. “Cut off used by (WHO 1990) $<30\text{kg/m}^2$ ”
10. **Overweight**- is generally defined as having more body fat than is optimally healthy. “Cut off used by (WHO 1990) $<25\text{kg/m}^2$ ”
11. **BMI**- or Body Mass Index, which is a numerical computation regarding height and weight.
12. **CAD**- or Atherosclerotic Heart Disease is the end result of the accumulation of atheromatous plaques within the walls of the coronary arteries that supply the myocardium (the muscle of the heart) with oxygen and nutrients. It is sometimes also called Coronary Heart Disease.
13. **VFA**- or abdominal fat also known as organ fat or intra-abdominal fat, is located inside the abdominal cavity, packed in between organs (stomach, liver, intestines, kidneys, etc.).
14. **Physical Activity**- is any bodily activity that enhances or maintains physical fitness and overall health and wellness.
15. **Physical Fitness**- comprises two related concepts: general fitness (a state of health and well-being) and specific fitness (a task-oriented definition based on the ability to perform specific aspects of sports or occupations).
16. **Passive Smoker**- is the inhalation of smoke, called secondhand smoke (SHS) or environmental tobacco smoke (ETS), from tobacco products used by others.
17. **Binge Drinker**- is the modern definition of drinking alcoholic beverages with the primary intention of becoming intoxicated by heavy consumption of alcohol over a short period of time.
18. **WHO**- or World Health Organization is a specialized agency of the United Nations (UN) that acts as a coordinating authority on international public health.
19. **Lifestyle Variables**- variables (smoking, drinking, and LTPA, sun & television exposure) used in the CRFAC that were used to analyze the Cardiovascular Disease risk factors amongst the Christchurch adolescents.

20. **Decile**- or Socio-Economic Decile Band is a widely used measure in education in New Zealand used to target funding and support to more needy schools.
21. **LTPA**- or Leisure-Time Physical Activity, which was one of the lifestyle variables that was used in the CRFAC that were used to analyze the Cardiovascular Disease risk factors amongst the Christchurch adolescents.
22. **Form**- is a class or grouping of students in a school. The term is used predominantly in the United Kingdom, although some schools, mostly private, in other countries, including New Zealand also use the title.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION.....	10
1.1 AN OVERVIEW.....	10
1.2 BACKGROUND & AIMS OF THE STUDY.....	12
1.3 CARDIOVASCULAR DISEASE EPIDEMIOLOGY.....	14
1.3.1 Introduction.....	14
1.3.2 Distribution of cardiovascular disease.....	15
1.3.3 Determinants of cardiovascular disease.....	15
1.3.3.1 Obesity.....	16
1.3.3.2 Physical Activity.....	19
1.3.3.3 Smoking.....	21
1.3.3.4 Summary.....	23
CHAPTER 2 LITERATURE REVIEW	24
2.1 INTRODUCTION.....	24
2.2 Demographics of Cardiovascular Diseases on a Global Scale.....	24
2.2.1 Description of Previous Studies.....	26
2.2.1.1 Studies in New Zealand	26
2.2.1.1.1 Results for New Zealand.....	29
2.2.1.2 Studies in the USA.....	32
2.2.1.2.1 Results in the USA.....	34
2.2.1.3 Studies in Europe.....	36
2.2.1.3.1 Results in Europe.....	36
2.2.1.4 Studies in the “Know Your Body” Program.....	38
2.2.1.4.1 Results in the “Know Your Body” Program.....	42
2.3 Overall Summary.....	45
CHAPTER 3 METHODS.....	47
3.1 INTRODUCTION.....	47
3.1.1 Proposal Development & Target Area.....	47
3.2 ETHICS APPROVAL	50

3.3 SAMPLING.....	50
3.4 DATA ANALYSIS.....	52
CHAPTER 4 RESULTS.....	54
4.1 INTRODUCTION.....	54
4.1.1 Demographic Variables of Population under Study.....	54
4.2 DEMOGRAPHIC CHARACTERISTICS OF THE STUDY GROUP.....	56
4.2.1 Main ethnic groups.....	57
4.2.2 Pacific participants	57
4.2.3 Socio-economic status of participants.....	58
4.3 LIFESTYLE VARIABLES.....	60
4.3.1 Smoking.....	60
4.3.1.1 Proportion that “Have Tried Smoking”.....	60
4.3.1.2 Smoking categories.....	62
4.3.1.3 Current smokers.....	63
4.3.1.4 Amount smoked in the week prior to the survey.....	66
4.3.1.5 Summary of smoking as a lifestyle variable.....	67
4.3.2 Drinking.....	68
4.3.2.1 Proportion that “Have Ever Consumed Alcohol”.....	68
4.3.2.2 Alcohol intake.....	70
4.3.2.3 Current alcohol drinkers.....	71
4.3.2.4 Binge drinking.....	73
4.3.2.5 Summary of alcohol as a lifestyle variable.....	75
4.3.3 Leisure-time physical activity.....	76
4.3.3.1 Types.....	76
4.3.3.2 Intensity & Limitations.....	78
4.3.3.3 Leisure-time physical activity and other lifestyle variables.....	79
4.3.3.4 Summary of leisure-time physical activity as a lifestyle variable.....	80
4.3.4 Television watching.....	81
4.3.4.1 Television watching on week days.....	81
4.3.4.2 Television watching on weekend days.....	82

4.3.5 Sun exposure.....	85
4.3.5.1 Sun exposure on week days.....	85
4.3.5.2 Sun exposure on weekend days.....	86
4.4 INTERMEDIATE VARIABLES.....	88
4.4.1 Body Mass Index.....	88
4.4.1.1 BMI and demographic variables.....	88
4.4.1.2 BMI and lifestyle variables.....	89
CHAPTER 5 DISCUSSION.....	93
5.1 ESSENTIAL FINDINGS PER EACH RISK FACTOR.....	93
5.1.1.1 Smoking.....	93
5.1.1.2 Alcohol.....	94
5.1.1.3 Leisure Time Physical Activity.....	95
5.1.1.4 Body Mass Index.....	96
5.1.2 Summary	97
5.2 COMPARISON OF RESULTS WITH PREVIOUS LITERATURE.....	98
5.2.1. Introduction.....	98
5.2.2 Comparison with previous literature on intermediate variables	99
5.3. SIGNIFICANT FINDINGS COMPARED TO PREVIOUS RESEARCH.....	101
5.3.1 Comparison of Intermediate Variable.....	101
5.3.2 Explaining Ethnic Variations to the Intermediate Variable.....	101
5.4 UNEXPECTED FINDINGS COMPARED TO PREVIOUS RESEARCH.....	103
5.4.1 Why adolescents?	103
5.4.2 Why Pacific people?	104
5.4.3 Why ethnic-specific Pacific groups?	105
5.5 SURPRISE KEY FINDINGS.....	106
5.6 WEAKNESS OF THE STUDY- LIMITATIONS.....	108
5.7 STRONG POINTS OF THE CRFAC.....	109
5.7.1 Recommendations.....	110

5.7.1.1 Smoking Recommendations.....	110
5.7.1.2 Alcohol Recommendations.....	111
5.7.1.3 Physical Activity (and inactivity) Recommendations.....	111
5.7.1.4 Policy Recommendations.....	112
5.8 CONCLUSIONS.....	113
REFERENCES.....	115
FIGURES & TABLE APPENDIX.....	124
APPENDIX A 1.1 STUDENT CONSENT FORM.....	124
APPENDIX A 1.2 STUDENTS' GENERAL QUESTIONNAIRE.....	126
APPENDIX A 1.3 ETHICS APPROVAL DOCUMENTATION.....	138
TABLE A 1.1 NEW ZEALAND CARDIOVASCULAR RISK PREDICTIONS CHARTS.....	139
TABLE A 1.2 LTPA.....	140
TABLE A 1.3 OTHER LTPA.....	141
TABLE A 1.4 Over Weight (EX)/Current Smokers.....	142
TABLE A 1.5 Obese (EX)/Current Smokers.....	142
TABLE A 1.6 Over Weight (EX)/Current Drinkers.....	143
TABLE A 1.7 Obese (EX)/Current Drinkers.....	143
TABLE A 3.1 Represents Questionnaire Used in the Survey.....	144

CHAPTER 1- INTRODUCTION

1.1 AN OVERVIEW

The National Center for Biotechnology Information defines *cardiovascular disease*, “as pathological conditions involving the cardiovascular system: including the heart, the blood vessels; or the pericardium” (www.ncbi.nlm.nih.gov/).

Cardiovascular disease rates are increasing and are a problem for many countries. As for an overall view in New Zealand on cardiovascular disease the Heart Foundation has provided some alarming statistics (www.heartfoundation.or.nz).

KEY FACTS

- Cardiovascular disease (heart, stroke and blood vessel disease) is still the leading cause of death in New Zealand accounting for 38% of deaths annually
- Every 90 minutes a New Zealander dies from coronary heart disease (16 deaths a day. Many of these deaths are premature and preventable.
- Obesity is a risk factor for a number of diseases including coronary heart disease, stroke and diabetes.
- One in twenty adults has been diagnosed with coronary heart disease. That's 161,000 adults and includes 118,500 with angina and 89,400 who have had a heart attack resulting in them being hospitalised.
- Approximately one in two adult New Zealanders are obese or overweight.
- One in five New Zealanders older than 15 smoke.
- Nearly 5,000 people in New Zealand die prematurely from smoking each year - this equates to around 13 people a day dying from smoking.

(Data Source from HF 2010)

Epidemiological research has determined several factors that increase the risk of coronary heart disease and heart attack. Major factors are those that research has shown significantly increase the risk of heart and blood vessel (cardiovascular) disease. The American Heart Foundation noted that: “Other factors are associated with increased risk of cardiovascular disease, but their significance and prevalence haven't yet been precisely determined”. They are called contributing risk factors. (www.americanheart.org)

In Auckland, the Auckland High School Heart Survey team determined the prevalence of risk factors for cardiovascular disease in an adolescent high school population in Auckland (Bathgate 1994). The AHHS was a school-based cross-sectional survey of 2,549 adolescent students, across 10 Auckland High Schools. A cluster

sampling technique was used to obtain the target of 1000 Pacific participants, to enable Pacific ethnic-specific analysis.

In **Table 1-1** and **Table 1-2** the percentages of Maori and Pacific Islanders (more specifically Tongan) lead in these categories amongst the youth.

Data Source from Bathgate 1994

Variables		N	Adjusted Mean
<i>Sex</i>	Male	1364	24.23
	Female	1101	25.14
<i>Age Group</i>	<16	675	24.15
	16	899	24.73
	17	594	24.71
	≥18	319	25.24
<i>Ethnicity</i>	Pacific Islander	1025	27.16
	Maori	332	24.95
	Asian	533	21.83
	European	597	22.62

Table 1-1: The Adjusted Average for BMI amongst Auckland Adolescents

Data Source from Bathgate 1994

Variables		N	Adjusted Mean
<i>Sex</i>	Male	468	26.75
	Female	467	28.16
<i>Age Group</i>	<16	257	26.8
	16	317	27.16
	17	233	27.65
	≥18	128	29.16
<i>Ethnicity</i>	Samoan	456	27.59
	Tongan	223	27.97
	Niuean	109	27.1
	Cook Islands	147	26.54

Table 1-2: The Adjusted Average for BMI amongst Auckland Pacific Islanders

In the South Island, there are fewer Maori and Pacific Islanders than compared to the North Island, but aside from the population difference, the lifestyles amongst ethnicities within this age group remain the same. This research provided a review of cardiovascular risk factors in Christchurch adolescent youth.

The purpose of this study was to get a clear understanding of the different cardiovascular risk factors that affect the future lives of the different ethnic groups in the city of Christchurch. The New Zealand government has stated: “Cardiovascular disease is the leading cause of death in New Zealand, with Maori and Pacific peoples having the highest rates of cardiovascular disease” (www.maorihealth.govt.nz). The results of this

study are used for future policy development to improve health outcomes for the New Zealand population.

1.2 BACKGROUND & AIMS OF THE STUDY

To get an understanding of why Maori and Pacific people are having higher rates of cardiovascular disease compared to any other ethnic group in New Zealand, the CRFAC was created. The Cardiovascular Risk Factors in Adolescents of Christchurch (CRFAC) is a cross-sectional study methodology that has been chosen for the survey which will be discussed later in Chapter 3. The CRFAC study is an epidemiological survey designed to determine the prevalence of risk factors for cardiovascular disease in an adolescent high school population in New Zealand. Between July 2010 and January 2011, 1,051 Form 9 to 14 students, aged 14 to 18 years, from 9 high schools, from all regions of Christchurch gave informed consent to participate in this Cardiovascular Risk Factors funded project.

This study is important because the investigators wanted to see if Pacific people living in New Zealand are at a higher risk of getting cardiovascular disease compared with European people by exhibiting known risk factors for CVD.

Some common and important diseases occur more frequently in Pacific people. For example, mortality rates from coronary heart disease, the major cause of death for all New Zealanders, were higher in Pacific people by 31% in men and 68% in women compared to Europeans (Hay 2001). The prevalence of hypertension was 94% higher in men and 65% higher in women for Pacific participants in a workforce survey compared to Europeans (Ministry of Health 2000); while the diabetes prevalence was increased 4-fold among Pacific participants in the same survey (Hay 1996).

The specific aims of the Hay's study (1996) were to interview high school students in order to:

1. Determine cardiovascular risk factor levels in; and
2. Compare the cardiovascular risk factor levels between:
 - Pacific and European students; and
 - Pacific communities (Fijian, Samoan, Cook Islanders, Tongan, and Niuean).

This introductory chapter gives an in depth analysis of cardiovascular disease and a time line history of how different population groups dealt with cardiovascular disease. This chapter also contains discussions on the distribution and determinants of

cardiovascular diseases both here in New Zealand and internationally, followed by a selective review of the literature in the epidemiology of cardiovascular diseases in adolescence. Adolescence is another term to describe a young adult or teenager. Adolescents in the CRFAC were defined as being between 15 and 19 years of age, inclusive.

This study provided a unique opportunity to systematically investigate cardiovascular risk factors in Pacific youth and compares them with a sample of European children and adolescents of similar socio-economic status.

This study also examined some other unknown factors:

1. Are the leisure activities undertaken now the same as to studies that was undertaken 10 years ago amongst the particular ethnicities?
2. Does BMI differ amongst specific Pacific Island groups?
3. What gender participates in riskier activities and makes compromised decisions in regard to cardiovascular health and why?

This study investigated possible differences in cardiovascular risk factors between adolescents of the main Pacific communities: Samoan, Cook Islands, Tongan and Niuean living in the South Island of New Zealand. By collecting a wide range of lifestyle risk factors including diet, physical activity, leisure-time physical activity, aerobic fitness, smoking and alcohol, this study was able to investigate, for the first time in New Zealand's South Island adolescents, the association between lifestyle, obesity, fitness and the major cardiovascular risk factors.

The Auckland High School Heart Survey (Bathgate 1994) was vital to this research since it was the groundwork to show New Zealanders that there was a problem with the amount of lower decile communities and minorities having a higher chance of cardiovascular disease sometime within their life. It also exposed risk factors that were devastatingly higher compared to other ethnicities and higher decile communities.

This research allowed the investigators to see if there was a link with the same ethnic groups and age groups within the South Island (particularly Christchurch) and see if there was any comparison to those living in the North Island of New Zealand.

1.3 CARDIOVASCULAR DISEASE EPIDEMIOLOGY

1.3.1 Introduction

The major goals of epidemiology are to evaluate hypotheses about the causation of disease and to relate disease occurrence to characteristics of people and their environment.

Epidemiology is concerned with the distributions and determinants of disease frequency in human populations (Lopez 1993). Thus, epidemiology can be defined as "the study of the distribution and determinants of disease frequency and other health-related conditions in populations" (www.medical-dictionary.com). All epidemiological principles and methods focus on frequency, distribution, and determinants of health.

The first component to be considered is measurement of disease frequency, which involves quantification of the existence or occurrence of disease. The availability of such data is a prerequisite for any systematic investigation of patterns of disease occurrence in populations (Hennekens 1987).

The second, the distribution of diseases considers such questions as, who is getting the disease in a population, as well as where and when the disease is occurring. Such questions may involve comparisons between different populations at a given time, between subgroups of a population, or between various periods of observation. Knowledge of such distributions is essential to describe patterns of disease as well as to formulate hypotheses concerning possible causal or preventive factors.

The third component, the determinants of disease, derives from the first two, since knowledge of frequency and distribution of disease is necessary to test an epidemiologic hypothesis. In this section, these three components of epidemiology are put in a cardiovascular disease context, as well in a New Zealand context to facilitate discussions later.

1.3.2 DISTRIBUTION OF CARDIOVASCULAR DISEASE

As mentioned above, the distribution of diseases considers such questions as who is getting the disease in a population. They are then in line with one of the main objectives of this study, which is to look at ethnic differences in cardiovascular disease risk factors. As part of the background to this discussion, this section attempts to pave the way by firstly looking at international differences and trends in cardiovascular disease mortality rates. This is compared to differences and trends in New Zealand. Finally this section ends with discussions of ethnic differences and trends in cardiovascular disease mortality in New Zealand.

Knowledge of international differences and trends in cardiovascular disease compared with that in New Zealand is essential to understand the pattern of this disease in the population (Beaglehole 1988). This systematic approach will help formulate hypotheses concerning possible causal or preventive factors in adolescent populations.

1.3.3 Determinants of cardiovascular disease

One of the main purposes of epidemiological studies of disease causation is to identify determinants whose manipulation could lead to prevention rather than determinants, such as genetic constitution, which although of great interest can not be manipulated at the present time.

As mentioned previously, the determinants of disease derives from the first two components of epidemiology, since knowledge of frequency and distribution of disease is necessary to test an epidemiologic hypothesis. Hypotheses about disease causation may arise directly out of a simple epidemiological description of a disease in terms of the kind of people affected by it (e.g. their age, gender, and occupation), its geographical distribution, and the variation in its frequency of occurrence at different times. While the etiologic link between the determinants or risk factors of CVD and heart disease measured in childhood and adolescents remains to be clarified, there are strong, consistent relationships between risk factor levels and cardiovascular disease in adults. The traditional risk factors for adult CVD such as serum lipids, lipoproteins, blood pressure, obesity, physical inactivity and cigarette smoking are also determinants of risk factors in childhood. However, there is a potential for misclassification by using cut-offs for determining levels of risks in adolescents. Thus in this section, the guidelines for major risk factors of CVD in adults are discussed.

1.3.3.1 Obesity

Obesity represents several distinct concepts pertinent to body composition, relative body weight and fat distribution. As a result obesity has become a non-specific term that may represent any of these concepts. Obesity is defined “as abnormal or excessive fat accumulation that may impair health” (WHO 1990). At the individual level, the term may refer to the appearance of extreme physical bulk, for example most Japanese 'sumo' wrestlers. At a population level, obesity may refer to the prevalence of an arbitrarily specified level of BMI (body mass index). Body mass index (BMI), is a simple index of weight-to-height that is commonly used to classify overweight and obesity in adults. It is defined as, “A person’s weight in kilograms divided by the square of his height in meters (kg/m^2)”, (www.who.int). It is helpful to make explicit the aspect of obesity addressed in any particular context and begin by clarifying the principal concepts of obesity found relevant to health: central adiposity, fatness, and overweight.

The term 'central adiposity' is often used to describe obesity especially, fat distribution, which concerns the anatomical distribution of body fat. This is only one aspect of the more fundamental phenomenon of 'body composition' considered specifically for different anatomic regions. The term fatness usually means the quantity of adipose tissue in the body. This may be expressed either in absolute units (fat mass, in Kg) or as the corresponding percentage of the total body mass that is adipose tissue (percentage body fat without units). “Overweight”, denotes a relative excess of weight. The current widely available measure of overweight is relative weight usually expressed as BMI (measured in kg/m^2) (Caballero 2005).

In adult populations, the thresholds for overweight in past literature vary from BMI of 22 to BMI of 30 (Berenson 1980). Between these extremes are commonly used threshold near BMI of 27 (Beaglehole 1977), and BMI of 25 (WHO 1990). The “normal” range of BMI for individuals was indicated as from 18.5 to 25 kg/m^2 , and obesity of three grades was defined corresponding to values of 25-30, 30-40, and 40 or greater kg/m^2 (WHO 1990). It was noted that for populations to achieve a distribution of BMI such that values of 25 kg/m^2 or greater occurred only rarely would require that a mean value of 22 kg/m^2 be attained.

The estimation from, (WHO 1990), has a critical impact on quantification and where one will place overweight as a preventable contributor to disease. One may be

classed over this threshold as a result of an excessive mass of muscle, bone or fat. Moreover, most research has been carried out on European populations, and as a result interpretation of threshold levels in non-European populations becomes difficult. For example, Polynesian people have a high mean BMI compared with those of European descent (Hetzel 1987, Scott 1993). Yet studies using bioelectrical impedance (BIA) (Bathgate 1994), and Isotope dilution methods found that, at any given BMI level, “Polynesians appear to have higher levels of fat-free mass and less body fat than Europeans” (Bell 1996). The BMI threshold used may have overestimated the body fat levels in Polynesian people. Swinburn (1998), proposed that the definition for overweight for Polynesians should be a BMI of 26- 32 kg/m² and that obesity is defined as a BMI >32 kg/m² (Skragg 1993, Bell 1994). The First National Health and Nutrition Examination Survey, 1971 to 1974 (NHANES I) in the United States (Scragg 1991), presented percentiles of BMI for white children aged 1 to 19 years. Currently, there are no guidelines for New Zealand adolescents.

Obesity and Cardiovascular disease

This issue has captured attention over recent decades, in particular the role of obesity, or overweight resulting from adiposity, and whether it plays a primary or causal role in cardiovascular disease (Garrison 1998). Although excess body weight is a relative modest independent CHD risk factor, it is important through its association with other risk factors. The evidence for this role came from observational studies in the 1960s. “The only problem was that although these were well designed prospective studies, there seemed to be equivocal, sometimes contradictory results regarding the role of overweight in CVD” (Garrison 1998). Some investigators suggested a protective role for being overweight and obesity in regards to CVD (NHSC 1976). Right before the 1990s, the idea that being overweight did not play a causal role in CVD was becoming realistic. The thought of this came from research that used longer periods of observation of overweight and obese individuals. Critical assessments were made of previously published studies which expanded or better defined the meaning of being overweight (Garrison 1998). In addition, research on large, well designed prospective studies in both women (Bonita 1997, Jackson 1989), and men (Truelson 1998, NZHIS 1996), became accessible giving witness that weight fluctuations induce equal changes in major cardiovascular risk factors, again further regarding obesity as a cause of CVD.

This role is believed to be mediated via other risk factors such as increases in blood pressure, circulating triglycerides, LDLC, and decreases in HDLC (Bonita 1984); although, there are some studies suggesting that overweight has direct impact on CVD and all cause mortality, even after correction for other risk factors (Statistics New Zealand 2004, Ministry of Health 2001).

Recent reports suggest that regional fat distribution may be important in determining risk of cardiovascular disease and not weight change (McNaughton 2002). Numerous reports have confirmed that an android fat pattern with excess fat in the upper (central) body region, particularly the abdomen, has been associated with increased risk compared with a gynoid pattern, with increased fat in the lower body segment, particularly the hips and thighs (Ministry of Health 1999, Ministry of Health 1991). One study that looked at the location of abdominal fat with coronary artery disease (CAD) who were not overweight (BMI range 17-26.3), compared with men of the same age and BMI who did not have CAD (Bell 1994). Visceral Fat Area (VFA) and subcutaneous fat area was measured by computed tomography at the level of the umbilicus in both groups. Patients with coronary artery disease had a higher average VFA. “The patients with elevated VFA also were more likely to have abnormal glucose tolerance tests a finding that confirms numerous other reports of such an association” (Beaglehole 1995). The study identified visceral fat as an essential domain for risk factors that increased the risk of CAD. The study also suggested an explanation for the occurrence of CAD in normal BMI people (BMI 22 to 25 ranges), (Salmond 1985).

1.3.3.2 Physical Activity

Physical inactivity guidelines and definitions

The term 'physical inactivity' represents a widely prevalent condition or behaviour in all modern societies as a result of the radical evolution in human lifestyle patterns from thousands of years ago up until the most recent century. Physical activity, as a prevailing characteristic of modern societies, has ranked for centuries along-side food consumption as one of the two most fundamental human activities (NCEP 1993). Each could be viewed as being necessary for the conduct of the other. The portrayal of this dynamic relationship in human development is the recent magnitude of mass sedentation and increased caloric intake of modern man. Many epidemiologic study of physical activity in relation to cardiovascular diseases, especially CHD, have been carried out (WHO 1982, Mann 1993).

Many terms are encountered in connection with physical inactivity. The term '*Physical activity*', can be defined as: "bodily movement produced by skeletal muscles that require energy expenditure" (Anderson 1990). '*Physical fitness*' can be defined as "a set of attributes that people have or achieve that relates to the ability to perform physical activity" and '*physical inactivity*' can be defined as "a level of activity less than that needed to maintain good health" (NCEP 1991). '*Physical exercise*' is a type of physical activity defined as "planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness" (medical-dictionary.com).

Other concepts of physical inactivity used in epidemiologic literature in relation to cardiovascular disease include the distinction between occupational activity and non-occupational or leisure-time physical activity. Physical activity is qualitatively expressed in three grades such as "light", "moderate" and "vigorous" (Labarthe 1997). Examples of light, moderate, and vigorous physical activity used in this study are given in the general questionnaire, which is in the appendix at the back of the thesis.

To perform physical activity or exercise, the body must increase its delivery and use of oxygen to fuel the working muscles. The amount of oxygen utilized [oxygen uptake (VO^2)] depends on the amount of physical activity performed. The amount of oxygen consumed by an individual at maximal exercise is termed the maximal oxygen uptake ($VO^2_{max.}$), (Morris 1973). Exercise testing (ET) is an inexpensive non-invasive

tool that enables the measuring (VO^2_{max}). Two main types of testing are: submaximal and maximal utilizing gas exchange (Heyward 2010).

Physical activity and cardiovascular disease

The epidemiology of the study of physical activity and morbidity and mortality had its origins in England (Labarthe 1998). That study found that London double-decker bus conductors who walked up and down collecting tickets had lower cardiovascular disease rate than bus drivers who sat most of the day. Conductors were more physically fit and had lower incidence of CHD than bus drivers. The conductors had reduced fatality rates and lowered the rate of early mortality from the disease. Research by Laemmle (1989) showed that vigorous sporting activities appeared to be more protective than vigorous exercise at work in that the risk of fatal attack was 40% of that of the subjects not undertaking vigorous exercise. Non-fatal episodes were reduced by about 50% while smokers were also protected to some extent (Beaglehole 1988).

Between 1951 and 1972, Paffenbarger, followed the work activity levels and coronary heart disease records of San Francisco longshoremen (Keys 1983, Physical Activity & Health 1996). Paffenbarger (1971) reported that the men who expended 8,500 or more kilo-calories per week at work had significantly less risk of fatal CHD risk at any age than men whose jobs required less energy expenditure. More recently, there was a study that the association between physical fitness and risk of all-cause and cause-specific mortality in 10,224 men and 3,120 women (Blair 1989). After an 8-year follow-up, advanced levels of physical fitness delayed all-cause mortality, primarily because of decreased rates of CVD and carcinogen diseases.

Sedgwick (1980) from Adelaide reported that: “The long term effect of a physical training program on coronary risk factors”. Three hundred and seventy men aged 60 to 65 years from upper and middle social classes were followed for five years. One-third remained physically active (at least two hours a week of moderate or heavy exercise) but their coronary risk factors did not differ from those who had continued their inactive habits. “Men who had improved substantially in fitness did not differ in risk factors from men whose fitness has not changed or declined” (Sedgwick 1980). Measurements of HDLC were not made. The authors commented that the protective mechanisms influenced by training might be independent of classical coronary risk factors and that higher levels of fitness might have yielded different results. It should be stated that the

evidence concerning exercise and CVD is also based on observational studies since controlled trials are difficult to conduct.

1.3.3.3 Smoking

Smoking guidelines and definitions

Over the decades, smoking has become an increasingly common target not only of health professionals but also of legislative and regulatory bodies. In the mid-1990s, it was regarded justifiably as "the risk factor of the century" (Labarthe 1998). In the twenty first century, reducing smoking continues to be an enormous public health goal.

Labarthe (1998) claims that, "The habits of smoking and other tobacco use have in common an underlying addiction to nicotine". Public marketing and distribution of tobacco products has spread rapidly over the years to adolescent teens, and the early use of tobacco begins the early stages of addiction. In the US and in many other countries, billboards, television, and radio that once advertised for tobacco products are now forbidden and are not advertised.

As a result, the public health burden is enormous, aggressive public health measures are needed to control this epidemic.

Labarthe (1998) defines smoking and tobacco use, which include "Tobacco exposure, categories of smoking status, quantization of smoking, and the processes of starting and stopping tobacco use". The term '*passive smoke*' is given "when non-smoking persons share the environment of smokers and are being exposed to tobacco smoke". 'Smokeless tobacco' is commonly used in the forms of a plug, dipping or chewing tobacco, or snuff. With respect to personal smoking behaviour, a common classification system used in the literature is '*never smoked*, '*former smoker*' and '*current smoker*'(Stanrler 1992). Definitions and criteria must be specified for each class. The quantization of exposure for both former, and current smokers, may be approximated by determining the age at the start of smoking, present age (or the age at stopping if one is not a current smoker), and the average number of cigarettes smoked per day over the smoking life time in units of cigarettes, packs, or portions of packs. "This provides an estimate of exposure in units of pack-years for either former or current smokers" (Labarthe 1998). For instance, a former or current smoker smoked half a pack of cigarettes per day for 36 years equates to 18 pack-years of exposure. The draw back in such a classification system is that for smokers, there is often additional exposure to

smoke generated by others and for non-smokers this is often not accounted for in research. Other drawbacks would include smokers who quit for a short period of time and then relapse. One would also need to take into account second hand smoke. This drawback, in my opinion, would be more prevalent towards smokers than non-smokers. This is due to the fact smokers have a higher chance of being around others that are smoking, but they themselves might not be smoking. Non-smokers tend to crowd with other non-smokers.

Smoking and cardiovascular disease

The effect of smoking on the risk of coronary heart disease within a population has been assessed in many studies. Among these studies was the United States National pooling project where five studies (Albany Civil Servants, Chicago Gas Company, Chicago Western Electric Company, Framingham and Tecumseh) were pooled to provide information based on 72,000 people, years of experience and the occurrence of 658 first major coronary events prior to age 65 (Fredrichson 1973). This study showed that men aged 30-59 years who smoked more than 20 cigarettes a day, in a 10 year follow-up had 3.2 times the risk of a major coronary event (angina, myocardial infarction or sudden death) compared with non-smokers. The quintile with the highest combined risk (based on cholesterol, blood pressure and smoking) had six times the risk of a coronary event compared with the lowest quintile.

Other famous studies were the 'British Doctors' Study (Dyerberg 1973). In this study a total of 34,440 men replied to the original questionnaire in 1951 and almost all were followed for 20 years during which 10,072 deaths occurred. For those under 45 years of age, heavy smokers (>25/day) were 15 times more likely to die of CHD than non-smokers. The risk fell to 3:1 for those aged 45-54 years, 2:1 for ages 55-64 years, and was relatively minor for those over 65 years. Men aged 30- 64 years who stopped smoking reduced their coronary risk to 2: 1 in the first 5 years after stopping and to 1.3: 1 after 15 years. Among male doctors under 65 years, the mortality rate from all causes from the fourth to the twentieth year of the study fell by 28% compared with 9% in the general United Kingdom male population. This was attributed to the fact that large numbers of doctors stopped smoking. Men under 70 years who were cigarette smokers had twice the overall of smokers. For men over 70 years the mortality ratio was 1.5: 1.

1.3.3.4 Summary

In regards to the three closely inter-related components: frequency, distribution and determinants of cardiovascular epidemiology, all were identified in the research of the CRFAC. The frequency shown there was an existing epidemic amongst Christchurch adolescents in relation to CVD. The second, the distribution of diseases answered such questions as, who was getting the disease amongst Christchurch adolescents, as well as when the disease first started occurring. The third, distribution, provided a hypothesis about CVD causation in Christchurch adolescents and was derived directly out of a simple epidemiological description of CVD in terms of the kind of people affected by it (e.g. their age, sex, and occupation), its geographical distribution, and the variation in its frequency of occurrence at different times. These results will be further explained in chapter four.

After the study commenced and the data was collected, results showed similar outcomes that not only were reported in previous studies of the North Island, but also a close relationship to the world-wide epidemic amongst lower decile ethnic groups in regards to cardiovascular disease.

The literature review in chapter two describes the studies which have examined these risk factors in adolescents.

CHAPTER 2- LITERATURE REVIEW

2.1 INTRODUCTION

The main purpose of this thesis is to examine the risk factor levels between Pacific and European adolescents and within the main Pacific groups. This has reflected on the 'selection criteria' used for this literature review. Thus this review will focus on coronary heart and cerebrovascular disease, which are the two major causes of CVD deaths and the following selected risk factors: lipids, blood pressure, body mass index, physical inactivity, and smoking. As a background to this, a discussion on bias is presented first which will be followed by a critical review, globally and by country, of the selected studies in this review.

2.2 Demographics of Cardiovascular Diseases on a Global Scale

In 2003, the World Health Organization (WHO) claimed that, “16.7 million people around the globe die of CVD each year”. By 2020, “heart disease and stroke will become the leading cause of both death and disability worldwide, with the number of fatalities projected to increase to more than 20 million a year and to more than 24 million a year by 2030” (Hopkins 1992). “Cardiovascular disease alone will kill five times as many people as HIV/AIDS in these countries” (Britain Lancet 1986). By 2020, “CVD, injury and mental illnesses will be responsible for about one-half of all deaths and one-half of all healthy life years lost, worldwide” (Knuiman 1982). **Figure 2-1** illustrates the top 3 chronic diseases projected in 2020 (Diet, Nutrition and the Prevention of Chronic Diseases. WHO, Geneva, 2003)

Data Source from WHO: Diet, Nutrition, & the Prevention of Chronic Diseases Division 2003

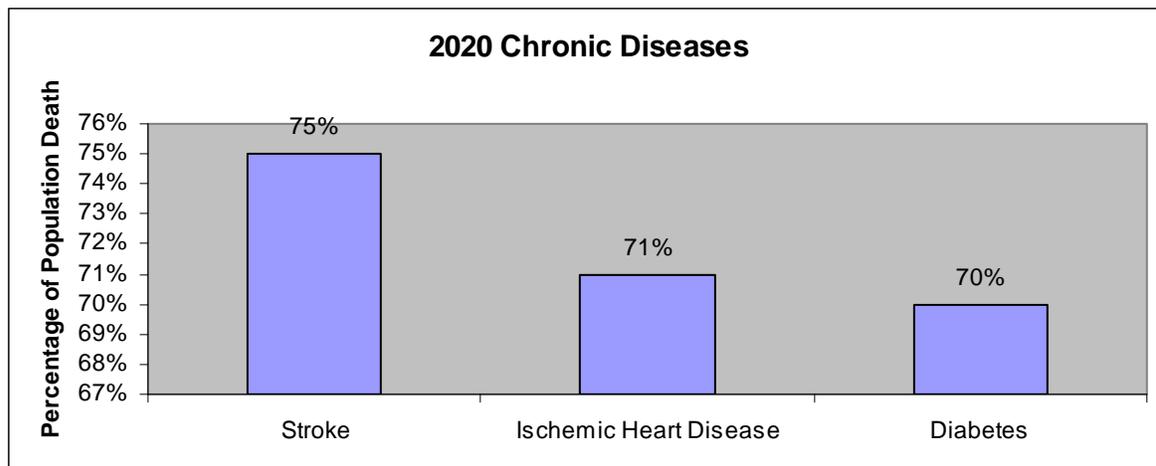


Figure 2-1: The 2020 Percentage Projections of Top 3 Chronic Deaths Worldwide

Much research now agrees that 60% of the burden of chronic diseases will occur in developing countries. Compared to the rest of the world many researchers investigating CVD claim that China and India have higher cases of CVD than any other country in the developed world. Durrington (1998) reported that the UK had 233,000 deaths that were attributed to CVD. Heart disease and stroke occur devastatingly in some of the most unthought-of health countries in the world. In Canada for instance, someone dies of heart disease or have a stroke ever seven minutes (Hulley 1980). Compared to all other diseases in Canada, CVD is the leading killer disease. With the number of elderly Canadians and Americans “Baby Boomers” increasing, the number of deaths due to stroke and CHD has increased as well. This trend is expected to continue for the next 15 years (Hulley 1980). “CVD costs the Canadian economy about \$18.4 billion annually” (Hulley 1980). Canada is not the only country in the world wondering how it will cover the costs, New Zealand is also wondering what it will do. Costs for chronic diseases rise, the number of elderly increase, but funding stays static.

2.2.1 Description of Previous Studies

2.2.1.1 Studies in New Zealand

In New Zealand, studies were carried out between the 1996 and 2005. The first of the New Zealand studies was the 'Rotorua Lakes Study' (Swinburn 1996). This cross-sectional study was initiated to describe the cardiovascular disease risk factor status and related characteristics of New Zealand adolescents, especially New Zealand Maori. All 298 students were invited to participate and all were enrolled, although only 271 (157 boys and 114 girls) were retained because of their ethnicity. Seventeen students were part-Maori and six belonged to 'other' ethnic groups (Asian, Indian, Pacific i.e. Cook Islands).

Families of participants received a questionnaire the day before the interview. Smoking data was obtained by confidential interview of each subject. Physical measurements (height, weight, triceps skin folds, and subscapular) were made. No data were collected on diet, physical activity or physical fitness.

Two other studies were in progress during 1972. The first of the two studies is the 'Longitudinal Study of Blood Pressure in Polynesian Children' (Swinburn 1998). This study was part of the 'Tokelau Island Migrant Study' (Beaglehole 1988) which was designed to document the health consequences of migration by comparing the health of Tokelauan migrants in New Zealand with the health of the Tokelauan people who remained on their home island. Beaglehole looked at blood pressure in adolescent Tokelauans living in New Zealand (Beaglehole 1988, Cole 2000). At the first examination, blood pressure was available on (87%) of the Tokelauan children aged between 5-14 years known to be resident in New Zealand. Follow-up blood pressures were recorded on 360 adolescents, (92%) of the original cohort. Blood pressures were taken with a random zero-mercury sphygmomanometer, while subjects were seated. No other cardiovascular risk factors were looked at.

The other study, carried out by (St. George 1996, Williams 1996, Rush 2004, and Fergusson 1994) was part of the 'Dunedin Multi-Disciplinary Health and Development study' (Mann 1974). This longitudinal study followed the health and development of 1,037 babies born in Dunedin between April 1972 and March 1973 until the age of 21 years. Blood pressure was measured at ages 7, 9, 11, 13, 15, and 18 years. Blood pressure measurements at all six ages were taken in only 579 study members with no reference to the ratio of boys to girls in this sample. Blood pressure was taken while subjects were in a

supine position. Fifteen and eighteen year olds underwent a standard 6-minute submaximal cycle ergometer test with blood pressures and heart rates taken while sitting on the cycle before exercise, after the 6 minutes exercise and after recovery. In addition to blood pressure, height and weight were recorded. Each student was asked about smoking habits and about family history of hypertension, heart attack or diabetes in first and second-degree relatives. No data were collected on dietary intake.

In 1974, a cross-sectional survey called the 'Auckland High School Health Survey' was carried out in a secondary school in South Auckland (Keys 1984, Stanhope 1976). **Figure 2-2** represents all the students in this school that participated.

Data Source from Keys 1984

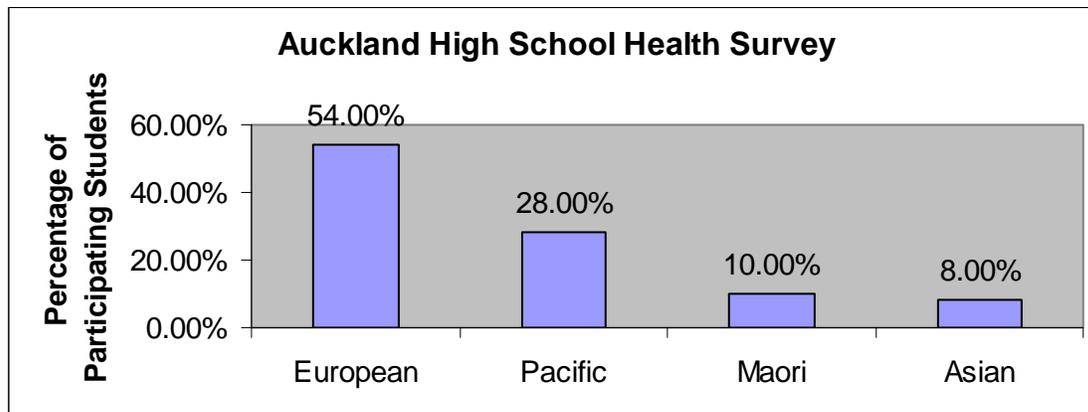


Figure 2-2: The Total Number of Ethnic Students Participating in the 'Auckland High School Health Survey'

Participants were asked to fill a questionnaire that contained demographic questions about: age, race, parental occupation and history of myocardial infarction in parents. Physical examinations were taken of participants. Participants were given a chest x-ray, impedance audiometry, and audiogram. Participants' weight and height were measured. In addition, no life-style information on, alcohol consumption, smoking, diet, or leisure-time physical activity was obtained.

The 'Christchurch Health and Development Study' (Barrett-Connor 1985) was another longitudinal study carried out in New Zealand that also started in the seventies. This study followed up 1,265 children born in the Christchurch urban region during mid-1977 up to the age of 16 years. This study, however like the Dunedin cohort, looked mainly at psychosocial issues and not cardiovascular disease issues. An important aim was to address the social consequences of smoking and alcohol during the growth and

development of the cohort. However, Maori and Pacific participants were under represented. No other risk factors for cardiovascular disease were looked at.

The next study was an opportunistic study of three General Practitioner settings in Dunedin (Kissebah 1994, Silva 1996). In this study, parents of all children in the 5 to 15 years age-group were approached to participate. Demographic data (sex, date of birth, race, socio-economic status, date and time of examination) were recorded. Overall, 547 children from 651 participated. The majority were European 96.7%. The rest were Maori, Asian and Pacific children. Two hundred and sixty seven were boys and two hundred and eighty were girls. Physical measurements of height, weight, triceps and subscapular skin-fold measurements were taken. Blood pressure was measured with a blind mercury sphygmomanometer. However, no blood or other cardiovascular risk factor measurements were taken.

The last study was 'The Health Status of Fourth Form Students in Northland Study' (Phillips 1999). This cross-sectional survey was carried out to obtain a baseline of health and health related habits of Northland 14-15 year olds for use in health promotion and other health plans. All secondary schools in Northland were listed and nine schools were selected at random. The names of each fourth form student was listed and a one in four sample drawn from each school by simple random sampling. A total of 332 fourth form students (145 boys, 187 girls), from a total sample of 410 students aged between 14 - 15 were selected. The study covered the following: relevant family and personal history, self-reporting smoking and drinking habits, by questionnaires (Willet 1995). Physical measurements (height, and weight) were made. No other CVD risk factors were recorded.

2.2.1.1.1 Results of New Zealand

BMI

The Dunedin Cohort data found that the mean BMI in males and females increased with age 15 years (20.0 and 21.0) and 18 years (22.7 and 23.9), respectively ($P < .005$). No ethnic comparisons were provided (Mann 1974).

These results were consistent with data from 'Northland Fourth Form Students' (Phillips 1999). Mean BMI values in the 'Northland Fourth Form' study were 20.3 kg/m² and 21.6 kg/m² for males and females aged between 14 and 15 years, respectively. Significantly more females 22.5% were classified as exceeding the desirable BMI range ($19 < \text{BMI} < 24$), than males (6.2%), ($20 < \text{BMI} < 25$). Amongst females only, Maori had 10.3% significantly higher BMI than Europeans, 23.1 kg/m² and 21.8 kg/m², respectively (Phillips 1999).

The Auckland High School Health Survey did not present data on BMI, however, it stated that both Maori and Pacific Island students "demonstrated a tendency to obesity compared with Europeans", and that Asians were "small and underweight compared with Europeans" (Nakamura 1994).

Smoking

In 'The Rotorua Lakes Study', adolescents were classified according to their smoking status at examination into four self-ascribed categories, 'never smoked', and 'ex-smoker', 'ex-smokers' (those who had given up smoking after smoking experience and more definite than mere trial) and 'current smokers' (Swinburn 1996). Overall, smoking increased with age. **Figure 2-3**, illustrates European & Maori students who have never smoked and **Figure 2-4** represents the ones that who have smoked.

Data Source from Swinburn 1996

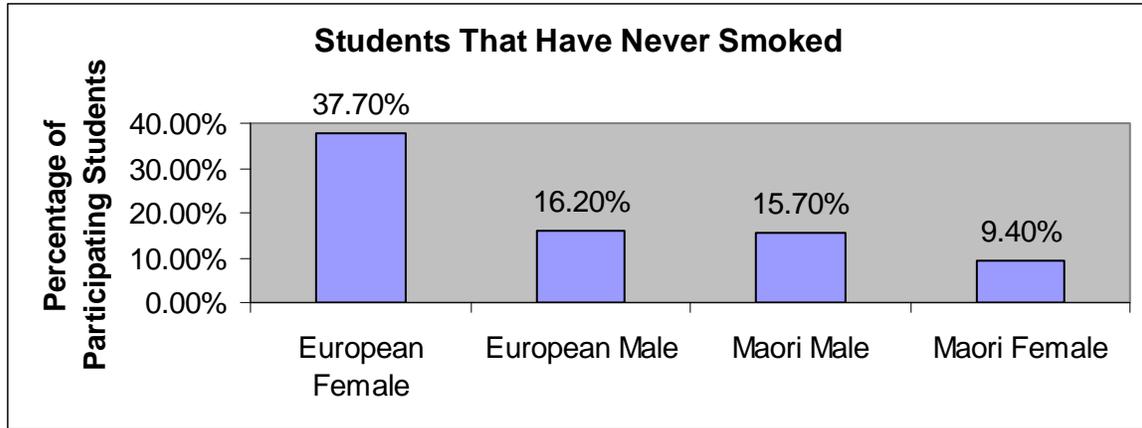


Figure 2-3: The Percentage of European & Maori Students in the 'Rotorua Lakes' Study who have never Smoked

Between both genders of the Maori race, there was no comparable data to differentiate the two, along with the comparison of different ethnicities and the male population.

Data Source from Swinburn 1996

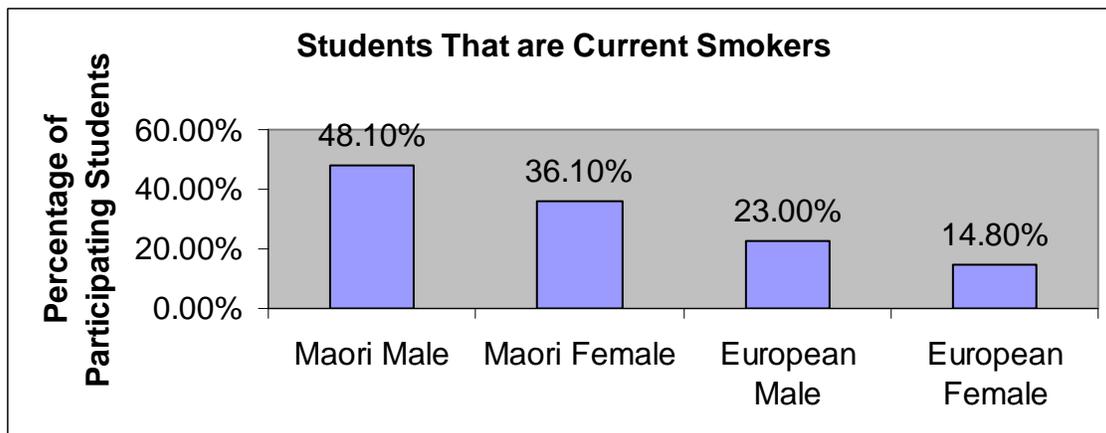


Figure 2-4: The Percentage of European & Maori Students in the 'Rotorua Lakes' Study who are Current Smokers

The median age at which smoking was first experienced was 12.3 years for European males, 12.9 years for Maori males, 13.2 years for Maori females and 13.9 years for European girls. European females tended to follow family patterns, as exemplified by older siblings smoking habits rather than peer pressure. Smoking expectations, peer pressures and family influences appear more divergent between the sexes among European than among Maori.

In the 'Dunedin Multidisciplinary Health and Development Study' (Mann 1974), four smoking groups were used to describe the prevalence of smoking. 'Daily smokers' were those who usually consumed tobacco at least once a day. 'Occasional smoker' were

those who only consumed tobacco within the tested month but not every day like the 'Daily Smoker'. 'Infrequent smokers' or not a current smoker were those who had not smoked in the last month, but had tried consuming tobacco by means of a type of pipe or even a cigar. 'Never smoked' were those who had never puffed on a cigarette, cigar or pipe. The report from study showed that from ages 9-15, there was a constant increase in the quantity of smokers and amount of cigarettes consumed by smokers. Proportionally more females than males had never smoked. However, from the age range of 13-15 the number females who had recently consumed tobacco (in the month up to the intervention) rose from 9% to 33% of the sample. In the same two years, the number of male smokers increased from 10% to 21% of the sample. This large increase in number of adolescents who smoked was associated with the start of secondary school, exposure to older peer group behaviour and social pressure resulting from friends' smoking. Family members of females were a great influence on if they smoked a lot or not. Where as friendships, not family, was the influential variable for the male counterpart. No ethnic data were reported.

The 'Christchurch Health and Development Study' also looked at adolescent smoking but from a psychological rather than an epidemiological focus (Keys 1984). It focused on adolescent behaviours, particularly risk taking behaviours. The study, however, did try to quantify adolescence smoking. Participants were asked to self-report whether they were daily smokers or non-daily smokers. Mathematical modelling was used to estimate the prevalence of smoking. Two models were used: Model 1 was a double model indicator of tobacco usage by adolescence and Model 2 was a quadruple indicator tobacco usage by child and mother. Model 1, estimated 38% of children in this sample had smoked, whilst Model 2 estimated about 30% of the children were smokers. Both estimates were extremely higher than the proportion of adolescence who admitted using tobacco 22.2% or whose mothers indicated that they had used tobacco 19.4%. This study highlighted the possibilities of errors in self-reporting questionnaires about smoking in adolescents.

Smokers in the 'Northland Fourth Form Study' (Barrett-Connor 1985) were categorised into two categories, smokers and non-smokers. Those who smoked were further categorised into the amount of cigarettes smoked per week. Of all that smoked, 38% were females and 23% males. There was an ethnic difference in the proportion of smoker with Maori males 42.2% and females 48.5% having more smokers than non-

Maori males 15% and females 32.6%. Of those who smoked 7 or more cigarettes per week, females 23.5% smoked more than males 15.1%. Maori males 31.1% and females 35.3% also smoked more than non-Maori males 8.4% and females 17.4%. Maori females smoked twice as commonly as non-Maori.

2.2.1.2 Studies in the United States

The first study carried out in the United States was the 'Coronary Artery Risk Development in Young Adults (CARDIA) study' (Goldstein 1973). This prospective cohort study was created to examine the life-style and other factors that influence, favourably and unfavourably, the creation of coronary heart disease risk factors during adolescence. A total of 5,116 Black and White men and women, aged 8-30 years, were recruited and the overall response rate varied between centres from 52% to 82%.

During the interview, anthropometry measures of height and weight, triceps, subscapular, suprailiac, waist, hip, arm circumference, and elbow breadth were taken. Self-administered questionnaires were used to obtain demographic information and personal health status plus information in regards to smoking, alcohol, and leisure-time physical activity (LTPA). A quantitative food frequency questionnaire was used to obtain dietary information on the previous month.

The next study as shown in **Figure 2-5**, was carried out in the United States. The study was called the 'Child and Adolescent Trial for Cardiovascular Health', or 'CATCH STUDY' (Fallat 1974). This was a multi-centre school-based intervention for promoting healthy behaviour in elementary school children in order to reduce the risk factors for heart disease. The study began with all intervention activities in 1991 and was completed by spring 1994. However the study cohort was followed until 1997. The study involved 96 elementary schools that were randomized into three experimental programs: 1) control, 2) school-based intervention, and 3) school-based and family-based interventions.

As part of the baseline (pre-intervention) measurements, cardiovascular risk factor screening was conducted at each school site. All third grade students were invited to take part in the screening, and

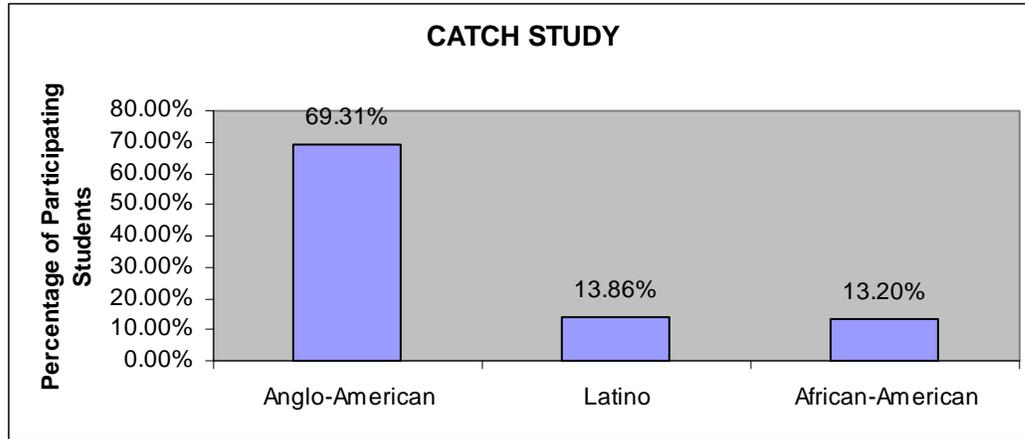
Data Source from Fallat 1974

Figure 2-5: The Total Number of Ethnic Groups Participating in the CATCH Survey

2,552 were boys and 2,360 were girls, mean age 8.76 years, response rate 61% took part in the screening. As part of the CATCH baseline survey, questionnaires were used to collect data on diet (24-hour diet recall), usual physical activity, knowledge and belief about food, although not presented in this article. The major significance of this study is the potential to look at a range of risk factors in a variety of different ethnic groups at different geographic locations.

The last study from the United States was the 'Project Heart Beat' (Viikari 1985) study, which was carried out in 'The Woodlands' and 'Conroe' communities, Texas. This study was unique as it was created to assess the dynamics of shift in cardiovascular risk factors. The number of participants was six hundred and seventy eight children. Of those, 49.1% were white and 20.1% were black. These students were of ages 8, 11, and 14 years and were followed-up every four months for 4 years, and that after four years of follow up, only 4% dropped out.

A variety of information was collected by a questionnaire. Extra tests were carried out; for example, cotinine determination was carried out randomly on >14 years old participants with and without changes in self reported smoking history. Physical measurements were carried out on blood pressure, weight and height, fitness, hand-wrist roentgenogram for bone age determination, and bioelectrical impedance for body composition, although results were not presented in this particular article. The main contribution of this study to the literature is that by following a group of adolescents regularly in four months intervals for four years, Viikari (1985) and his colleagues were able to demonstrate sharp fluctuations during these intervals. Their main argument was that, had only the baseline and anniversary data been collected, the pattern for an

individual would have provided less insight into the actual variability occurring during this age interval.

2.2.1.2.1 Results of Methods for the USA

BMI

Mean BMI levels in the US studies increased with age in both males and females. Mean BMI levels reported ranged from 17.4 kg/m² in white children and 17.8 kg/m², in Black children aged 8 years (Manson 1996) to 24.3 kg/m² and 24.9 kg/m² in Black males and females aged between 18 and 24 years respectively, in the 'CARDIA Study' (Goldstein 1973). BMI did differ significantly between Blacks and whites in the 'CARDIA' (Goldstein 1973) and the 'CATCH Study' (Reeder 1992) with Blacks having statistically significantly higher mean BMI levels than Whites. Both these latter studies had big sample sizes with 2,644 Blacks and 2,472 Whites in the 'CARDIA Study' and 674 Blacks and 3,530 Whites in the 'CATCH Study'.

Smoking

In the 'Bogalusa Cohort Study' (Stregioulas 1998, Blackburn 1983), smoking status was found that the percentage of smokers increased with age in all sex and ethnic groups. In whites, more males aged between 14 and 15 years were categorised as 'current smoker' than females, 34% versus 24%, respectively. However, this trend reversed at aged 16 to 17 years where 44% of females were categorised as 'current smokers' compared with 36% of males. The percentage of Black 'current smokers' was lower compared with Whites. However, more Black males were categorised as 'current smoker' than females. Between age 14 and 15 years, 20% of Black males were 'current smoker' compared with 15% of Black females and between ages 16 and 17 years, 33% of Black males were 'current smoker' compared with 26% for Black females.

In the 'CARDIA Study', participants were asked if they had ever consumed tobacco products on a normal basis for at least 3 months (Goldstein 1973). The term regularly was used by Goldstein and it was defined as, "at least 5 cigarettes per week almost every week". If the student responded that they "did" intake the tobacco product on a regular basis, then they were asked if he or she still smoked daily. In regards to gender, smoking on an everyday normal basis did not have any correlation to gender, but

there was a link to ethnicity (African-Americans rates were higher), age (older Americans has higher rates than youth) and level of education (higher in those without a high school diploma). For those who reported 'current regular smoking', 37% and 31% were African-American males and females, respectively, and 26% and 28% in Caucasian males and females, respectively.

LTPA

A 'Self-administered Physical Activity Checklist' (SAPAC) was used in the 'Bogalusa Cohort Study' to assess physical activity (Stregioulas 1998, Blackburn 1983). "The SAPAC is an all day recall of selected physical and sedentary activities using a checklist format developed for school age children 10 years of age and older" (Stregioulas 1998). The checklist consisted of 21 physical activities, areas for activities not listed, and an additional section for mentioning any electronic gaming or TV usage that the participant might have thought of that would be considered 'physical activity'. The adolescence in the 'Bogalusa Study' reported a mean of 168 minutes of persperating activity per day. In regards to the 'National Children and Youth Fitness Study' Phase I for Grades 5-9, the rates were higher (102 -120) minutes per day when comparing males vs. females, respectfully (Morris 1973). By the numbers, males compared to females were more physically active than females (153 minutes vs. 110 minutes) and participated in activities that were more extensive than average 21% vs. 8%. More males claimed to participate in team sports such as soccer, basketball, and baseball compared to females who claimed to dance, which was more than their male counterparts. In regards to race, African-Americans were more sedentary than Caucasians. The rates were for both in absolute minutes (220 min vs. 165 min) and percentage of time spent in selected sedentary activity 61% vs. 55%. Fifth and sixth graders had significantly lower percentage of sedentary time than 8th graders.

In the 'CARDIA Study' (Goldstein 1973), two methods for assessing physical activity were being compared, the physical activity history PAH questionnaire and the 7-day recall (PAR) questionnaire. The PAH questionnaire asked about the level of participation over the previous year in 13 specific activities that required comparable levels of physical intensity. Participants were asked how many months they performed each activity for at least an hour in total each month (in any number of sessions). Also for activities that were executed for at least an hour a month, participants were questioned

the quantity of months in which they performed the activity frequently, i.e., at least the number of hours ranging from 2 to 5, depending on the activity per week. The activities included in the questionnaire, along with the intensity and the number of hours per week required for them to be classified as frequent performers.

2.2.1.3 Studies in Europe

Only two studies were carried out with subgroup comparisons. The first was in Europe which satisfied the selection criteria because they had the 'Young Finns Study' (Brotons 1998), while the other, the 'Northern Karelia Youth Project' (Flight 1984) will be discussed together with the studies in the 'Know Your Body' program (Stanhope 1975). At least eleven other studies were carried out in Europe but did not meet the selection criteria of this review.

One of the biggest studies in Europe was the 'Cardiovascular Risk in Young Finns Study' (Hornick 1981). Baseline data collection for this multi-centered longitudinal study was carried out in 1980 at five university cities (Helsinki, Kuopio, Oulu, Tampere and Turku), in Finland. A total of 4,320 randomly selected persons were invited to participate by letter and 3,596 (1764 boys and 1832 girls) aged 3, 6, 9, 12, 15 or 18 subjects responded. Families of participants received questionnaires, which asked about the socio-economic background of the family, general health of the participants, smoking and exercise habits of the participants. Physical measurements were made of height, weight, subscapular triceps, and biceps skin-folds, upper arm circumference and puberty rating. Interestingly, subgroup comparisons were presented for East and West Finland, particularly when there were known differences between the East and West with the East having higher mortality rates compared with the West (Pelletier 1986).

2.2.1.3.1 Results of Methods for Europe

BMI

Mean BMI in males and females in the 'Finnish Cohort' also increased with age (Margolis 1996). Levels of BMI reported from the two Finnish studies were comparable with each other and ranged from 17.9 kg/m² and 18.7 kg/m² in 12 and 13 year olds, respectively (Garrison 1985). There were no significant sex differences in the levels of BMI reported within different age groups, although the 'Northern Karelia Youth Project' (Nichols 1976) reported a higher percentage of females 2.6% than males 1.6% who were

classified as 'overweight' (i.e. BMI > 25 kg/m²). There were no comparisons given for East and West or urban and rural.

Smoking

In the 'Northern Karelia Youth Project', adolescents were asked whether they were daily smokers, occasional smokers, or non-smokers (Nichols 1976). 6.8% of both genders consumed tobacco products and the percentages of occasional smokers were 20.4%, respectively. Overall, the percentages of those who smoked daily plus those that smoked occasionally were 10.5% for females and 16.9% for males. Smoking was more common in the city than in the country communities, but the differences were not statistically relevant. In total, 63.1% of adolescence whose peers consumed tobacco at one point or another before the month the survey had commenced, where as 5.5% of adolescence whose peers were non-smokers had consumed tobacco. These results were slightly higher than a national survey carried out in Finland at the time that reported 12% of children aged 14 years were smokers (Nichols 1976)

Figure 2-6 represents the 'Smokers in the 'Finnish Cohort' which was categorised into three categories (Nichols 1976).

Data Source from Nichols 1976

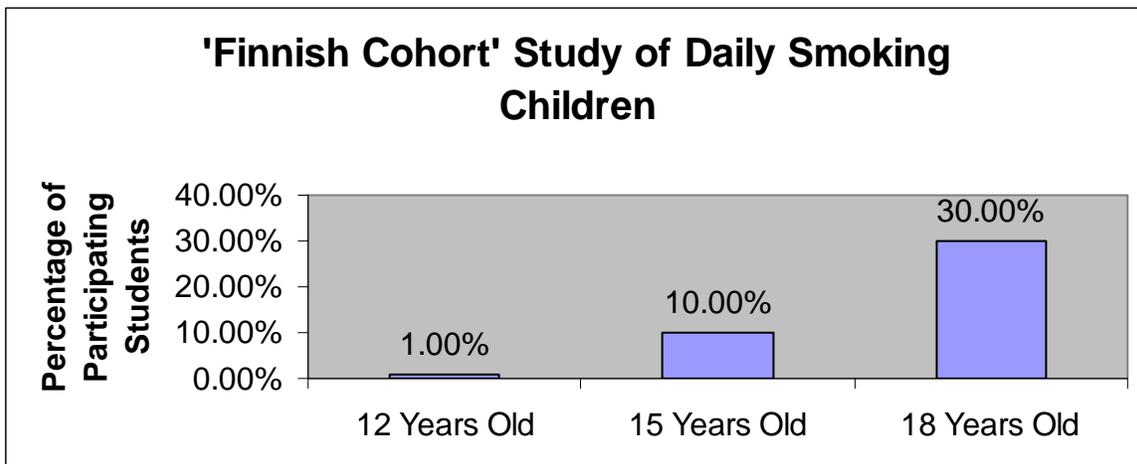


Figure 2-6: The Percentage of Students who Smoked Daily in the 'Finnish Cohort' Study

Tobacco consumption was common among males than females in the older cohort, 37% vs. 23%, respectively. If 'occasional smokers' were used, then the results would be skewed in the other direction where females would have higher rates than males 26% vs. 21%, respectively. The only statistically significant regional difference was found in 15 year olds where the habit was more significant in country communities in the western province compared with the eastern province. The lower proportion of 15 year

old tobacco users in the country side of the eastern province was due to the preventative tobacco program of the North Karelia Youth project (Nichols 1976). The total daily number of cigarettes smoked amounted to 6 and 7 cigarettes per day in 15-year-old females and males, respectively, and 9 and 12 cigarettes per day in 18-year-old females and males, respectively.

LTPA

'Young Finns Cohort' looked at children from ages 9-18 and their level of physical activity. The study was assessed with a questionnaire and it involved questions as to the frequency of participating in different types of physical activities on a weekly basis and the level of intense strain it puts on the participant. In females 69% of 12 year olds and 47% of 18 year olds participated in PA more than once a week compared with 81% of 12 year old and 51% of 18-year-old males. Intensity was higher with 18 year olds compared to 12 year olds and males compared with females. There was no geographic difference between West and East. The two categories listed in Young Finns Study for the selected age range in regards to physical activity were supported by the findings in the 'Juvenile Health Habit Study' (Hornick 1981).

2.2.1.4 Studies in the "Know Your Body" Program

The next group of studies belongs to an international program carried out in 15 countries called the 'Know Your Body' (KYB). Only four studies from this program fit the selection criteria for this review. These four are: the 'Know your Body' Study (Williams 1977), the 'Know Your Body Program' in the United States' (MacMahon 1986), and the 'Northern Karelia youth project in Finland' (Nichols 1976).

The rest of the studies did not fit the selection criteria for this review, as they did not present any subgroup comparison, although these studies are combined in that report (Whelton 1999, Tyroler 1975).

The main objective of the 'KYB' program was to study the feasibility of screening and to analyse specific clinical indices related to known cardiovascular risk factors among sample of multi-ethnic children. These 15 countries collaborative health-screening projects involved a total of 17,150 children, aged between 10 and 15 years and it is summarized by (Wynder 1981).

Smoking habits, obesity, blood pressure, and cholesterol were the targeted risk factors. Variation in protocol occurred in some countries. Pending on interest and funding, other technical measurements and analysis were used in different countries. For example, everywhere except for (Taiwan and France), samples from blood to analyse total cholesterol were done. HDLC, triceps skin-fold, and post-exercise heart rate 'Recovery Index' measurements were created in only a few countries. Two countries collected dietary data; however, only Finland reported it (Kuczmarski 1994).

As it was difficult to create a standard of measurement for all countries, an attempt was made to compare the frequency of distributions of the following risk factors: cholesterol, systolic blood pressure, weight, height, BMI, smoking status, and cholesterol in 13 year olds of all participating countries (Manson 1996). This report was a total of 5,331 thirteen year olds. In the 12 month time span from the middle of 1978 to 1979, that is when all medical examinations took place. Questionnaires were used to gather demographic, life-style and dietary information. Perhaps the most important contribution of this program to the literature is the fact that a number of risk factors in a multinational sample can be looked at in the same period in time.

The first article as shown in **Figure 2-7** is by Williams, being the 'Know Your Body Program' in New York (Rimm 1995). This report did not belong to the international part of 'Know Your Body Program' (KYB) as shown in **Figure 2-8**, which ran in 15 countries in Europe, USA, Asia, Middle East and Africa which started in 1978. This study started in the fall of 1975.

Data Source from Rimm 1995

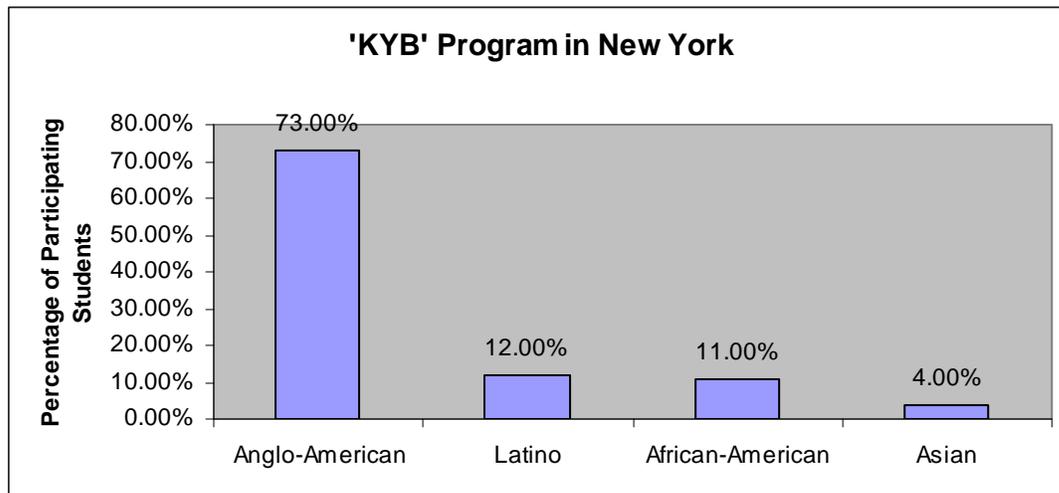


Figure 2-7: The Total Number of Ethnic Students Participating in the "KYB" Program in New York

Six intermediate, junior high and middle schools were invited to participate. All 6th through 8th Graders were requested to participate in this 3 year preventative intervention. Three schools were provided with a health education curriculum, and specialized intervention activities. These study schools were teamed up with three control schools of comparable ethnic and socio-economic status in which the health educational and intervention component were removed. Of the total 1,491 male and 1,473 female school children participated.

The Anthropometric measurements taken were height, weight, and triceps skin fold thickness was taken. Participants were advised to fill out a 'health knowledge questionnaire' designed to provide demographic, general health knowledge, and personal habits related to risk of disease that could effect the life in the future. Smoking and alcohol status was asked. Participant's physical fitness was assessed using the 'Modified Harvard Step Test' (Nutrition and Your Health 1990). No information on diet or leisure-time physical activity was collected. The first of the international 'KYB' Program is the program in the US conducted by the same group as mentioned above (WHO 1990). Sampling was from six schools from the New York metropolitan area where all 7-10 Graders were invited. Of the total 1,844 male and 1,814 female participated. The ethnic mix was 75.5% White, 11.9% Hispanic, 8.4% Black, 2.5% Asian and 1.7% other.

Data Source from Rimm 1995

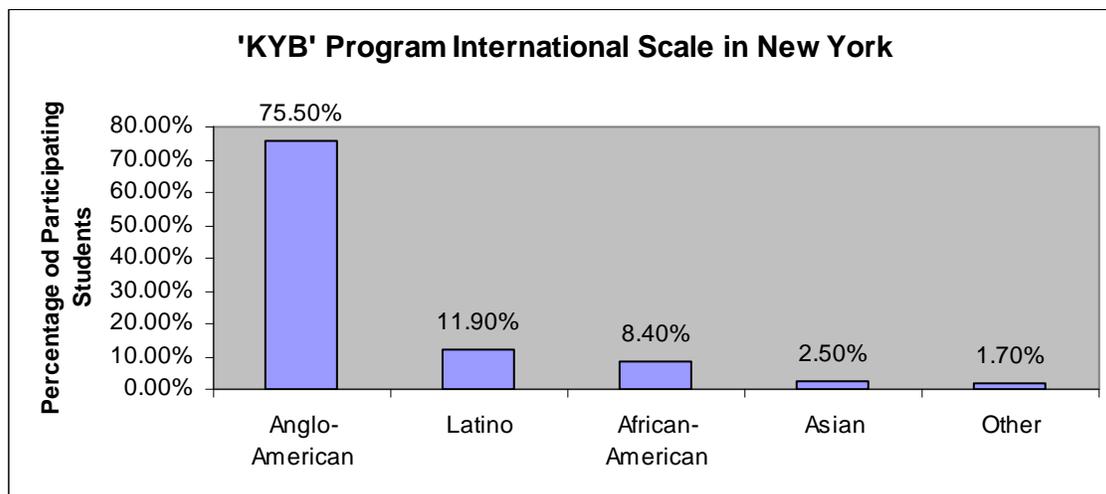


Figure 2-8: The Total Students Participating in the 'KYB' Program, but on an International Research Level in New York

The next program was that in the 'Northern Karelia Youth Project', Finland. "Cardiovascular disease is common in Finland; the mortality rate in middle-aged men has been one of the highest in the world" (Nichols 1976). "Within Finland regional

differences occur in the mortality and morbidity from CVD, the highest rates being found in North Karelia a large mainly rural county in eastern Finland” (Nichols 1976). The children of North Karelia were studied within this area. In the fall of 1978, a survey was conducted for children representing the 7th Grade. The two schools (one urban, one rural) had an intensive intervention. Of the 967 children in the 7th grade, 99% participated in the survey. 48% of those screened were female and 50% were from urban schools.

Participants completed a questionnaire which included topics on smoking, possible health problems, health attitudes, dietary habits, and health knowledge, and other forms of health behaviour. Measurements made included weight, height, triceps, and skin fold thickness. No detailed dietary information was collected although the questionnaire used contained some questions on dietary habits and no information on leisure-time physical activity. However, contents of the school meals from foodstuffs entering and devoured in the institute for a month were examined. One interesting contribution of this study to the literature is that in this study, there was a unique situation of only one ethnic group, but there are geographic differences in mortality and morbidity of cardiovascular disease within this country. The East has a higher mortality rate for coronary heart disease than the West.

The last study in the 'KYB' program was in Thailand (Blessing 1995). A non-random sample of five schools from Bangkok was invited to participate in this study. The sampling of schools was based on the socio-economic status of the students that attended the schools. Three of the schools chosen were attended by children from higher socio-economic backgrounds and the other two from lower socio-economic backgrounds. Of the total, 544 male and 546 female students, aged between 10 and 14 years took part in the survey.

Participants completed a questionnaire including questions on possible health problems. Questions covered smoking, alcohol, exercise, dietary habits, health attitudes and health knowledge, and other forms of health behaviour. A medical screen for possible risk factors was undertaken where physical measurements were made. These included weight, height, and triceps skin fold thickness. One interesting contribution of this study to the literature is that a comparison of mean cholesterol levels was given by school, which enabled one to look at any effect socio-economic status had on cholesterol levels of Thai school children.

2.2.1.4.1 Results of KYB Program

BMI

The 'KYB Program New York City Metropolitan Area' (Rimm 1995) consistently reported mean BMI levels between 20.0 kg/m² and 21.0 kg/m² during puberty. However, this study found no significant ethnic difference in the levels of BMI during adolescence. In contrast, the 'KYB New York Metropolitan Area Study' (Rimm 1995) had smaller ethnic sample sizes with 130 Blacks and 404 Whites, and 307 Blacks and 2,762 Whites respectively, in the two studies.

Smoking

Figure 2-9 represents the first of the 'Know Your Body' programs in New York also (Rimm 1995), adolescents aged 10 to 15 years from the New York Metropolitan area and neighbouring Westchester county area were asked about their smoking habits. Participants were asked whether they used tobacco products daily, occasionally or 'never'. A 'Current smoker' was defined as having smoked one or more cigarettes in the past week. Those who smoked were also asked the quantity of cigarettes smoked, age when they began, guardians, brothers & sisters, and their friends smoking habits. 'Current smoker' increased with age. 8% were current tobacco smokers, while an additional 30% had or were testing the use of tobacco. No definition was given for 'regular smokers'. Of those who were 'regular smokers,' 63% were female and 37% males.

Data Source from Rimm 1995

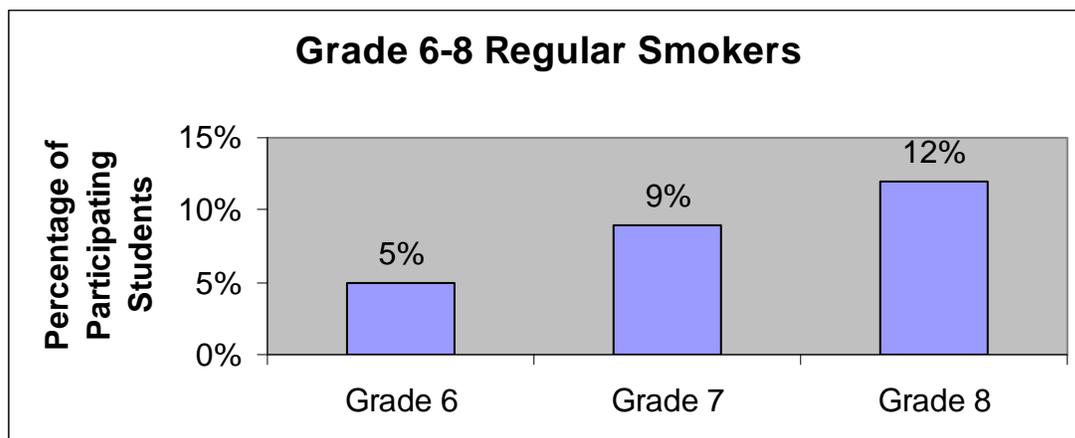


Figure 2-9: The Percentage of "Current Smokers" at the 'KYB' New York Study

The majority of 'current smokers' smoked less than 10 cigarettes per week, and were more likely to use tobacco of the same brand for which their classmates choose at the institute they went to. (Rimm 1995). There was no ethnic comparisons reported.

Figure 2-10 represents the second 'KYB' program (Rimm 1995); females were, on average, twice as likely as males to report tobacco usage on a daily scale between the age groups of 12-15.

Data Source from Rimm 1995

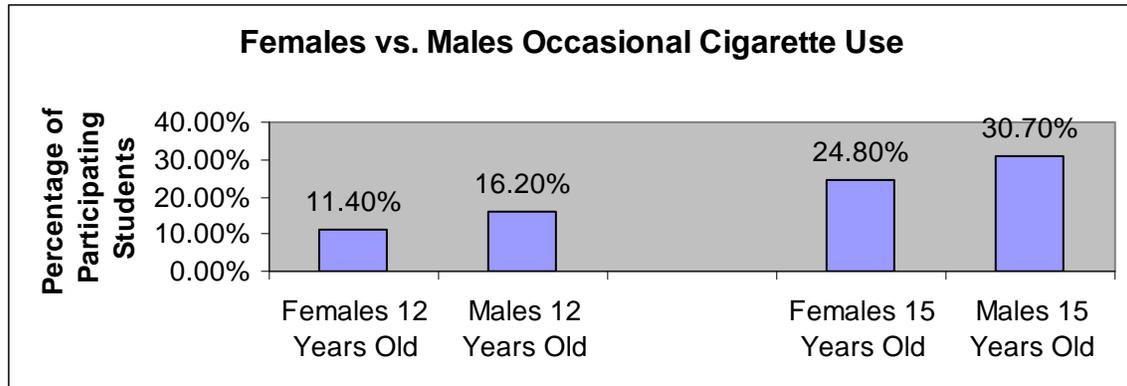


Figure 2-10: The Percentage of Females vs. Males in the 2nd 'KYB' New York International Study of Occasional Smokers

Within the 12-15 year old bracket, females had a 3-6% range more than their male counterparts. Overall, 8.2% of females and 3.3% of males were daily smokers.

Figure 2-11 represents students who smoked on a daily basis. The average report was about 40-60 cigarettes smoked per week. Smokers that smoked occasionally consumed about a pack per week and of course people who did not smoke had an answer of none smoked. **Figure 2-12**, represents the children who did not smoke and there were no ethnic comparisons reported (Kannel 1991).

Data Source from Rimm 1995

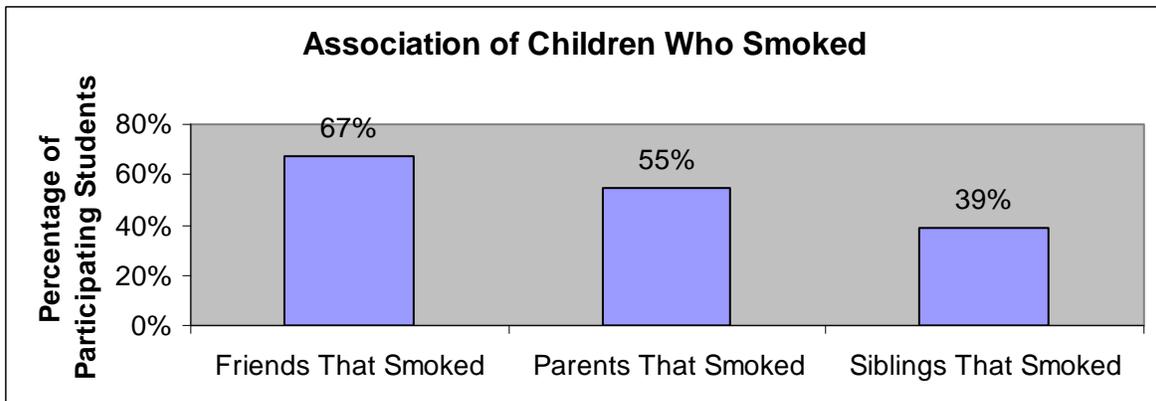


Figure 2-11: The Percentage of Children Who Smoked in the 'KYB' Study in New York & Who They Associated Themselves that Smoked

Data Source from Rimm 1995

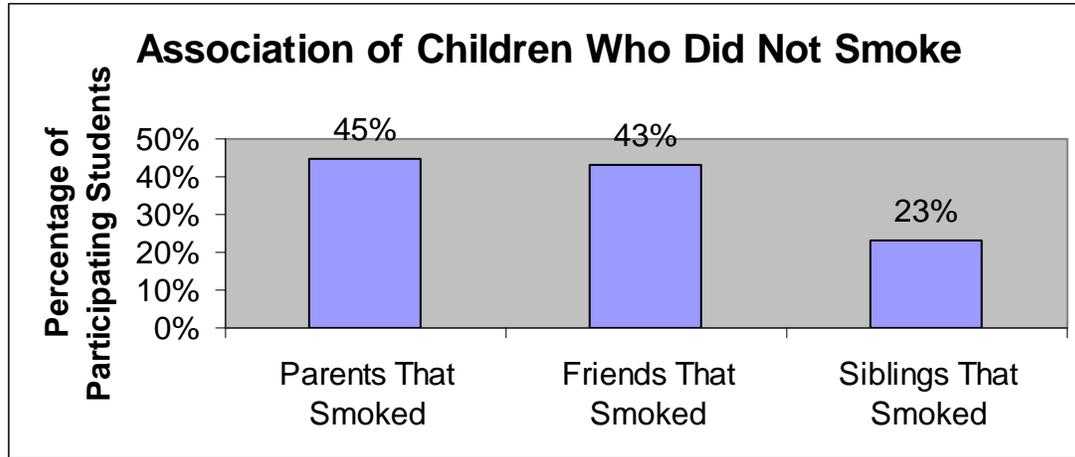


Figure 2-12: The Percentage of Children Who Did Not Smoked in the 'KYB' Study in New York & Who They Associated Themselves that Smoked

LTPA

The last two studies that reported PA in the US were the studies in the 'Know your Body' program (Collins 1990). Both studies looked at recovery of pulse rate score for participants who did the 'Modified Harvard Step-Test'. Both studies showed that males were statistically significantly better than females. In the first study, 31.1% of males and 18.1% of females had pulse rate recovery score less than 133 (Mogadam 1990). In the second study, the pulse rate recovery score for males and females were 138 and 150, respectively. The lower pulse rate after the 4 minutes of stepping was understood as better cardiovascular fitness. The point system declined for each gender along with their respective age. Both studies reported no ethnic comparisons.

2.3 Overall Summary

BMI

In general, BMI increased with age in both males and females, but there were no significant gender differences in levels of BMI reported during adolescence. However, there were significant ethnic differences in the levels of BMI reported with Blacks having higher BMI than Whites during adolescence and onto adulthood. There were similar trends within New Zealand (Bjorntorp 1990). The highest levels of BMI reported in these studies for adolescents aged between 14 and 15 years were found in Maori students from the 'Northland Fourth Form' (Phillips 1999). Moreover, this latter study also reported the highest percentage of participants that were classified overweight during adolescence. The lowest BMI reported for adolescents were values reported for 13 year olds from Northern Karelia, Finland (Nichols 1976).

Smoking

Comparing data on adolescent smoking is not an easy task as different surveys used different methods. Very often young smokers have been grouped as 'current smokers' or 'regular smokers'. The majority of past studies grouped adolescence smokers into 'regular daily smokers' or 'weekly/monthly smokers' (Physical Activity & Health 1996, Pate 1995). Despite the difficulties with comparing data on adolescent smoking, there were some noticeable trends. The majority of studies showed that smoking increased with age, not only in the proportion that smoked but also the quantity of cigarettes that was smoked.

Also, there were ethnic differences shown in the proportions of self reported smokers world-wide. The lower decile communities and the minority groups tended to have higher rates compared to higher decile communities and majority groups.

Physical Inactivity

Comparing data on adolescent physical activity is not an easy task as different surveys used different methods mentioned above. Despite these difficulties there were some noticeable trends. In the United States, males reported more overall physical activity in terms of minutes spent and intensity, than females (Lee 1996, Rimm 1995). In terms of pulse rate recovery score as an assessment of physical fitness, males reported a better score than females (Lee 1996, Rimm 1995). This gender difference was supported by the 'Young Finns Study' in Europe (Nichols 1976). Overall males participated in more rugged, physical sports compared to females. Biological differences may be responsible for the gender differences in physical activity (e.g. adiposity, muscle mass) in that it acts as an incentive for males and females to select activities at which they are more competent (Paffenbarger 1971). In the USA ethnic differences were prevalent, but gender differences were more visible than ethnic differences. Children of Caucasian race chose more outdoor play compared to African-American children. Lee also noticed they choose football and gymnastics more so than African-Americans and their duration was longer when testing length of play (Lee 1996). These differences were also experienced in the older age groups. There was some suggestion that Anglo-American adolescents participate in more aerobic-type activities than Mexican-American or African-American (Sedgwick 1980). African-American children also spent more time engaged in selected low-levels of activities both in total minutes and in percentage of overall informed activity that was similar to females when compared with males. Finally, no studies in the selected studies from New Zealand reported physical activity in this age group.

CHAPTER 3- METHODS

3.1 INTRODUCTION

In this chapter, the methodology utilised for this study is described in detail. The key goals of the research were to:

Objective 1: To identify evidence based list of significant cardiovascular risk factors for adolescents in Christchurch.

Objective 2: Estimate the prevalence of significant known cardiovascular risk factors.

3.1.1 Proposal Development & Target Area

A cross-sectional study design approach was selected for this research project. The unit of the survey was the student, and in which this was a school based survey.

After promoting the study to all possible schools, One thousand and fifty one (1051) participants decided to participate in the cross-sectional study. The participating schools were made up of boys only, girls only, and co-education schools. The participating schools came from all *quadrants* (one-fourth of the circumference of a circle or area) within the Greater Christchurch area. Fourteen schools, which made up all 4 of the quadrants, were selected to increase the number of possible participants. Fourteen high schools are in the Greater Christchurch region and 9 choose to participate, which resulted in 64.2% response rate. As for the five schools that declined, their reasons were due to time constraints that the earthquake on 4 September 2010 caused for them the rest of the year. Only the schools that agreed to participate were then interviewed. Age ranged from 14-18 years as representing their forms 3-7/or grades 9-13.

Inclusion criteria for each school

Each target school was selected, if the school had a representation of forms 3-7. After the head administrator of each participating school consented, they met with each school's representing Health Department personnel and/or PE administrator and informed them that they were to set a time throughout the week and allow the investigator to come to their class periods and administer the survey. The investigator agreed on the time frame to show up and administer the survey. The students were informed the day before of the survey by the administrator of the survey, what it was about, and the consent

form/leaflet which is presented in **APPENDIX A 1.1** for students who wished to participate. All students were issued the survey the day of the survey, and there were students who were present that chose to not participate, and some students that were absent did not participate. Incentives were discussed from head administrators to the non-participating adolescents for participating, to try and increase the sampling size for the project. Questions and concerns from the students regarding the survey were answered by the investigator before and after the survey. Head administrators were informed that after all data was finalised, that they, along with the students and their parents, would get a copy of results to show their school, but more so to cause awareness towards the cardiovascular risk factors that are currently developing within their school and community.

Determination of sample size for this survey

The study consisted of at least 1000 adolescent students. This was due to the average number of students who participated in previously similar studies, and due to the sample size that would be proportional to the frequency of the total possible number of students, for which would participate. A total of 1051 students participated (the ethnic makeup of these students were 109 Maori, 87 Asian, 762 European, and 93 others). From the total 14 regional schools in Christchurch, 9 schools chose to participate. These schools have a good representation in terms of region and type of school (i.e. co-ed, boys only, girls only, private and public schools). All students in Forms 3-7 at each school were invited to take part. The average number of Form 3-7 students at these schools was 160. Given response rates in the range of 30-55%.

Schools were chosen as the sampling frame, rather than individuals or classrooms within these schools, for the following reasons:

1. Offering participation in the survey to all students in a school room could possibly result in a higher response rate compared to sampling individuals at random throughout the school in a non-isolated managed area, like predetermined class rooms with administrators and where students have to be during a certain time of the day and attend.

2. By recruiting participants from a limited number of schools, it is possible to make ethnic comparisons which would minimise confounding due to household living arrangements (HLA) by adjusting for each school in multivariate analyses. Because methods of measuring socio-economic status are not perfect, there is no guarantee that socio-economic differences between ethnic groups could be completely controlled in multivariate statistical analyses when ethnic groups differ greatly in their HLA (Rose 1972).

3.2 Ethics Approval

Ethics approval for the study was sought from the Educational Research Human Ethics Committee in July 2010. This process was needed to be accomplished due to the research having direct contact and communication with adolescents. The Educational Research Human Ethics Committee raised a number of issues that needed to be remedied before final approval was granted. These issues were resolved to their satisfaction. Ethics approval was granted on the 1st of September, in 2010. A copy of ethics approval documentation is provided in the Appendices Appendix 1.8.

3.3 Sampling

Recruitment of Schools

When coordinating the CRFAC, the investigator had to determine how many schools and how many students of each school should participate to get a highly valid response rate, which would illustrate a transparent picture of cardiovascular risk factors amongst different ethnic groups. After the proposed number of schools and students were selected, a proposal of the research to be presented to the schools was sent to the Ethics Committee for approval. Consent by the university was given for the proposed research, and, letters as illustrated in **APPENDIX A 1.2** were sent to the principals of the schools inviting them to take part. This was followed by a call by the investigator to give more information about the survey.

Once approval was given by the head administrators, for the investigator to commence the survey to its students, a time was arranged so that the investigator could visit the school. At this meeting, the investigator would meet with the senior management and those who are going to implement the survey at the school setting, and supervise the investigator as he administers the survey. This meeting would also provide the opportunity to set up the logistics of where and when the survey would start.

Sampling Students

Most of the sampled students in Christchurch lived within Christchurch. At the start of the study in 2010, Christchurch had 14 schools with Form 3-7 children. The ethnic composition of these 9 schools, in 2010, was Pacific N= 5539, 35%, Maori N= 5075, 16%, Asian N= 2084, 12%, and the remainder, mostly European, N= 36312, 37%.

The Questionnaire used in the survey

The investigator came up with questions in which he thought would be relevant in gaining the optimal visibility on cardiovascular risk factors and how they are correlated to different types of cardiovascular diseases. The psychometrics of the questionnaire had already been established.

Each question was validated in regards to:

1. Demographics (which targeted the different ethnic groups to prove which one is more prone to CVD thanks to previous studies).
2. Leisure time & lifestyle variables (which added to the make-up of the results to prove who is more likely to get a form of CVD in the future).
3. BMI (through calculated measurements showed how ones height & weight increases the chance for a type of CVD).

*** The questionnaire is illustrated in Table A 3.1 in the appendix section.**

3.4 Data Analysis

Data Pre-Processing and Cleaning

In the data pre-processing and cleaning stage, the investigator put all the data together from the databases to a spreadsheet as mentioned earlier. Three steps were done during this stage. Specific queries were created to clean out the unnecessary data.

1. **Identifying Outliers**
2. **Identifying Missing Data**
3. **Impossible Combinations of data**

Data Processing and Handling

A spreadsheet from the 1st school that was complete was used within Microsoft Excel ® to commence data processing. Each variable whether single or multiple, would be inserted into the main spreadsheet, in a way that it would be able to create a graph. The 1st tab on the spreadsheet would be the overall total for each question. Every tab following would be the corresponding graph to each question one at a time. Each question from the 1st tab of the spreadsheet total would be formula fed to produce a graph on its representative graph tab.

Finally when all of the participating schools information was accounted for in each of its own respective spreadsheets, an overall totals spreadsheet was created to populate all the schools data into one master spreadsheet. This was made possible by Microsoft Excel's ability to create a formula that would in turn cause zero error.

Once all data was ready to be submitted into the thesis, extra calculations were designed to create the null hypothesis, which was the chi-square test. This will be explained in the next section. Those results were then added to the figures as they were input into Microsoft Word.

Univariate analysis

The distribution and spread of the single variables in the dataset was created by frequency distribution tables. All the variables are categorical variables. Hence the reason why frequency distribution tables were used to categorize age, gender, forms, ethnicity, and household living arrangements. Each outcome variable, i.e., smoking, drinking, sun & television exposure, leisure time physical activity, and nutrition intake will be analyzed

by bar plots in the results section. Frequency distribution tables were ran for each of the individual variables.

Bivariate analysis

As illustrated in **Table 4-2**, an analysis was run on two variables at a time. The research was operationalized for “smoking status”, “drinking status”. The five bivariate analyses for each of the two outcome variables gave a total of ten separate analyses. The chi-square test was used to determine if there is an association between if there was an association between the variable of interest and ethnicity. The secondary analysis that I conducted looked at the variable of interest in regards to other demographic variables such as gender, and living arrangements.

CHAPTER 4- RESULTS

4.1 INTRODUCTION

4.1.1 Demographic Variables of Population under Study

Table 4-1 shows the distribution of demographic variables from this cross-sectional study. The impression of the data from the table below displays the variables with its categories and the total numbers that represent the categories.

Table 4-1: Distribution of Demographic, Socioeconomic, and Description of the Study Population

Variable	Category	N (%)
Age in years	15	336 (31.97)
	16	347 (33.02)
	17	170 (16.18)
	18	159 (15.13)
	19	39 (3.71)
Gender	Male	742 (70.60)
	Female	309 (29.40)
Ethnicity	European/Pakeha	762 (72.50)
	Maori	109 (10.37)
	Asian	97 (9.23)
	Pacific Islanders	50 (4.76)
Form	3	339 (32.26)
	4	342 (32.54)
	5	177 (16.84)
	6	156 (14.84)
	7	37 (3.52)
Household Living Arrangement	Boarding	44 (4.19)
	Single Parent	230 (21.88)
	Two Parent	693 (65.94)
	Extended Family	56 (5.33)
	Other	28 (2.66)
Outcome variable-1 (Smoking)		335 (31.87)
Outcome Variable-2 (Alcohol)		727 (69.17)
		<.001***

Table 4-2: Represents the Bivariate Analysis

Variable	Category	N (Counts)	Smoking (%)	Drinking (%)
Age in years	15	336	20 (5.95)	17 (5.06)
	16	347	27 (7.78)	21 (6.05)
	17	170	25 (14.70)	32 (18.82)
	18	159	42 (26.42)	44 (27.67)
	19	39	18 (46.15)	16 (41.03)
			<.001***	<.001***
Gender	Male	742	83 (11.19)	490 (66.04)
	Female	309	64 (20.71)	102 (33.01)
			<.001***	<.001***
Ethnicity	European/Pakeha	762	503 (66.01)	648 (85.04)
	Maori	109	84 (77.06)	96 (88.07)
	Asian	97	60 (61.86)	36 (37.11)
	Pacific Islander	50	17 (34)	31 (62)
			<.001***	<.001***
Form	3	339	21 (6.19)	18 (5.31)
	4	342	25 (7.31)	23 (6.72)
	5	177	27 (15.25)	34 (19.21)
	6	156	40 (25.64)	42 (26.92)
	7	37	17 (45.95)	15 (40.54)
			<.001***	<.001***
Household Living Arrangement	Boarding	44	23 (52.27)	15 (34.09)
	Single Parent	230	85 (36.96)	93 (40.43)
	Two Parent	693	187 (26.98)	112 (16.16)
	Extended Family	56	15 (26.79)	3 (5.36)
	Other	28	1 (3.57)	1 (3.57)
			<.001***	<.001***

➤ *** P=<.001, based on chi-square test of trend for linearity of the percentages.

4.2 Demographic characteristics of the study group

The demographic characteristics of the 9 high schools that participated in this survey are illustrated below in **Table 4-3**.

Table 4-3: The CRFAC Dates of Interviewing

SCHOOL	INTERVIEW DATES	PARTICIPANTS
Riccarton High School	September 3 rd - December 14	M: 51 F: 27
Shirley Boy's High School	September 12 th - December 14	M: 49 F: 0
Hornby High School	October 4 th - December 14	M: 10 F: 15
Mairehau High School	October 5 th - December 14	M: 64 F: 61
Papanui High School	October 11 th - December 14	M: 64 F: 87
Christchurch Boy's High School	October 12 th - December 14	M: 59 F: 69
St. Andrew's High School	October 18 th - December 14	M: 161 F: 0
St. Bede's High School	October 19 th - December 14	M: 98 F: 50
Aranui High School	October 25 th - December 14	M: 186 F: 0

- Interviews listed in order with (schools, dates, and number of gender.)

The dates when interviewing at each school began and was completed are also given. Interviewing started at the first school on the 3rd of September 2010 and finished on the 14th December 2010. Interviewing at the last school started on the 25th of October 2010 and finished on the 14th December 2010. The interviewing process spanned a total of 5 months from August 2010 to December 2010.

A total of 1,051 adolescent high school students took part in this survey. The response rate varied from school to school. The response rate of 78% was calculated using the individual class roll at the morning of recruitment as the denominator. The latter does not include those who were not in class during recruitment.

4.2.1 MAIN ETHNIC GROUPS

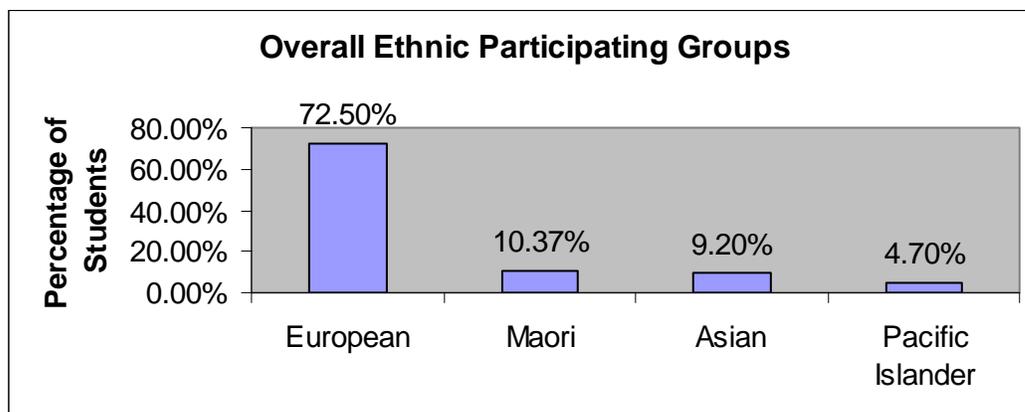
Of the 1,051 adolescent high school students that participated in the survey, 9 were from Africa, 1 from the Middle East, and 1 from South America. The distribution of survey participants in school form, ethnicity, and household arrangements are shown in **Figure 4-1**. The large numbers of European and Maori students reflected our aims to compare cardiovascular risk factors between them and the rest of the main Pacific communities and ethnicities.

Only students in forms 3 to 7 or years 9 to 13 were invited to participate in the survey. The reasoning for higher turn out rates for Forms 9 and 10 were due to the fact that during the time of research, upper level forms were studying and preparing for their exit exams and university preparatory exams. This was found to be true amongst all schools public and private around Christchurch.

4.2.2 PACIFIC PARTICIPANTS

A total of 50 Pacific adolescent high school students participated in the survey 30 Samoans 60%, 2 Tokelauans 4%, 3 Fijians 6%, 5 Cook Islanders 10%, 2 Niueans 4%, 4 Tongans 8%, and 4 8% that were self identified that they belonged to the 'Other Pacific' ethnic group. These participants were included with all other ethnic specific analyses of the data, but were excluded in the individual breakdown analysis amongst themselves due to limited participants. The 4 that were self identified as “Other” were excluded from any analysis from Pacific data breakdown

Figure 4-1: Represents the Percentage of Total Participants & Their Respective Ethnicity

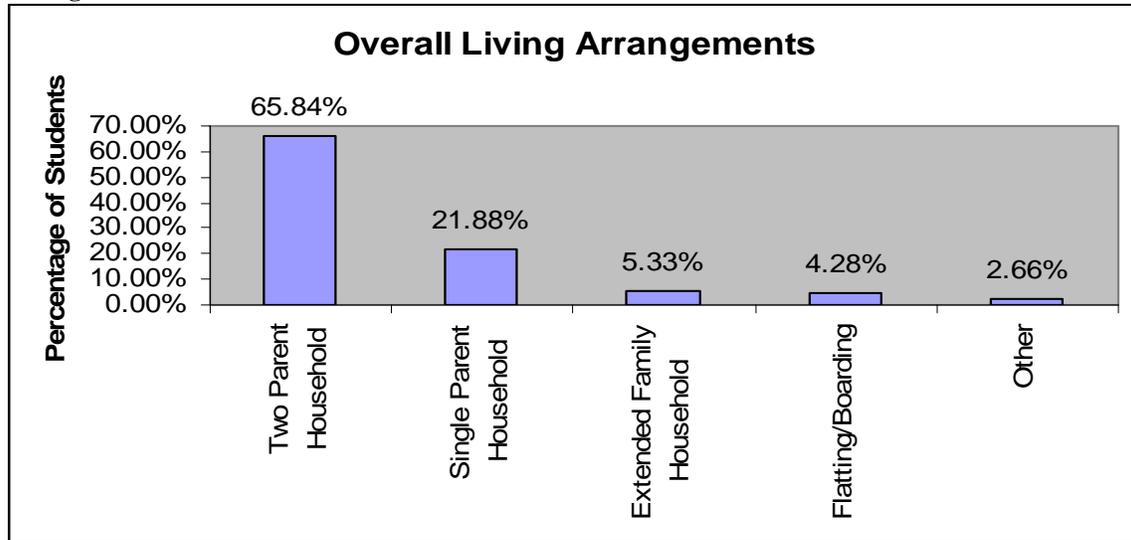


4.2.3 SOCIO-ECONOMIC STATUS OF PARTICIPANTS

One measure of economic status was used; household living arrangement (HLA), as shown in **Figure 4-2**.

European students had the highest proportion living in a household with 'Two Parents' as seen across many parts of the country this upper decile and the ethnic majority population will show this result. Pacific students showed to have the highest rates of 'Extended Family' households. Extended family households are (aunts/uncles, grandparents, and cousins) of the students immediate family which is located outside of Christchurch. Over the course of history many countries in the pacific near New Zealand gave citizenship to its countries citizens and there has been a large influx of immigrants that have took advantage of that opportunity for a higher quality of living and education. This possibility of citizenship was due to the reason for such a high results amongst Pacific Islanders. Interestingly enough, since 2010 the country of Fiji was removed from the Commonwealth and its citizens will now have to pay international rates for a student's education. Research over the next 10 years will see a decline in Fijian students in Christchurch and New Zealand wide. The Maori population reported to have the highest 'Single Parent' household as lower decile communities and minority ethnic group would show to be proven. Asians had the highest results for 'Flatting/Boarding' as free trade opened recently this decade so to have the opportunities of Asian students to travel abroad to countries like New Zealand for education. With Asia being the closest and largest economy to New Zealand these numbers will more than likely increase over time.

Figure 4-2: Represents the Percentage of Total Participants & Their Respective Living Arrangements



4.3 LIFESTYLE VARIABLES

4.3.1 Smoking

4.3.1.1 Proportion that 'Have Tried Smoking'

Participants were asked the question: 'Have you ever tried smoking a cigarette, even just a few puffs? The results showed a significantly higher proportion of lower decile and minority communities reported having ever tried smoking.

For both sexes combined, Maori had the highest proportion of participants who have ever smoked at least once **Figure 4-3**. Maori females and males had the highest proportion for consuming tobacco products **Figure 4-4 & Figure 4-5**. The reason for smoking was, stress that was mentioned by the female students. Responses of peer pressure, teenage pregnancy, superficial body appearance, and problems at home were reasons why females turned to cigarettes more so than the males. Some even mentioned the stress release of nicotine detoured many women away from psychological mental relapses and past thoughts of bodily harm done onto them.

Figure 4-3: Represents the Percentage of Total Ethnicities that “Have Smoked at Least Once”

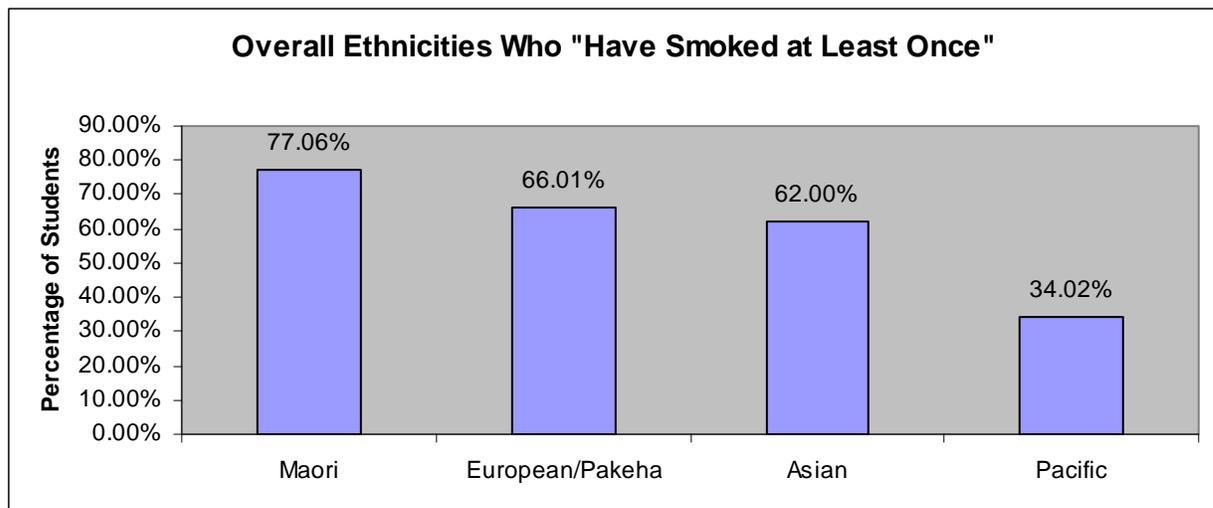


Figure 4-4: Represents the Percentage of Males who have “Ever Smoked Once”

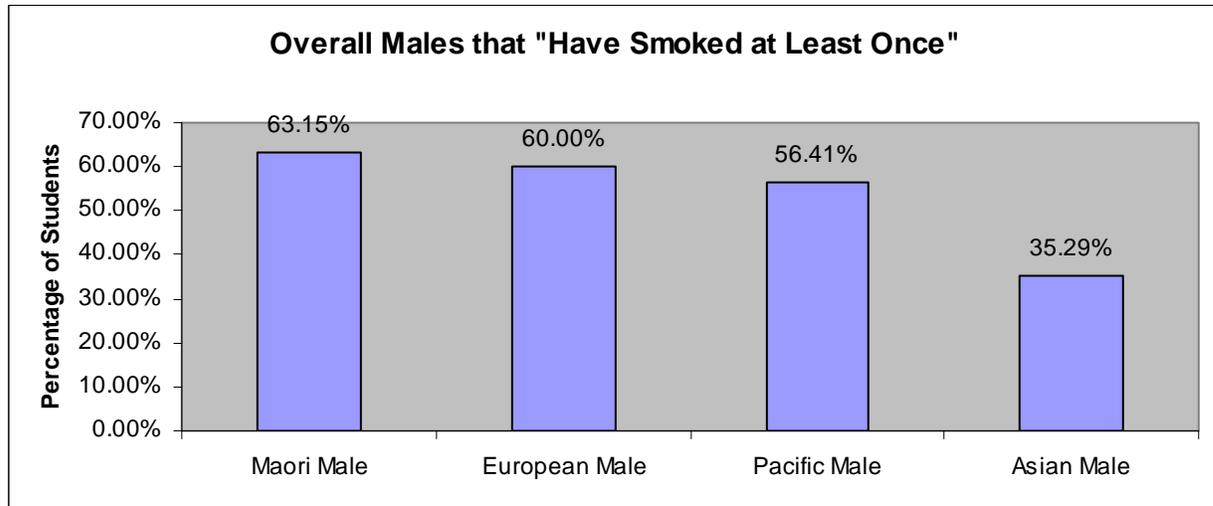
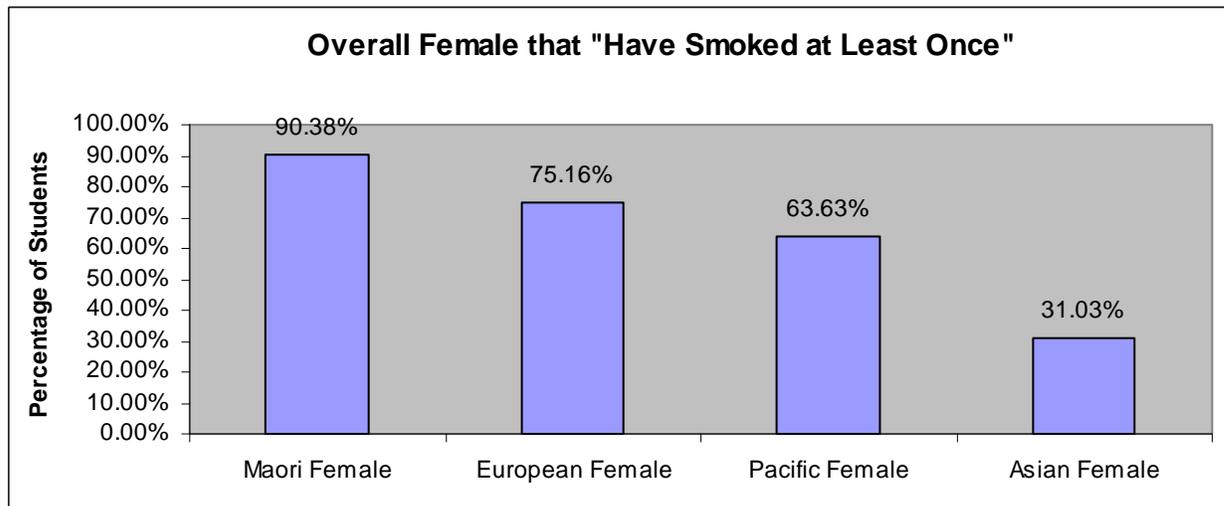


Figure 4-5: Represents the Percentage of Females who have “Ever Smoked Once”



Among male participants, the risk for having tried smoking was independent of their 'Living Arrangement'. The risk was higher 24% for males who were 'Boarding' compared with males who were living in a 'Two Parent' household, and this risk was even higher 37% when compared with a 'Single Parent Household'. Asian males had a 43% lower risk compared with European males 55%.

Among female participants, the risk was 27% for females who were in a 'Two Parent Household' compared with females who were in a 'Single Parent Household'.

Pacific and Asian females' risk was 10% and 59%, respectively, compared with European females, although only Asian females remained statistically significantly lower by 57%. Maori females had a 22% higher risk compared with European females. Females who came from 'Single Parent' and 'Extended Family' Households had higher risks by

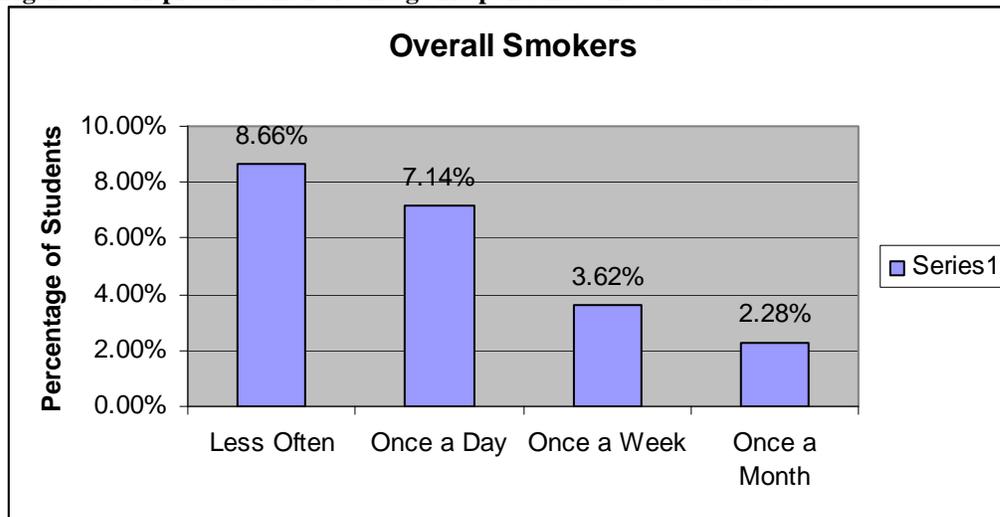
15% and 10%, respectively, compared with those who came from 'Two Parent Households.'

4.3.1.2 Smoking Categories

Participants were categorised according to how often they now smoke **Figure 4-6**. Smoking was categorised into five categories with the lowest 'Less Often' and the highest category is smoking 'Once a Day'.

It is promising to see more adolescents decreasing their amount of cigarettes than when they first started, but it's disheartening to see the percentage of students that smoke daily.

Figure 4-6: Represents the Percentage Respondents who are Smokers



Regular smoking was related to gender, with a higher proportion of females 57.4% in the highest smoking category daily compared with males 42.6%. Ethnicity was also related to regular smoking, where a higher proportion of Pacific and Maori students in the highest smoking category daily than in the 'never smoked' regularly category **Figure 4-7 and Figure 4-8**.

Figure 4-7: Represents the Percentage of Maori that “Have never Smoked” Compared to Pacific Islanders

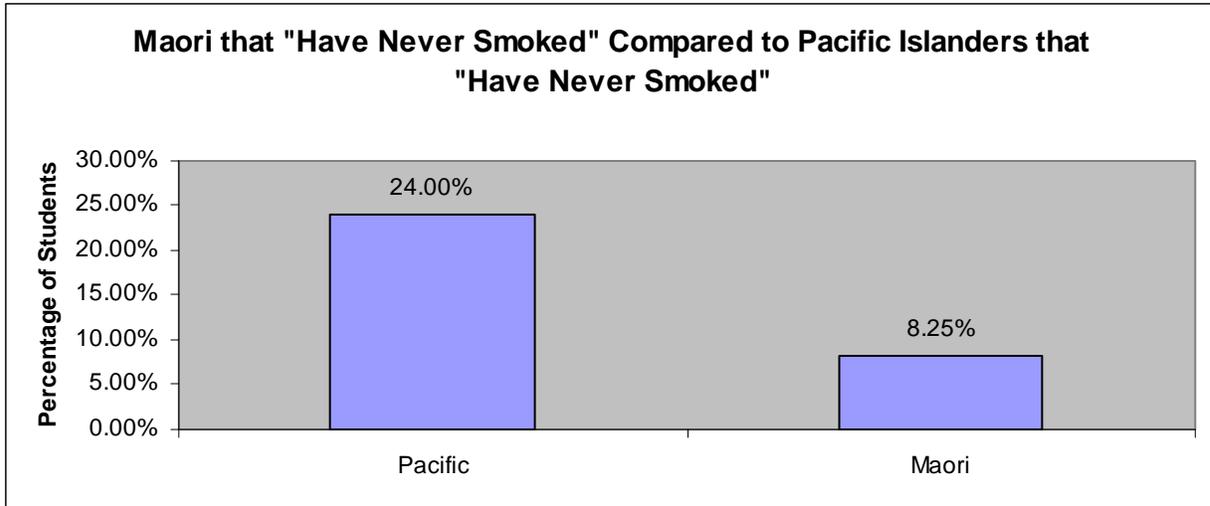
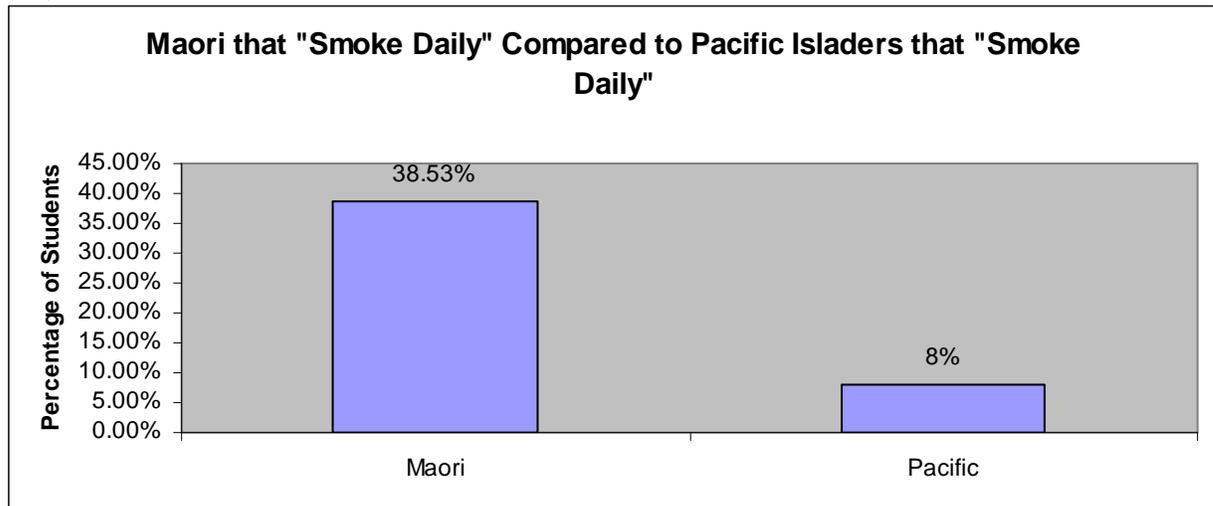


Figure 4-8: Represents the Percentage of Maori that “Smoke Daily versus Pacific Islanders that Smoke Daily”



4.3.1.3 Current Smokers

Current smokers were those who responded to the question: How often do you now smoke? Those who answered 'never' and 'less often' to this question were combined with those that never 'ever tried smoking' a cigarette and were compared to those who were in the 'Currently Smoking' category (i.e. smoking monthly or more often) **Figure 4-9**. It was promising to see that students that were ‘Current Smokers’ smoked overall less than when asked if they had ever smoked. Could a few months or years of knowledge and maturation of the harmful effects of tobacco usage cause such a decline in the number of current smokers? By law today the selling of tobacco products are not allowed to be viewable to the buyer and must be hidden under the counter. This “invisibility” policy

change might have slipped the thoughts of cigarettes from adolescents when they go to grocery stores and to dairies or also known as convenient stores in North America.

Overall, 14.8% of all participants were 'Current Smokers', with a statistically significantly higher proportion of female 29% than male 19% students currently smoking

Figure 4-10.

Figure 4-9: The Percentage of the Sample who are Total Current Smokers

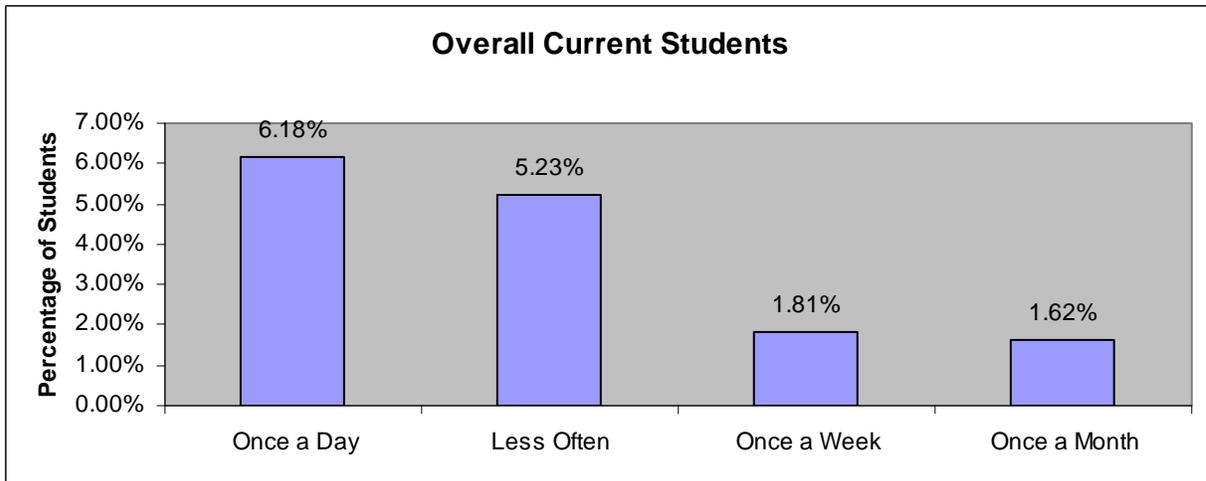


Figure 4-10: The Percentage Respondents by Ethnicity who are a Current Smoker

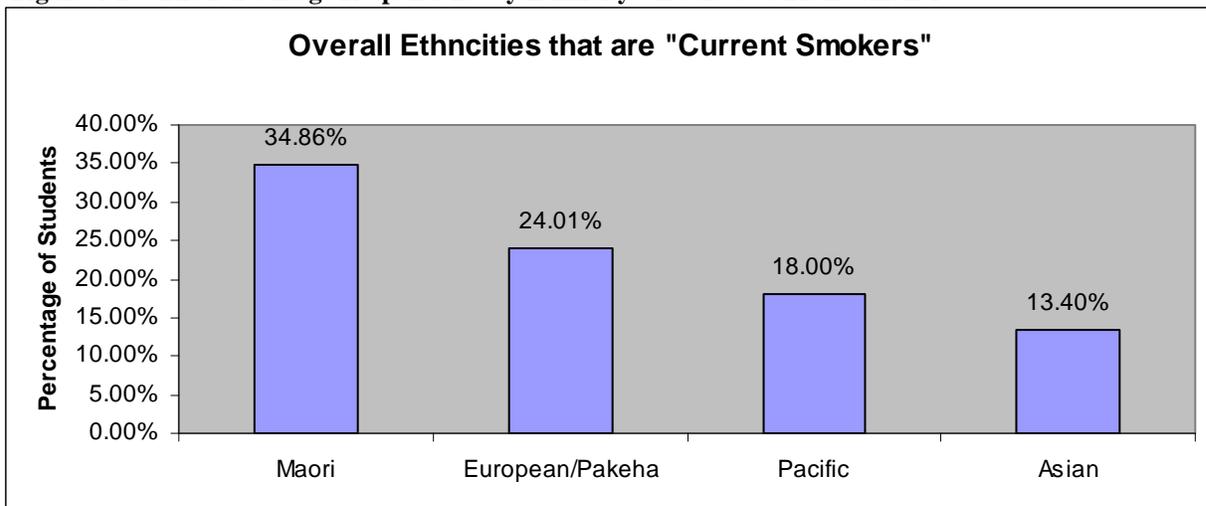


Figure 4-11 and Figure 4-12 illustrates the proportion of participants by gender and ethnic group who were currently smoking cigarettes during the time of the survey. These ethnic differences in proportions of current smokers were statistically different. **Figure 4-11**, illustrates that among males, unlike the previous question to who smoked at least once, Europeans males had a higher percentage of current smokers than compared to the other ethnicities, particularly Maori.

Why would a major and overall higher decile group overall compared to the other ethnicities that tend to show higher rates in smoking all the sudden be higher? The possibility of affordability may be a factor, along with the costs of cigarettes by the pack being cheaper than a case of beer.

Figure 4-12, illustrates that when compared amongst females Maori females still had the highest rate of tobacco intake compared to the other ethnicities.

Figure 4-11: The Percentage of Males that have “Smoked During time of the Survey”

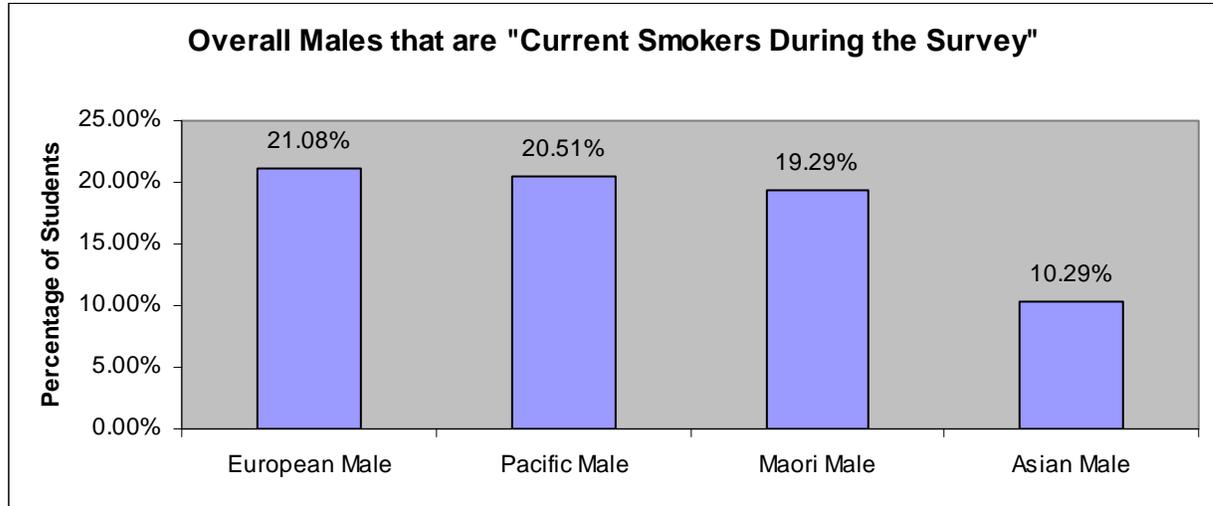
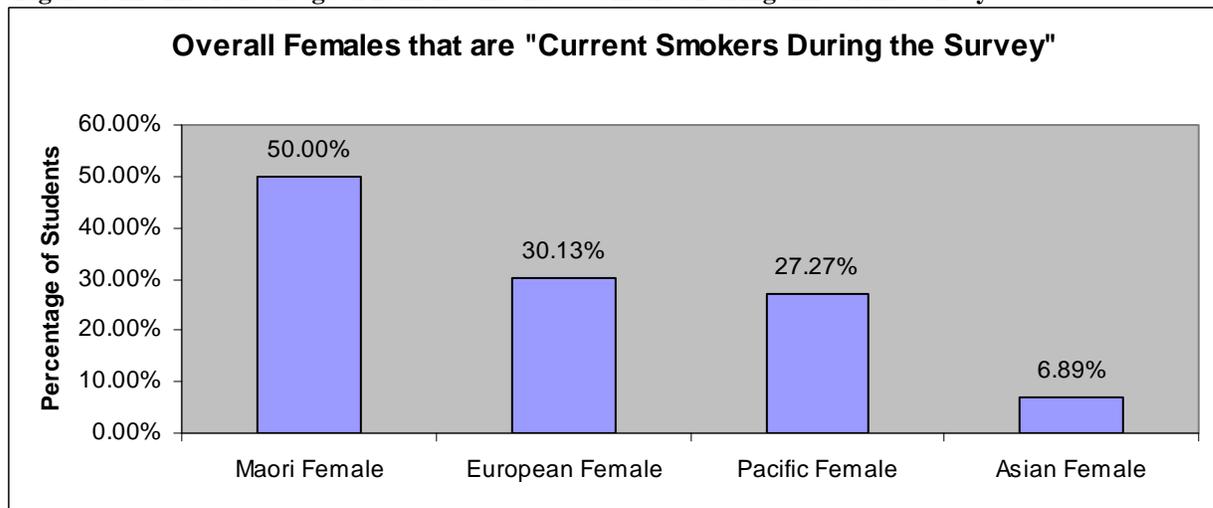


Figure 4-12: The Percentage of Females that have “Smoked During time of the Survey”



The likelihood for male participants who were 'currently smoking' cigarettes during the survey was associated with household living arrangement variables. The probability was 36% higher in males who lived in an 'Extended Family' setting compared with those living in 'Two Parent' Households, although after adjusting for other variables, this was no longer significant. Probability for 'currently smoking' cigarettes was also related to ethnicity, where Asian males had a 46% lower risk, compared with European

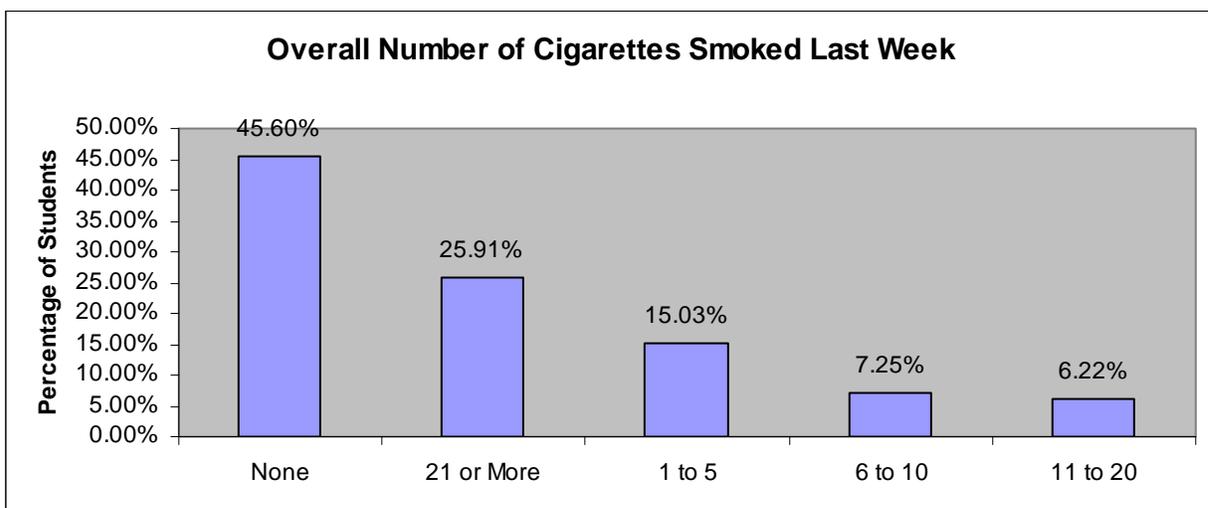
males and this difference remained statistically significantly different even when other variables were adjusted for.

Among females, the likelihood for those who were 'currently smoking cigarettes' during the survey was associated with demographic variables. Ethnicity was related to the likelihood for current smoking. The probability for Maori females was 70% higher than European females. Asian females on the other hand were 74% lower than European females.

4.3.1.4 Amount Smoked in the Week Prior to the Survey

Participants were asked "How many cigarettes did you smoke last week?" Participants who had not 'ever tried smoking' were included in the chart, but were removed when other related were derived. Five categories were used to represent the total number of smokers and of how many cigarettes they smoked up to the week of the survey, as shown in **Figure 4-13**. The number of cigarettes consumed the week prior to the survey being conducted among smokers did not differ by gender or household living arrangements. However, ethnicity was related to the number of cigarettes smoked the week prior to the survey by smokers. A higher proportion of Asian and European students were in the lowest smoking category 15.6% and 43.0%, respectively, than in the higher category 8.6% and 23.8%, respectively.

Figure 4-13: The Percentage of the Total Participants by “How Many Cigarettes they smoked the Week up to the Survey”



The opposite pattern occurred for Maori with a higher proportion 27.2% in the highest category compared with the lowest category 9.4% indicating that Maori smokers

consumed more cigarettes than smokers in other ethnic groups. Pacific smokers also had a high proportion in the highest category 40.4% compared with the lowest category 32%.

4.3.1.5 Summary of Smoking as a Lifestyle Variable

Gender Comparisons

Overall, the proportion of female participants smoking was statistically significantly higher in all four domains when compared to males. They were more inclined to smoke daily, and smoke higher amounts than males. Coincidentally, when one looks at 'current smoking' by gender, the risk was lower for both male and female Asian participants compared with Europeans, and the risk higher in Maori females compared with European females.

Ethnic Group Comparisons

When looking at the four main ethnic groups, Asian participants smoked less in all five domains compared with European. Lower proportions of Asian participants tried smoking for the first time and were less likely to start smoking compared with European participants. Asian participants were less likely to be regularly smoking or currently smoking and were less likely to have smoked large amounts in the week prior to the survey.

In comparison, Maori participants were significantly higher to smoke in all domains when compared with European participants. Maori participants were more likely to have tried smoking for the first time and started smoking at an early age than European participants.

Pacific participants did not differ from Europeans in a statistically significant way in any of the four domains due to the number of participants which represented the Pacific Island adolescents. Therefore, in each domain the proportion of Pacific participants smoking was not significantly different from European.

Relationship between Smoking and Other Lifestyle Variables

Current smoking was positively related to regular alcohol intake and sun exposure. However, it was unrelated to television exposure or leisure-time physical activity.

4.3.2 Drinking

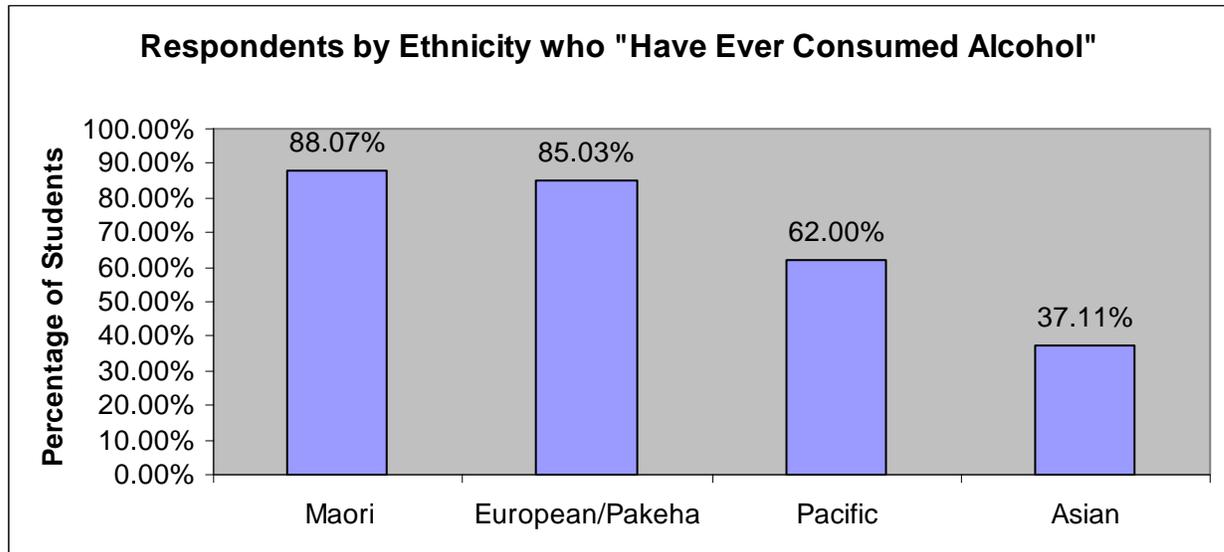
4.3.2.1 Proportion that 'Have Ever Consumed Alcohol'

Participants were asked the question: Have you ever drunk alcohol, excluding sips? Overall, 727 or 69% of the participants in the survey responded with a 'Yes'.

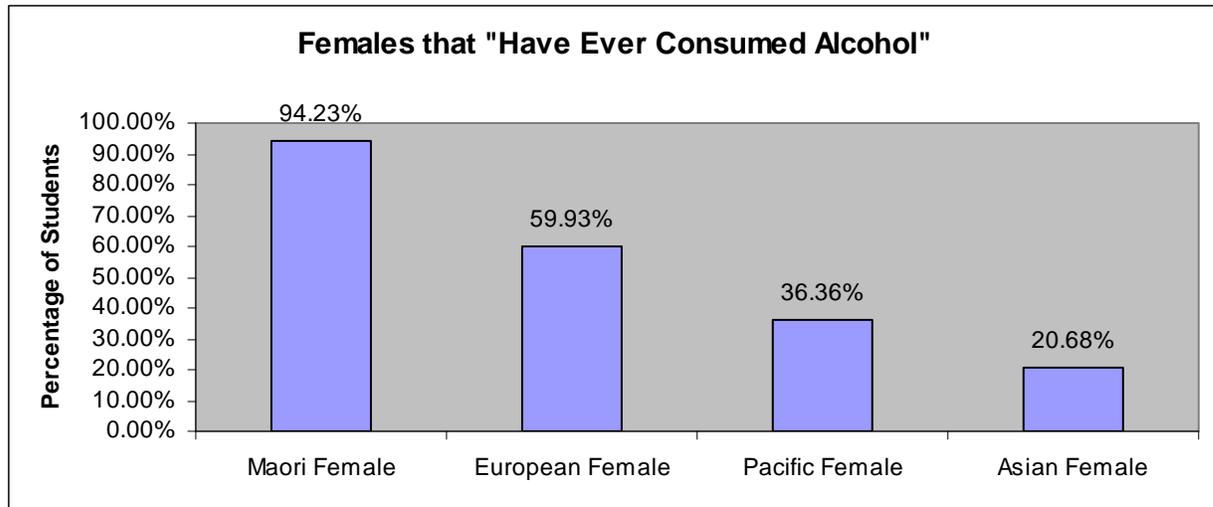
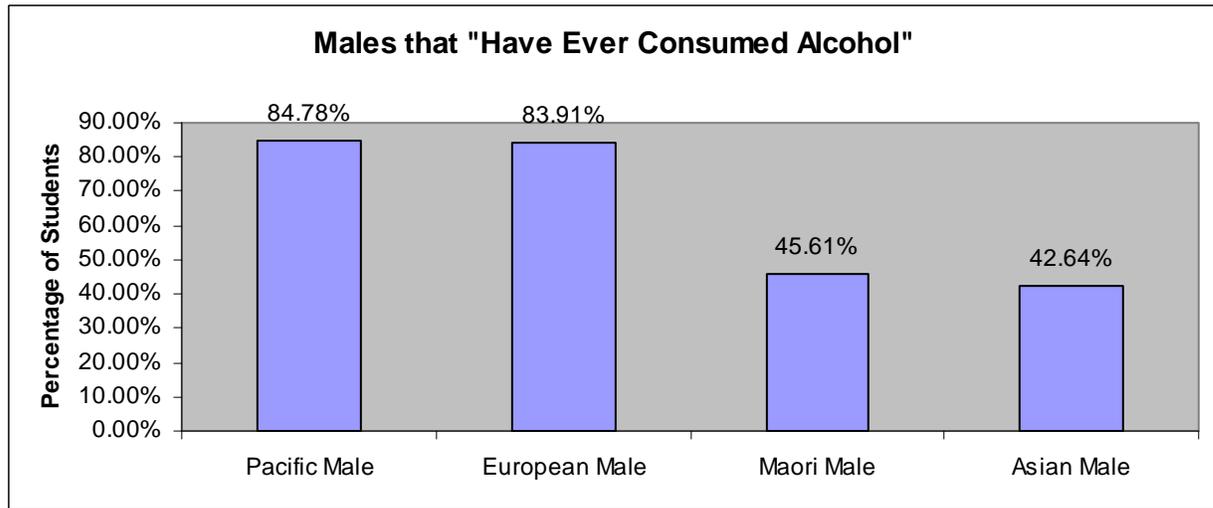
The proportion who responded with a 'Yes' did not differ by sex, being 66% males and 33% females, except for Maori where the proportion for females was significantly higher than for males. However, the proportion who responded with a 'Yes' did differ by ethnic groups.

Just like when asked if one had ever 'Smoked at Least Once', the Maori population had the highest overall percentage of 'Ever Consuming Alcohol' as illustrated in **Figure 4-14**.

Figure 4-14: The Percentage of Respondents by Ethnicity who have "Ever Consumed Alcohol"



In regards to gender, **Figure 4-15 & 4-16**; illustrate which ethnicity has 'Ever Consumed Alcohol'. Again leading the way within the female population the Maori females have higher percentages than any other ethnicity.

Figure 4-15: The Percentage of Females that have “Ever Consumed Alcohol”**Figure 4-16: The Percentage of Males that have “Ever Consumed Alcohol”**

The correlation of having 'ever drunk alcohol' associated with demographic variables was prevalent among male participants.

Students who came from a 'Boarding' household had a 19% higher probability, compared to those from a 'Two Parent'. Pacific and Asian male students both had lower rate by 20% and 54%, respectively, compared to Europeans.

The correlation of having 'ever drunk alcohol' was associated with demographic variables among female participants. The probability for female students from 'Single Parent' Households was 21% higher, compared with females from 'Two Parent' household. Maori females had a 12% higher rate, compared with European females. The rate was lower for both Pacific and Asian females 24% and 44%, respectively.

4.3.2.2 Alcohol Intake

Participants have been categorised according to how often on average they ‘Drank Alcohol in the Past Four Weeks’ prior to taking part in the survey. Alcohol intake was categorised into five categories with the lowest 'never' who are participants that never drunk alcohol ever in their lives. This category was different to the next category 'Two or Three Times' who are participants that have drunk alcohol but have not done so in the four weeks prior to the survey. The highest category is 'Several Times a Week’ which contain those, that drank alcohol more than once a week, on average in the past four weeks prior to the survey.

Alcohol intake was unrelated to gender. In **Figure 4-17**, ethnicity was strongly related to alcohol intake, there being a higher proportion of Maori and European students in the highest alcohol category ‘Several Times a Week’ than in the never drinking category. The opposite pattern occurred for Pacific and Asian students, who both had higher proportions among the never drinkers compared with the more than weekly drinkers.

With the prices of alcohol being very high it is easy to assume why one would find Europeans to ‘Drink Several Times a Week’ more so than Maori. With that proportion being so high it is also easy to premeditate the thought that there would be a very low percentage of Europeans to ‘Not Ever have a Drink’ as shown in the **Figure 4-18**.

Figure 4-17: The Percentage of European Males versus Maori Males that “Thank Drink Several Times a Week”

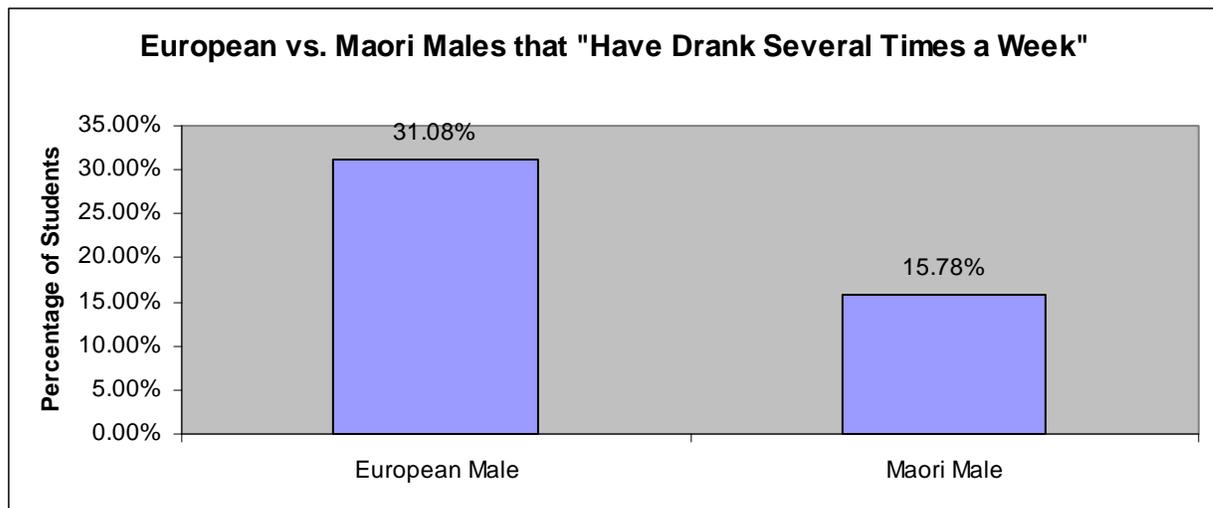
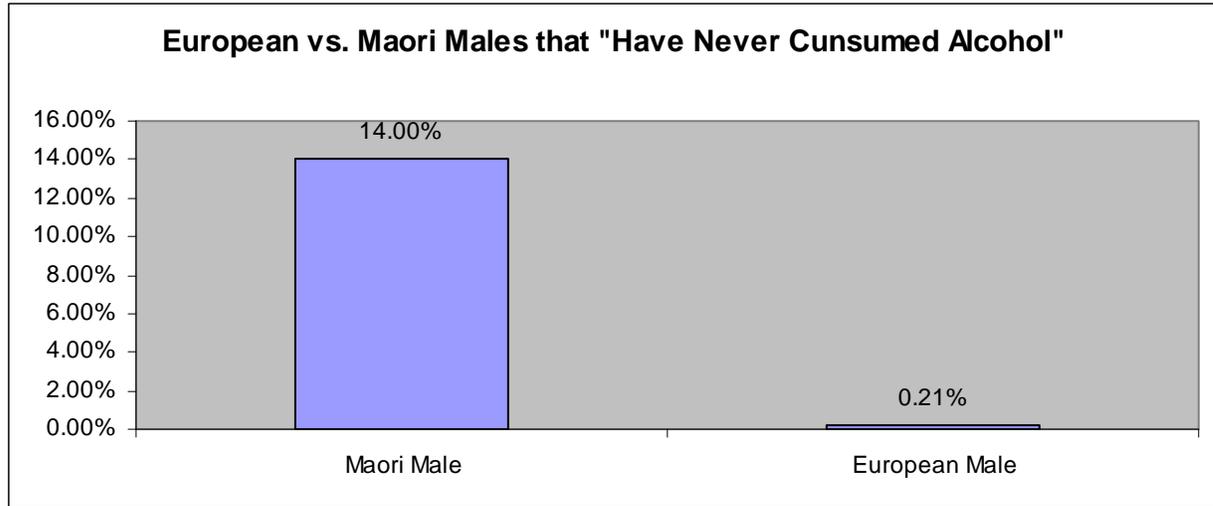


Figure 4-18: The Percentage of European Males versus Maori Males that have “Never Consumed Alcohol”

Analyses of HLA showed that it was strongly associated with regular alcohol intake. Household living arrangements were strongly associated to regular alcohol intake, with no clear pattern, although a high proportion of 'Boarding' students were in the highest drinking category than the lowest drinking category 15% vs. 9%.

The likelihood of being a weekly alcohol drinker was associated with demographic variables. The probability of being a weekly alcohol drinker was associated with gender. Male participants had a higher rate 28% compared with females; however, once adjusted for the HLA variable, and ethnic group, the difference were no longer statistically significant. Household living arrangement was associated with the probability of being a weekly alcohol drinker, where adolescents who were boarding had a 65% higher rate compared to those living with two parents.

4.3.2.3 Current Alcohol Drinkers

'Current Alcohol Drinkers' were those who responded to the question: During the past four weeks, how often on average did you drink alcohol? Two categories were used, 'current alcohol drinkers' were those that did drink alcohol during the past four weeks prior to the survey, 'noncurrent alcohol drinkers' contained those that never 'ever drunk alcohol' and those that did not drink alcohol in the past four weeks prior to the survey

Figure 4-19. The proportion of these two categories varied by ethnicity, but not sex. The notion again was the reason to being a moderate drinker throughout the given weeks up

to the survey, was it stress relief for the upcoming exams? Was it due to the catastrophic earthquake? Or is the consumption of a few drinks every week just a normal social event?

As **Figure 4-20** illustrates, European adolescents had the highest percentage of drinking within this category.

Figure 4-19: The Percentage of Overall “Alcohol Consumption up to the Survey”

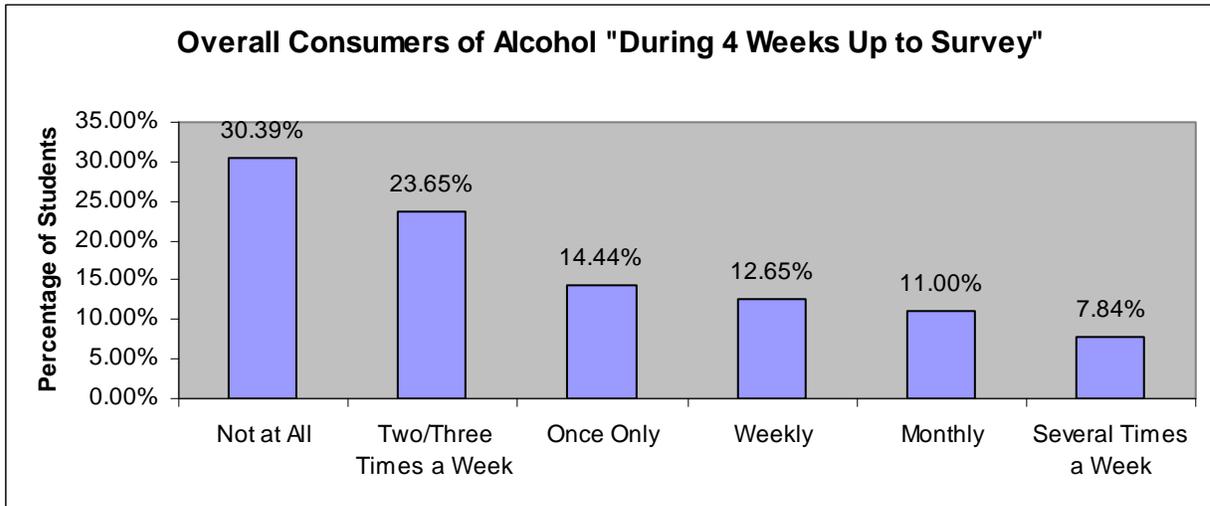


Figure 4-20: The Percentage of Respondents by Ethnicity “Alcohol Consumption up to the Survey”

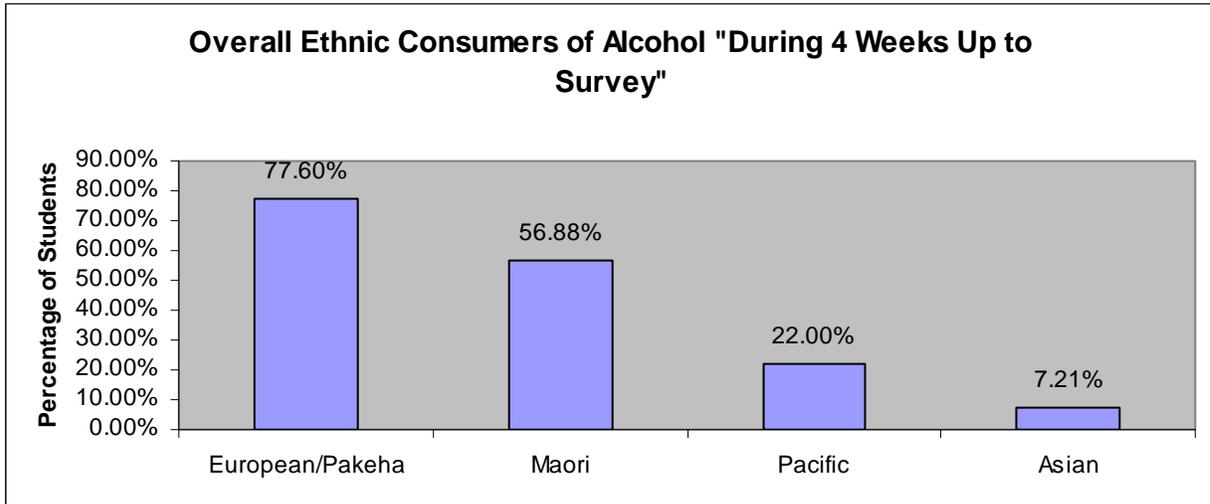


Figure 4-21 and Figure 4-22 illustrates the response of adolescent participants by sex and ethnic group to the question above. Again, the Maori females reported the highest proportion amongst all ethnicities, while the European males had the highest proportion amongst all of its opposing ethnicities.

Figure 4-21: Represents the Percentage of Males that are “Current Consumers of Alcohol”

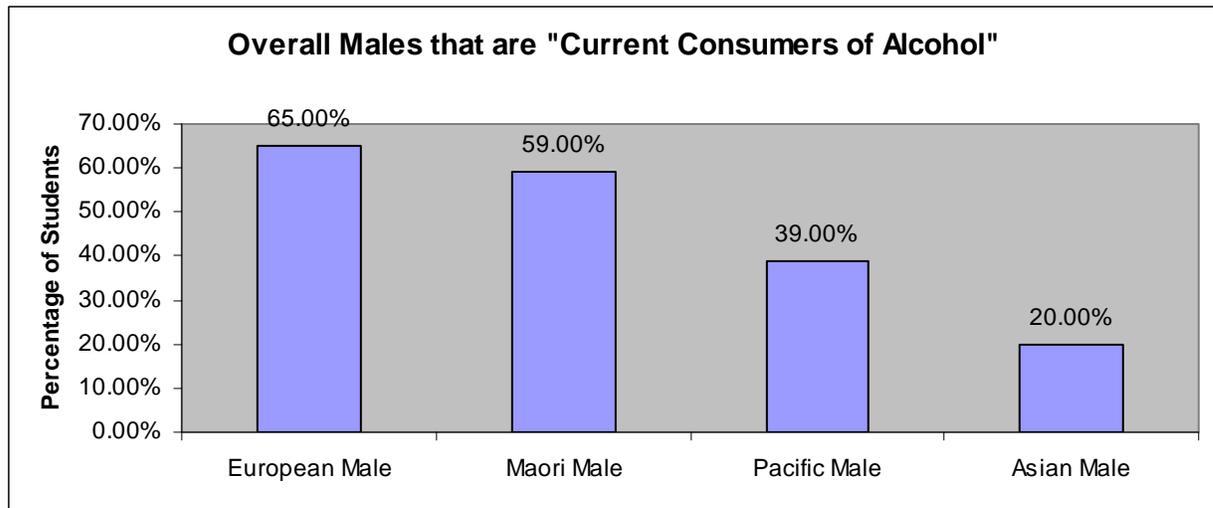
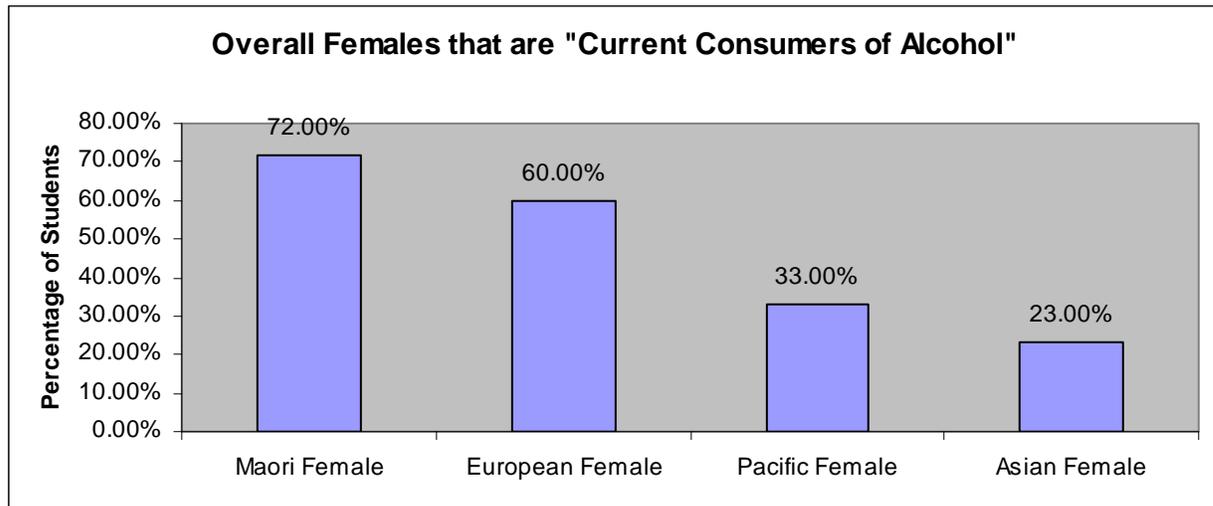


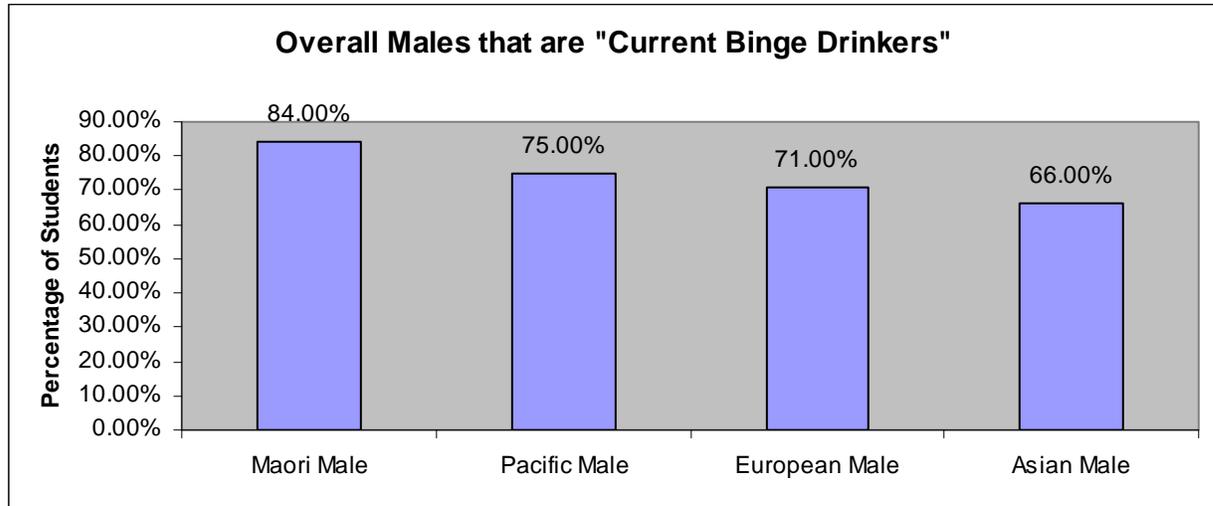
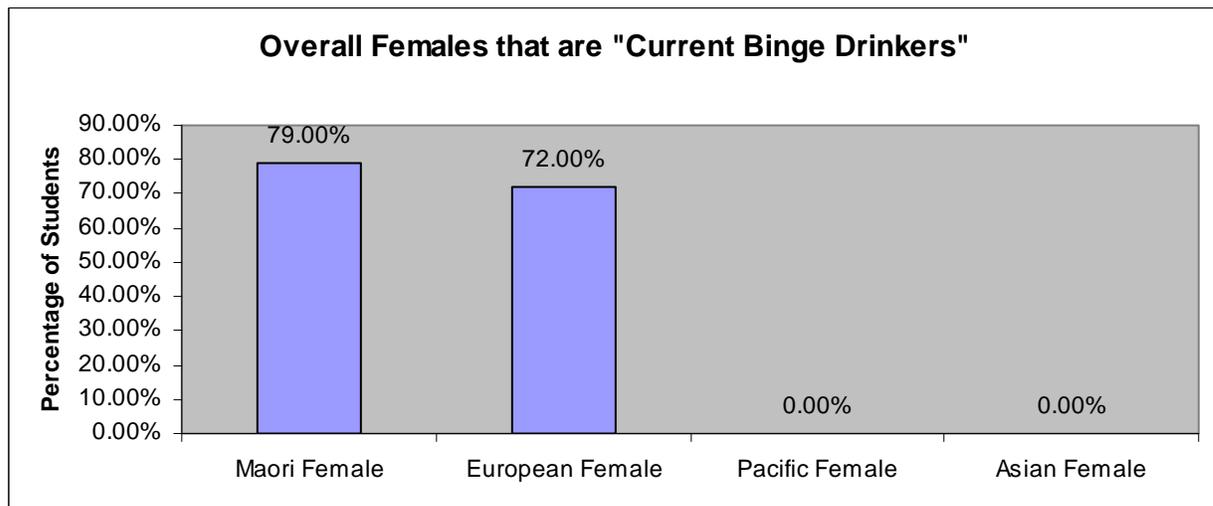
Figure 4-22: The Percentage of Females that are “Current Consumers of Alcohol”



4.3.2.4 Binge Drinking

In this section, participants were asked the question: During the past four weeks, how many times did you have 5 or more alcoholic drinks in one session, within a couple of hours. Overall, 73% of all participants binge drink and binge drinking did not vary between male 74% and females 72%. **Figure 4-23 and Figure 4-24** illustrates the proportions of binge drinking by ethnic group and by gender. Binge drinking differs by ethnic group ($p < 0.001$).

Maori males reported drinking in higher quantities than European males, but European males will tend to drink more over a longer course of time, hence the previous questions.

Figure 4-23: The Percentage of Males that are “Current Binge Drinkers”**Figure 4-24: The Percentage of Females that are “Current Binge Drinkers”**

Binge Drinking Weekly

The most frequent alcohol bingeing category was “those that binge drink at least 4 or more times in the last 4 weeks”.

Overall, of all participants that drink alcohol, 17% had a binge drinking session at least once a week in the last 4 weeks, prior to the survey. The proportion of participants who binge weekly differed by sex and by ethnic groups.

The probability of weekly alcohol bingeing was associated with sex (males), 58% higher. Age however, was related to the risk of bingeing ≥ 4 times. Amongst ethnicity, Maori compared with European, was also related to the probability of weekly alcohol bingeing where the rate of bingeing weekly was 2 fold higher among Maori participants

compared with European. Weekly bingeing was unrelated to household living arrangements.

4.3.2.5 Summary of Alcohol as a Lifestyle Variable

Gender Comparisons

Overall, there were no significant differences between males and females. The proportions of male and female participants who have ever tried alcohol and the age of onset were not statistically significantly different. Alcohol consumption and binge drinking levels between male and female participants were also not statistically significant.

Ethnic Group Comparisons

When looking at the four main ethnic groups, Asian participants were significantly lower in all five domains when compared with European. Lower proportions of Asian participants tried alcohol for the first time and were less likely to start drinking alcohol at an early age compared with European participants. Asian participants were less likely to be regular alcohol drinkers or currently drinking alcohol and were less likely to binge drink.

In comparison, Maori participants were significantly higher in all domains when compared with European participants. Maori participants were more likely to have tried alcohol and started drinking alcohol at an early age when compared with European participants. Maori were more likely to drink regularly, that is more than weekly, be current drinkers and binge drink.

Relationship between Alcohol and Other Lifestyle Variables

Two domains of alcohol consumption were analyzed, 'current alcohol' drinking and 'binge' drinking. Current alcohol drinking was positively related to regular smoking, sun exposure, and physical activity. However, it was unrelated to television exposure or leisure-time

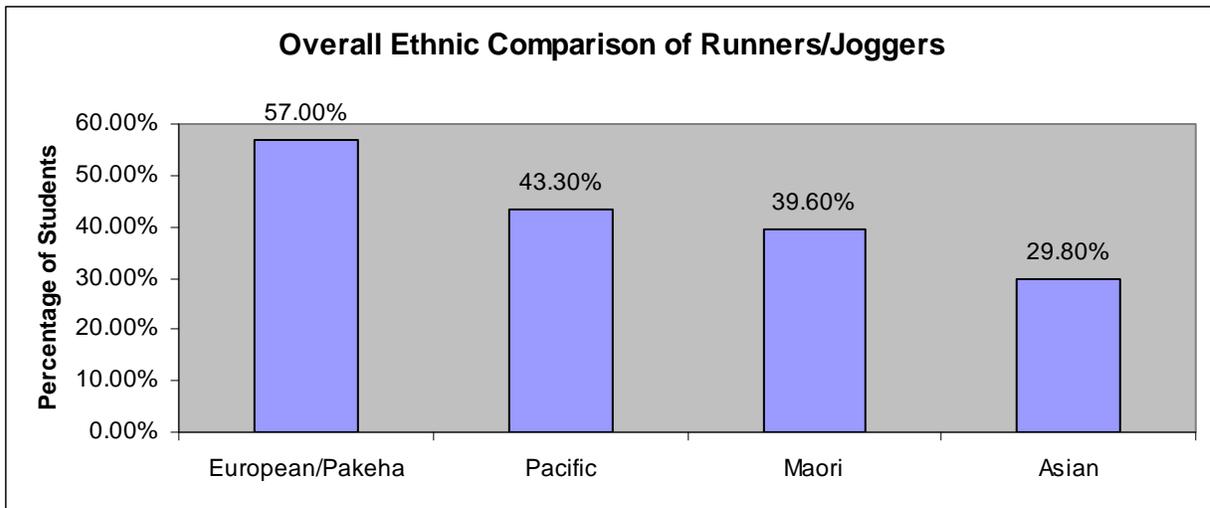
4.3.3 Leisure-time physical activity

4.3.3.1 Types

Leisure Time Physical Activity (LTPA) in the last four weeks prior to taking part in the survey was analyzed. A total of 42 types of LTPA were recorded as mentioned earlier in Chapter 3. **TABLE A 1.2 & TABLE A 1.3** shows the frequency of LTPA listed by all research participants, including a chart with “Other Activities” that were not listed in the survey in which the participant thought would qualify for LTPA. Running and jogging were the most popular types of LTPA, with 50.42% of total participants taking part, followed by soccer with 31.01% participants taking part. Cricket Pacific League was the least participated LTPA type with only 1.33% of total participants respectfully. Overall, 22 LTPA types differed by gender. Females were more likely than males to participate in brisk walking, playing indoor volleyball, dancing, netball, playing hockey and aerobics. Males were more likely than females to participate in rugby/league/touch, basketball, soccer, weight training, indoor/outdoor swimming indoor, cycling, indoor/outdoor cricket, outdoor volleyball, skating/roller-blading, boxing, martial arts, surfing/wind-surfing, squash and water skiing.

Figure 4-25 shows the frequency of “Running/Jogging” listed in descending order by ethnic group. “Running/Jogging” was strongly related to ethnic groups. Europeans reported the highest proportion. Many all boys and all girls’ schools that the investigators went to was predominately European. These schools were quite active in some sort of running and jogging, hence that is a good reason why Europeans are high in the number of Runners/Joggers. Also with overall numbers for the number of participating Europeans being the highest, the probability will be greatest with them. Asians who had the lower number of participants showed lower numbers to correlate with their participation.

Figure 4-25: The Percentage of Respondents by Ethnicity that are “Runners or Joggers”



Pacific participants were more likely to participate in Pacific Island cricket, dancing and outdoor volleyball, than any other ethnic group. Maori participants were more likely to participate in martial arts and baseball compared with Asian participants, who were more likely to be playing badminton, indoor cricket and table tennis. European participants were more likely to do brisk walking/ tramping, cycling, skating/roller blading, playing hockey, surfing, horse riding, and sailing than any other ethnic groups. Pacific and Maori participants were more likely to participate in basketball, weight training, play indoor volleyball, netball, and boxing than European and Asian participants. European and Asian participants were more likely to brisk walk/tramping, play soccer and swim indoor than Pacific or Maori participants. Asian participants were less likely to swim outdoor than Pacific, Maori or Europeans. Pacific participants were less likely to play squash or water polo.

It seems as if the culture overtime has followed each ethnicity. Europeans, Maori, and some Pacific Islanders will tend to participate in physically extreme sports, whereas Asians will stick to mentally challenging, indoor, and less physically demanding sports.

4.3.3.2 Intensity & Limitations

LTPA in the last four weeks prior to taking part in the survey were categorised into three categories according to the intensity of LTPA. Vigorous LTPAs were defined as those that made the participants 'breathe hard'. Moderate LTPAs were defined as activities involving movement such as walking, but did not make participants 'breathe hard' and finally, those who did not do any LTPA.

Figure 4-26, 4-27, and 4-28 shows the distribution of demographic variables by LTPA 'Limitations'. More students had difficulties with 'vigorous activities' and 'climbing several stairs'.

Figure 4-26: The Percentage of Total Participants that have "No LTPA Limitations"

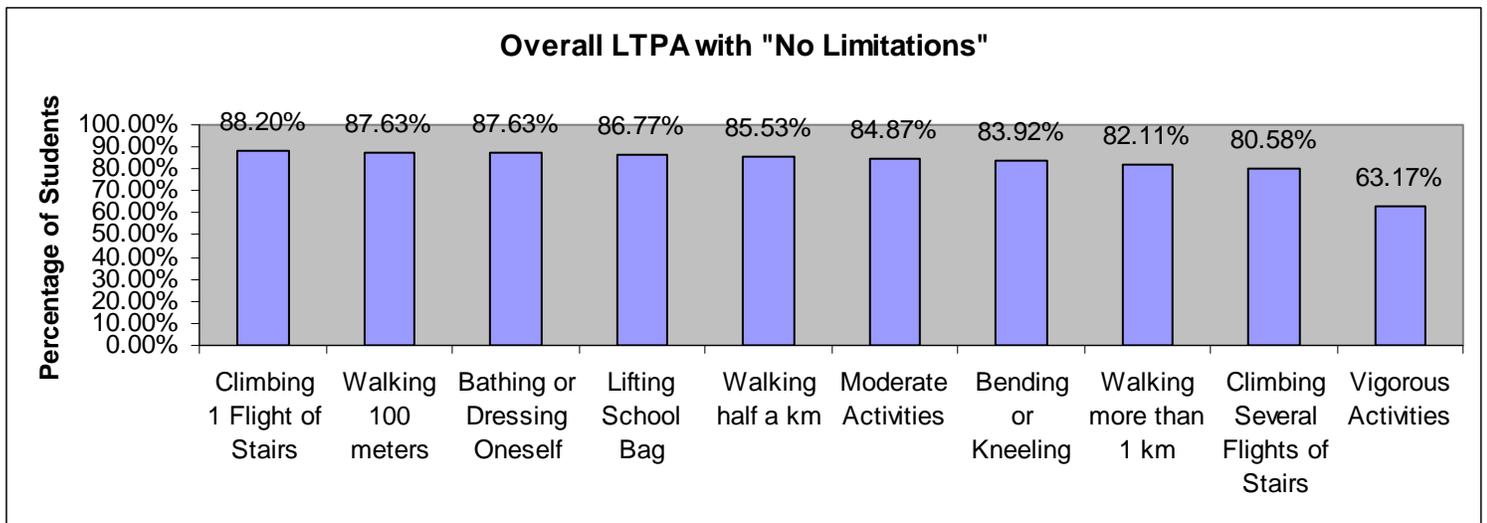


Figure 4-27: The Percentage of Total Participants that have "A Small Amount of LTPA Limitations"

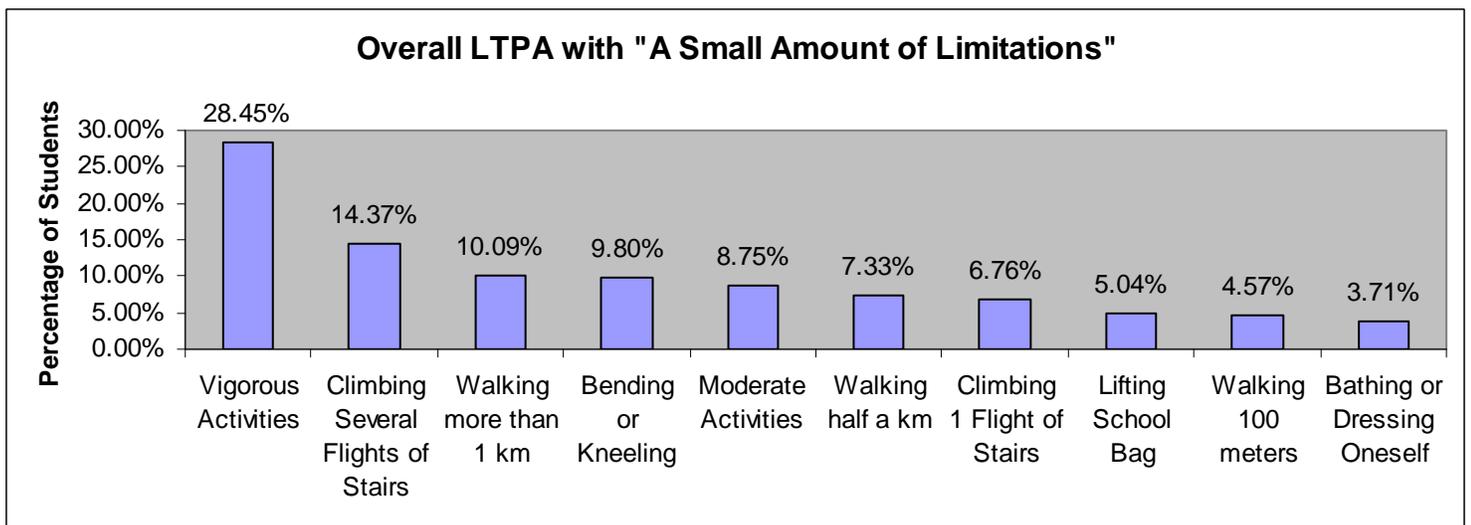
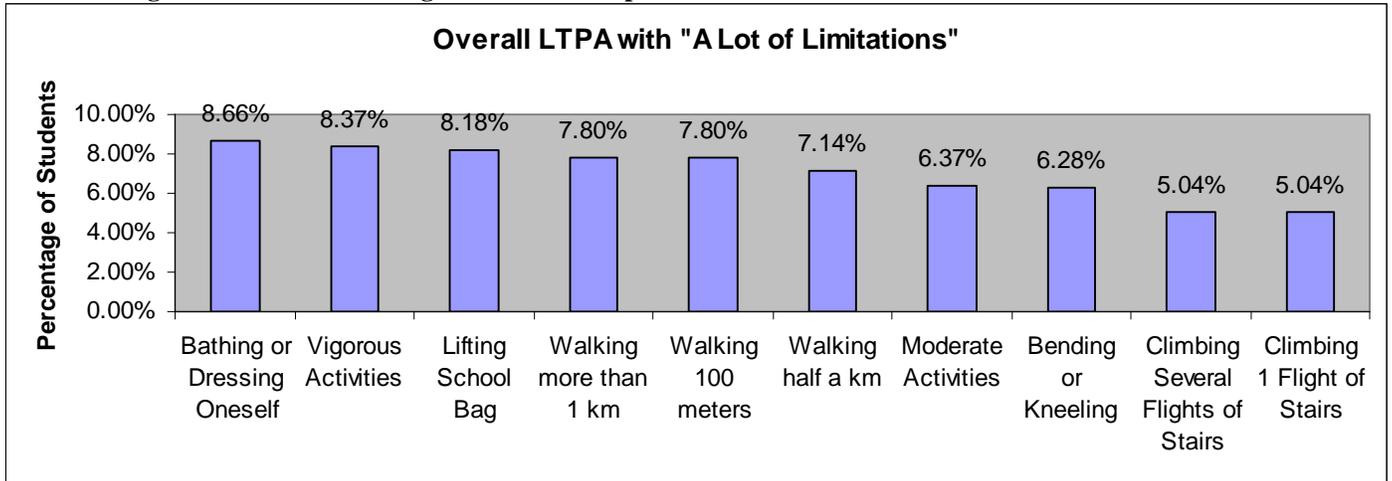


Figure 4-28: The Percentage of Total Participants that have “A Lot LTPA Limitations”

LTPA was related to sex with a higher proportion of males 91.5%, than females 80.0% doing more vigorous LTPA, but there was no relationship amongst any other HLA. Ethnicity was strongly related to LTPA but with no clear pattern. A higher proportion of Pacific, Maori and European participants did vigorous LTPA 90.9%, 88.8%, and 83.9 %, respectively; compared with Asian participants 79.2%.

4.3.3.3 Leisure-time physical activity and other lifestyle variables

The lifestyle risk factors associated with regular vigorous physical activity in the last four weeks prior to taking part in the survey were determined by calculating relative risks adjusting for the main demographic variables sex and ethnicity. The most intense physical activity category, vigorous, was chosen as the outcome of interest because any beneficial health consequences from leisure-time physical activity are likely to occur in this group.

The likelihood of doing regular vigorous physical activity in the last four weeks was associated with other life style risk factors. Sun exposure was weakly associated with regular vigorous physical activity. Students exposed to the sun of 14 to 29 and >29 hours per week were 6% to 9%, respectively, were more likely to do regular vigorous physical activity than those with less than 14 hours of sun exposure, when adjusted for sex and ethnicity. Energy expenditure and aerobic fitness were both associated with increased risk of regular vigorous physical activity, in that students in the highest energy expenditure and fitness categories were more likely to do regular vigorous physical activity than their respective lowest categories- Regular smoking, usual alcohol intake and TV exposure were all unrelated to the risk of regular vigorous physical activity.

4.3.3.4 Summary of Leisure-time Physical Activity as a Lifestyle variable

Gender Comparisons

There were significant differences between males and females for leisure-time physical activity. A higher proportion of males than females engaged in more vigorous Leisure-time physical activity.

Ethnic Group Comparisons

When looking at the four main ethnic groups, there were significant differences among the main ethnic groups but no clear pattern.

Among Pacific participants only, LTPA did not differ among the four main ethnic groups.

Relationship between Leisure-time Physical Activity and Other Lifestyle Variables

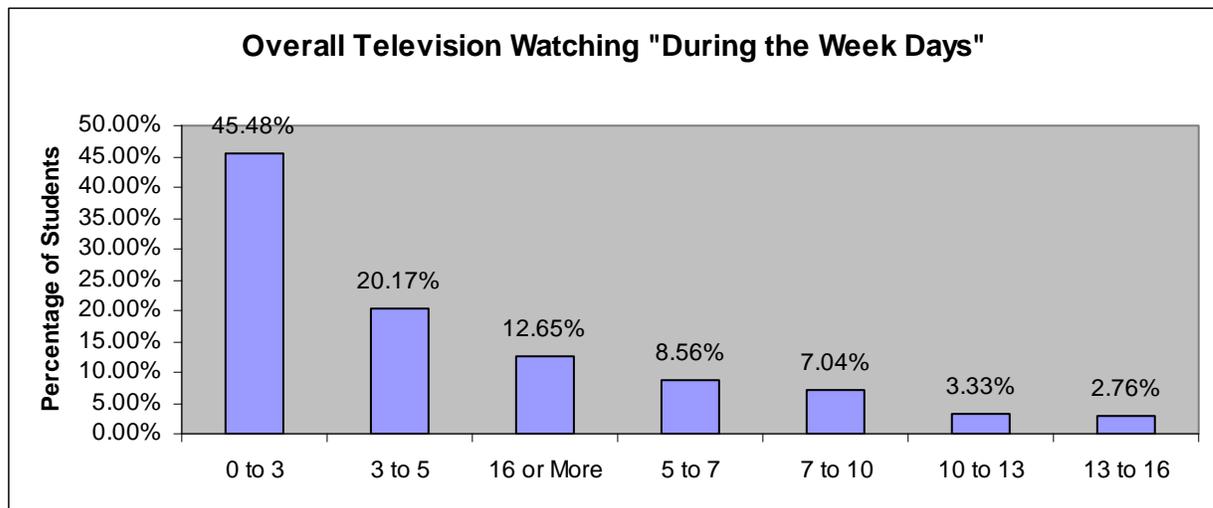
Vigorous LTPA was not related to any other lifestyle risk -factors except for a positive relationship with sun exposure.

4.3.4 TELEVISION WATCHING

4.3.4.1 Television Watching on Week Days

The distributions of demographic variables, by the amount of TV watching in hours of participants during week days are illustrated in **Figure 4-29**. The majority of participants chose watch little to no television, but it seems television came at extremes. One would either watch very little television or they would watch a lot as shown in the graph below.

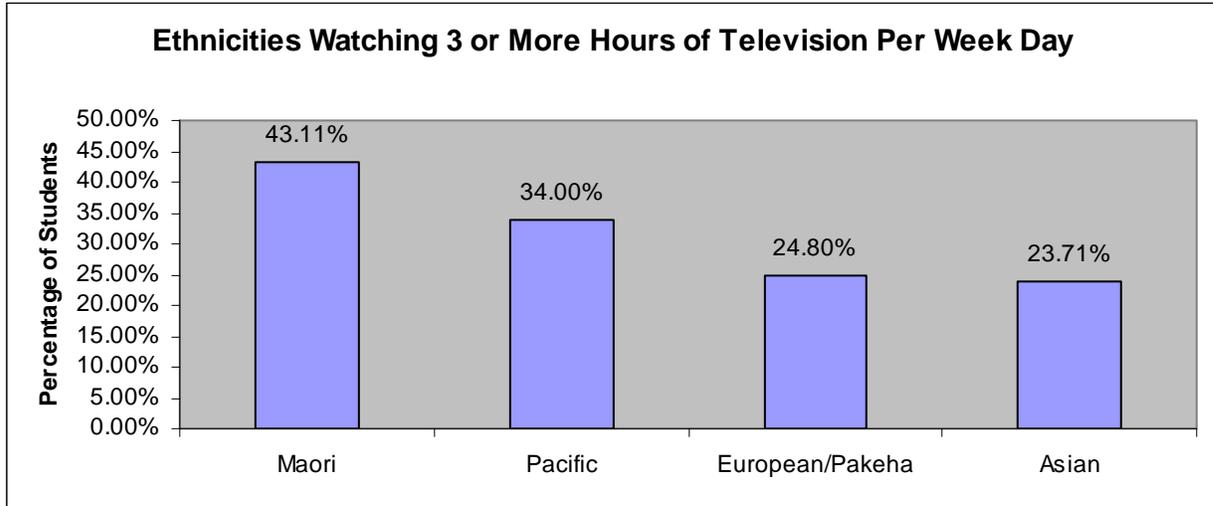
Figure 4-29: The Percentage of Total Participants & the Amount of Week Day TV Watching



Television watching varied according to the household living arrangements, where those that boarded, mostly Asians, had a lower proportion of 17.8% in the 3 or more hours category compared to extended family, single parent and two parent Households 33.9%, 36.6%, 29.6%, respectively. Maori and Pacific also had a higher proportion 43.4% and 33.7%, respectively, who watched TV 4 or more hours per week day, than Europeans and Asians 24.8% and 23.3%, respectively.

Figure 4-30 shows the distribution of hours spent watching TV each day during the week for the four main participating ethnicities.

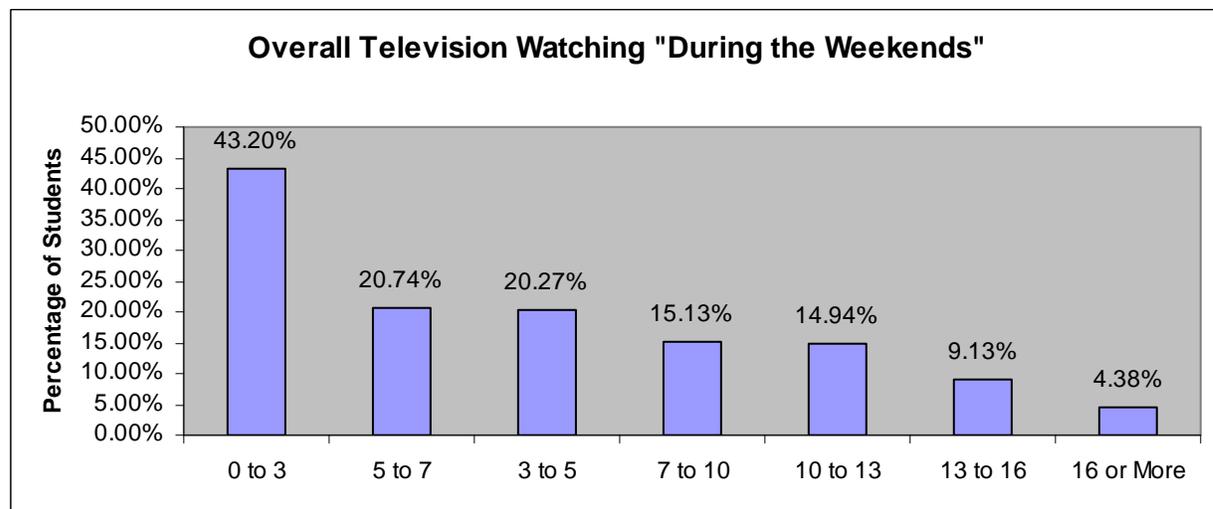
Figure 4-30: The Percentage of Respondents by Ethnicity that “Watch 3 or More Hours of TV per Week Day”



4.3.4.2 Television Watching on Weekend Days

The distributions of demographic variables, by the amount of TV watching in hours of participants during weekend days are illustrated in **Figure 4-31**. Overall, almost half the participants did not watch or watched less than 3 hours of television per weekend day. When comparing weekends and weekdays, the participants on the weekends spent more time doing other activities than finding themselves caught up in watching 16 or more hours a day on the weekend then compared to that category during weekdays.

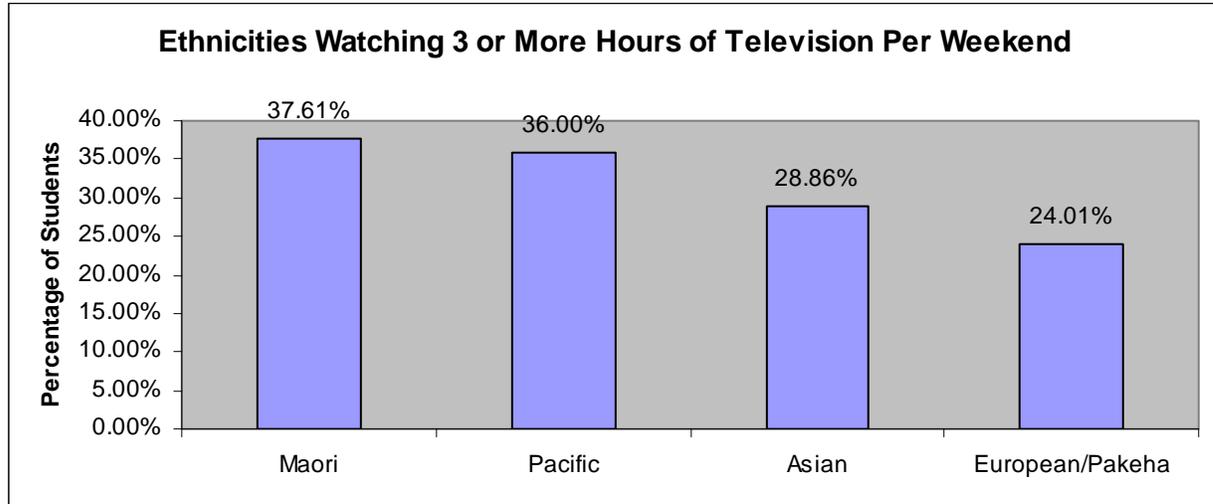
Figure 4-31: The Percentage of Total Participants & the Amount of Weekend TV Watching



The average amount of TV watching during weekend days was unrelated to gender.

Television watching varied with household living arrangements. Those who boarded, mostly Asians, had a lower proportion of 18.7% in the highest TV watching category compared to extended family, single parent and two parent Households 36.3%, 32.2%, 32.1%, respectively. Maori and Pacific also had a higher proportion 37.4% and 35.4%, respectively, in the highest TV watching category, than Europeans and Asians 24% and 28.7%, respectively as shown in **Figure 4-32**.

Figure 4-32: The Percentage of Respondents by Ethnicity that “Watch 3 or More Hours of TV per Weekend”



4.3.4.3 Summary of Television Watching as a Lifestyle Variable

Television watching as a lifestyle variable was analyzed using only one domain. 'Duration' was the domain nominated for analysis.

Gender Comparisons

The proportions of males and females spending time watching television were similar in the week days and in the weekend days.

Ethnic Group Comparisons

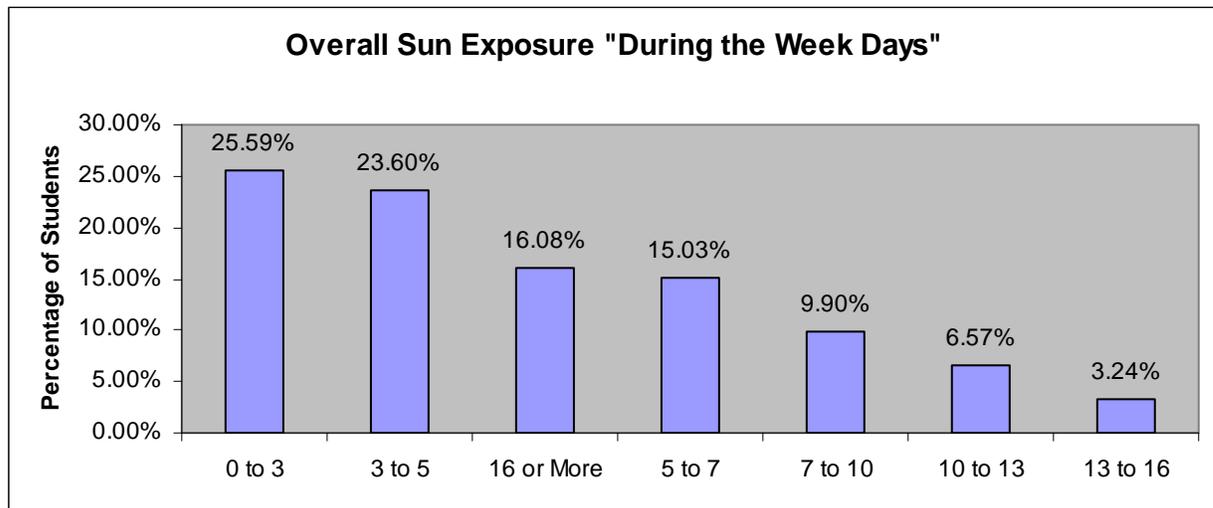
Maori participants had the highest levels of television watching when compared with all other ethnic groups in both the weekend and weekdays. Pacific participants had the highest levels of television watching after Maori, during the week and during the weekend.

4.3.5 SUN EXPOSURE

4.3.5.1 Sun Exposure on Week Days

The distributions of demographic variables, by the categories of sun exposure during week days are illustrated in **Figure 4-33**. Like television watching, it seems as if the participants take sun exposure to an all or nothing extreme. The majority, as the graph shows below, spent little to no exposure or spend more than 16 hours or more per the week days.

Figure 4-33: The Percentage of Total Participants & the Amount of Week Day Sun Exposure”

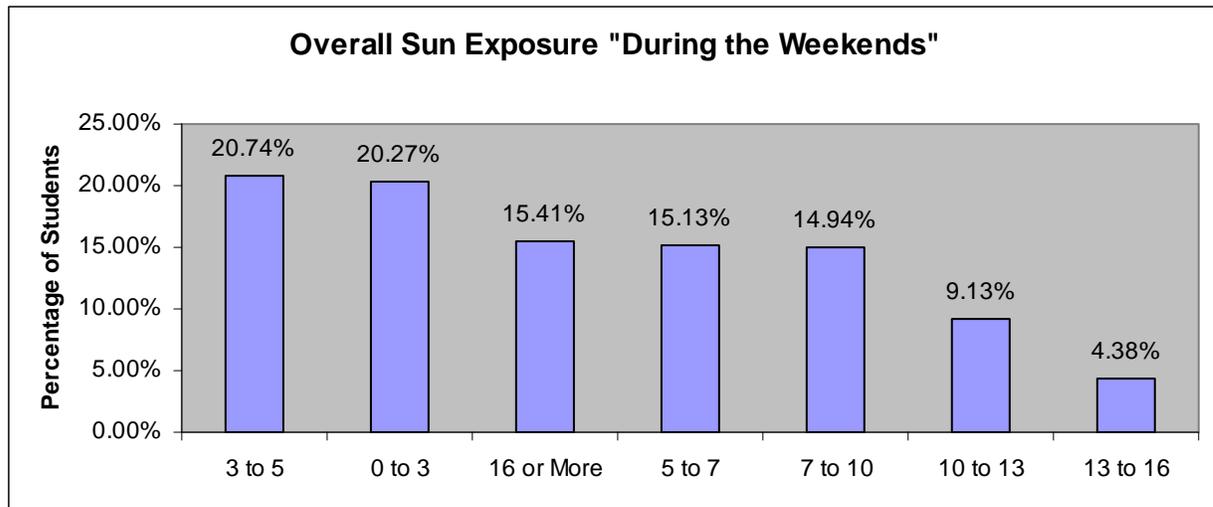


Average sun exposure during week days was related to sex, male participants spent more time outside in the sun than females with a higher proportion 38.2% vs. 20%) in the highest sun exposure category (>4 hours). A higher proportion in which 77.2% of boarding participants spent two or more hours in the sun compared to other participants. Interestingly, sun exposure varied strongly with ethnicity, with Asian students having a smaller proportion of 20.1% in the high sun exposure category compared with Maori 40.8%.

4.3.5.2 Sun Exposure on Weekend Days

The distributions of demographic variables, by the category of sun exposure during weekend days are illustrated in **Figure 4-34**. Sun exposure increased during weekend days. More than likely cause for such a spike in weekend exposure compared to week day exposure is due to the amount of indoor isolationism of their respective institutes, whereas they are “free” on the weekends.

Figure 4-34: The Percentage of Total Participants & the Amount of Weekend Sun Exposure”



Sun exposure during weekend days was unrelated to household living arrangements. However, as with sun exposure during week days, male participants spent more time outside in the sun than females, with a higher proportion 70.3% vs. 48.9% in the highest sun exposure category (>3 hours). Sun exposure during the weekend also varied with ethnicity, with Asian having the lowest proportion 44.3% in the highest sun exposure category compared with the highest, Maori 75.5%. Interestingly, Pacific levels of sun exposure are now second to Asian with just over half 57.4% in the highest sun exposure category. This is due to Sunday church going.

As for Pacific participants only, hours spent outside each day in the sun during weekend days was not significantly different between Pacific ethnic groups.

4.3.5.3 Summary of Sun Exposure as a Lifestyle Variable

Sun exposure as a lifestyle variable was analyzed using only one domain. 'Duration' was the domain nominated for analysis.

Gender Comparisons

There were statistically significant differences between males and females regarding exposure to the sun. Males spent more time outside in the sun than females with a higher proportion of males in the highest sun exposure category.

Ethnic Group Comparisons

When looking at the four main ethnic groups, there were statistically significant differences. Asian participants had the lowest proportions of sun exposure in the weekdays and weekends.

Maori participants were more likely to spend time in the sun than any other ethnic group. Pacific participants on the other hand had a similar level of sun exposure to Europeans during the weekdays. However, during the weekend their time spent outdoors was lower than European.

With melanoma rates so high in New Zealand, which ethnic group would have the highest rates of reported skin cancer? Take into account some lower decile ethnicities may have melanoma and never know it, or can not afford to have it treated, hence a lower report rate. This needs further research to investigate.

4.4 Intermediate Variable

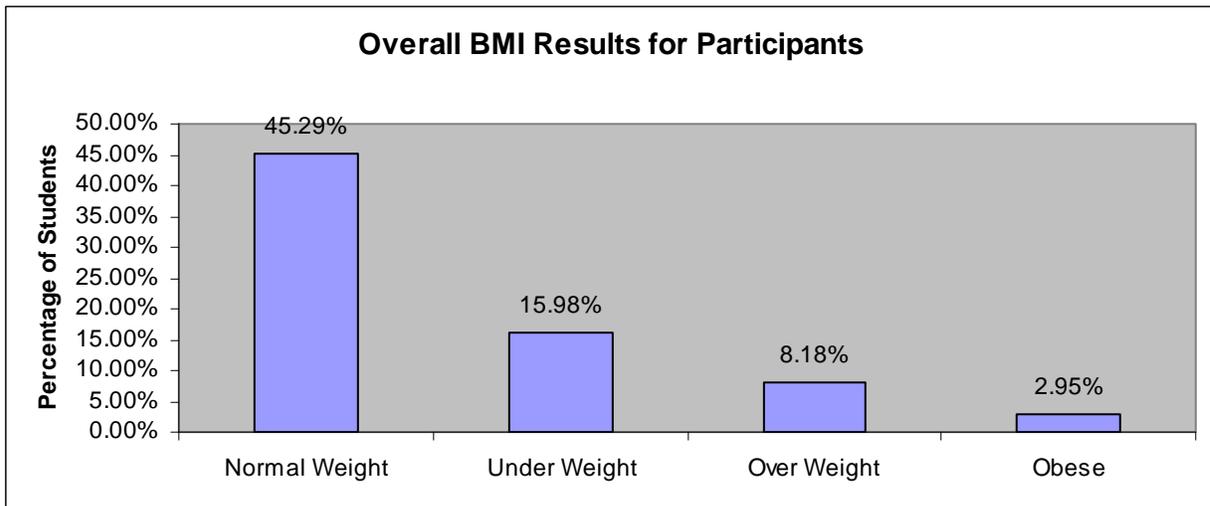
In this section, an intermediate variable will be looked at. This is body mass index (BMI). BMI is a measure of body composition.

4.4.1 BODY MASS INDEX

4.4.1.1 BMI and Demographic Variables

The mean BMI was calculated for each gender and ethnic group. Adjustments for the main demographic variables were sex and ethnic group. **Figure 4-35** illustrates all participants BMI.

Figure 4-35: The Percentage of Total Participant BMI Results



Adjusted mean BMI was significantly higher in females compared with males, and did not differ by age. However, adjusted mean BMI varied between the four main ethnic groups, being highest in Pacific, followed by Maori, European and then Asian participants. Adjusted mean BMI was statistically significantly higher in females compared to males. Interestingly, adjusted mean BMI increased with age. Among Pacific participants, adjusted mean BMI was not statistically significantly different between the four main Pacific ethnic groups. Participants that were 'Overweight & (EX)/Current Smoker' as well as 'Obese & (EX)/Current Smoker' were analyzed and the chart is illustrated in **Table A 1.5 and Table A 1.6**. Participants that were 'Overweight & (EX)/Current Drinker' as well as 'Obese & (EX)/Current Drinker' were analyzed and the

chart is illustrated in **Table A 1.7 and Table A 1.8**, 290 participants refused to have their height and weight measured, and also refused to give the knowledge of their height and weight.

4.4.1.2 BMI, Nutrition Intake, and Vitamin Intake

Aside from leisure activities and relationship to BMI, it is important to incorporate Nutrition Intake and Vitamin Intake comparison and relationship to BMI.

The participants preferred to drink non-alcoholic drinks more than the average serving size, this is illustrated in **Figure 4-36, 4-37, 4-38, 4-39**. What is not known is that the possibility of liquid meal replacements might be a reason for such high liquid intake. The pro to meal replacements is the vital nutrients one would get from a solid meal and it acts like a cost saving initiative. Amongst food groups: beef, grains, and other vegetables were also significantly higher than the recommended daily intake. The figures below show the results of the nutrition diet.

It was promising to see that the amount of sweets were low amongst all adolescents.

Participants were also asked within the past 4 weeks up to participating in this research if any of them took vitamins. The distribution of demographic variables, by the category of 'Vitamin Intake' is illustrated in **Figure 4-40**. Other vitamins that participants took, that was not listed was mainly fish oil and iron, which made up of 20% of the "Other" category. A good conclusion of such a high fish oil intake is likely due to the lower cost of buying a large quantity of fish oil pills compared to buying whole fish from the grocery store. A person can receive the same daily amount of Omega 3 from pills as from the whole fish. Not to mention the taste and smell may cause the adolescents to stray away from sea food.

Figure 4-36: The Percentage of Participant Serving Size “Consuming Less than the Average Serving Size”

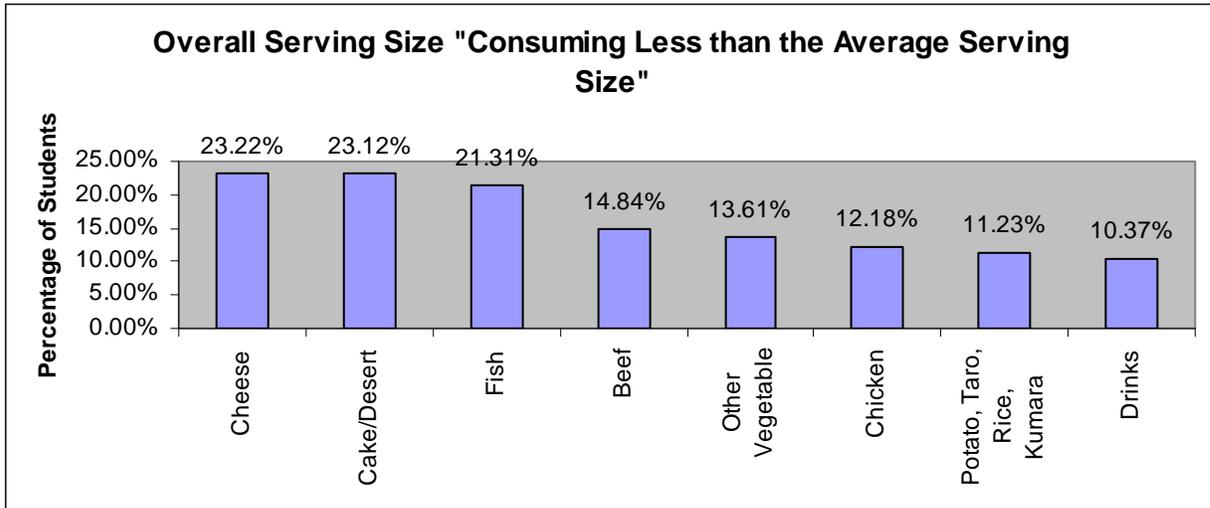


Figure 4-37: The Percentage of Participant Serving Size “Consuming About the Same Average Serving Size”

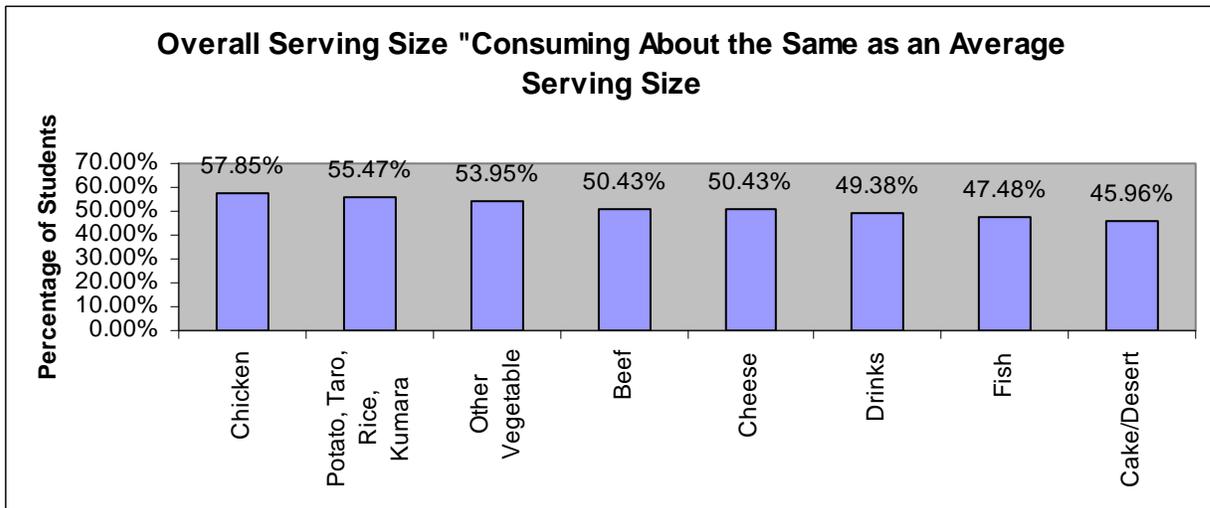


Figure 4-38: The Percentage of Participant Serving Size “Consuming More than the Average Serving Size”

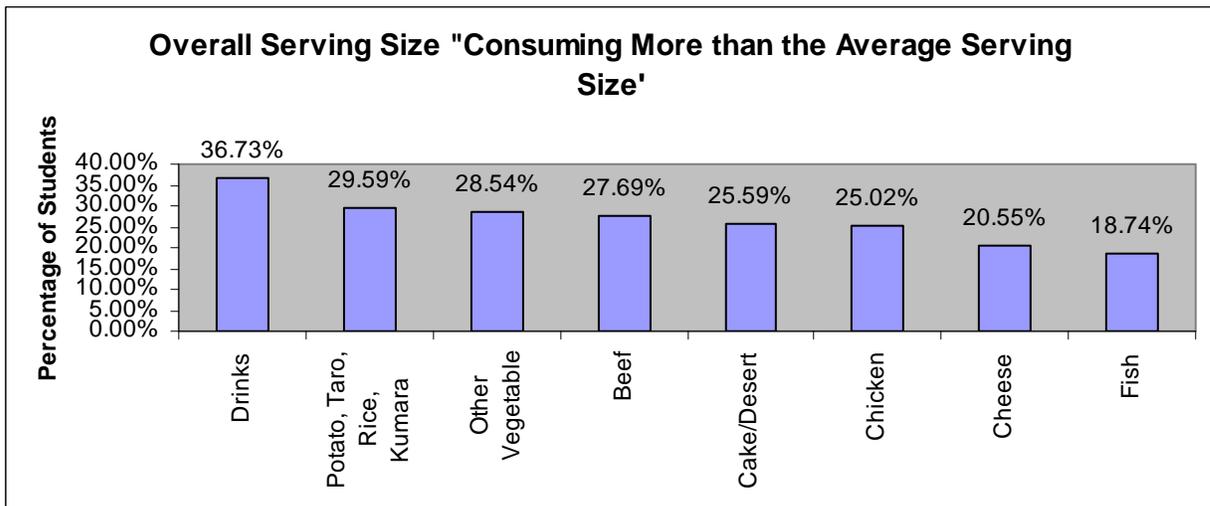


Figure 4-39: The Percentage of Participant Serving Size “Not Consuming any of the Aforementioned Food or Beverage Choices”

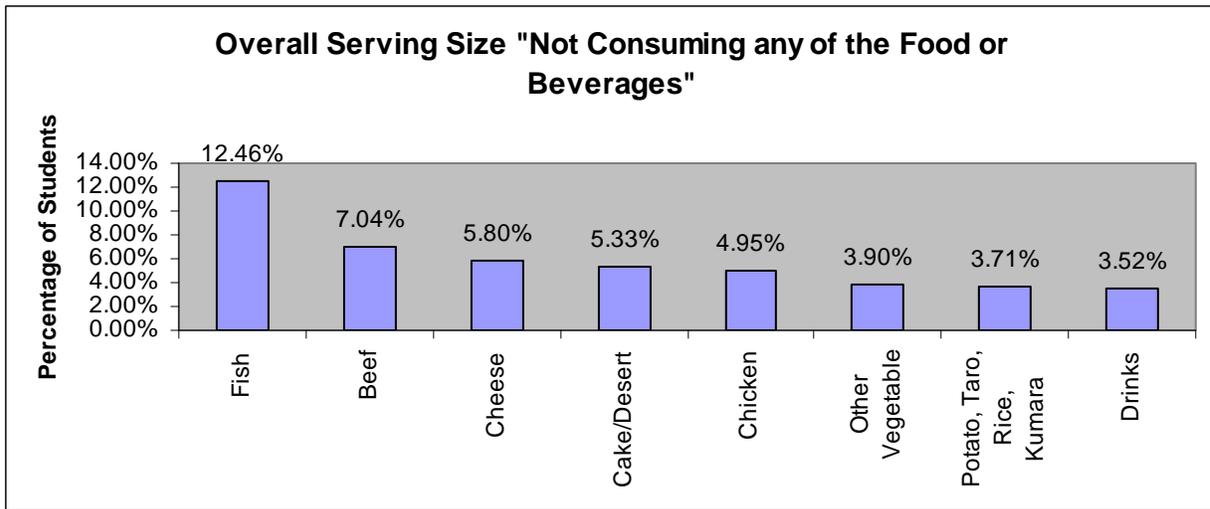
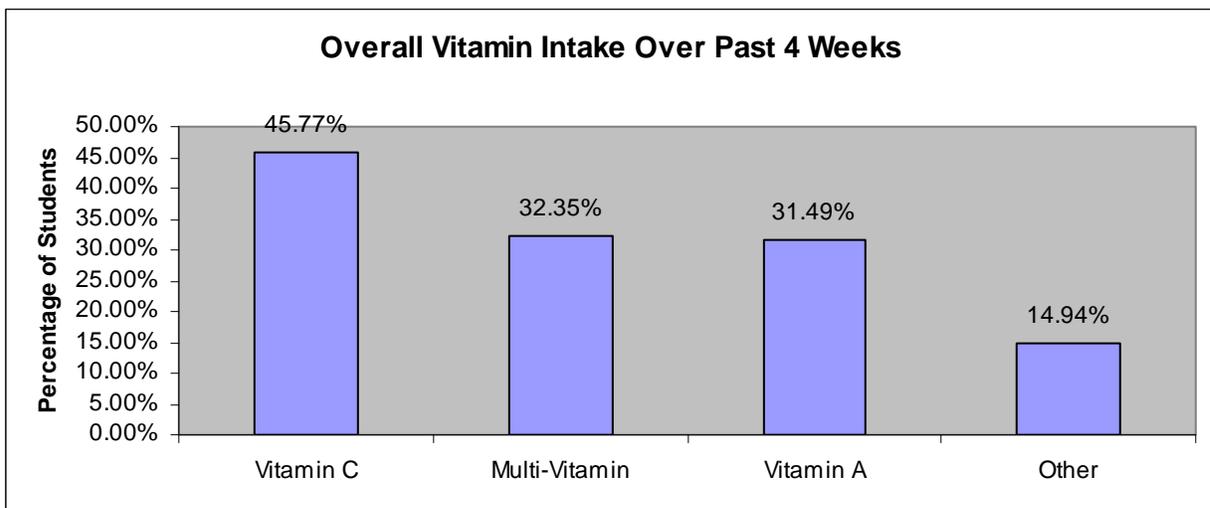
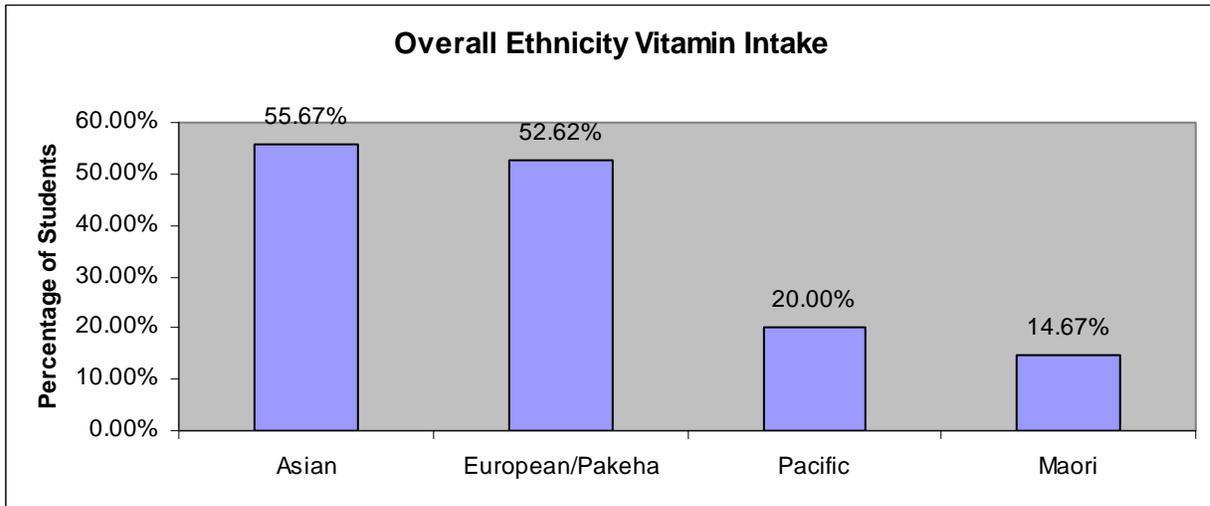


Figure 4-40: The Percentage of Participant Total Vitamin of Choice Intake Over the Past 4 Weeks”



The average amount of ‘Vitamin Intake’ was unrelated to gender.

In regards to Vitamin C being the most heavily consumed vitamin there was a relationship between ethnicities. **Figure 4-41**, illustrates that 481 participants consumed Vitamin C with the past four weeks on a regular basis respectfully, with Asians and Europeans had a higher proportion of daily recommended ‘Vitamin Intake’ of any type, than Maori and Pacific. This is the only category where Asians represent the highest proportions.

Figure 4-41: The Percentage of Ethnicities that had some sort of “Vitamin Intake”

CHAPTER 5- DISCUSSION

5.1 Essential Findings per Each Risk Factor

In this final chapter, the research will conclude with the following takeaways.

1. Summarizing key findings.
2. To review prior research and from there identify which ones coincide with the investigators findings and why they may be genuine findings.
3. Identify research that has not agreed with the investigator's conclusions and identify the reasons why they may be so.
4. Then identify surprising findings in the CRFAC study and why they are surprising findings.
5. Answer takeaway questions
6. Then discuss, "What needs to be done now?"

5.1.1.1 Smoking

When talking about heart disease, smoking seems to always be a contributor, but shouldn't it be the most preventable attribution to heart disease? "The population prevalence of smoking in New Zealand is estimated at around 25%" (Labarthe 1991). In the CRFAC, 14.8% of all participants were 'current smokers', with a significantly higher proportion of female 29% than male 19% students currently smoking. Maori reported the highest proportion 35%, followed by European 24%, Pacific 18%, and Asian 13%.

Overall, the majority, tried smoking during their early High School years, although Maori were more likely to start earlier.

Smoking had an affirmative correlation with alcohol and physical activity. The relationship between smoking and fitness merits further research. Alcohol and smoking were also positively associated with sun exposure which also warrants further research.

In regarding household living, the thought of living abroad for 'Boarding' household students and not being under the care of a 'Two Parent' household causes curiosity and free range to be demonstrated amongst adolescents who wish to consume tobacco products. The tight grip of the society of which they come from and the protectiveness of their parents not being around is the reason for such high rates amongst 'Boarding' household adolescents.

In Chapter 4, results showed that Pacific Islanders consume less tobacco products than Maori, but why? Decile ratings from both ethnicities tend to be low overall. Could it be the method of social networking and relaxation? Other harmful risk factors like alcohol showed that Pacific Islanders choose this instead. What makes tobacco less appealing to the eyes of the Pacific Islanders than to the Maori adolescents? Further research is needed to determine why poor habits are chosen differently amongst different ethnic groups.

Finally, the question arises why was there such a large spike in dangerously high consumption of cigarettes within the week leading up to the survey? Possible mental strain of upcoming exams for many students and also the thought in the back of all adolescents' minds when a devastating earthquake shook the Canterbury region not too long ago. The earthquake and aftershocks still lingered within all the students that the investigators interviewed and it caused mental hardship at home along with in the classroom. Interventions for mental disturbances should be more heavily relied on in and outside of the classroom to educate adolescents on how to cope with tragedies without relying on tobacco.

5.1.1.2 Alcohol

The CRFAC results are consistent with findings from the following previous research (Swinburn 1996 & 1998, Phillips 1999), due to the fact the earlier they begin drinking will determine what type of future alcoholic consumption category they will fall into (occasional, binge, etc.). Areas that overall have more sun and outdoor play seem to draw in crowds and the presence of alcohol. This comparison is relevant due to the amount of alcoholic consumption being higher in the summer than the winter, leading to a need for more intervention for the summer than the winter, and this should be implemented in the spring.

The CRFAC research shows that at the high school level that interventions and awareness are needed for Pacific Islanders. Pacific males had a higher frequency of alcohol consumption, being 75%, and more likely to be heavy drinkers than female Pacific counterparts. Could this finding answer the question from the previous section in regards to method of socialising and relaxation choice? Maybe Pacific Islanders find alcohol more appealing to use than smoking. If so, then why?

The most important findings of the research is the discovery of the different category results within Pacific Island people. For example, the alcohol consumption rates between Fijian and Cook Island youth would need to be examined. Also, the results that show children born in New Zealand had higher rates of alcohol consumption compared with children born outside of New Zealand. This was proved with the living arrangements of the researched adolescents. The likelihood was due to the cultural differences at their home compared to living abroad, along with peer pressure from their respective social groups.

The CRFAC showed that if a child was a smoker, than they were more likely to becoming a drinker. This is consistent with other research about adolescents and their choice to participate in multiple risk taking behaviours. Alcohol and smoking were also positively associated with sun exposure. Since sun exposure was very high with Pacific Islander adolescence, this may prove that with their alcohol rates high, that they drink heavily outside and away from their immediate family.

Could the notion of cost play apart for the Maori male in the category of binge drinking as results in chapter 4 show? With the possibility of alcohol being a higher commodity than cigarettes, is it an all or nothing approach to drinking once having alcohol within ones grasp, hence the high rates for binge drinking? This needs further research investigation.

Regular alcohol consumption was positively associated to a diet high in fat or a relatively unhealthy diet. Hence the adolescent should break sequence or prevent initiation of sequence of bad habits of smoking, drinking, and poor diet.

5.1.1.3 Leisure Time Physical Activity

In the CRFAC, there were a number of variables that were associated with a measure of physical activity. These included LTPA and less directly television watching. “Physical inactivity is a well-established risk factor for cardiovascular disease” (Lippert 1981). Far too many times we have seen people that live a sedentary lifestyle be more prone to obtaining a form of cardiovascular disease, like coronary heart disease.

Aside from one’s BMI and biological levels, diseases like stroke may also be heavily reduced when an adequate amount of physical activity is present. The question arises, does the amount of physical activity that is present or absent within adolescence

carry over to adulthood. Or does it naturally decrease or increase due to age, personal choice, or by cell signalling within the body?

The findings of the CRFAC for LTPA showed that males were more likely to engage in LTPA. However, the ethnic differences were inconsistent and there appeared to be no difference in LTPA between Pacific ethnic groups.

Television exposure was an indirect measure of physical activity in that it provided information about 'physical inactivity' and sedentary behaviour. Low levels of physical activity were associated with high levels of television watching.

5.1.1.4 Body Mass Index

In the CRFAC, there was one variable that was associated with the measure of body composition, this being BMI.

“It is well established that Polynesian people have a high mean BMI compared with those of European descent” (Warnick 1982). However, there have been concerns with the accuracy of calculating BMI in Pacific and Maori populations. Johnson’s studies show using bioelectrical impedance (BIA) and isotope dilution methods found that, at any given BMI level, when compared to Europeans, Polynesians appear to have higher BMI and higher levels of body fat (Johnson 1993). Therefore, the BMI threshold used may have overestimated the body fat levels in Polynesian people. Swinburn (1998), proposed that the definition for overweight for Polynesians should be, “a BMI of 26-32kg/m² and that obesity is defined as a BMI >32kg/m²”.

Using the standard BMI calculation methods, the 1997 National Nutrition Survey estimated 75% of Pacific Islanders in New Zealand are either overweight or obese (Dancause 2010). Within Pacific populations, the prevalence of obesity is 26% for men and 47% for women. The New Zealand Children's Nutrition Survey identified that obesity is more prevalent in Pacific males 26.1%, females 31% children, compared with New Zealand European and other ethnic groups (Hazzard 1985).

The WHO defines ‘overweight’ in adulthood as a “BMI of at least 25 kg/m² and obesity as a BMI of at least 30 kg/m²” (WHO 1990).

Research has also shown that, “People who are obese are two to three times more likely to develop coronary heart disease than those who are not obese” (Warrell 2003). In 1997, 11% of mortality was attributed to higher than optimal BMI (>21 kg/m²), with 24%

of these deaths due to ischaemic heart disease and 15% due to ischaemic stroke (Dawson 2005).

The CRFAC results showed that Pacific participants had the highest levels of BMI.

An important question arises about BMI and its correlation to nutrition intake. In Chapter 4 results showed that the consumption of fish was consumed at a low rate? Why is this? Is it merely personal preference by the adolescents? One would think the abundance of fresh sea food in a country that is an island would not be a problem. Also most seafood costs less than red meat and chicken. This would rule out a family not being able to afford it in comparison to other high protein meats. More research is needed to investigate.

Importantly, from the CRFAC study results, television watching was the one lifestyle risk factor that was positively associated with BMI.

5.1.2 SUMMARY

When looking at associations between lifestyle variables and the intermediate variable such as BMI, there were times a lack of association and this is most likely due to measurement error. When collecting lifestyle variable information, there is a strong dependence on participants recalling data about smoking, alcohol, LTPA, television, and sun-exposure levels. In order to overcome this recall bias, a prospective cohort design could be used. This would be done by taking biochemical measures/markers of smoking inhalation, alcohol consumption to verify recall results. It is likely that measurement error in lifestyle variables may be the reason that other associations are not detected. However, the results show that demographic variables: age, gender, HLA, and ethnicity were strongly associated with the intermediate variable BMI.

5.2 Comparison of Results with Previous Literature

5.2.1 INTRODUCTION

New Zealand Studies

There have only been a limited number of studies in New Zealand that focus on cardiovascular risk factors in adolescents. Not one of these research projects had comparable demographic representation to the CRFAC. The most similar was the 'Auckland High School Health Survey' carried out nearly twenty years earlier, (Keys 1984) where all students from one school in Auckland were invited to participate and therefore all the four ethnic groups from the CRFAC study were represented.

The majority of studies carried out in New Zealand had a very limited number of Pacific participants and did not have sufficient power to make ethnic comparisons for Pacific participants, although there are some studies that were able to make significant ethnic comparisons between European and Maori (Rush 2004, Mann 1974, Keys 1984). The age group of the studies ranged between age 5 and 18, with a large number of the studies focusing on primary school aged children. In addition, the numbers of participants in the New Zealand studies were relatively small, with the largest sample sizes being around 1000 participants in both the Christchurch and Dunedin cohorts (Keys 1984, Mann 1974), but with the majority of studies having less than 600 participants.

5.2.2 COMPARISON WITH PREVIOUS LITERATURE ON INTERMEDIATE VARIABLES

New Zealand Studies

No New Zealand studies examined the intermediate variable to the extent CRFAC study did in the literature reviewed. However, the majority of New Zealand studies collected height and weight data, although only two presented BMI data. The Dunedin cohort presented the best data on the relationship between BMI and age, in that it showed BMI does increase with age, although it was not significantly different between males and females and had no ethnic comparison (Mann 1974). The other study that presented BMI in New Zealand for this age group showed that more females were classified as exceeding the desirable BMI range than males, and among females Maori had significantly higher BMI than Europeans (Webber 1983). High BMI in females compared to males, was consistent with the findings of CRFAC study. In addition, the ethnic differences in BMI reported in previous New Zealand surveys have been further expanded in this study and have been shown to be significant among the four main ethnic groups in New Zealand. Moreover, studies previously undertaken in New Zealand were not designed to understand the relationship between BMI and other lifestyle risk factors (Laskarzewski 1979). Therefore, the results of the CRFAC study, which show that BMI was positively and independently associated with television exposure, is the first time New Zealand has been provided with epidemiological findings in this area, for this age group.

Other studies used triceps skin fold. Although this method seems popular with previous New Zealand studies reviewed here, they are more susceptible to measurement error compared with BMI when used with field surveys.

International Studies

Body Mass Index (BMI), has been extensively studied internationally. These international studies indicated generally that BMI increases with age in both males and females (Iribarren 1997, Viikari 1987). As the CRFAC was cross-sectional, it was not able to measure the trend of BMI increasing with age. International studies show that while females are more likely to be overweight and the mean differences in BMI are

usually higher for females, these gender differences are often not significant in adolescence (Porkka 1997, Rasanen 1978). While there are only limited international studies that compare ethnic sub-groups, the studies with large sample sizes do show that the ethnic differences in the levels of BMI are significant. Studies in the United States consistently show Blacks having higher BMI than Whites during adolescents and as adults (Kannel 1991).

Closer to home, consistent with the findings of the CRFAC, an Australian study indicated that Asian children had dramatically lower BMI than other children (Tell 1988). Interestingly, of all studies, both local and international, the highest levels of BMI were shown in the New Zealand study for Maori, although there is some concern about the small sample size of that study (Phillips 1999). Clearly, the results of the CRFAC study show that Pacific participants had higher BMI than Maori, and the most significant variable in determining ethnic differences in a wide range of cardiovascular risk factors was BMI. Higher BMI in Pacific and Maori participants is consistent with international findings which show that Asians and Europeans have lower BMI than other ethnic groups.

5.3 Significant Findings Compared to Previous Research

5.3.1 COMPARISON OF INTERMEDIATE VARIABLE

The intermediate variable that was examined in the study was body mass index (BMI). BMI was high in females compared with males, high in Pacific and Maori and low in Asians compared with Europeans and was positively associated with television exposure.

The gender patterns of BMI for the Pacific only data were consistent with those described above for all participants. However, among Pacific adolescence the variables did not form any ethnic differences, within the Pacific ethnic groups.

5.3.2 EXPLAINING ETHNIC VARIATIONS TO THE INTERMEDIATE VARIABLE

Age and sex adjusted mean BMI was significantly higher in Pacific, followed by Maori, but significantly lower in Asian, compared with European participants. For Asian participants, the mean difference in BMI increased and still remained significantly lower than European participants. Controlling for TV exposure which was the only lifestyle risk factor positively associated with BMI did not have an effect on adjusted mean BMI difference in any of these ethnic groups. These results suggest that part of the increased BMI in Pacific and Maori participants, compared with Europeans is explained by ethnic differences in leisure-time activity, and not due to TV exposure or any other lifestyle risk factors.

Summary

Mean BMI results reported from the CRFAC was higher than most results reviewed. A number of reasons could explain why this is: The first reason is that most of the New Zealand studies were carried out more than 20 years ago. The environment now is very different to the environment 20 years ago.

Interestingly the only two studies that were close to the results from the CRFAC were the Northland study, and the 'Dunedin Cohort' study (Phillips 1999, Mann 1974). The 'Northland' study however only looked at Fourth Form students and the 'Dunedin Cohort' study had predominantly Europeans in the sample. If one compared the mean

BMI for <16 year olds in the CRFAC with that of the Northland study, one could argue that they are comparable. Similarly, the data from the Dunedin cohort is comparable with the mean BMI levels reported for European participants in the CRFAC. Overall, the CRFAC results were consistent with the results reported in the international literature reviewed.

5.4 Unexpected Findings Compared to Previous Research

5.4.1 WHY ADOLESCENTS?

As the literature review of New Zealand studies indicates, there is very little research that focuses on cardiovascular risk factors for adolescents. The decision to target adolescents was made for three main reasons.

First, cardiovascular disease does not happen 'overnight' but is the culmination of a variety of risk-taking behaviours and other factors, over many years. "It is widely accepted that a person's risk of cardiovascular disease is determined by the synergistic effect of all the cardiovascular risk factors" (Hay 2001). The Framingham study determined that an additive effect of risk in the presence of multiple risk factors and the extended exposure to these risks will result in a form of cardiovascular disease (Garrison 1998). Adolescents are able to make changes in lifestyle behaviours and prevent cardiovascular disease in the future. The focus on adolescents is consistent with a "life course" perspective on cardiovascular disease prevention and control, just like normal everyday habits are established early in life. It has been shown that as Pacific Islanders get older their chances of dying from cardiovascular disease increases (Bernstein 2009). At a certain stage in life, interventions to reduce the chances of accumulating cardiovascular disease become less effective and the options available are treatment and management of CVD, rather than prevention.

Second, adolescents are still creating behaviour patterns and "living" their own life and are consequently at a stage in their life that is more conducive to adapt, when compared to adults that have formed their own foundation of living and are not up for adapting their lifestyle or behaviour.

Third, was to address the paucity of information and evidence in the area of cardiovascular risk factors for adolescents in New Zealand. Understanding ethnic variations in regards to cardiovascular risk factors for adolescents in Christchurch, and elsewhere for that matter will assist public health initiatives that aim to decrease the threats of cardiovascular disease in the future. The results should inform and guide the development of ethnic-based programs and interventions. The results of the CRFAC study support lifestyle interventions targeted at adolescents, as significant ethnic differences in cardiovascular risk were identified in this age group.

5.4.2 WHY PACIFIC PEOPLE?

While there are some Pacific participants in past studies that have been undertaken in New Zealand, there is no comprehensive evidence available about Pacific adolescents and cardiovascular disease, despite the high prevalence of obesity, cardiovascular, non-communicable and lifestyle-related diseases in the Pacific population.

Recent information about the nutritional health of Pacific children shows high rates of obesity as well as unhealthy and concerning patterns of food consumption (Gittelsohn 2010). The extremely high prevalence rates of overweight and obesity in both children and the older Pacific population demonstrates the need to develop reliable, accurate and comprehensive information about cardiovascular disease for Pacific people at all age levels.

However, as there are many causal pathways for CVD mortality, one could hypothesise that these results suggest that the causal pathway for CVD mortality for Europeans is more likely to be through an atherosclerosis process. “The atherosclerosis process is associated with cholesterol levels and involves the accumulation of cholesterol in vascular tissue and formation of plaque called atheroma which leads to CVD” (Beaglehole 1980).

5.4.3 WHY ETHNIC-SPECIFIC PACIFIC GROUPS?

An important understanding is that there is no 'single' Pacific ethnicity, but that Pacific peoples come from a number of distinct ethnic groups' each with its own language, culture, and traditions (Sullivan 1987). Not many previous studies have been able to provide a Pacific ethnic-specific analysis of cardiovascular risk factors for adolescents. Very few large-scale epidemiological studies in New Zealand - regardless of focus - have been designed to have the statistical power to calculate Pacific ethnic-specific differences, which appears to be a gap in our current knowledge base.

The public health significance of this approach is that the CRFAC is one of the few epidemiological studies to explore whether there are ethnic-specific differences within the Pacific people in New Zealand. Importantly, the CRFAC study is also one of the first epidemiological studies to try and actually demonstrate significant Pacific ethnic-specific differences. The findings were consistent with the one other study that has examined Pacific ethnic-specific differences in cardiovascular disease for adults (Schaaf 2000). The results of this study show that cardiovascular risk factor levels varied between the ethnic-specific Pacific people in New Zealand and goes on to recommend that targeted interventions to specific Pacific communities may be more beneficial than the current homogenous programs that the rest of the population receives. These findings provide an influential mandate for other epidemiological studies targeting Pacific health priority areas, to take a Pacific ethnic-specific approach.

The findings of the CRFAC study, like adult survey described above, also raises questions about to what extent important ethnic-specific information is 'buried' within pan-Pacific data. For example, if a pan-Pacific approach to data collection and analysis was taken in the CRFAC study to understand smoking levels, it would show that Pacific participants did not differ from Europeans in any significant way. Therefore, the conclusion would accurately be that the proportion of Pacific participants smoking was not significantly different from European, but would have been captured if the CRFAC had taken a pan-Pacific approach, as to show the low rates of smoking in other Pacific ethnic groups that have would effectively 'bury' these significant findings that a pan-Pacific approach would have had a significant difference compared to Europeans.

The validation of ethnic-specific differences within the Pacific population is also important information for policy makers and health funders and planners. It provides evidence that affirms the validity and value of ethnic-specific approaches in specific priority health areas. In some cases, health promotion, intervention and service delivery approaches may benefit from an ethnic-specific Pacific focus.

5.5 SURPRISE KEY FINDINGS

BMI was the most significant key finding variable in determining the ethnic differences. Television viewing, being a sedentary activity, was the one lifestyle risk factor that had a positive association with BMI.

The CRFAC study results showed that smoking and alcohol consumption levels for Pacific participants were lower compared to Europeans. On the contrary, Pacific adolescence had higher levels of television-exposure in the weekdays and weekends compared to Europeans. Pacific participants also had higher levels of sun-exposure during the weekdays compared to Europeans, but lower levels of sun-exposure in the weekend. The CRFAC study also found that Pacific participants had significantly higher BMI compared to Europeans. In fact, the Pacific adolescence had the highest overall BMI when compared to all of the other ethnic groups: European, Maori, and Asian. The CRFAC study also showed that BMI was positively associated with television exposure, which will be discussed further.

Early Intervention

The results of the CRFAC study show that differences amongst ethnicities are present in the adult population are already embedded in adolescents. Taking a 'life course' approach to cardiovascular disease is recommended. The findings of the CRFAC indicate that many behaviours and choices that increase the chance for cardiovascular disease are present in grades 9-13, especially when talking about the use of alcohol and tobacco products. Lifestyles, which are inactive in the realm of physical active, such as above average levels of television watching are also firmly established in adolescence.

Programs that are focused on the adult youth and interventions that decrease different types of cardiovascular disease is what the CRFAC represents.

Validation of a Pacific Ethnic-specific approach

It is already acknowledged that, “DHBs should identify the cardiovascular burden within their population, particularly for Maori and Pacific peoples, and determine service provision within their DHBs in preparation for the development of national service specifications for stroke and cardiac services” (Ministry of Health 2003). Public health initiatives, health promotion, intervention, and service deliveries would need to be created to target Pacific communities. The goal is to make sure they are pan-Pacific in design and orientation. This means that they target the Samoan, Tonga, Cook Island and Niuean communities as one, and are not cognizant of potential ethnic-specific differences. The CRFAC study in New Zealand furnishes witness that there are significant differences between these groups.

There is a chance that the higher prevalence of lifestyle cardiovascular risk factors in Pacific Islander adolescents is related to the length of time these communities have spent in New Zealand. Further research to explore ethnic-specific differences in the Pacific population is strongly recommended.

The Significance of BMI in Explaining Ethnic Variations

The CRFAC study findings show that BMI is the most significant variable in informing ethnic differences in outcome variables in this age group. Interventions and programs that aim at decreasing BMI and modifying physical fitness should have an impact on an amount of essential cardiovascular risk factors. In this instance, programs at the school level would reevaluate their time spent on physical fitness and determine if the physical fitness implemented towards the students are activities to target and reduce BMI. Away from school, policies that target BMI should be advertised not just on billboards or television, but in areas that have high concentration of adolescent viewing (i.e. facebook, wikis, telephone provider daily text reminders). Even though the rates differ amongst different ethnic groups, today’s youth all utilise the latest technology. It is up to policy makers to utilise the latest trend of technology and use it to promote cardiovascular disease awareness.

5.6 Weaknesses of the Study- Limitations

A School-Based Approach

When undertaking a school-based study, sampling schools rather than students was chosen for the following reasons:

- Likely to achieve a higher response rate compared to sampling individuals or classrooms within schools;
- School management is more likely to support the survey if all students in Forms 3-7 are invited to take part rather than selected individuals;
- Logistically more difficult to sample from a large number of schools;
- It is easier to follow-up students in future surveys through school based networks.

However, while a school-based approach was most effective in meeting the CRFAC study aims, it's recognized that there are some limitations of a school-based study. For example, a school-based study does not capture school leavers. In addition, there is a high truancy level in schools which proved to influence the response rate, especially in low Decile schools (for the CRFAC study). Participation in this research was voluntary, and was a limitation as it reduced the overall study response rate. In regards to BMI and height/weight, this target area is an embarrassing and sensitive topic towards a minority group of females during this period in their life. When this age group tends to feel pressured towards having to "Look" a certain way, females will tend to not want to think and write down how they are physically in this period of their life. Another limitation that was not projected to occur during the proposal stage of this research topic was the devastating earthquakes that hit the Canterbury region on September 4th, 2010. The travesty of these unexpected natural disasters formed a complete realignment of time and willingness for schools to take extra time out of their realigned schedule to continue to be committed in participating in this study. The presence of the earthquakes formed many instructors and schools to withdraw their commitment towards participating in this research. As mentioned before 9 schools out of 14 participated due to the natural disaster.

In addition, it was recognized that random sampling is the statistical ideal, to meet all of the aims of the CRFAC study, (i.e. budgetary constraints, operational and logistical issues, over-sampling requirements), it was decided a whole of school approach was an acceptable alternative to random selection of schools to participate.

5.7 Strong Points of the CRFAC

The ultimate purpose of the CRFAC study was to ascertain cardiovascular risk factor levels in adolescents and to analyse the levels of these risk factors between European and Asian participants, as well as among Pacific adolescents.

What gave the investigator control and made the research representative and comprehensive? All success was made possible by listening to the student's initial understanding of cardiovascular disease. With the investigator giving out the "truth" behind cardiovascular risk factors, the students left with a more educated and applicable understanding of how cardiovascular risk factors effect their future and the society for which they live in. Their attitude and reactions were mostly positive and they seemed to have a desire to make a difference not only within their selves but also in the community they live in. Listening to their wants and desires and then countering with awareness to the consequences of their choice of lifestyle variable opened the eyes to many students. The District Health Board Toolkit (Ministry of Health 2004) was thoroughly explained to students of its nature and why it should be used. The Health Department of each school took note of it and released the vital information to the parents of the students to cause awareness of its benefits.

The District Health Board Toolkit should be used to help reduce the incidence of cardiovascular disease, which refers to *primary prevention*, defined as 'the long term management of people at increased risk but with no evidence of cardiovascular disease', (Dwyer 1980). The Toolkit identifies primary prevention of cardiovascular disease, as interventions such as:

- Cease the use of tobacco products
- Full diabetic Manipulation
- Decreasing high BP levels
- Lifestyle shifting

To align with the key intervention areas highlighted by the Ministry of Health, the CRFAC integrated the intervention to findings on smoking, alcohol, physical activity, overweight and obesity with relevant current evidence documented in these areas. For each area, a list of recommendations is made for the health sector (i.e. policy, promotion and education) and for further research.

With the risk factors at hand, so what? What recommendations need to be addressed to reverse the negative effect of cardiovascular disease? The points below are guaranteed initiatives that will have positive and efficient returns on the lives of CVD victims and will ease financial pressure of a target area's health sector budget.

5.7.1 RECOMMENDATIONS

5.7.1.1 Smoking Recommendations

Early intervention is critical and should be focused towards high-school adolescence. Since the Maori population had higher rates of tobacco usage and with many adolescents claiming they started smoking earlier compared to any other ethnicity, it may be wise to start interventions with the Maori population during secondary education.

Further research should be undertaken in the following areas:

- Discovering reasons why young adults' smoking varies between Pacific cultures.
- Realising the connection between physical activity and exposure to the sun.
- Further research in ethnic-specific Pacific people targeting resiliency and/or risk factors of distinctive Pacific populations.
- Understanding the relationship of Pacific Islanders choice to use tobacco products and physical activity.
- Understanding the association of Pacific HLA, exposure to the sun, and the usage of tobacco.
- Understanding acculturation factors causing increased smoking.

5.7.1.2 Alcohol Recommendations

With alcohol consumption in Pacific males being high, early interventions should be aimed specifically at the Pacific male population.

Regular alcohol consumption, at least weekly in adolescence, is impacting on overall health, indicating that primary prevention for cardiovascular disease should begin early and be targeted at High school students.

Further research should be undertaken in the following areas:

- Examining reasons why the levels of alcoholic consumption vary between the different Pacific Islanders.
- Realising the connection between physical activity and exposure to the sun.
- The relationship between sports and fitness and increased consumption of alcohol should be explored in further research.
- Understanding the association of Pacific HLA, exposure to the sun, and the consumption of alcohol indoor and outdoor.

5.7.1.3 Physical Activity (and Inactivity) Recommendations

Physical fitness was linked to the viewing of numerous hours of television watching, a type of sedentary lifestyle if you will. Targeted interventions to reduce television watching are recommended. It is recommended that interventions are school-based and provided through the curriculum, in which the curriculum being health education and physical education being intertwined into one class. Far too often health education is only taught once in the tertiary education system and physical education being optional in the later years of student's education before college. If physical education and health education were mandatory for each tertiary school year, then one would see positive results in regards to an adolescent's sedentary lifestyle.

The CRFAC discovered limitations with the way physical activity information was collected in the survey. Improved measures of physical activity should be developed. There should be targeted programs to increase fitness in the Pacific populations. This may include targeting sports that were favoured by Pacific participants in the CRFAC study.

Promote and expand school-based programs promoting physical activity after school and to strengthen physical activity curriculum currently provided in schools, as

mentioned previously making health and physical education mandatory in each year of one's tertiary education.

Further research should be undertaken in the following areas:

- Examining reasons why LTPA varies between the different Pacific Islanders.
- Further exploratory research to understand the association between physical activity and smoking and alcohol in adolescents
- Further exploratory research to understand the relationship between television watching, BMI in Pacific peoples and cardiovascular disease.
- Interventions designed to reduce television exposure in the Pacific population.
- Further research into the uptake of organised sport, including barriers.
- Further research that focuses on other sedentary behaviour, such as non-homework related computer activity and video games.
- Examine to see if innovative use technology would help trigger physical activity to the adolescent. (i.e. the usage of text messaging feedback, and motivational prompts sent to smart phones daily.
- Examine how social networks affect physical activity in a positive or negative manner (i.e. facebook, twitter, wikis, and blogs.)
- Examine the positive affects of restricting the advertisements of junk food ads. (i.e. Removing junk food ads on television during children's programming times, and to not being used in fundraisers at schools.)

5.7.1.4 Policy Recommendations

By examining the life style variables and the risks they have had on New Zealanders, the following policies could benefit in the present and future by the Ministry of Health if acted on:

- Increasing sales tax on tobacco and alcoholic products.
- Mirror countries like the US and increase the age of purchase and consumption on tobacco and alcoholic products.
- Reduce outlets country wide that sell these products (i.e. Gas stations and dairies)

5.8 Conclusions

Why Cardiovascular Disease

Why should a society dedicate time, research, exhaust funds, and labour hours towards Cardiovascular Disease? “Cardiovascular disease is the leading cause of death in New Zealand, accounting for 41% of all deaths in 1999; thus it has a large impact on the delivery of health services” (Ministry of Health 2004).

The Ministry of Health in New Zealand has clearly indicated, “That reducing the incidence and impact on cardiovascular disease is a priority in New Zealand” (Ministry of Health 2004). The New Zealand Health Strategy identifies various priority health objectives for the Ministry and District Health Boards to concentrate on. In addition to the priority objective focusing on cardiovascular disease, other related priority objectives include: improving nutrition, reducing smoking and reducing obesity.

Main messages arising from the thesis

1. Tobacco intake of all forms was shown to be high within the CRFAC study. As the research proved, adolescents begin smoking tobacco at very young ages.
2. Alcohol consumption amongst the majority of both genders and ethnicities shown that almost everyone has drunk some quantity already within the young life. Why? How are these young adolescents some younger than 12 years old able to consume alcohol, and just a little, we’re talking drinking alcohol at the state of binge drinking.
3. LTPA of each adolescent was dependent on many levels. Where the student went to school, what ethnic background the student came from, what culture did the student come from, in what region did the student live in, what was the HLA of the student? All these factors played apart in the results of the CRFAC. Aside from physical ailments and handicaps, there should be balancing acts between too much sun exposure (leading to increased levels of skin cancer rates) and too little sun exposure (whereas proved in the study to have elevated levels of BMI and could also lead to possible Vitamin B deficiencies).

So What to Do Now?

“Never put off until tomorrow what you can do the day after tomorrow.” (Mark Twain).

Has the risk factors of Cardiovascular diseases been put off till tomorrow? It sure seems to have had not only in the North Island, but more so here in the South island.

The situation does not originate from the schools in particular the PE, Science, and Health departments, but it starts at the home. New research should probe deeper into the community and see where the breakdown of communication is between the citizens of Christchurch and the DHB. Forums should be held at schools, community boards, and consultations with Ngai Tahu on marae. Is the information only being presented to the affluent and majority citizens? Is there a language barrier from television ads or brochures that may not facilitate languages spoken aside from English?

These questions need to be on the “Top Priority” of things to do in the health sector. Leveling out the cardiovascular risk factors graph of disparities amongst different ethnicities, let alone lowering the levels for all, needs to be accomplished now. A country like New Zealand can not become complacent and allow there to be a large gap in the disparities amongst different ethnicities, especially due to their decile ratings. Awareness should be addressed through media sources in regards to CVD and everyone should be held accountable for their actions.

In regards to cardiovascular disease risk factors amongst ethnic adolescents in Christchurch, more could be undertaken and these are the approaches that could be added to what had already been implemented by the DHB’s and the Ministry of Health.

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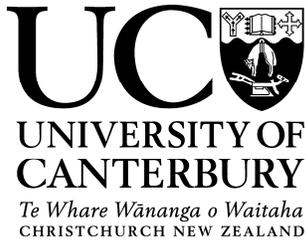
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FIGURES & TABLE APPENDIX**APPENDIX A 1.1****Health Sciences Centre**

Tel: +64 3 364 2987, Fax: + 64 3 364 2490

Email: healthsciences@canterbury.ac.nz

Student CONSENT FORM

For the study

**“Cardiovascular Risk Factors in Correlation with Ethnic Diversity
amongst Christchurch Adolescents”**

Please tick to confirm.

- I have read and understand the information sheet for the above research study dated 8th August 2010.
- I have had the opportunity to ask questions about the research study and have had time to consider whether to take part.
- I understand the purpose of the research study, and how I will be involved.
- I understand that taking part in the study is voluntary (my choice) and that I may withdraw from it, at any time and for any reason.
- I understand that my participation in this study is confidential and that my name and personal details will not be included in the report.

- I wish to receive a summary of the study's results. Address _____

I _____ (please print full name) consent to take part in
the above research
study.

HEIGHT & WEIGHT

Q8. What is your current height?

Q9. What is your current weight?Kg

Q10. How would you describe your present weight?

- 1. Very underweight
- 2. Moderately underweight
- 3. Slightly underweight
- 4. Just the right weight
- 5. Slightly overweight
- 6. Moderately overweight
- 7. Very overweight

BMI RESULTS :.....(BMI FOR INTERVIEWER ONLY, PLEASE OMIT)

TELEVISION WATCHING

Q11. In the **last four weeks**, how many **hours** each day, did you watch TV;

a) During the week?

b) During the weekend?

SUN EXPOSURE

Q12. In the last four weeks, **how many hours** each day, on average, did you usually spend outdoors in the sun?

a) During the week?

b) During the weekend?

Q13. What is the **natural color** of **your hair**?

- 1. Red
- 2. Blond
- 3. Brown
- 4. Black

SMOKING & DRINKING ALCOHOL

	YES	NO	DON'T KNOW
a. smoke cigarettes?	1	2	3
b. drink alcohol?	1	2	3
c. use illegal drugs?	1	2	3
d. have unprotected sex?	1	2	3
e. go on a diet	1	2	3
f. sniff glue?	1	2	3
g. swim in clothes other than swimsuits?	1	2	3
h. get into a car with a driver who has been drinking?	1	2	3
i. become depressed?	1	2	3
j. have access to a firm arm?	1	2	3

Q17. In general, do you see the **adults** in your community engaging **in risk taking activities** such as:

	YES	NO
a. drink to much alcohol	1	2
b. take illegal drugs	1	2
c. drink alcohol and drive	1	2
d. any other	1	2

VITAMIN SUPPLEMENTS

Q18. In the **past four weeks**, have you regularly (i.e. at least once a week) taken?

	YES	NO
a. Vitamin A	1	2
b. Vitamin C	1	2
c. Multi-Vitamins	1	2
d. Other	1	2

If any other supplements, *Please specify*

**LEISURE TIME ACTIVITIES IN THE LAST FOUR WEEKS
(INCLUDING PRACTICE SESSIONS)**

Q19. Below is a list of **vigorous** and **moderate** activities which you may do in your leisure time, **EXCLUDING ACTIVITIES** during classes/periods (ex: PE), Please Circle

VIGOROUS activities are ones which make you **breathe hard**.
 MODERATE activities involve movement such as walking, but DO NOT make you **breathe hard**.

Read carefully through this list and **circle** each activity you have done regularly at least ONCE A WEEK in the **last four weeks**.

Ball Games

- | | |
|----------------------|-------------------------------|
| 1. Tennis | 9. Rugby (Union/Touch League) |
| 2. Squash | 10. Cricket-Outdoor |
| 3. Badminton | 11. Cricket-Indoor |
| 4. Bowling | 12. Cricket-Pacific Island |
| 5. Soccer | 13. Hockey |
| 6. Basketball | 14. Volleyball-Indoor |
| 7. Netball | 15. Volleyball-Outdoor |
| 8. Softball/Baseball | 16. Table tennis |

Water Sports

- | | |
|----------------------|-------------------------|
| 17. Swimming-Indoor | 21. Water Skiing |
| 18. Swimming-Outdoor | 22. Rowing or Canoeing |
| 19. Scuba diving | 23. Sailing |
| 20. Snorkeling | 24. Surfing/Windsurfing |

Other Leisure Time Activities

- | | |
|-------------------------------------|--|
| 25. Running or Jogging | 31. Skating/Roller blading |
| 26. Brisk walking or Tramping | 32. Aerobics |
| 27. Weight lifting or Body building | 33. Cycling (includes cycling to school) |
| 28. Martial Arts | 34. Horse riding |
| 29. Boxing | 35. Snow skiing |
| 30. Dancing | 36. Fishing |

Do you do any **other** vigorous or moderate activities in your leisure time?

- | | |
|--------|-------|
| 1. Yes | 2. No |
|--------|-------|

If **YES**, *Please describe*

.....

HEALTH STATUS

The following questions ask for your views about your health, how you feel, and how well you are able to do your usual activities. Please CIRCLE your best CHOICE.

Q20. In general, would you say your health is:

Excellent	Very Good	Good	Fair	Poor
1	2	3	4	5

Q21. Compared to ONE YEAR AGO, how would you rate **your health in general** NOW?

Much Better Now	Somewhat Better Now	About The Same	Somewhat Worse Now	Much Worse Now
1	2	3	4	5

The following questions are about activities you might do during a typical day.

Q22. Does **your health now** limit you in these activities? Is so, **how much**?

	YES, limited a lot	YES, limited a little	NO, not limited at all
a. Vigorous activities , such as rugby aerobics, soccer, running etc.	1	2	3
b. Moderate activities , such as walking, bowling, fishing, etc.	1	2	3
c. Lifting your school bag	1	2	3
d. Climbing several flights of stairs	1	2	3
e. Climbing one flight of stairs	1	2	3
f. Bending, kneeling or stopping	1	2	3
g. Walking more than one km	1	2	3
h. Walking half a km	1	2	3
i. Walking 100 meters	1	2	3
j. Bathing or dressing yourself	1	2	3

Q23. During the **past four weeks**, have you had any of the following problems with your school work or other regular daily activities, **as a result of your physical health**?

	YES	NO
a. Cut down on the amount of time you spent on school work or other regular daily activities.	1	2
b. Accomplished less than you would like	1	2

c. Were limited in the kinds of work or other activities	1	2
d. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

Q24. During the **past four weeks**, have you had any of the following problems with your school work, or other regular daily activities, **as a result of any emotional problems** (such as feeling depressed or anxious)?

Not at all	Slightly	Moderately	Quite a bit	Extremely
1	2	3	4	5

Q25. During the **past four weeks**, to what extent has your **physical health or emotional problems** interfered with your normal activities with family, friends, neighbors, or groups?

None	Very mild	Mild	Moderate	Severe
1	2	3	4	5

Q26. How much **bodily** pain have you had during the **past four weeks**?

Not at all	Slightly	Moderately	Quite a bit	Extremely
1	2	3	4	5

Q27. During the **past four weeks**, how much did **pain** interfere with your normal work (including both school work and other daily activities)?

Not at all	Slightly	Moderately	Quite a bit	Extremely
1	2	3	4	5

Q28. During the **past four weeks**, how much of the time has **your physical health or emotional problems** interfered with you social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
1	2	3	4	5

Q29. How TRUE or FALSE is **each** of the following statements for you?

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
a. I seem to get sick a little easier than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1	2	3	4	5
d. My health is excellent	1	2	3	4	5

Q30. These questions are about how you feel and how things have been with you **during the past four weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. *How much of the time during the past 4 weeks*.....

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
a. Did you feel full of life?	1	2	3	4	5	6
b. Have you been a very nervous person?	1	2	3	4	5	6
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
d. Have you felt calm and peaceful?	1	2	3	4	5	6
e. Did you have a lot of energy?	1	2	3	4	5	6
f. Have you felt down?	1	2	3	4	5	6
g. Did you feel worn out?	1	2	3	4	5	6
h. Have you been a happy person?	1	2	3	4	5	6
i. Did you feel tired?	1	2	3	4	5	6

ACCESS TO HEALTH CARE

GP or Family Doctor

Q31. The **last time you saw a GP/family doctor** about your health, was it to do with:

	YES	NO
a. disability	1	2
b. other long term medical condition like asthma?	1	2

c. other short term illness or temporary condition, like a cold or flu?	1	2
d. an injury or accident?	1	2
e. routine check-up or health advice?	1	2
f. was it for contraception or sexual health in general?	1	2
g. something else?	1	2

If something else, *Please specify*.....

Q32. In the **last 12 months**, has there been any time when YOU needed to see a **GP/family doctor** about your health but **COULD NOT**?

1. Yes 2. No (GO TO Q31) 3. Don't Know (GO TO Q31)

If **YES**, what were the reason(s) you DID NOT get to see a doctor?

	YES	NO
a. couldn't spare the time	1	2
b. costs too much	1	2
c. had no transport	1	2
d. don't have a family doctor	1	2
e. didn't want to make a fuss/couldn't be bothered	1	2
f. couldn't get in touch with the doctor	1	2
g. wanted to go but couldn't because of those Circled above	1	2
h. don't know	1	2
i. other reason(s)	1	2

If any other reason(s), *Please specify*.....

Q33. The **last time** you were sick, which of the following people did you visit for health care or advice.

	YES	NO
a. physiotherapist?	1	2
b. optician or optometrist?	1	2
c. social worker?	1	2

d. dentist or dental nurse?	1	2
e. practice nurse?	1	2
f. family doctor?	1	2
g. traditional healer such as a tohunga or fofu?	1	2
h. chemist or pharmacist for health advice or getting medication only?	1	2
i. church minister?	1	2
i. any other ?	1	2

If any other, *Please specify*.....

OTHER HEALTH PROFESSIONALS

Q34. In the **last 12 months**, has there been any time when you needed to see **any other health professionals** about your health but WERE NOT able to?

1. Yes 2. No (GO TO Q33) 3. Don't know (GO TO Q33)

If **YES**,

a) Which **health professional** did you need?

	YES	NO
a. physiotherapist?	1	2
b. optician or optometrist?	1	2
c. social worker?	1	2
d. dentist or dental nurse?	1	2
g. traditional healer such as a tohunga or fofu?	1	2
h. chemist or pharmacist for health advice or getting medication only?	1	2
i. church minister?	1	2
i. any other ?	1	2

(*Please specify*).....

b) What were the reason(s) you DID NOT get to see the **health professional** on this occasion?

	YES	NO
a. couldn't spare the time	1	2
b. costs too much	1	2
c. had no transport	1	2

d. don't have a family doctor	1	2
e. didn't want to make a fuss/couldn't be bothered	1	2
f. couldn't get in touch with the doctor	1	2
g. couldn't get an appointment soon enough/at a suitable time/it was after hours	1	2
h. wanted to go but couldn't because of those Circled above	1	2
i. don't know	1	2
j. other reason(s)	1	2

If any other reason, *Please specify*.....

SERVE SIZE

Q35. How does your usual serve size of the following foods compare with the life size photos, or glasses? (Please circle your serve size for each food)

	1	2	3	4
a. chicken	Less	Same	More	Don't eat it
b. fish	Less	Same	More	Don't eat it
c. red meat (ex. Steak, or roast)	Less	Same	More	Don't eat it
d. cheese	Less	Same	More	Don't eat it
e. potato, taro, rice, kumara	Less	Same	More	Don't eat it
f. other vegetable	Less	Same	More	Don't eat it
g. cake/desert	Less	Same	More	Don't eat it
h. glass of milk, cordial, juice, fizzy drink, water	Less	Same	More	Don't eat it

THE FOLLOWING QUESTIONS WILL ASK ABOUT HOW YOU FEEL ABOUT THIS SESSION

Q36. Please circle one word you feel best apply to this session. You can add others.

1. Helpful
2. Boring
3. Dumb
4. Stimulating
5. Interesting
6. Useless

- 7. Confusing
- 8. Informative
- 9. Other (*Please*

specify).....

Q37. Circle the number that is **closest** to how you feel.

- a) How interesting did you find this session overall?
Very 1 2 3 4 5 Not at all
- b) How relevant do you think the issue covered in the session is to you?
Very 1 2 3 4 5 Not at all
- c) Do you think other students your age would benefit from a similar session?
Definitely 1 2 3 4 5 Not at all

PLEASE HAND THE QUESTIONNAIRE TO AN INTERVIEWER

****EHERC COMPLAINTS PROCEDURE****

In regards to any complaints please address to the following

Complaints may be address to:

The Chair

Educational Research Human Ethics Committee

University of Canterbury, Private Bag 4800, Christchurch

Email: human-ethics@canterbury.ac.nz

APPENDIX A 1.3

Ref: 2010/05/LR-ERHEC

1 September 2010

Brandon Byford
Health Sciences Centre
UNIVERSITY OF CANTERBURY

Dear Brandon

Thank you for forwarding to the Educational Research Human Ethics Committee a copy of the low risk application you have recently made for your research proposal “Cardiovascular risk factors in correlation with ethnic diversity amongst Christchurch adolescents”.

I am pleased to advise that this application has been reviewed and I confirm support of the Department’s approval for this project.

With best wishes for your project.

Yours sincerely

Dr Mere Skerrett and Nicola Surtees
Co-Chairs
Education Research Human Ethics Committee

Table A 1.1: The New Zealand Cardiovascular Risk Chart

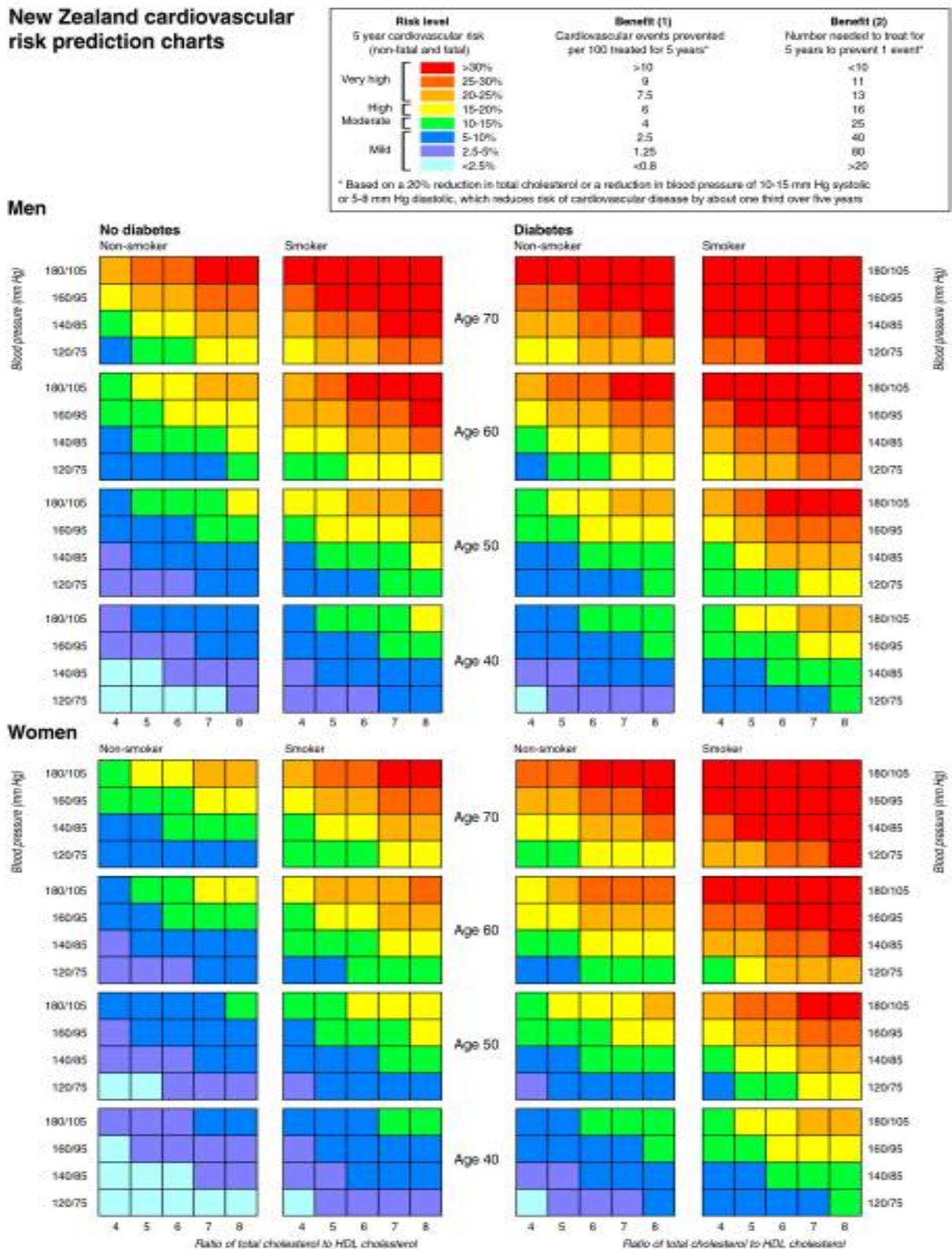


Table A 1.2: The Total LTPA Choice of Activities by the Participants

	Leisure Activities
Tennis	244
Squash	62
Badminton	98
Bowling	34
Soccer	326
Basketball	259
Netball	85
Softball/Baseball	68
Rugby (Union/Touch League)	309
Cricket-Outdoor	151
Cricket-Indoor	52
Cricket-Pacific Island	14
Hockey	67
Volleyball-Indoor	133
Volleyball-Outdoor	58
Table Tennis	161
Swimming-Indoor	205
Swimming-Outdoor	183
Scuba Diving	24
Snorkelling	36
Water Skiing	41
Rowing or Canoeing	72
Sailing	26
Surfing/Windsurfing	49
Running or Jogging	530
Brisk Walking or Tramping	204
Weight Lifting or Body Building	156
Martial Arts	67
Boxing	101
Dancing	166
Skating/Roller Blading	126
Aerobics	37
Cycling	291
Horse Riding	51
Snow Skiing	55
Fishing	107

Table A 1.3: The Total Other LTPA Choice of Activities by the Participants

Other Activities	
Abseiling	1
Air soft	1
American Football	3
ATV Racing	1
Back Yard Cricket	1
Base Jumping	1
Cage Fighting	1
Canoe Polo	1
Chess	1
Computer Gaming	2
Cross Trainer	1
Dodge ball	4
Fencing	3
Flag Football	1
Futsal	6
Golf	10
Gym	2
Gymnastics	1
Handball	3
Hunting	10
Ice Hockey/ Ice Skating	2
Jump Rope	1
Lacrosse	1
LARP	1
Mechanic	1
Motor biking	11
Mountain Biking	1
Palities	1
Play Guitar Hero	1
Play Playstation	3
Refereeing	1
Rock Climbing	6
Shuffling	1
Singing	1
Skipping	1
Snowboarding	1
Surfing	1
Trampolining	12
Treadmill	1
Tree Climbing	1
Wake Boarding	3
Walking the Dog	3
Water polo	9
Wii	7
Wrestling	1
Xbox	12
Zumba	2

Table A 1.4: The Total Over Weight & (EX) Smokers in the Survey

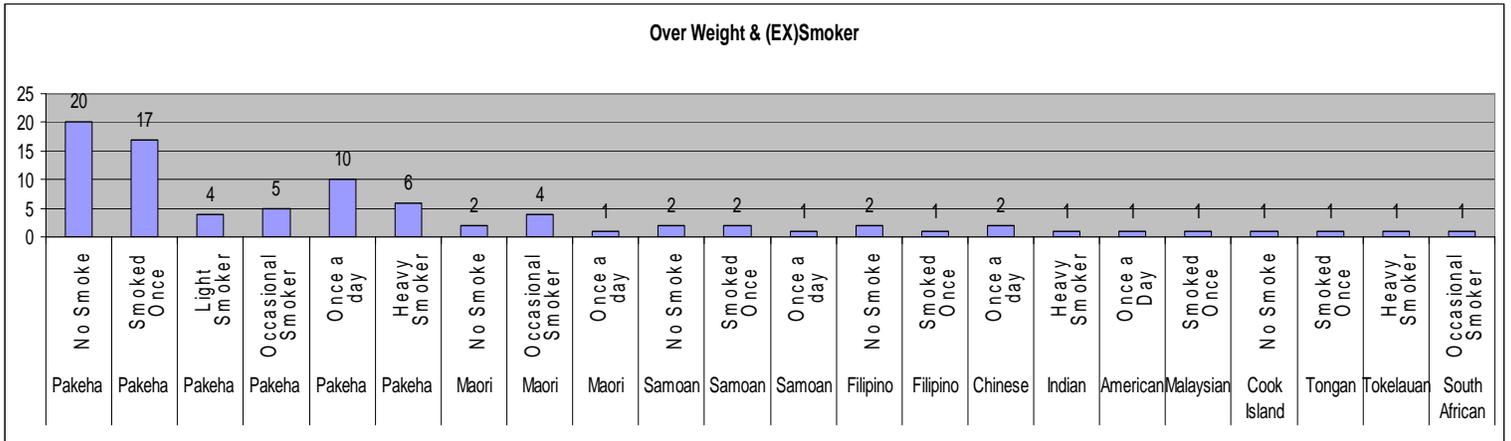


Table A 1.5: The Total Obese & (EX) Smokers in the Survey

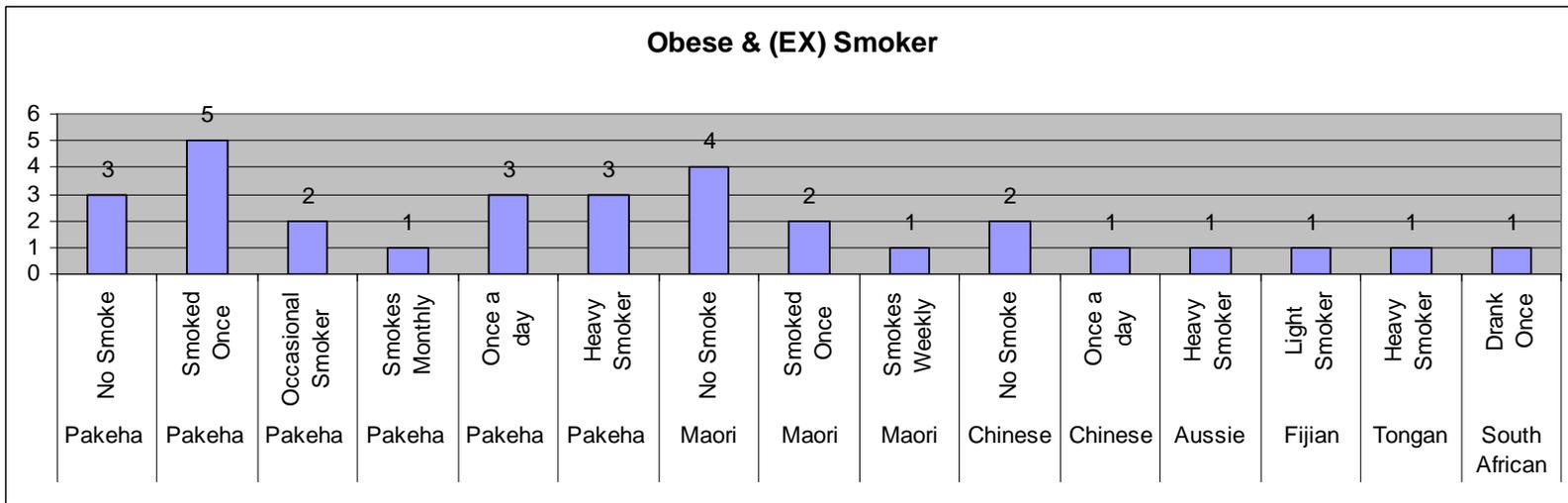


Table A 1.6: The Total Over Weight & (EX) Alcohol Consumers in the Survey

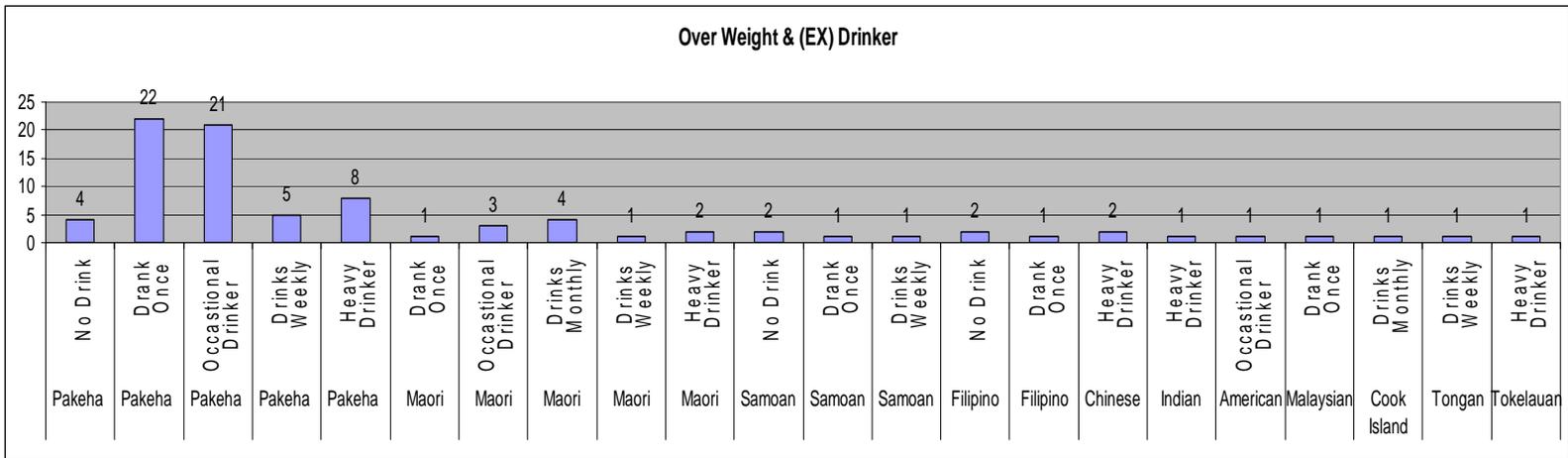


Table A 1.7: The Total Obese & (EX) Alcohol Consumers in the Survey

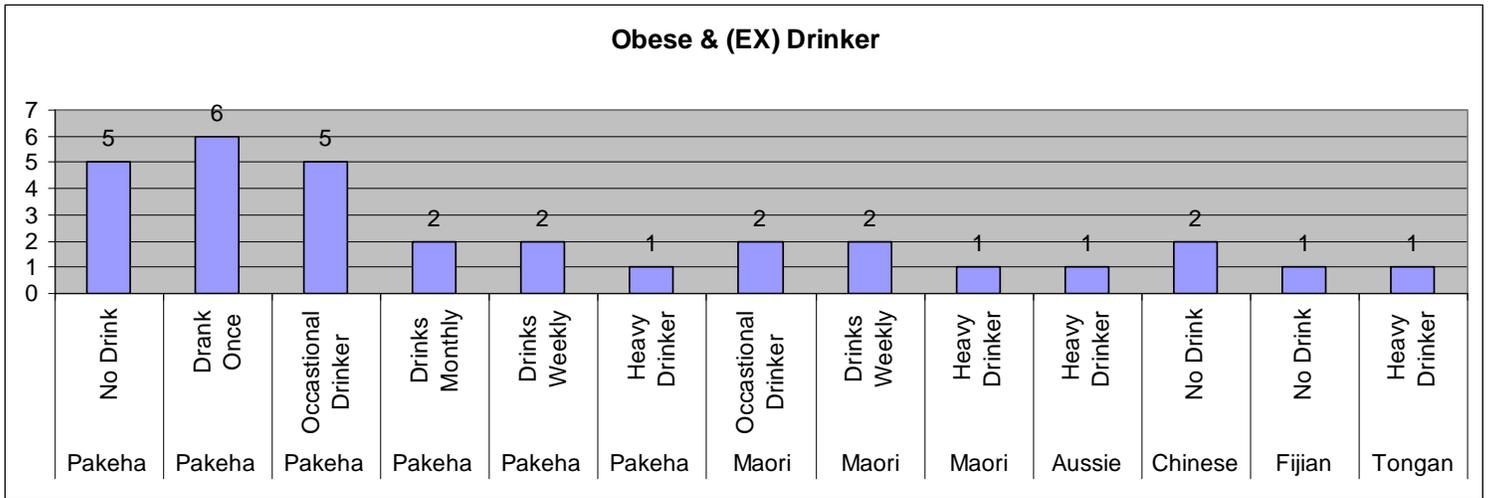


Table A 3.1: Represents the Questionnaire used in the Survey

Questions & Sub-Questions	Relevant Variable Category	Description
Q1	Demographics	Age variable used to categorize possible future CVD in students.
Q2	Demographics	Gender variable used to divide students for later questions in regards to CVD.
Q3	Demographics	Birth place is needed to separate main ethnic groups under study
Q4	Demographics	Ethnicity gave representation of who is more prone to CVD.
Q5	Demographics	Language is needed to see if there is a barrier when causing community awareness on CVD
Q6	Demographics	School Form is needed to categorize students for further CVD questions.
Q7	Demographics	HLA is needed to see how different living arrangements increase or decrease the risks for CVD.
Q8	BMI	Height was calculated on site in meters.
Q9	BMI	Weight was calculated on site in kilograms.
Q10	BMI	One's personal opinion on their own weight will show how educated adolescents are, if they are under/over weight, or if just right
Q11	Leisure Time Variable	TV watching was calculated in hours per day.
Q12	Leisure Time Variable	Sun exposure was calculated in hours per day.
Q13	Demographics	Hair color was recorded to observe any correlation to color and CVD.
Q14	Lifestyle Variable	Smoking Question & Sub questions are needed to see which adolescents take part in this activity which increases risk of future CVD
Q15	Lifestyle Variable	Drinking Question & Sub questions are needed to see which adolescents take part in this activity which increases risk of future CVD
Q16	Lifestyle Variable	This chart of questions gives the investigator a better idea of how aware adolescents are when it comes to risky behaviour and its negative effects
Q17	Lifestyle Variable	This chart of questions gives the investigator a better idea of the environment that adolescents are in when it comes to risky behaviour and how they are more likely to take part in the same activities
Q18	Lifestyle Variable	This chart of questions gives the investigator a look at all adolescents who take vitamins to increase a healthier lifestyle compared to those that don't and correlate all back to CVD
Q19	Leisure Time Variable	This chart of LTPA options gives the investigator a better idea of which activities the targeted adolescents do to prevent CVD, and which ones do nothing that increases CVD chances
Q20	Demographics	One's personal opinion on their own weight will show how educated adolescents are, if they are under/over weight, or if just right
Q21	Demographics	One's personal opinion on their own weight will show how educated adolescents are, if they are under/over weight, or if just right
Q22	Leisure Time Variable	One's personal opinion on their LTPA limitations may determine if any CVD may exist
Q23	Leisure Time Variable	One's problems with their school work or daily activities may determine if any CVD may exist
Q24	Leisure Time Variable	One's emotional problems with their school work or daily activities may determine if any CVD may exist
Q25	Leisure Time Variable	One's extent to their emotional problems with their school work or daily activities may determine if any CVD may exist

Q26	Leisure Time Variable	One's body pain may determine if any CVD may exist
Q27	Leisure Time Variable	One's body pain over the past 4 weeks may determine if any CVD may exist
Q28	Leisure Time Variable	One's health or emotional problems that interfered with social activities may determine if any CVD may exist
Q29	Demographics	One's personal opinion on their own health status compared to others will show how educated adolescents are in regards to CVD
Q30	Demographics	One's personal opinion on their own health status compared to others will show how educated adolescents are in regards to CVD
Q31	Demographics	This chart will see if there is any correlation to who the adolescent has visited and if that visit can link to CVD
Q32	Demographics	This chart will give reasons why the adolescent did not visit his/or GP and if there is any link to their reason not going and getting a form of CVD later due to that reason
Q33	Demographics	This chart will see if there is any correlation to who the adolescent has visited and if that visit can link to CVD
Q34	Demographics	This chart & Sub question will give reasons why the adolescent did not visit his/or GP and if there is any link to their reason not going and getting a form of CVD later due to that reason
Q35	Lifestyle Variable	This chart will show what type of nutrition intake the adolescent intakes which could link to CVD
Q36	Demographics	Question for how the participant felt about the session
Q37	Demographics	Question & Sub questions reveal the relevancy of the survey to the participant & how others would view its relevancy to others