

**4<sup>th</sup> Year MBChB Public Health Project 2014**

# **Through the Looking Glass: A Snapshot of Kiwi Kids' Environment**

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## Abstract

Children's wellbeing is an important facet of today's society, given that children represent the future of our community. Despite this, NZ has poor records with regard to children's health. This study addresses, firstly, whether children living in New Zealand grow up in a healthy environment and, secondly, whether using digital camera technology is a feasible method of observing this environment. New Zealand European, Maori and Pasifika children wore portable cameras around their necks for four days; the cameras automatically took photographs every ten seconds. We analysed the resulting 106,688 images for exposures to alcohol, tobacco products, and influences on screen time, self-image, methods of transport and the dinner environment. We found that, on the whole, the participants' environment contained many potentially health-modifying exposures. Eleven out of twelve participants were exposed to alcohol in various forms. Only two participants were exposed to tobacco use. Average screen time was below the international recommended average. There was a wide variety of exposures to self-image influences. There was observed to be a wide variety of transport methods shared between the different ethnicities. Dinner environment was also analysed and it was shown that there were a variety of settings in which families ate their meals. We also found that digital camera technology was an effective tool for observing the aforementioned exposures and would be useful in future, more comprehensive studies. Potential limitations included social desirability bias, selection bias and missed data. The cameras have widespread potential for future applications to research.

## 1. Introduction

Supporting good health among our children should be an important goal for New Zealanders. Unfortunately, New Zealand's child record compared to other nations is woeful. The Organisation for Economic Co-Operation and Development (OECD) recently ranked New Zealand twenty-ninth out of thirty for childhood health and safety (OECD, 2009). This report also found that New Zealand was:

- 21st for infant mortality;
- 20th for the percentage of children living in poor houses;
- had 14 times the average OECD rate of rheumatic fever;
- had rates of whooping cough and pneumonia five to ten times greater than the United Kingdom and United States.

Additionally, New Zealand has a high rate of child injury (Chalmers & Pless, 2001) as well as high rates of child abuse and child neglect (Adamson, Brown, Micklewright, Schnepf, & Wright, 2003).

New Zealand government spending is below the OECD average for all childhood age groups, while New Zealand has the highest rates of youth suicide in the OECD (OECD, 2009).

One of the major factors influencing children's health is their environment. A 'healthy' physical and social environment is recognised as a determinant of health; a child's environment also provides safety, opportunities for social integration, and the ability to predict and/or control aspects of that environment. An 'unhealthy' environment threatens safety and undermines the creation of social ties (Taylor & Repetti., 1997). For example, a favourable social environment was positively associated with several measures of physical activity and that physical activity was negatively associated with obesity in children (Franzini, et al., 2009).

The advent of automated camera technology has provided researchers with a novel method of objectively recording a subject's environment. The automated digital recording of one's day-to-day activities using a camera, or "life logging" (Sellen, Aitken, Hodges, Rother, & Wood, 2007) followed Microsoft's development the SenseCam in 1999 (Microsoft, 2013); a small digital camera that can be worn on a lanyard around the neck that automatically takes two to three digital pictures every minute. The device responds to built-in sensors or to a user-programmable timer. The SenseCam was originally used in health research to aid in rehabilitation of patients with cognitive impairment (Pauly-Takacs K, 2011) and memory loss after acquired brain injury (Brindley R, 2011).

The use of wearable camera technology has recently become a popular research tool to objectively measure life-style behaviours and the context in which they occur. This is especially relevant as lifestyle behaviours are increasingly associated with mortality from non-communicable diseases, yet the relationships between lifestyle behaviours and health outcomes are usually based on self-reported data. Automated cameras in research potentially reduce the recall bias associated with self-reporting.

Our study uses automated cameras to qualitatively evaluate the environment of 13 children of varying ethnicities and deciles in the Wellington region. Our data was obtained from the Kids'Cam study, a project lead by Associate Professor Louise Signal at the University of Otago, Wellington.

## **2. Aims & Objectives**

This study aimed to address two research questions:

- 1) Do New Zealand children grow up in an environment that supports their health and well-being?
- 2) What public health issues can be observed using automated cameras?

We used data from automated cameras and global positioning systems to provide an objective evaluation of the environments of 15 Wellington children. Comparison of these environmental influences to demographic data allowed us to determine aspects that may contribute to, or detract from, their health and wellbeing. The areas of interest are defined as:

- Exposure to alcohol
- Exposure to smoking
- Time spend engaged with a screen (e.g. computer, cellphone, video gam use)
- Perception of the human form
- Transport to and from school
- Dinner Environment

## **3. Literature Review**

We reviewed the literature for current opinion on the effect of those aspects of children's environment that had the potential to affect their health and wellbeing.

### **Alcohol**

Excessive alcohol consumption and alcohol misuse is a major preventable cause of death and hospitalization in New Zealand (Alcohol Advisory Council of New Zealand, 2005). The burden of alcohol misuse affects individuals and the people in their environment, including infants and children. Exposure to unhealthy parental behaviours, including alcohol use, smoking and overfeeding, was found to have negative impacts on children's health (Bell, McNaughton, & Salmon, 2009), including physical and behavioural issues. Bijur et al. (1992) examined the association between children's health and parental drinking in American children by specifically looking at serious injuries that result in hospitalization. They concluded that children of mothers categorised as problem drinkers were 2.1 times more likely to be involved in serious injury in comparison to

children of non-drinkers. The risk of serious injury to children increases to 2.7 when both parents are problem drinkers (Bijur, Kurzon, Overpeck, & Scheidt, 1992).

Parental alcohol use also negatively impacts children's behaviour. The children of problem drinkers frequently suffer from less parental contact time and a dysfunctional family structure compared to children from households without a problem-drinking parent (Snow Jones, Miller, & Salkever., 1999). Parental attitudes and drinking habits also play a part in their child's attitude towards alcohol use. Greater parental disapproval of alcohol is associated with less involvement with friends and peers who use alcohol, less peer influence to use alcohol, greater self-efficacy for avoiding alcohol use and lower subsequent alcohol-use-related problems (Nash, McQueen, & Bray, 2005). Furthermore, parents who established clear alcohol-specific rules lowered the likelihood of their child drinking, regardless of the child's age. However, this effect seems to diminish if the child has already established a drinking pattern (Van Der Vorst, Engels, Dekovic, Meeus, & Vermulst, 2007).

## **Smoking**

Tobacco use is one of the largest public health concerns worldwide. More than five million deaths are attributed to direct tobacco use while more than 600,000 are the result of being exposed to second-hand smoking (WHO). In New Zealand, more than 650,000 people currently smoke on a regular basis; the rate among youths aged 15-17 fell to 6% in 2011/2012 (NZ Ministry of Health, 2012).

Children whose parents smoke have an increased risk of having night coughs, snoring, and early respiratory infections compared to other children (Forastière, Giuseppe M. Corbo, Pistelli, Nera Agabiti, Ciappi, & Perucci., 1992) and parental smoking is directly associated with significant childhood morbidity (Aligne & Stoddard, 1997). A study by Weitzman et al (1992) found a link between childhood behavioural problems and maternal cigarette smoking in a dose-response relationship (Weitzman, Gortmaker, & Sobol, 1992).

Childhood and adolescent smoking is a multifactorial phenomenon that is influenced by local and social factors. Parental or household members smoking status is a crucial factor in determining the smoking behaviour in children (Pust et al, 2007). Other factors influencing childhood and adolescent smoking include socioeconomic status and the highest level of schooling attained. Tobacco consumption is associated with lower socioeconomic strata and low level of schooling (Pust, Mohnen, & Schneider, 2008). In New Zealand, people living in socioeconomically deprived areas are 2.5 times as likely to smoke as people in the least deprived socioeconomic areas (NZ Ministry of Health, 2012).

The tobacco industry spends billions of dollars in promoting tobacco smoking using various media including newspapers, magazines and TV. Exposure to these advertisements has been found to increase the likelihood for tobacco use amongst children (DiFranza, Wellman, Sargent, Weitzman, Hipple, & Winickoff, 2006). Luckily, however, anti-tobacco advertising campaigns and warnings do reduce the number of children who begin smoking and increase the number of smokers who quit (WHO). In New Zealand, however, no tobacco advertising has been allowed following the introduction of the Smoke-free Environments Act, 1990.

## **Screen Time**

High screen time (television, video, computer and electronic game use) is defined as  $\geq 2$  hours per day and very high screen time as  $\geq 4$  hours per day and the American Academy of Paediatrics recommendations not more than 2 hours of screen time per day in school-age children. Despite this, Biddle showed Scottish adolescents watched, on average just below 2 hours of television on weekdays and 2.5 hours on weekend days, with approximately 25% of children watching more than 4 hours per day on weekends (Biddle, Gorely, Marshall, & Cameron., 2009). In America screen time is higher still. Anderson found that 65% of 4-11 year olds spend, on average, more than 2 hours per day using computers or television (Anderson, Economos, & Must, 2008). 84% of Canadian youth (10-16yrs) have more than 2 hours of television and computer screen time per day, with an average total screen time of more than 4 hours per day (Mark, Boyce, & Janssen, 2006). Most adolescents watch between 2 and 2.5 hours of television per day, with access to a computer or video games increasing screen time by 30 to 45 minutes; these patterns are similar across Europe and North America (Marshall, Gorely, & Biddle, 2006). Furthermore, the most deprived are at highest risk of high screen time. Having a lower parental income, being a single parent, having lower educational attainment and a lower socio-economic status are all correlated with higher screen time (Salmon, Tremblay, Marshall, & Hume, 2011).

High screen time has been associated with increased risk of being overweight, obese and pre-diabetic. Hill reviewed the growing agreement that the environment, not biology, is driving an obesity epidemic; an increase in time spent on sedentary activities such as watching television, surfing the Web, and playing video games was implicated (Hill, Wyatt, Reed, & Peters, 2003). Mark and Janssen (2008) found a dose-response relationship between screen time and the metabolic syndrome in 1803 Canadian adolescents. The prevalence of the metabolic syndrome was 3.7% in the youth who had  $\leq 1$  hour of screen time per day, increasing linearly to 8.4% in the  $\geq 5$  hours per day group (Mark, Boyce, & Janssen, 2006).

High screen-based media use has also been correlated with physical aggression, cigarette smoking and alcohol use in Canadian and American youth (Iannotti, Kogan, Janssen, & Boyce, 2009). The only positive health outcome that has been linked to high screen time is improved quality of peer relationships (Iannotti, Kogan, Janssen, & Boyce, 2009). It has been suggested that the effects of high screen time are simply due to low physical activity. Time spent behind a screen is time not spent being active, however the adverse effects remain true even after controlling for low activity levels, which suggests screen time is an independent risk factor for poorer health outcomes in adolescence (Mark 2008; Iannotti 2009).

Factors associated with high screen time include perceived lack of neighbourhood safety, living in urban areas and parental attitudes to screen use eg. allowing TV at meal times; TV's in children's bedrooms (Salmon, Tremblay, Marshall, & Hume, 2011). Interventions to reduce television time have had varying success. As high screen use is a behavioural habit, successful interventions are likely to require external regulators of screen use, removal of environmental prompts and long term follow-up (Salmon, Tremblay, Marshall, & Hume, 2011). The most effective interventions have high levels of parental involvement and use electronic monitoring of screen use or clinic-based counselling. Interventions are most effective on children who are already overweight or obese at baseline (Schmidt, et al., 2012). Current research on screen time in adolescents relies on self-reports or parent-reports of use, introducing the possibility of bias or inaccuracies in data. There is an opportunity for more objective measures of behaviour to better assess children's actual screen use.

## **Perception of the Human Form**

Theories of body image suggest that body dissatisfaction results from unrealistic societal beauty ideals; one method of transmitting these ideals is through mass media (Hargreaves & Tiggemann, 2004). Hargreaves et al. studied the effect of exposure to images of idealised beauty in the media on adolescent girls and boy's body image. Body image was assessed before and after viewing commercials. They found an increase in body image dissatisfaction among girls but not among boys (Hargreaves & Tiggemann, 2004). On television programmes, the range of acceptable body types portrayed for women was found to be narrower than for men, with obese women the single group most likely to be the target of jokes (Smolak, 2003). Smolak's research suggests that up to 40% of late elementary school girls experience body dissatisfaction, and that girls seem to be more directly and extensively affected by media images than boys (Smolak, 2003). In addition, many more girls' magazines focus on appearance, and girls are more likely to read magazines (Smolak, 2003).

In comparison, Cohane et al. (2001) reviewed the literature regarding body image among boys. The review found that although girls frequently wanted to be thinner, boys frequently wanted to be bigger (Cohane & Pope., 2001). However, boys displayed less dissatisfaction with their bodies compared to girls.

## **Transport To and From School**

Active transport to school is an important factor used to increase the amount of physical activity of young children (Faulkner). In Faulkner's systematic review the effects of active transport on body weight were investigated in current literature. The objective of this study was to assess whether there was a relationship between mode of travel to school and objective measures of levels of activity in children. Eleven of the thirteen studies observed that children who had active transport to school, were more physically active than those who used motorised transport. The accelerometer was most commonly used to assess levels of physical activity. Of note, this investigation found that there was often a lack of detail in the included studies of how participants were classified as being active or passive school commuters, where participants were generally asked "their usual method of transport, to/from school".

In Merom's study, researchers used a telephone interview to ask the parents of school children in NSW their method of transport to school. Options included walk, cycle, and travel by car or public transport. Parents were also required to estimate the time spent travelling. Overall less than half the children were "active commuters". Of those who were found to be active commuter the average journey was found to be short, on average 4-7 minutes.

## **Dinner Environment**

Non-communicable diseases like obesity and diabetes impact the health and wellbeing of children in New Zealand. These diseases have modifiable risk factors that include dietary intake. Children whose families watch TV during mealtime eat fewer fruit and vegetables and more take away and snack foods (Coon 2001). Eating frequently at fast food restaurants are associated with high energy intake and inversely associated with eating fruit, vegetables and milk in adolescents (French 2001). A systematic review examined the family and social factors that influence children's eating patterns and diet quality (Heather 2005). They suggested that to promote healthy eating patterns in children it is necessary to target families and schools too.



## **Automated Camera Use in Children's Health Research**

Automated cameras have been used to record energy intake in previous research. The images generated by SenseCam enhance the accuracy of self-reported dietary patterns, with self-reported energy intake by increasing by 12.5% compared with 24 hour recall alone (Gemming 2013). When combined with food diary reporting, the SenseCam also increases the accuracy of total energy intake estimates by subjects (O'Loughlin 2013).

Until recently, automated camera technology has been primarily in adult-focused research regarding health behaviours such as sedentary transport to work. Research of this nature has been useful to those designing active transportation interventions (Kelly P. , Doherty, Berry, Hodges, Alan, & Foster, 2011). The use of cameras in children has been used to assess the feasibility of children's exposure to food marketing and sedentary behaviour (Barr, Signal, Jenkin, & Smith., 2013).

Automated cameras have been used as an aid in research classifying sedentary behaviour in free-living settings (Kerr, et al., 2013). This study highlighted the advantages of wearable cameras over accelerometers in providing type and context information about sedentary behaviour, as-well as identifying errors in self-reported information about travel times. Physical activity can be associated with important health outcomes in children (Kelly P. , Doherty, Berry, Hodges, Alan, & Foster, 2011). Automated cameras have also been used in children to evaluate feasibility of measuring travel to school, where previous to this measurement was based around self-reported journey time, which is subject to human error (Kelly P. , Doherty, Berry, Hodges, Alan, & Foster, 2011).

To date there has been no use of wearable cameras to assess the exposure of other aspects of environment to children; a novel area for research development.

## **Limitations and Challenges**

The use of automated cameras in life-logging, especially in the analysis of the everyday activities of the wearer, creates a challenging amount of work for researchers. There are large volumes of visual images with significant amounts of repetitive data. Manual coding of data is time consuming and can introduce coding errors (Kerr, et al., 2013). Barr et al (2013) used only a small sample of participants and highlighted that manual coding on a large scale may not be feasible. This is an area that needs to be addressed in further studies.

## **Ethical Considerations**

There are a number of ethical issues identified in the literature regarding automated cameras as an investigating tool into health behaviours (Kelly, et al., 2013). The large volumes of image data create

confidentiality and security issues; data must be stored securely with password protected software to avoid becoming public (Kelly, et al., 2013). The use of the images must be in accordance with the study aims and informed consent must be obtained from the participants. However, confidentiality of the participant and third parties may not always be possible, and informed consent may not be able to be supplied by individuals that the participant comes into contact with, who have their image captured. Some cameras, including Microsoft's SenseCam, contain a privacy function which halts image capture for a set time period (Kelly, et al., 2013). Despite these features, participants must be allowed access to the photos so they can screen for unwanted images, e.g., if they forgot they were wearing the camera in a private setting. This should occur prior to handing the data to researches (Kelly, et al., 2013).

## **4. Methods**

### **Literature Review**

We performed a literature search using Medline, INNZ and Google Scholar during the period September 30th to October 21st, 2014. The project supervisors provided additional literature and published material. Search terms included:

- child AND environment AND health
- alcohol AND children AND environment
- alcohol AND children AND health
- smoking AND children AND health
- body AND image AND children
- children AND food AND meals
- screen AND use AND children

### **Ethics Approval**

This study received ethics approval from the University of Otago Human Ethics Committee (Ref No. 13/220). Protocol for the management of privacy and safety issues was put in place as part of the wider Kids'Cam study. This protocol included ensuring the provision of information to participants, requiring informed consent from participants, their parents and the participating school; the development of protocols for data collection and data handling to protect the privacy, confidentiality and anonymity of participants and third parties captured in the images (Barr, Signal, Jenkin, & Smith., Using SenseCam to Capture Children's Exposure to Food Marketing: A Feasibility Study, 2013).

## Participants

Volunteer Year 8 students were recruited from 24 schools across Wellington to take part in the larger Kids'Cam study, with 214 students selected in total. For this study, 15 students (aged 12-13) who gathered data in August 2014 were selected from the 214 in the wider study. After data review, it was found that three of the participants had less than five hours of data from the four days of data collection, and these three were subsequently removed from the study population.

The participating schools were sorted into three categories based on the Ministry of Education's decile rankings. Deciles 1-3 were classified as low, 4-7 as medium and 8-10 as high. One school was randomly chosen from each category; five students were then randomly selected from each school, stratified by ethnicity. The 12 participants with full data sets included four high decile Māori students, five medium decile NZ European students and three low decile Pasifika students. There were four boys and eight girls. The majority of the students had low NZiDep scores (i.e. less deprived), with 10 having an NZiDep score of 1 or 2 and one having a score of 3. One participant from the high decile school had the highest possible NZiDep score of 5 (i.e. most deprived). Demographic information for the 12 students is displayed in Table 1.

## Inclusion and Exclusion Criteria

The inclusion criteria required a child's expression of interest in participating in the study, provision of written consent, and commitment to attendance of multiple sessions at school. These sessions were either during class time, during lunchtimes or before or after school. The provision of written parental consent to participate and to record images in the home environment was also part of the inclusion criteria. Children were only included if they had collected more than five hours of data over the four days.

A lack of desire to participate by either the parent or child, or a refusal of parental consent, comprised the main exclusion criteria. Children who were unable to either collect data or cope with the requirements of the study, due to disability or circumstance, were also excluded.

**Table 1: Baseline characteristics**

Student	School decile	Gender	Date of birth	Ethnicity - selected	Ethnicities- self identified	NZiDep
1	7	F	16/06/02	NZE	NZE	1
2	7	M	24/04/02	NZE	NZE	2
3	7	M	09/05/02	NZE	NZE	1
4	7	M	21/01/02	NZE	NZE	1
5	7	F	23/12/01	NZE	NZE	2

6	9	F	08/04/02	Maori	Maori, Samoan, Chinese	5
7	9	F	30/09/01	Maori	NZE, Maori	1
8	9	M	28/11/01	Maori	NZE, Maori	1
9	9	F	18/06/01	Maori	NZE, Maori, Dutch	1
10	2	F	17/09/01	Pacific	Tokelauan	3
11	2	F	13/05/01	Pacific	Tokelauan	2
12	2	F	02/01/02	Pacific	Samoan, Cook Island Maori	2

Student	Smoking at home	Smoking in other places regularly visited	Height (m)	Weight (kg)	BMI	BMI – age and sex adjusted percentile	BMI – converted to adult equivalent	Age at data collection (years)
1	No	No	1.57	35.2	14.21	1 <sup>st</sup> (underweight)	17	12.2
2	No	No	1.61	46.0	17.75	45 <sup>th</sup>	23	12.3
3	No	No	1.42	31.1	15.51	9 <sup>th</sup>	18.5	12.3
4	No	No	1.59	39.3	15.58	8 <sup>th</sup>	18.5	12.6
5	No	No	1.59	50.3	19.90	67 <sup>th</sup>	23	12.6
6	Yes	No	1.59	66.0	25.98	95 <sup>th</sup> (obese)	30	12.4
7	No	No	1.62	53.9	20.51	71 <sup>st</sup>	23	12.9
8	No	No	1.55	37.1	15.54	6 <sup>th</sup>	18.5	12.7
9	Yes	No	1.64	48.0	17.89	36 <sup>th</sup>	18.5	13.2
10	Yes	Yes	1.54	54.6	23.02	87 <sup>th</sup> (overweight)	25	12.9
11	Yes	Yes	1.60	50.4	19.76	61 <sup>st</sup>	23	13.3
12	Yes	No	1.62	46.9	17.87	41 <sup>st</sup>	18.5	12.6

*Note on BMI:* Children's BMIs must be compared with other children of the same age and sex. They can either be converted to an adult equivalent BMI (Cole & Lobstein, 2012) or the appropriate adjustments can be made to find how a certain child compares to others of the same age and sex (i.e. to find what percentile they are in). Children less than the 5<sup>th</sup> percentile are underweight, in the 5<sup>th</sup> to less than the 85<sup>th</sup> percentile are of a healthy weight, in the 85<sup>th</sup> to less than the 95<sup>th</sup> percentile are overweight and in the 95<sup>th</sup> percentile or above are obese (CDC)

## Data Collection

### Briefing Session

A briefing session was held with all study participants to discuss the ethical, legal and practical issues associated with using the various recording devices; to familiarise participants with the devices; and to discuss what they would be asked to do during data collection.

The Kids'Cam project was explained to the participants and they were instructed to wear a camera and GPS recorder for 4 days, including two weekdays and two weekend days. Participants were told that they can remove the devices at any time for any reason, and they were encouraged to remove them in situations where others may be uncomfortable with their presence. Additionally, they were

told to remove the camera before entering: changing rooms (school, club, and swimming pool); toilet or shower facilities; or in any other situation or location in which people could be partially clothed or would feel uncomfortable being photographed, for example in healthcare facilities. Participants were asked to either activate the privacy setting on the camera when using the bathroom or changing, or to turn off and remove the device. They were also advised to remove the camera if entering retail outlets where signage advises that photography is not permitted. The participants were advised to remove the cameras in any cases where damage might occur, i.e. heavy rain or vigorous physical activity.

Participants were briefed on how to handle any attention they may receive while wearing the camera. If challenged by third parties, participants were advised to explain that they are participating in a study being conducted by researchers from the University of Otago, Wellington; that the project aims to document their environment and that they are wearing a camera that automatically takes pictures continually throughout the day. Furthermore, they were advised to state that they are not intentionally taking photographs of specific people or places. As an alternative, they were provided with information cards to hand out if challenged by third parties while wearing the camera. They were also encouraged to tell third parties to contact the Kids'Cam research team using the contact details given on the information card if they required additional information or had further questions.

## **Review Session**

On the first weekday following the participants' four-day data collection period, the devices were collected and the data was downloaded onto a laptop computer using purpose-designed software. The participants were then able to review their images and (in private) remove any sensitive or personal photographs. Participants were also asked questions to determine the extent of their usage of the camera and GPS.

As a token of appreciation, schools were provided with book vouchers and a letter of thanks at the end of data collection in lieu of their time and assistance in recruiting and providing facilities for data collection. Participants received a certificate and voucher to thank them for their participation and time.

## **Data Analysis**

Following data collection, the images from the 12 participants were downloaded onto a shared drive and were reviewed manually to identify and code any exposures to the pre-defined contributors to

health and well-being. This involved two coders viewing each photo and deciding if it fell into the pre-determined coding category.

## Alcohol

Every photo containing alcohol, images of alcohol or advertising of alcohol was classified as:

- Drinking (others)
- Drinking (self)
- Bottles or boxes
- Alcohol advertising or retail
- Recycling
- Legal signage
- Art

A pre-coded schedule was used to record data on the type of exposure and the date it occurred. We did not include images of alcohol seen on computer or TV screens, as the photo quality was not sufficient to accurately see what was on screens viewed by participants. If the same exposure (e.g. to the same bottle) occurred multiple times, it was only counted as one exposure per day.

## Smoking

All photos containing smoking, images of smoking, or smokefree signs were classified as either:

- Cigarette smoking
- Cigarette packets
- Ashtrays
- Smokefree signs

A pre-coded schedule was used to record data on the type of exposure and the date it occurred. Images seen on computer or TV screens were not included. If the same exposure occurred multiple times, it was only counted as one exposure per day.

## Screen Time

Images were included if an 'on' screen could be seen, that the participant was presumably looking at. This included partial screens with the participant sitting in front of it, but did not include screens that someone else was in front of, for example, a parent using the computer. Variations in screen type were also recorded. These variations were:

- Computer

- Television
- Phone
- Mobile device (tablets, iPads, Nintendos)
- Multiple screens (more than one active screen viewed)

Data was compiled for each participant and analysed to determine time of exposure in hours. This analysis assumed that each image represented 10 seconds of screen time. Time of exposure was then averaged over the twelve participants for daily, total and device-specific screen time values.

## Perception of the Human Form

All pictures that portrayed the human form were identified and classified on a pre-coded schedule which included the following categories:

- Magazine and Newspaper Advertisements
- Billboard Advertisement
- Beauty Products or Objects
- Clothing Brands
- Television Programmes and Internet Videos
- Video Games
- Social Media
- Posters
- Books
- DVD and Book Covers
- Food Packaging

Data was labelled with category, time, date, and specifics related to the category (e.g. location of exposure, gender, approximate age, description of the person seen). Exposures were counted as a single event, rather than counting the number of photos containing the exposure. If the same exposure occurred on a separate occasion it was counted again as a separate event. A separate occasion was defined as occurring after the child had left the exposure for a different activity and then came back, excluding breaks for food at home and bathroom breaks.

## Transport To and From School

Trips to and from school were classified by mode of transport:

- Car
- Walking

- Scooter
- Bus
- A combination of transport modes

Trips to school were counted separately from trips from school.

## Dinner Environment

All photos were searched for evidence of a main evening meal eaten between the hours of 5-9pm only. The search was stopped once the meal had been identified. No snacks or desserts noted within this time period were recorded. Meals were separated into four main categories:

- Home-cooked meals
- Ready-made meals (only needed heating before consumption)
- Takeaways
- Restaurant meals

All meals were also examined to identify whether they contained vegetables (excluding potatoes and pizza toppings).

Meals were also categorized depending on where the meal took place. The categories were:

- Meal eaten at family dining table
- Meal eaten in front of television
- Meal eaten outside of home
- Other

## Spatial Analysis

The GIS (geographic information system) software ArcGIS10.2.2 was used to create a map for each participant. The GPS coordinates were uploaded and converted to a GPX file. A map was created for each participant with all of the GPS data they collected during the 4 day study period using ArcMap. The participant's movements were plotted on the map for the periods when they had the GPS on. The 'Community' base map was added and the map was zoomed to a level where all of the participant's data points could be observed on one map. Finally, the map was exported as a .jpeg file (Figure A1-12).



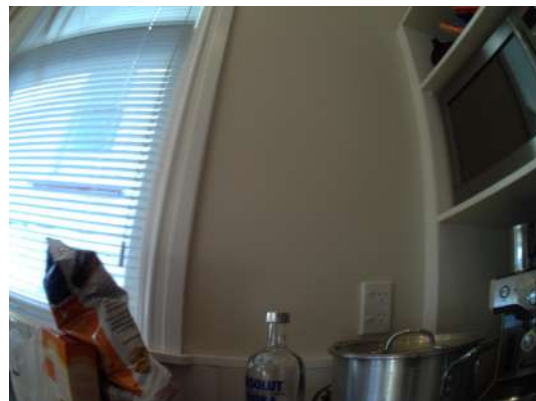
## 5. Results

### Exposure to alcohol

11 out of 12 participants were exposed to alcohol in some way during the 4 days of the study. This included exposure to drinking, bottles, advertising and legal signage. The most common exposure was to bottles in the household, which ten out of twelve participants witnessed. The most common type of exposure to bottles was wine, but we also saw beer bottles, as well as bottles of vodka and other spirits. Bottles were often seen on the kitchen bench and in the fridge (Images 1-4). All of the participants of European ethnicity were exposed to bottles in their homes. In contrast, only 3 of the Maori participants (75%) and 2 of the Pacific participants (67%) were exposed.



**Image 1. Exposure to beer bottle on kitchen bench  
07/08/14**



**Image 2. Exposure to vodka bottle on kitchen bench  
08/08/14**

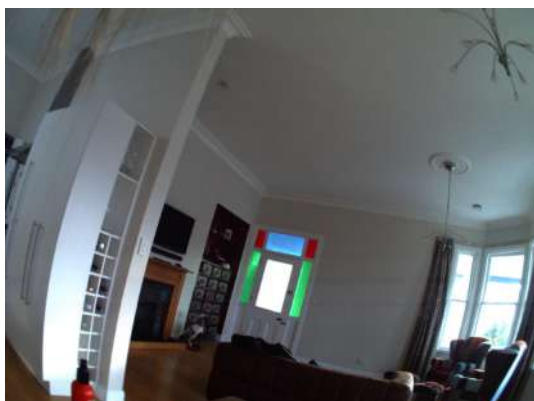


**Image 3. Exposure to wine bottle in fridge 10/10/14**

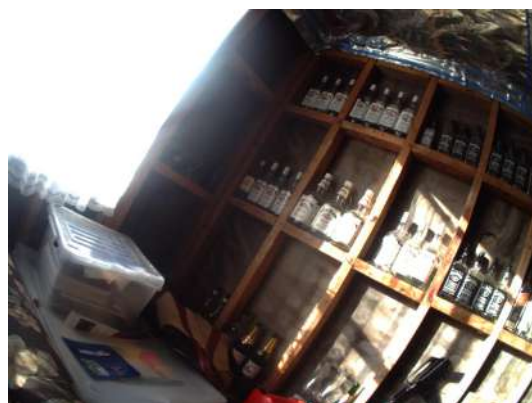


**Image 4. Exposure to wine bottles on bench and in  
fridge 08/08/14**

Other examples of alcohol bottles that were seen were alcohol storage in the home (image 5), bottle collections in the garage (image 6) and bottles seen in recycling bins in the street (image 7).



**Image 5. Exposure to wine storage in the home  
07/08/14**



**Image 6. Exposure to alcohol bottle collection in  
garage 15/08/14**

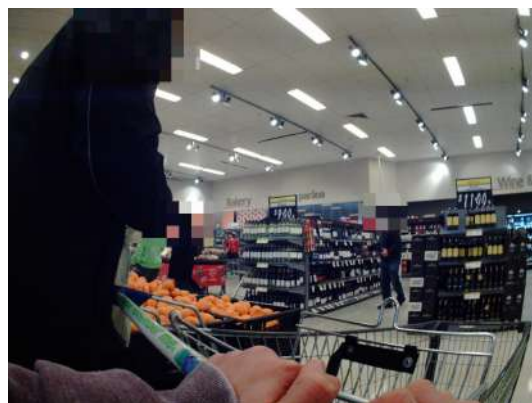


**Image 7. Participant carrying alcohol bottles to recycling bin 10/08/14**

Seven of the twelve participants were exposed to some form of alcohol advertising or retail. This included paper advertising (image 8), the alcohol section in supermarkets (image 9) and liquor stores (image 10).



**Image 8. Exposure to alcohol advertising in flyer 16/08/14**



**Image 9. Exposure to alcohol retail in supermarket  
10/08/14**



**Image 10. Exposure to liquor store 10/08/14**

There was relatively little exposure to legal signage, with only two of the twelve participants being exposed to signs relating to the permissibility of alcohol consumption (image 11).



**Image 11. Exposure to liquor ban signage 16/08/14**

Four participants witnessed alcohol being consumed around them, which in every case was due to parents and other adults drinking wine or beer in the context of a family dinner (images 12 and 13). Only one participant was seen to be drinking what was presumably wine himself, during what appeared to be a Shabbat dinner (images 14 and 15).



**Image 12. Exposure to adults drinking alcohol at dinner table 09/08/14**



**Image 13. Exposure to adult drinking alcohol at dinner table 07/08/14**



**Images 14 & 15. Participant drinking alcohol at Shabbat dinner 08/08/14**

All of the four participants who were exposed to actual drinking were of New Zealand European ethnicity and were either 1 or 2 on the NZiDep index. Out of the ten participants who were exposed to bottles, five were New Zealand European, three were Māori and two were Pacific.

European and Pacific participants were more likely to be exposed to any kind of alcohol (bottles, drinking, advertising or signage) on a weekday than a weekend. European participants were exposed to alcohol on 100% of weekdays and 80% of weekend days. Pacific participants were exposed to alcohol on 67% of weekdays and 50% of weekend days. In contrast, Maori participants were exposed to alcohol more frequently on weekend days (63%) than weekdays (38%).



## Smoking

Only two participants were exposed to any type of smoking or cigarette packaging. The first participant witnessed an adult (presumably a parent) with an unlit cigarette in her mouth both in and outside the house (images 1 and 2). There was also evidence of what appeared to be an ashtray in her house (image 3). The second participant had exposure to a packet of roll-your-own tobacco (image 4) and witnessed an adult rolling a cigarette (images 5 and 6). Both of these participants were of Pacific ethnicity. For both of the participants, the exposure occurred on the weekend and the person smoking was someone known to the child.



Images 1 & 2. Exposure to parent smoking 16/08/14

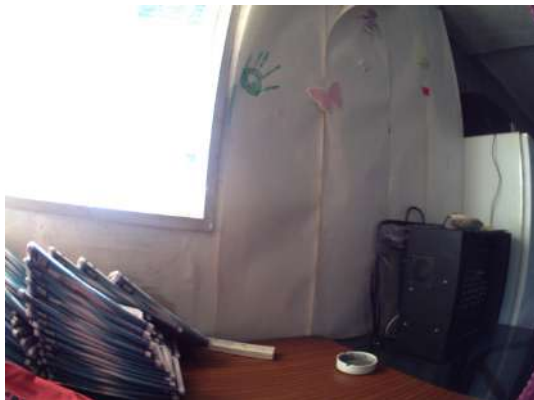


Image 3. Exposure to ashtray 16/08/14



Image 4. Exposure to cigarette packaging 17/08/14



**Images 5 & 6. Exposure to cigarette package and adult rolling a cigarette 17/08/14**

Four participants were exposed to smokefree signs in public buildings (image 7), and one other child owned several “auahi kore” (smokefree) drink bottles (image 8). All of these participants were either Māori or Pacific ethnicity.



**Image 7: Exposure to smokefree sign 17/08/14**



**Image 8. Exposure to smokefree drink bottle 21/08/14**

## Screen Time

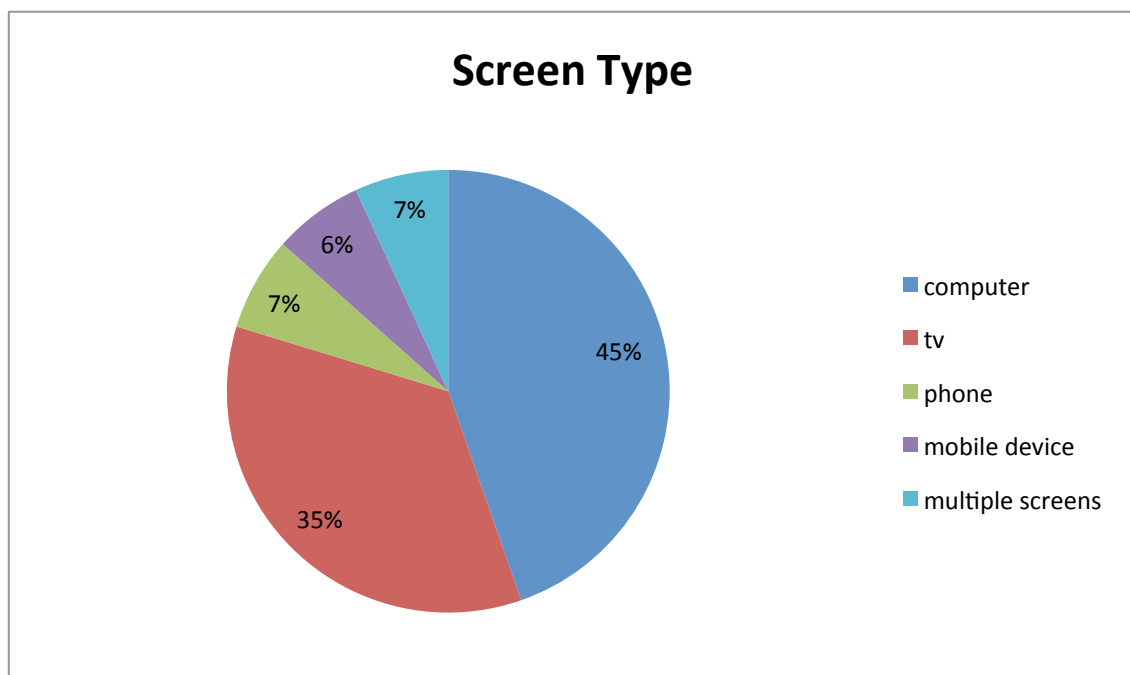
Overall, we found that the participants were exposed to 7.3 hours of screen time over the four days. Each day they were exposed to, on average, 1.8 hours of screen time. The maximum amount of screen time for a participant in one day was 7.1 hours; the minimum screen time was 0 hours. Overall, participants were exposed to screens on a daily basis.

Participants saw screens in a variety of settings, which were mainly within their home environment. Participants also viewed screens at various points throughout the day, the patterns included; watching a screen as they prepared for school, using screens for homework directly after school as well as a regular exposure to screens in the late afternoons prior to the cameras being turned off.

Screen types included: computer, TV, phone, mobile device and multiple screens. The screen types seen varied between the different ethnicities. NZ European participants were exposed to 3.4 screen types on average, whilst Maori and Pacific participants saw 2.7 screen types.

**Table 1 Screen time data set**

	Computer	TV	Phone	Mobile device	Multiple screens	Total Screens
Average total time	3.25	2.55	0.51	0.48	0.50	7.29
Average daily time	0.81	0.64	0.13	0.14	0.12	1.8
Maximum daily time	6.04	5.8	0.69	1.68	2.14	7.13
Minimum daily time	0	0	0	0	0	0



## Computer

On average, participants were exposed to 0.81 hours of computer time each day, with a maximum daily exposure of 6 hours for one participant. Personal computers and laptops were used for a variety of purposes including: gaming, social media, homework, music, googling and movies.



**Image 1. Exposure to computer screen whilst eating breakfast  
10/08/14**



**Image 2. Exposure to a computer screen whilst gaming one  
evening 21/08/14**

## Mobile Device

On average, participants were exposed to 0.14 hours of screen time on mobile devices, with a maximum daily exposure of 1.68 hours for one participant. Mobile devices were defined as personal computing devices, which included: tablets i-pads and Nintendo. These devices were used for a variety of purposes. Outside the house, they were commonly used on car rides.

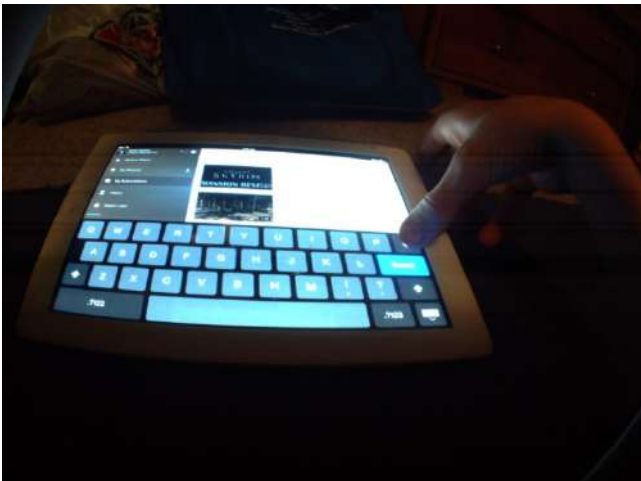


Image 3. Exposure to a tablet/mobile device 7/8/14



Image 4. Exposure to a Nintendo- mobile device 8/8/14

## Multiple Screens

On average, participants were exposed to 0.12 hours of multiple screens each day, with a maximum daily exposure of 2.14 hours for one participant. The most common scenario for multiple screens was using a tablet or phone, whilst the TV was on in the background.

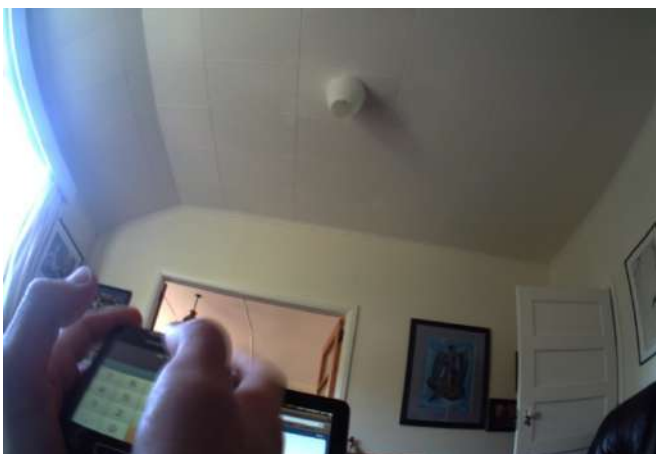


Image 5. Exposure to a phone and laptop screen 10/8/14



Image 6. Exposure to a tablet and television 21/8/14



## Phone

On average, participants were exposed to 0.13 hours of mobile phone time each day, with a maximum daily exposure of 0.51 hours for one participant. Phones were used for a variety of purposes, including: communication, gaming, social media, photography and web searching.

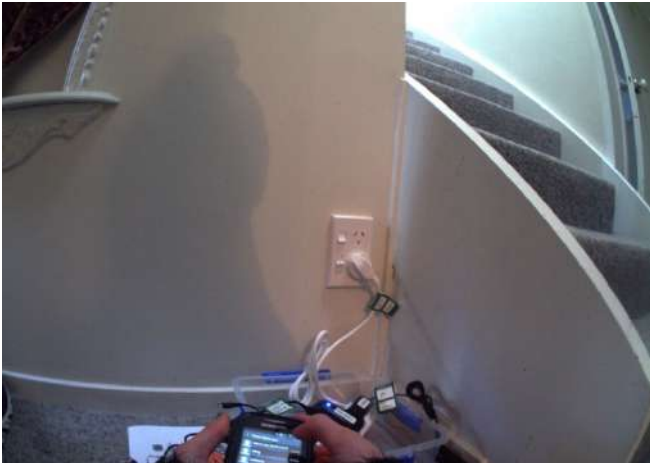


Image 7. Exposure to a phone screen for communication 9/8/14

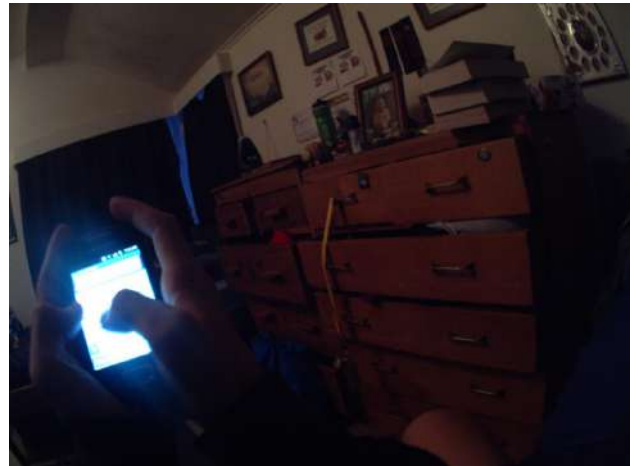


Image 8. Exposure to a phone screen 4 8/8/14

## TV

On average, participants were exposed to 0.64 hours of TV time each day, with a maximum daily exposure of 5.8 hours for one participant. TV was watched before school, after school, and in the weekend. Some families ate dinner in front of the television, whilst others ate breakfast in front of it. The TV was playing in the background for most of the evening in some households.



Image 9. Exposure to TV screen whilst gaming 9/8/14



Image 10. Exposure to TV screen whilst eating dinner 7/8/14

## Perception of Human Form

There were multiple different exposures to portrayals of the human form. It is these exposures that may contribute to what is seen as the 'social-norm' and have a potential influence over the self-image related behaviours of these participants. Repetition of exposures illustrating social status, physique and appearance may create a perceived idea of what a 'normal' person is.

### Magazines and Newspaper Advertisements

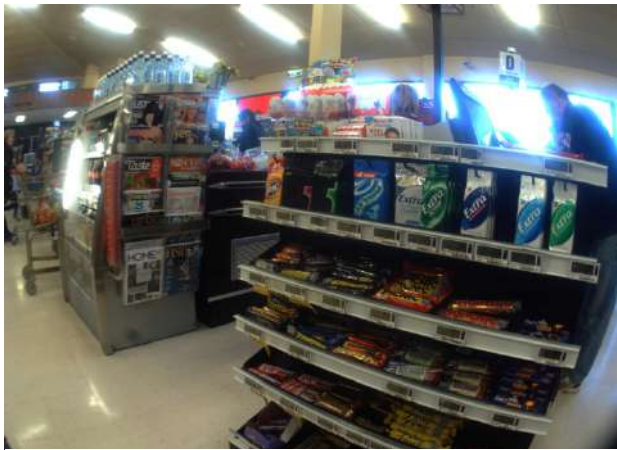


Image 1: magazine stand at supermarket 10/08 (left), Image 2: celebrity photographed in magazine article, at child's home 21/08 (right)

Magazines/newspaper advertisements were seen at the supermarket, dairies or in the participants's own homes. In the supermarkets and dairies it was only the covers of magazines seen; in the participants's homes it was covers as well as articles, and newspaper advertisements. More than half of the participants (7/12) had at least one photograph containing a magazine. Many of the magazine covers had American and British celebrities on them. These potential exposures contribute to what being successful and famous may look like, or what you need to look like to be famous and successful.

## Public Billboards/Posters



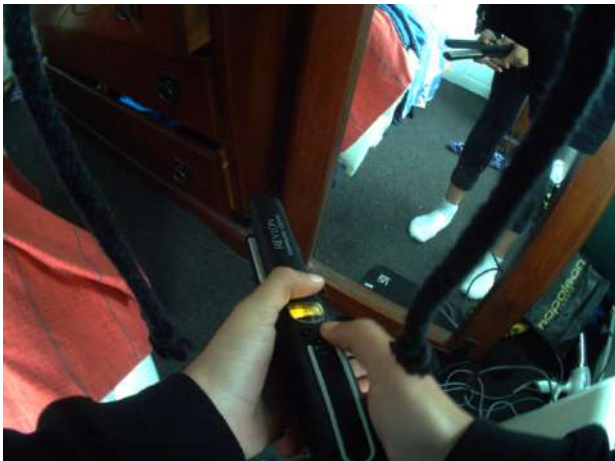
**Image 2: Male clothing billboard portraying three muscular young males on the beach 09/08 (left), promotional voting poster featuring three ethnically diverse young adults 09/08 (right)**

Billboard advertisements were photographed at least once by just under half of the participants (5/12). Three quarters of these were seen on the weekend, and of those taken on a weekday, there were no exposures on the journey to and from school. One third of the photographs were taken by one participant on a trip into Wellington CBD; they were the only participant to go into Wellington CBD whilst wearing a camera.

Billboards included clothing advertisements, radio station advertisements, election voting promotion and sports players/athletes. A number of participants saw posters of athletes at sports arenas. These athletes were all slim and toned, wearing short or tight sports uniforms. These images may portray what an athlete looks like, or what you will look like if you play sport. The clothing advertisements seen were of young, attractive, slim models with their friends. This may portray what types of people wear the clothes advertised or what you will look like if you wear the clothes. The voting poster photographed had three young adults with differing genders and ethnicities. All of these examples have the potential to contribute to what a 'normal' person looks like.



## Beauty Products and Objects



Images 3 (clockwise from top left): participant holding a hair straightener and standing in front of a mirror 24/08, participant looking in mirror holding an unspecified beauty product 16/08, beauty aisle in supermarket showing hair dye packaging with young attractive females on boxes 07/08



Only one participant did not have a photograph containing a beauty product or object. Three quarters of the photographs recorded had mirrors in them, either in bedrooms, bathrooms or living areas. The other photographs were of beauty products (including hair straighteners, face wash, make-up, hair spray, nail polish, deodorant), and exercise machines in the home.

In the beauty aisle in the supermarket, all of the photographed packaging had attractive Pakeha women with long hair and perfectly made-up faces. This creates the ideal of what people do, or should look like, and sends the message to use the product to achieve this. Most of the beauty products seen at the participants's houses were in the bathroom around the sink or on the participants's dressers – both mostly within view when looking in the mirror. Location around the mirror may show the reflection of 'enhancing' or 'bettering' the human form through the use of products and that it is an everyday and normal occurrence.

## Branded Clothing



**Image 4: 5 girls photographed on the way to school wearing bright coloured Nike shoes 07/08 (left), girl with Nike backpack and Nike shoes 08/08 (right)**

All but one of the participants had a photograph of branded clothing in at least one of their photographs. Three quarters of the participants had a photograph/s of branded clothing which included branded shoes or a branded backpack on other participants on their way to and from school (5/5 NZ European 1/3 Pacific 3/4 Maori).

Many participants were seen to be wearing brightly coloured Nike sneakers or Converse Shoes, and having Nike or Adidas schoolbags. This may be an example of the perception of a 'social-norm' directly influencing a participant's behaviour. We noticed that the trend of shoe brand was reflected within groups, and if one participant had a pair of Nike sneakers, many of the others would too. Another recurring fashion we noticed was Kathmandu/Macpac puffer jackets, a number of photographs showed girls wearing these inside (at McDonalds). This may show that wearing the puffer jacket is not only for warmth, but also as fashion.

## Television Programmes and Internet Videos



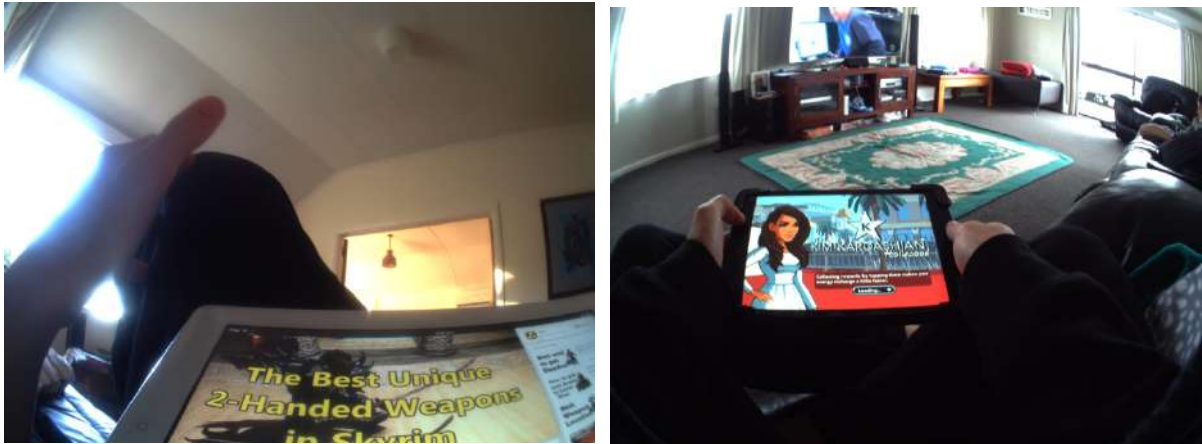
**Image 5: Woman featured in an internet video with a small waist, and large breasts and bottom 07/08 (left), heavily made-up blonde young female on an American television program 07/08 (right)**

Only one participant did not have a photograph of a television programme, movie or an internet video. Almost three quarters of the participants photographed television programmes that featured teenagers of the same gender. While watching TV programmes, there were limited advertisements seen, with no advertisements showing human form photographed.

Almost half of the participants had photographs only showing a television show, while the others had a mixture of television programmes, movies and internet videos. Girls in American television programmes were dressed maturely for their age and wearing make-up, jewellery and tight fitting clothing. Some photographs showed participants wearing plain grey school uniforms (e.g. Summer Heights High). News presenters were photographed well-presented and in sensible clothing, but only one quarter of the participants had one or more photograph of the 6pm news.

The participants showed differences and preference for the videos they watched on the internet. Some chose to watch mainly music videos showing scantily clad women with small waists and large hips/bottoms. Another child showed a preference for an Asian Reality programme and one child watched a set of made-up teenagers singing on multiple occasions. This may also be an example of self-image behaviours, as the images of human form were self-chosen.

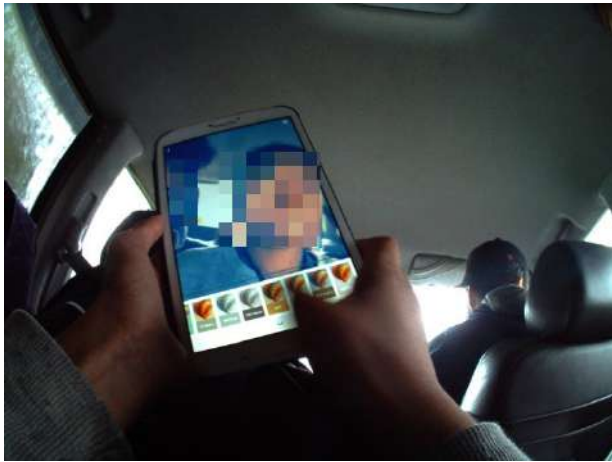
## Video/Computer games



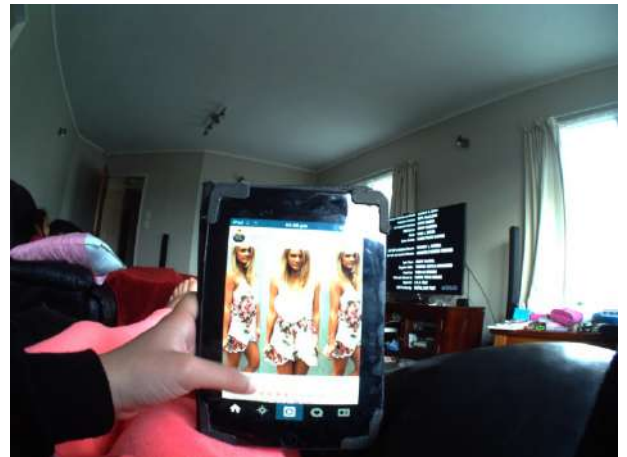
**Image 6: computer game with male character holding weapons 09/08 (right), animated picture of Kim Kardashian portrayed with voluminous hair, a small waist and large breast and hips 21/08**

One third of the participants (3 male and 1 female) had photographs of video games with human characters at least once. All of the male participants had one or more photograph of a masculine character or violence in the video game, while the girl was playing a Kim Kardashian fashion game. The 'masculine' characters were large, muscular and carried weapons. The Kim Kardashian fashion game portrays a slim, very curved (small waist, large breasts, large hips and bottom) woman on a fashion runway. Similar to the internet videos, these games are also self-chosen exposures to masculine and feminine stereotypes, but may contribute to the perception of normal human form.

## Social Media



**Image 7 (clockwise from top left): editing a 'selfie' image with filters on a mobile device 14/08, Facebook showing young girl posing 10/08, Instagram featuring slim blonde model 22/08**



Over half of the participants had photographs containing a form of social media. From these all but one were girls. The identifiable social medias photographed included: Facebook, Twitter, Snapchat, Instagram and Skype. Facebook and Instagram showed a trend of young adults of similar age and gender as the participants posing in photographs.

One participant had multiple photographs which showed her taking pictures of herself. She also had photographs that showed her editing these 'selfies' with different filters.



## Posters



Image 8: Multiple posters with male football players on the wall of a child's bedroom 10/08 (left), multiple One Direction posters on the wall of a child's bedroom 09/08 (right)

Over half of the participants had a photograph of a poster on one of the walls in their house. Half of the participants had one or more photograph of a poster in their bedroom; the others had posters photographed in other regions in the house. Posters included those of sports players, singers (e.g. One Direction), and movie characters (e.g. The Hobbit).

The placement and choice of poster may reflect what the child aspires to be or look like. The placement of the posters is significant to the regularity of exposure.

## Books

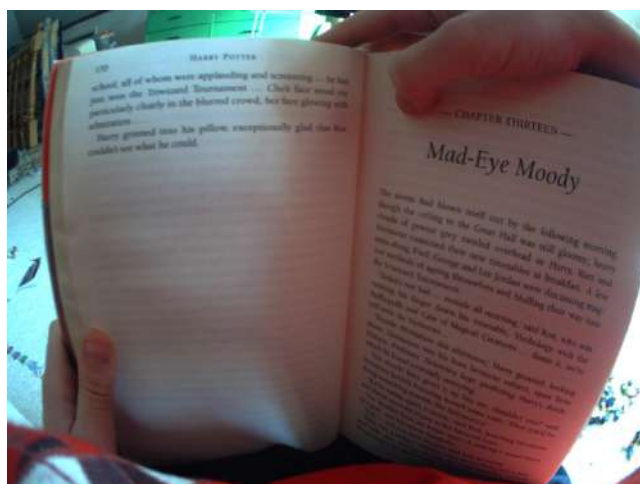


Image 9: holding a Harry Potter novel 09/08 (left), holding The Guinness Book of World Records 09/08 (right)

One third of the participants had at least one photograph holding a book. All but one of the participants photographed with a book were holding a novel in at least one photo, the other

participant had the book on their mobile phone. We were able to identify the novel titles in half of the participants: a number of the Harry Potter Series and The Subtle Knife.

### Covers (Game, Book, DVD)



**Image 10: child holding a video game with male character holding a weapon in an electronic shop 09/08**

One third of the participants had at least one photograph of a DVD, book or game cover that had a human or human character on the front. These photographs were split between home, the library and book/electronic shops. Like with the computer/video games, the male characters were generally muscular and holding weapons. Other DVD covers had examples of attractive couples and celebrities.

### Food Packaging



**Image 11: taking the contents out of a Nutrigrain box, picture of a male skier on front 07/08**

Only 2 participants had a photograph with the human form on food packaging. Both of these were on cereal boxes and at the child's home. These were a Nutri-Grain box with a male skier on it and the other was a Weetbix box with the All Blacks on it.

## School Transport

We gathered data for 37 trips to and from school, out of the 48 possible trips over 2 weekdays for the 12 participants. Trips were classified by mode of transport as car, walking, scooter, bus, or a combination. We did not see any bicycle use or other forms of transport.

The most common type of transport was car (image 3), which alone accounted for 15 trips. When trips that involved travelling by car for part of journey were also included, the number of trips totalled 21 out of 37 (57%). Walking accounted for 8 trips alone (image 2), and travelling by scooter for 4 trips (image 1). Participants travelled by bus on 4 trips (image 4), with 2 of these in combination with walking and 2 in combination with using a scooter.

Using a combination of modes of transport in a single trip was relatively common. There were a total of 10 combined trips, for example, there were 5 trips which involved both walking and driving by car.

Pacific participants were only seen walking (37.5% of trips) or going by car to school (62.5%). NZ European participants were driven at least part of the way to school on 37.5% of trips. Maori participants were driven on 76.9% of trips, but half of these were in combination with walking.

European participants had the most variation in mode of transport overall, with participants observed using walking, cars, busses and scooters. In contrast, Maori and Pacific participants both only walked or travelled by car.

One thing that we noticed was that many of the participants who walked or travelled by scooter to school did so with a group of friends. It would be difficult to accurately collect data on how frequently this occurs and the size of the groups because it is hard to tell if the other participants seen in the photos are actually travelling with the child or not.

## Car Transport

21 of the 37 individual recorded journeys of all participants used a car at least part of the time. Maori participants were most likely to travel by car to or from school, with 10/13 or 76.9% of trips using a car at least part of the way. 62.5% (5/8) of the journeys made by Pacific participants also used a car as transport. Only 6/16 or 37.5% of the individual journeys undertaken by NZ European participants involved travelling by car for all or part of the journey.

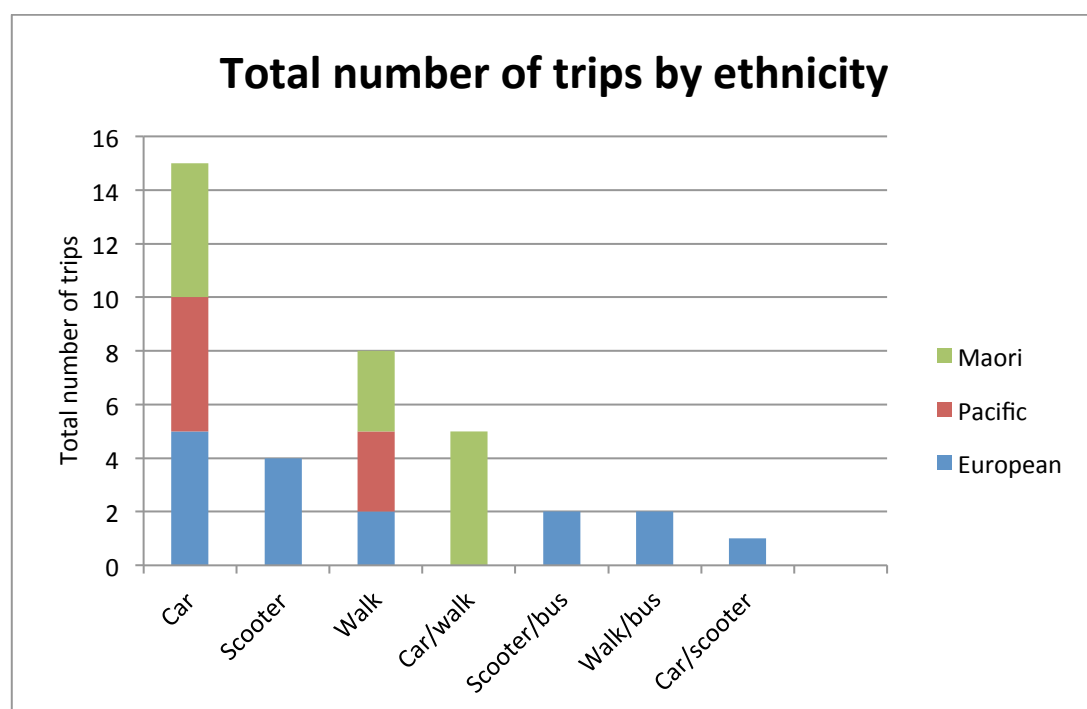
Only one participant out of the twelve went both to school and back by car on both of the school days that they were observed and that child was of Pacific ethnicity.

## Walking

15 out of 37 (40.5%) of the individual journeys involved the participants walking all or part of the way to or from school. Maori participants were most likely to use this method of transport, with 61.5% (8/13) trips involving walking at least part of the way. This also accounted for 37.5% (3/8) of all Pacific Islander participants's journeys, and only 25% (4/16) of the NZ European participants's journeys.

## Scooter

NZ European participants were on the only participants observed travelling to school by scooter, with 7/16 journeys undertaken this way. 4 out of the 5 NZ European participants used a scooter at some point. None of the four Maori or three Pacific participants were seen to be using scooters at all.





**Image 1. Example of using a scooter to get to school**



**Image 2. Example of walking to school**



**Image 3. Example of driving to school**



**Image 4. Example of catching the bus to school**

## Dinner Analysis

### Aim

To identify what each child ate for their main evening meal and where that meal was eaten.

### Methods

All photos were searched for evidence of a main evening meal eaten between the hours of 5-9pm only. The search was stopped once the meal had been identified. No snacks or desserts noted within this time period were recorded. Meals were separated by four main categories:

- Home-cooked meals
- Ready-made meals (only needed heating before consumption)
- Takeaways
- Restaurant meals

All meals were also examined to identify whether they contained vegetables (excluding potatoes and pizza toppings).

Meals were also categorized depending on where the meal took place. The categories were:

- Meal eaten at family dining table
- Meal eaten in front of television
- Meal eaten outside of home
- Other

### Results

We recorded what each of the twelve participants ate for dinner over the four days of the study. We were able to record 32 meals out of a possible 48. Meals that were unable to be recorded were mostly due to the participants turning off the camera during the hours that we searched, from 5-9pm, but on two occasions a child did not appear to eat dinner during these hours. Two of the meals that were recorded were unidentifiable foodstuffs due to poor camera quality.

Out of the entire 30 meals where it was possible to identify what the child was eating, 16 meals (53%) were home cooked. Of these, 14 meals (87.5%) included some sort of identifiable vegetable. (figure 1). 11 dinners out of the 30 (36.7%) consisted of either takeaways (including pizza, Chinese meals, fish 'n' chips) or "ready-made" store bought food such as pies or cordon bleu. 3 meals were

eaten out in restaurants with family members (two Italian restaurants and one Indian restaurant). One meal was eaten at a McDonalds (figure 2).

We also recorded where the participant ate when eating at home. Of the 28 meals that were eaten at the participant's house, 19 of these (67%) were eaten sitting around the dining table with the family. The remainder (32%) were eaten in front of the TV with siblings or other adults

We also analysed the participants's data by ethnicity. We recorded 13 meals from the NZ European participants, 8 meals from the Maori participants and 11 meals from the Pacific participants. However, of the 11 meals eaten by Pacific participants, only 9 contained identifiable foodstuffs.

Nine of the 13 meals eaten by NZ European participants (69.2%) and 5 of the 8 meals eaten by Maori participants (62.5%) were home cooked. All of these meals included some sort of identifiable vegetable. In contrast, only 2 of the 9 identifiable meals (22.2%) eaten by Pacific participants were home cooked, neither of which contained any vegetables. During the four day period, Pacific participants did not appear to eat vegetables (excluding potatoes and pizza toppings) at the dinner time meal. Pacific participants were much more likely to eat either takeaways or ready-made meals (such as pies), with 6 of the 9 meals (67%) consisting of takeaways, ready-made meals or McDonalds. Only 2 meals (15.4%) from two separate NZ European participants consisted of takeaways (pizza in both instances). Three meals (37.5%) from the Maori participants consisted of takeaways (fish n chips on two occasions). None of the NZ European or Maori participants were observed to be eating ready-made meals for dinner.

Two meals from two separate NZ European participants and 1 meal from a Pacific child were spent eating out at restaurants (non-fast food outlets) with their families. Maori participants did not eat dinner outside of the home during the four days.

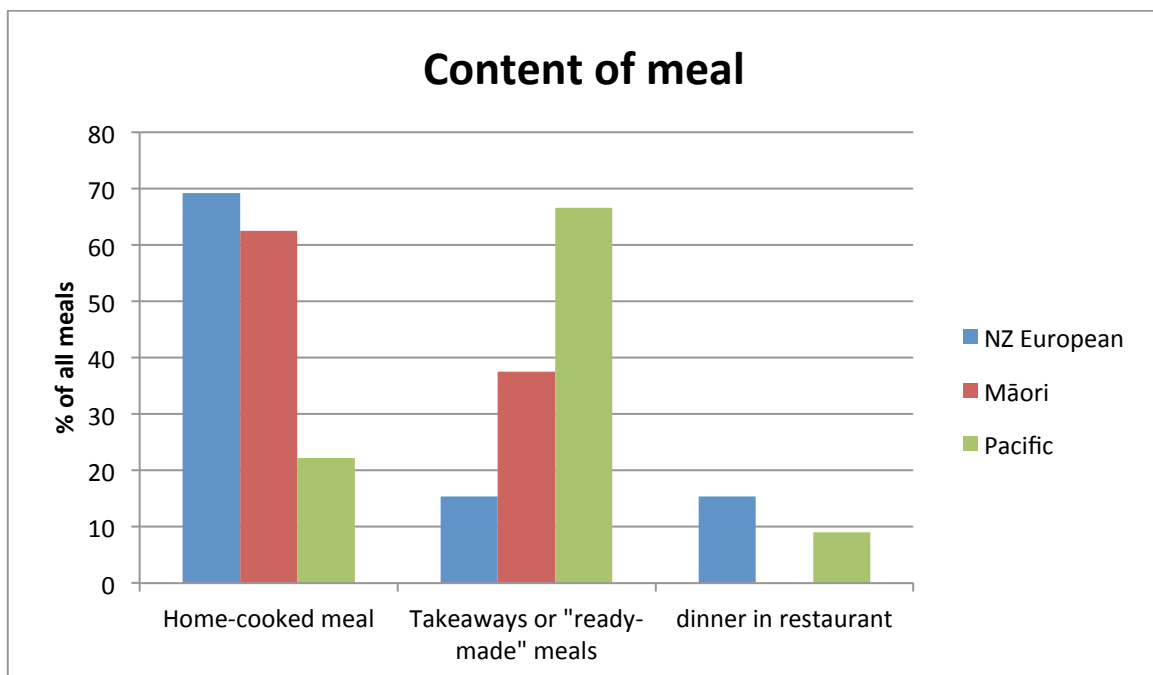
Both NZ European and Maori participants were more likely to eat dinner at the dining table with family than Pacific participants. Ten of the 11 meals (91%) eaten at home by NZ European participants were carried out around the family dining table. Seven out of the 8 meals eaten by Maori participants were also held at the dining table. However, only 2 of the 9 meals eaten at home by the Pacific participants were at the dining table. On both occasions the meal consisted of takeaways brought home by an adult (Figure 3). The 7 remaining meals from the Pacific participants were eaten in front of the TV (Figure 4).



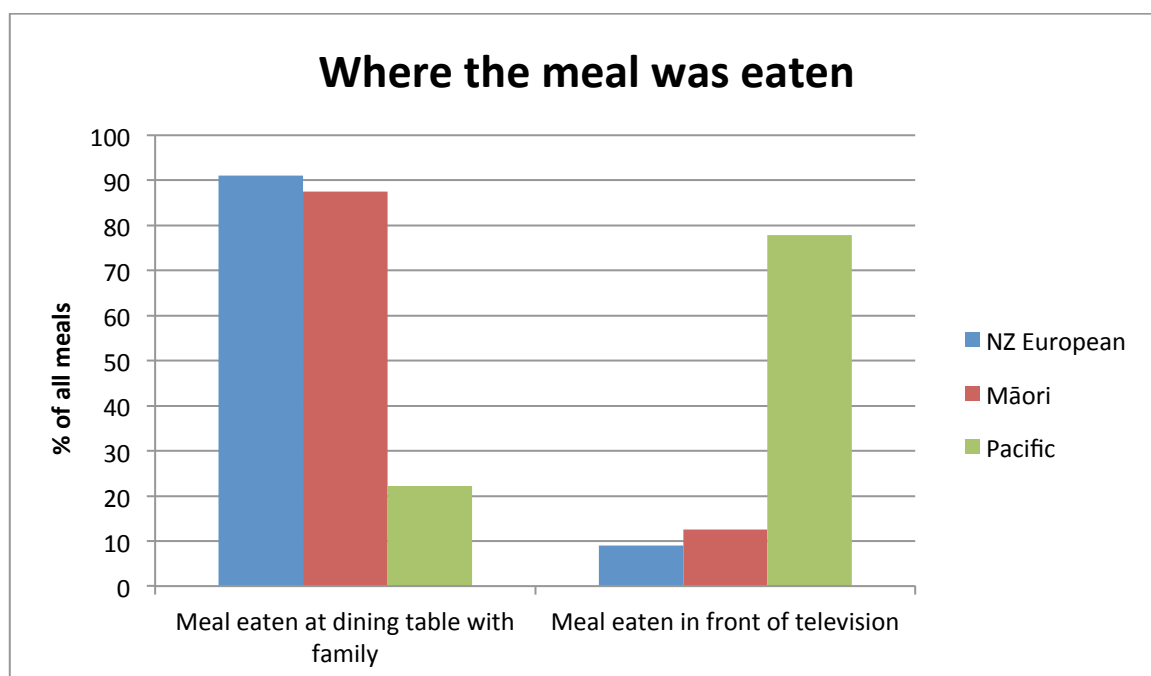
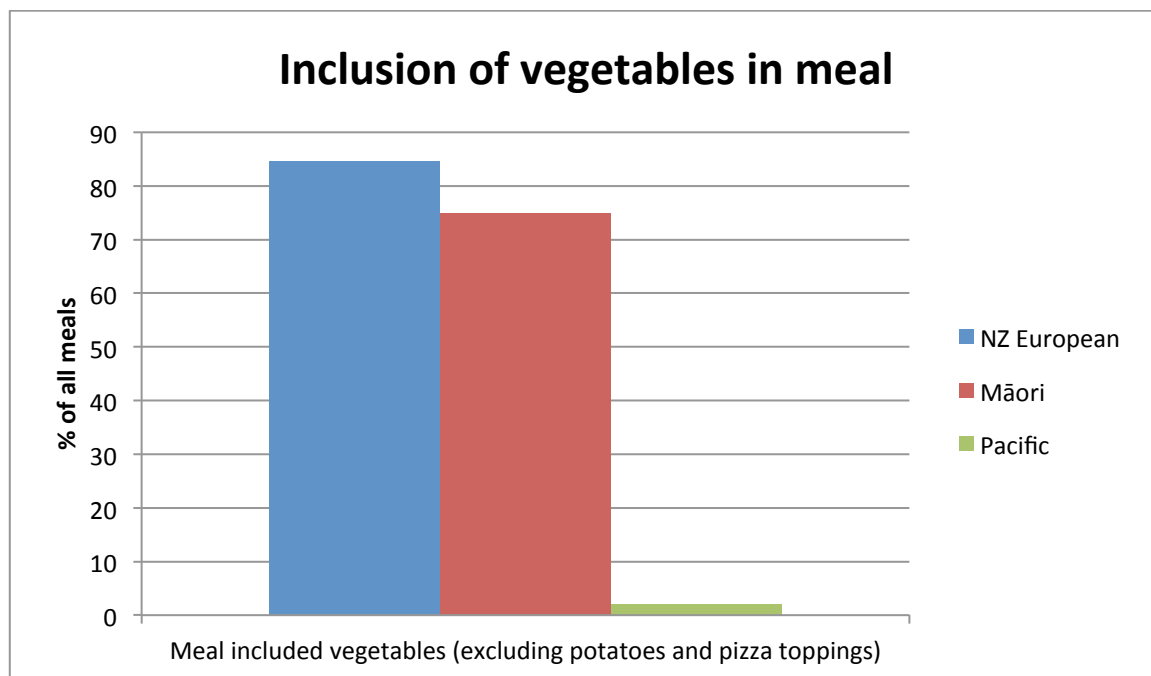


Images 1-4 (in clockwise order): home-cooked meal with vegetables, McDonald's for dinner, fish'n'chips, 'ready-made' meal eaten in front of the television

Breakdown of what the participants ate for dinner (%)







## Feasibility

The Autographer appears to be an effective tool for recording images of participants's food consumption, and would be a useful vehicle to use in future studies exploring eating environments. The camera is able to capture most of the food that the child is eating and being exposed. The Autographer also captures other aspects of food and eating behaviour including; who is eating with

the participant, how often the participant eats, the type of food that is stored in the house and how often the participant visits the supermarket.

The main limitation is that it is not always possible to identify what the participant is eating, either due to poor camera quality or, more commonly, poor angle of the camera. It is also difficult to see what is being eaten out of bowls, for example, or to see what the participant is eating if they are lying on the floor or sofa.

Another potential limitation is the likelihood of the participant turning the camera off during meal times, either on their own volition (due to shame at their own diet, for example) or at the request of the people who are eating around them.

## 6. Discussion

This was a small scale qualitative study, where the primary aim was to determine aspects of children's environments which modify their health and well-being. Secondly we aimed to explore the value of automated cameras as research tools.

### Alcohol

This study found that 11 out of 12 participants were exposed to alcohol in some way during the 4 days of the study. Whole alcohol bottles in the household were the most common type of exposure, witnessed by ten of the twelve participants. This finding suggests that the participants were routinely exposed to evidence of alcohol consumption in their home environment. Bottles of beer, wine, vodka and other spirits were all observed indicating that the participants were exposed to a variety of different alcoholic beverages.

Future studies on a larger scale could feasibly examine whole alcohol bottles quantitatively. With respect to those participants who were not exposed to whole alcohol bottles in their household, we are unable to tell from the data whether this was truly because there was no alcohol. It is possible that this absence is due to storage of alcohol in a way that meant these participants were not exposed to it during the four days of the study.

Four of the participants witnessed alcohol being consumed around them, which in every case was due to parents and other adults drinking wine or beer in the context of a family dinner. Considering the frequency with which the participants were exposed to whole alcohol bottles within their household environment, this represents a notably smaller exposure than that seen in alcohol consumption. All four of the participants who were exposed to actual drinking were of New Zealand European ethnicity and were either 1 or 2 on the NZiDep index. This suggests that the participants of higher socioeconomic status may have been more likely to be exposed to drinking in a family dinner setting. Within the framework of a larger study it may be possible to further explore the social context surrounding alcohol consumption to which children are exposed.

Considering the adverse health outcomes associated with excess alcohol consumption and the prevalence of these within New Zealand, qualitative data on childhood exposure to parental drinking are of potential significance. It has been demonstrated that exposure to unhealthy parental behaviours including alcohol misuse and smoking have negative impacts on children's health. Our study has shown that the participants were very likely to be exposed to evidence of alcohol consumption but less likely to witness actual consumption. Our study is limited in the context of

unhealthy drinking behaviours by tendencies to have the camera turned off during weekend evenings and the possibility that study participants were less likely to exhibit alcohol misuse.

We found exposure to alcohol advertising or retail to be at a moderate level, with seven of the twelve participants exposed. In contrast there was relatively little exposure to legal signage, with only two of the twelve participants exposed to signs relating to the permissibility of alcohol consumption. There is a reasonable discrepancy here between children's exposure to advertisements encouraging consumption of alcohol and signage advocating its responsible use.

Our study indicates that the participants grow up in an environment where alcohol use meets very little disapproval. This is significant considering that greater parental disapproval of alcohol is associated with lower numbers of children's alcohol-use-related problems. While we are limited in this sense by few data on exposure to parental drinking behaviour, our finding that most participants were exposed to evidence of alcohol consumption in the form of whole alcohol bottles suggests that alcohol consumption is fairly normalised.

The cameras provided an original method to explore the ways in which children were exposed to alcohol. We found the cameras were particularly good at picking up on background or subliminal exposures, including items such as whole alcohol bottles and advertisements. They were less adept at providing information on drinking behaviour. Whole alcohol bottle exposure could potentially be further explored using quantitative studies. Our findings also build on the work of Kerr et al in suggesting that automated cameras offer an advantage in providing contextual information unavailable through other methods.

## **Smoking**

We found that only two participants were exposed to any type of smoking. Both of these participants were of Pacific ethnicity. In both instances the exposures were to adults handling cigarettes but not smoking them. The absence of exposure to actual smoking suggests the participants were rarely exposed to the act of smoking. Four participants were exposed to smoke-free signs in public buildings; all of these were of either Māori or Pacific ethnicity.

According to the demographic data of the participants, 6 live in households where there is a smoker at home. However, we only saw two examples of exposure to smoking. There could be a number of reasons why we did not see examples of smoking in the other smoking households, including parents only smoking away from the participants and parents preferring not to smoke when they knew there was a camera around. The four-day data collection period may also not have been long enough. It is

also likely that the cameras may have missed a chance exposure to smoking, such as if the participant was riding or driving past someone smoking on the street.

New Zealand remains burdened with a significant amount of disease related to direct and second hand smoking exposure. Given the links between parental smoking and children's respiratory problems, breathing difficulties and morbidity it is positive to note the very low level of children's exposure to smoking that our study found. It should be noted that this observation is limited by the potential for adults to have modified their behaviour given the presence of the cameras. Our study indicates that the participant's environments included smoke free signage and that this is an exposure they received regularly. This is beneficial given the proven efficacy of these advertisements. Considering the greater likelihood for tobacco consumption in people living in socioeconomically deprived areas there is some consolation in our finding that the participants in these areas tended to be the most exposed to smoke free advertisements.

The cameras captured very little exposure to smoking in this study. There were instances of exposure to cigarettes being prepared and exposure to anti smoking advertisements. The cameras tended to be less adept at collecting information on behavioural exposures. This was especially true of smoking. It is difficult to claim whether this is because children truly are minimally exposed to smoking or whether an element of bias is present. Adults may have altered their exposure due to the presence of the cameras, leading to an underrepresentation of stigmatised behaviour such as smoking.

## **Perception of Human Form**

Our study found that the participants were subjected to a wide variety of exposures which have an influence on perception of the human form. These portrayals of social norms may have contributed to a range of self-image related behaviours. Exposure to magazines/newspaper advertisements was at a moderate level, with seven of the twelve participants exposed. Many of these magazines portrayed British and American celebrities and potentially establish an archetypical sense of success and fame. Five of the twelve participants were exposed to billboard advertisements on a range of subjects. Several of these instances involved girls encountering posters of athletes which potentially demonstrate an idealised athletic human form.

All but one participant were exposed to a beauty product at some point in the study. Only bottles or containers for such products were coded as beauty products. By not coding these products when encountered while 'in use', i.e. women wearing nail polish, we aimed to eliminate gender bias. Of these photos, 75% also contained mirrors. Location around the mirror may show the reflection of

'enhancing' or 'bettering' the human form through the use of products and that it is an everyday and normal occurrence. This indicates that the participants are being raised in an environment that contains many products geared to improve one's self-image. In the beauty aisle in the supermarket, all of the photographed packaging had attractive Pakeha women with long hair and perfectly made-up faces. This may have suggested to the participants an ideal of what should look like, as well as suggesting this product should be used to achieve this image.

All but one of the participants were exposed to branded clothing at least once. Many participants were seen to be wearing brightly coloured Nike sneakers or Converse Shoes, and having Nike or Adidas schoolbags. This may be an example of the perception of a 'social-norm' directly influencing a child's behaviour. We noticed that the trend of shoe brand was reflected within groups, and if one child had a pair of Nike sneakers, many of the others would too.

All but one of the participants were exposed to television, movies or an internet video. Of these, eight participants watched television programmes featuring teenagers of the same gender. This suggests that the participants were commonly exposed to television paradigms of teenage image. Girls in American television programmes were dressed maturely for their age and wearing make-up, jewellery and tight fitting clothing. Only a limited number of advertisements were seen, none of which were related to the human form. Four of the twelve participants were exposed to video games with human characters, three of which were male and were playing games involving violence and masculine characters. The one girl was playing a fashion game which portrays a slim, very curved (small waist, large breasts, large hips and bottom) woman on a fashion runway.

Over half of the participants had photographs containing some form of social media, six of whom were female. These exposures included Facebook, Twitter, Snapchat, Instagram and Skype use. Social media use unanimously involved exposure to images of children of similar age and gender. A moderate number of the participants (8/12) were exposed to posters. These posters included a variety of sports players, singers and movie characters. The placement and choice of poster may reflect what the child aspires to be or look like. The placement of the posters is significant to the regularity of exposure.

In total our study has found that the participants were highly exposed to media which had the potential to influence their concept of social norms relating to the human form. These exposures were often dispersed throughout their environment. Across the range of exposures certain body types tended to recur. This suggests that the participants may have been exposed to a relatively

narrow set of variations of the human form. In concordance with this it is possible that they exhibit behaviour which strives to emulate the window in which this variation falls.

Considering the study by Hargreaves et al and its finding that body dissatisfaction increases with exposure to commercials relating to body-image among adolescent girls, the participants may well be growing up in an environment rife with such exposures. The literature suggests that media images have proven to influence girls' satisfaction with their appearance. Our study indicates the participants may be routinely subjected to a large variety of such exposures and therefore it is quite possible that they grow up in an environment where they become increasingly dissatisfied with the way they look.

This phenomenon is more pronounced for girls than for boys as described by Cohane et al (2001). While boys displayed less dissatisfaction, they often exhibited a desire to look bigger and more muscular. Our findings show several examples of these archetypes tend to reappear in products pitched at young boys such as the video games and posters. This indicates boys may be subject to a separate sphere of social norms with impacts further research could feasibly explore.

We found the cameras were particularly good at picking up on subliminal exposures such as the advertisements and products which influence self-image. All of these are predominantly visual by nature and gave us a picture of the environment these participants were exposed to. Given the rich array of information captured by the cameras it is highly feasible to use these for further research on a larger scale both qualitatively and quantitatively exploring these exposures.

## **Screen Time**

Participants in this study spent an average of 1.8 hours per day outside of school hours watching an active screen. The range in screen time exposure was from 0-7.13 hours per day. The majority of the screen time was spent on the computer or watching television, with these screens accounting for 45% and 35% of total screen time respectively. Mobile devices, phones and situations where multiple active screens were present made up the remainder of recorded screen time.

The American Academy of Paediatrics recommends that school age children are exposed to no more than 2 hours of screen time per day (Committee 2003). Sedentary activities like screen time are associated with an increased risk of being overweight, obese and pre-diabetic (Hill *et al* 2003). Although the average screen time for participants in this study was below the recommended limit, some participants spent more than 2 hours per day in front of screens with one child having a total

of 7.13 hours of screen time in one day. This suggests that some of the participants do not grow up in an environment that supports their health and wellbeing due to high screen time.

The KidsCam™ photographs allowed researchers to observe what screens were being used for and the context in which they were used. Computers and laptops were used for gaming, viewing social media, homework, playing music, searching the internet and watching movies. Portable computing devices defined as 'mobile devices' in this study were often used while the participants were in the car. Multiple screen exposure commonly occurred when the TV played in the background while the participant used a portable computing device or phone. Some pictures showed families eating breakfast or dinner while watching the television.

The use of automated cameras is a novel way to investigate screen time in children. Previous methods use self-reported screen time, accelerometers (Anderson 2008) and ecological momentary assessment (Biddle 2009). The photographs generated by automated cameras provide rich data about the purpose and context of the screen time, which allows for more comprehensive analysis of sedentary behaviour.

## **Transport To/From School**

Out of 46 trips to and from school 16 (% would be better) were by car alone, 12 by walking alone, 8 by scooter and the remaining trips included a combination of transport methods. Driving in the car either in combination with another mode or alone accounted for 37.5% of school transport trips in New Zealand European participants, 50% in Pacific participants and 66.6% in Māori participants. New Zealand European participants travelled to school by scooter more frequently than Māori or Pacific children.

Levels of physical activity are higher in children who use active transport to school (Faulkner 2009). The use of passive transport methods could be contributing to the growing overweight and obesity rates in New Zealand. A study in Australia showed that overall less than half of children were 'active commuters', which is similar to our finding in this study (Merom 2006).

The automated camera provided an accurate and simple way to categorise transport to school in New Zealand children. Although not measured in this study, the cameras could be used to provide an objective measure journey duration.

Previous researchers have also used automated cameras to categorise transport methods and measure journey duration (Kelly 2011). Kelly *et al* found that the automated cameras provided a more accurate measure of journey duration than self-reported journey times. Research using self-



reported transport methods noted a lack of detail because they asked for the 'usual method' of transport (Faulkner 2009).

## **Dinner environment**

Of the 30 meals recorded 53% were home cooked and 36.7% were takeaways or 'ready-made' food. Given that frequent fast food eating is associated with high energy intake in adolescents (Coon 2001), this result is concerning for the wellbeing of the participants. Of the 28 meals eaten at home 67% were eaten around the dining table with the family and 32% were eaten in front of the television. Participants whose families watch television during meal times are more likely to have a diet containing high energy and low fruit and vegetables (French 2001).

Of the recorded meals 69.2% eaten by New Zealand European participants were home cooked and 62.5% eaten by Māori participants were home cooked, all of which contained vegetables. In contrast, 22.2% of meals eaten by Pacific Island participants were home cooked, none of which contained vegetables. 91% of meals eaten at home by New Zealand European participants were eaten around the dining table, 87.5% for Māori participants and 22.2% for Pacific Island participants. Given that the family eating environment has an influence on children's diet quality (Heather 2005), these results are concerning for the health and wellbeing of the Pacific participants in this study.

## **Strengths**

The major strengths of our study lie in the use of the automated cameras as research tools. Often qualitative studies considering exposures similar to those we have investigated rely on self-reporting and thus are limited by recall bias. The 10 second photograph interval allowed for an objective measurement of exposures, eliminating recall bias encountered in previous research. By employing a qualitative approach we are able to explore a much greater range of exposures and collect subtler information which enables us to contextualise the experience of growing up in a modern New Zealand environment. The qualitative nature of the study is perfectly suited to undertake the preliminary investigation giving an overview of the feasibility of automated cameras in research. The regularity and clarity of photographs taken by the automated camera made meal identification simple. The pictures provided rich data about the children's eating environment, allowing the location of the meal, who the meal is eaten with and vegetable content to be recorded.

Additionally by limiting the number of people analysing the photos to two per exposure category our study aided the conformity of the coding process and minimised the effects of misclassification bias.

## Limitations

This study had a number of limitations which could be overcome by conducting a larger, funded study, including the sample size and time periods available for collection of data. Our study rests on the assumption that the participants actually noticed or observed the exposures that we have observed in the photographs taken by the automated cameras. A number of the participants had data missing from weekend evenings, which may be the time where alcohol and smoking exposure would be most likely to occur. In conjunction with this we are limited by the likelihood that participants may turn off the cameras if they were doing or seeing something they knew was illegal or frowned upon.

The greatest limitation faced by this study was the potential for study participants and their families to alter their behaviour around the camera. This may be connected with an element of selection bias. In this case, study participants are more likely to be those who are happy to be filmed, which could be because they do not exhibit stigmatised behaviour such as smoking. This may have led to an underrepresentation of such behaviour.

We were not able to analyse exposure to smoking on television or computers, because it was too difficult to make out what was on the screen. This also meant we could not see if they were exposed to anti-smoking television advertisements. In some photographs the camera was covered or pointing at the roof. This may have led to an underestimation of screen time because these photographs were not counted in the coding system. Screen time at school was not counted in this study, which may have led to an underestimation of screen time.

We were also unable to capture activities that the participants were likely very aware of but did not witness, such as the parents going outside to smoke, or hearing adult parties after they had gone to bed. Also the photographs did not enable researchers to record whether participants were travelling alone or in a group. Participants would turn their cameras off to go to the toilet, however this may have led to underestimation of exposure to beauty products and mirrors in the bathroom.

Another potential limitation is the likelihood of the participant turning the camera off during meal times, either on their own volition (due to embarrassment regarding their own diet, for example) or at the request of the people who are eating around them.

Other limitations of using the cameras to analyse this data include difficulties with photo quality in definitively ascertaining the types of food, beverages, advertisements, signage etc. The coding

process itself was also prone to error in this fashion. This is especially true considering the large amount of time necessary to conduct manual coding of the data.

## **7. Conclusions**

Our study has found that the participants are raised in environments replete with health modifying exposures. These included a high likelihood to be exposed to alcohol, especially evidence of its consumption in the form of whole alcohol bottles. Smoking exposure was considerably lower with exposure to anti-smoking advertisements reaching the areas where they are most needed. The participants were heavily exposed to self-image related influences, several of which have been demonstrated to contribute to girls' dissatisfaction with their appearance. This study suggests that the participants grow up in an environment with a level of screen time that supports their health and wellbeing. However, some participants are at risk of diseases associated with sedentary behaviour due to a high level of screen time. Some participants used active transport to get to school, which supports their wellbeing. However, there is an ethnic disparity in transport methods, with Maori and Pacific participants having used more sedentary transport types more frequently. The proportion of takeaway meals consumed and meals eaten in front of the television among participants in this study may reflect negatively on the environment that they grow up in. The effects of this environment show inequities, with Pacific participants having been exposed more often than New Zealand European and Māori participants to an eating environment that doesn't support their health and wellbeing. Automated cameras appear feasible as tools to investigate a wide variety of public health issues. This is particularly true of static, background exposures such as advertisements.

Future qualitative studies could examine the attitudes surrounding children's exposure to alcohol. Both parents and children may be able to provide some commentary on the place of alcohol within New Zealand society. Our study suggests that the use of automated cameras could be of use in further research aimed at assessing exposure to advertising of alcohol, tobacco and food in environments beyond the home.

In conjunction with the use of automated cameras further studies could potentially explore more qualitative aspects of children's attitudes regarding social norms. Our study has highlighted the aptitude of these cameras for research involving assessment of background exposures. Influences on children's perception of social norms tend to lie within this set. Future research could also investigate the effects of exposure to these social norms in both boys and girls.

Further research could focus on finding out why some New Zealand children are spending more than the recommended 2 hours per day in front of a screen. Parental attitudes and neighbourhood safety

have been shown to influence screen time (Salmon 2011). These factors could be explored within the environment of children in Wellington. Health policy could focus on increasing awareness of the harmful effects of screen time on children's wellbeing.

The automated camera could be used to calculate journey duration in New Zealand children. The GPS devices they carried could be used to calculate journey distance. The camera could be used to explore the ethnic difference observed in travel methods, which may have been due to school journey distance or other factors. This research suggests that sedentary behaviour may be contributing to the growing rate of overweight and obesity in New Zealand, and lends itself to evidence for the development of policy to encourage families to use active school transport methods.

The automated camera could be used to record more eating behaviours like how often the child eats, the type of food that is stored in the house and how often the child visits the supermarket. It is feasible that the cameras could be used to comprehensively describe the eating environment of children in New Zealand, and correlate this to the individual child's health and wellbeing. This research indicates that the eating environment of Pacific children in particular could be addressed to improve their health and wellbeing.

Automated cameras are demonstrably good at producing data on advertising or other passive or subliminal type exposures. However they are less adept at capturing active or behavioural exposures. It is possible that this is due to a propensity for people to alter their behaviour around the camera, or be disinclined to participate in the study, leading to a likely underrepresentation of stigmatised behaviours such as smoking. Many of the exposures we have examined including whole alcohol bottles, advertisements and beauty products lend themselves to future studies on a larger scale which could feasibly investigate these aspects quantitatively.

## **Acknowledgements**

We would like to acknowledge the help and support received from our supervisors Louise Signal and Richard Jaine. We also received valuable assistance from Moira Smith and Michelle Barr.

We would like to acknowledge the work and experiences of the 15 children on which this study is based.

We would like to also thank the Kids'Cam team at the University of Otago and the National Institute of Health Innovation at Auckland University and Kids'Cam funders the Health Research Council.

A special thanks to all the staff in the Department of Public Health, University of Otago, Wellington.

## Appendix

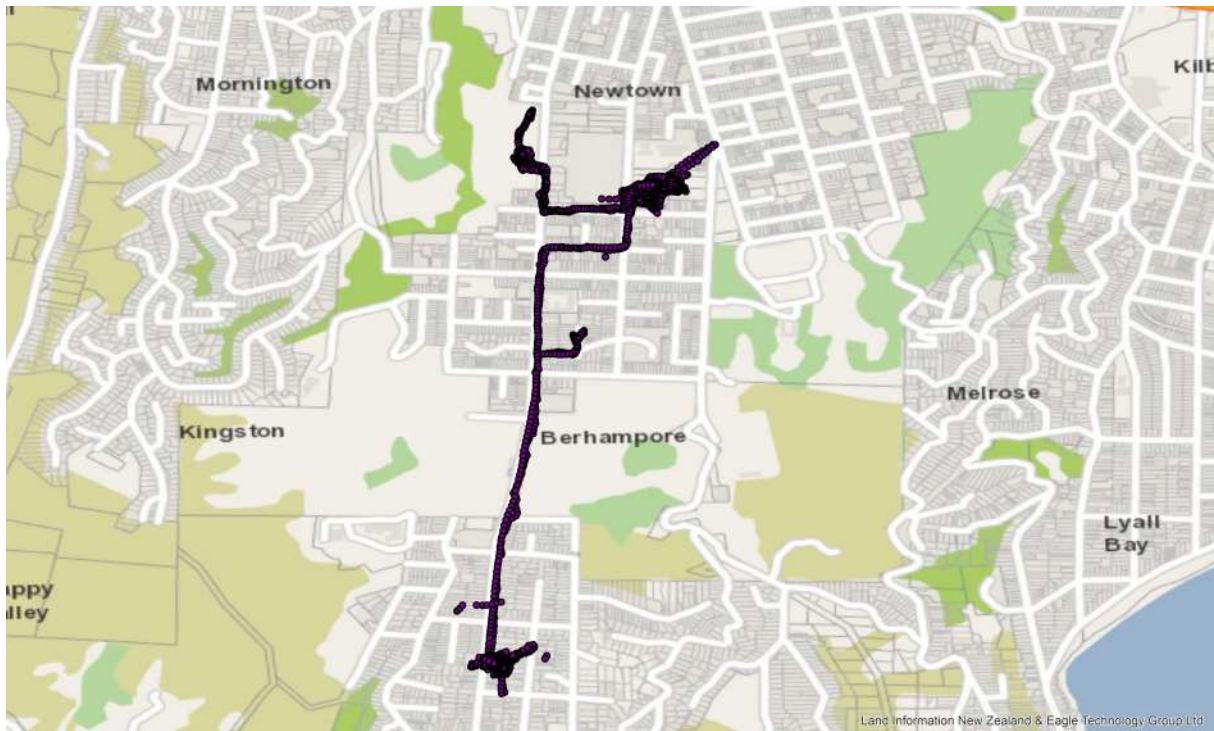


Figure 1A. Map of GPS data collected by student 1 on 7-10<sup>th</sup> August 2014



Figure 2A. Map of GPS data collected by student 2 on 7-10<sup>th</sup> August 2014



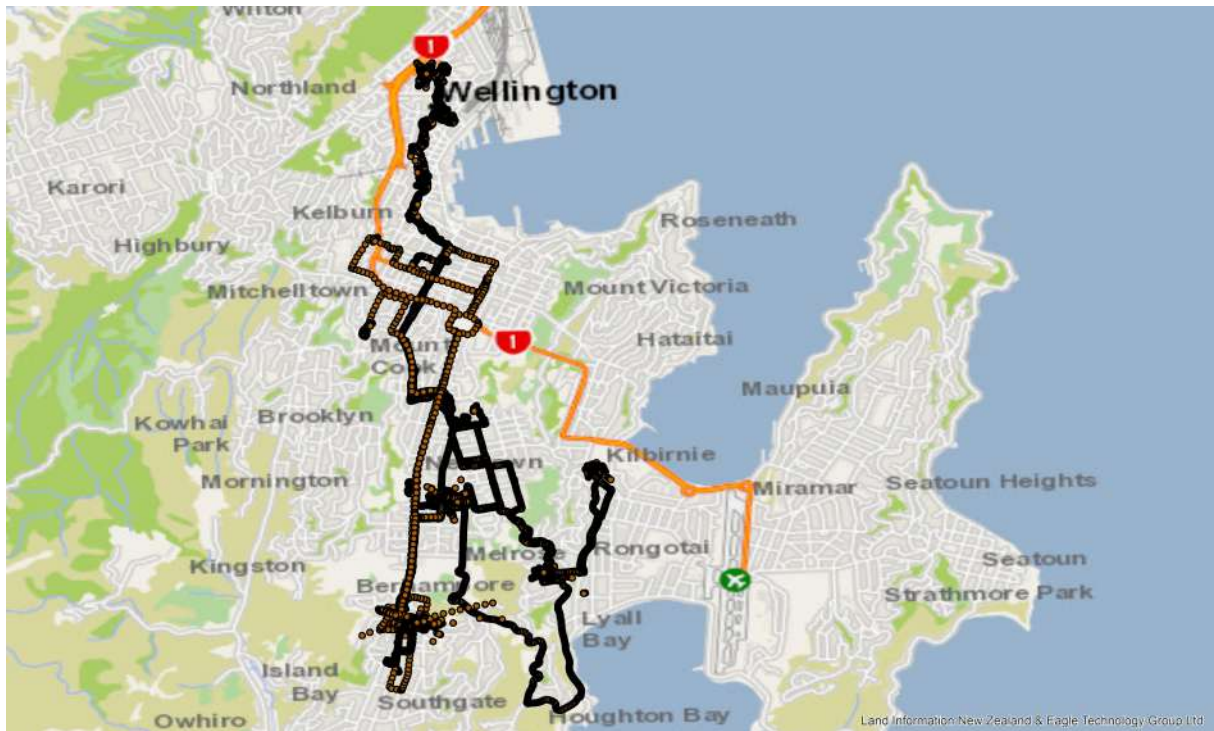
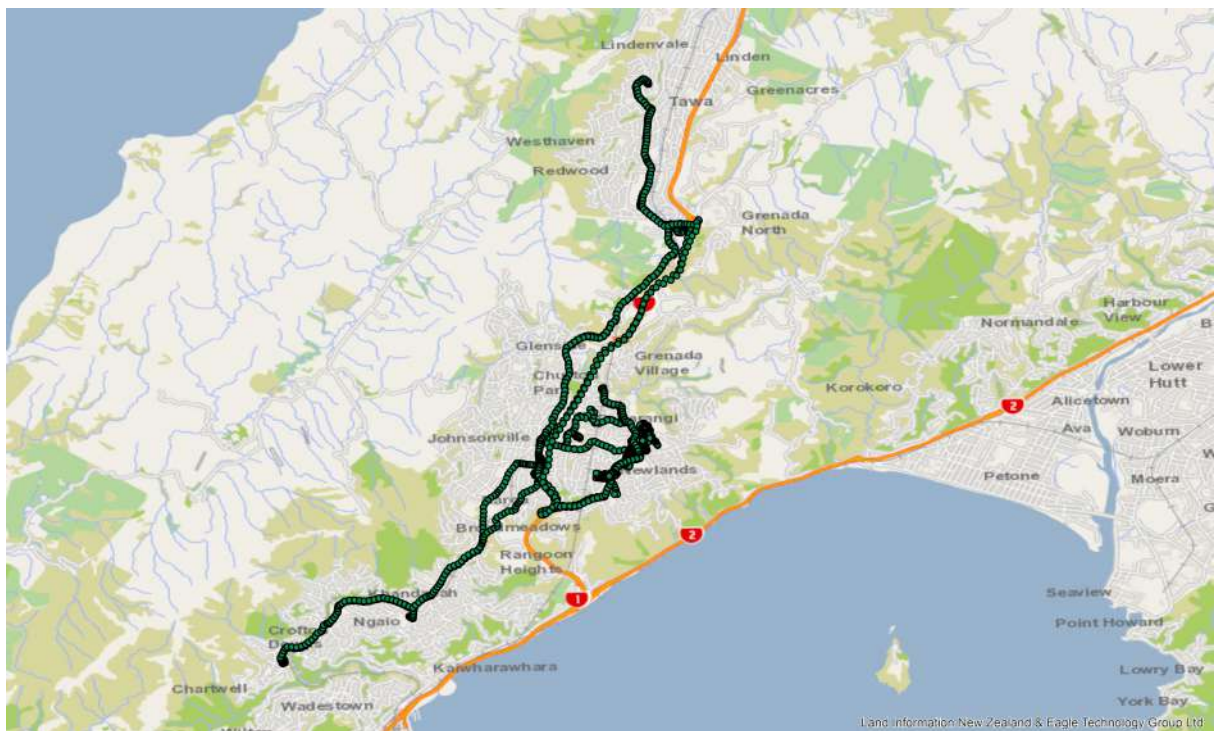


Figure 3A. Map of GPS data collected by student 3 on 7-10<sup>th</sup> August 2014



Figure 4A. Map of GPS data collected by student 4 on 7-10<sup>th</sup> August 2014





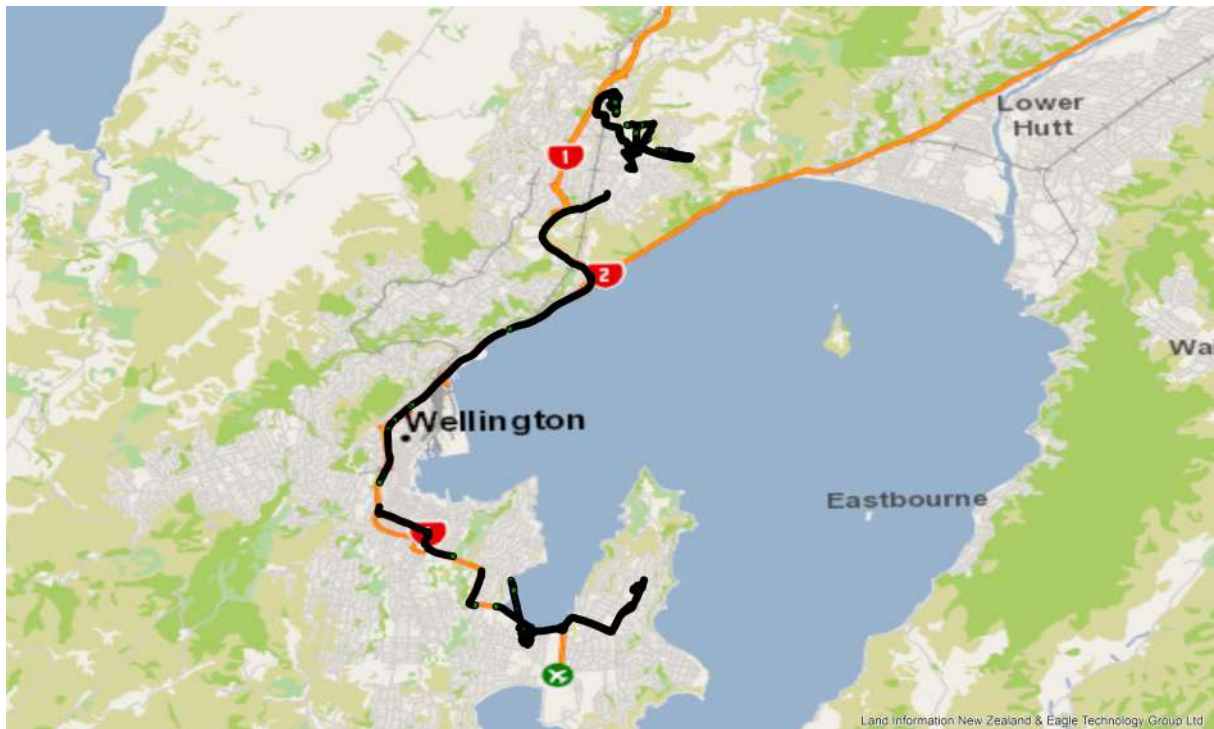


Figure 7A. Map of GPS data collected by student 7 on 21-24<sup>th</sup> August 2014

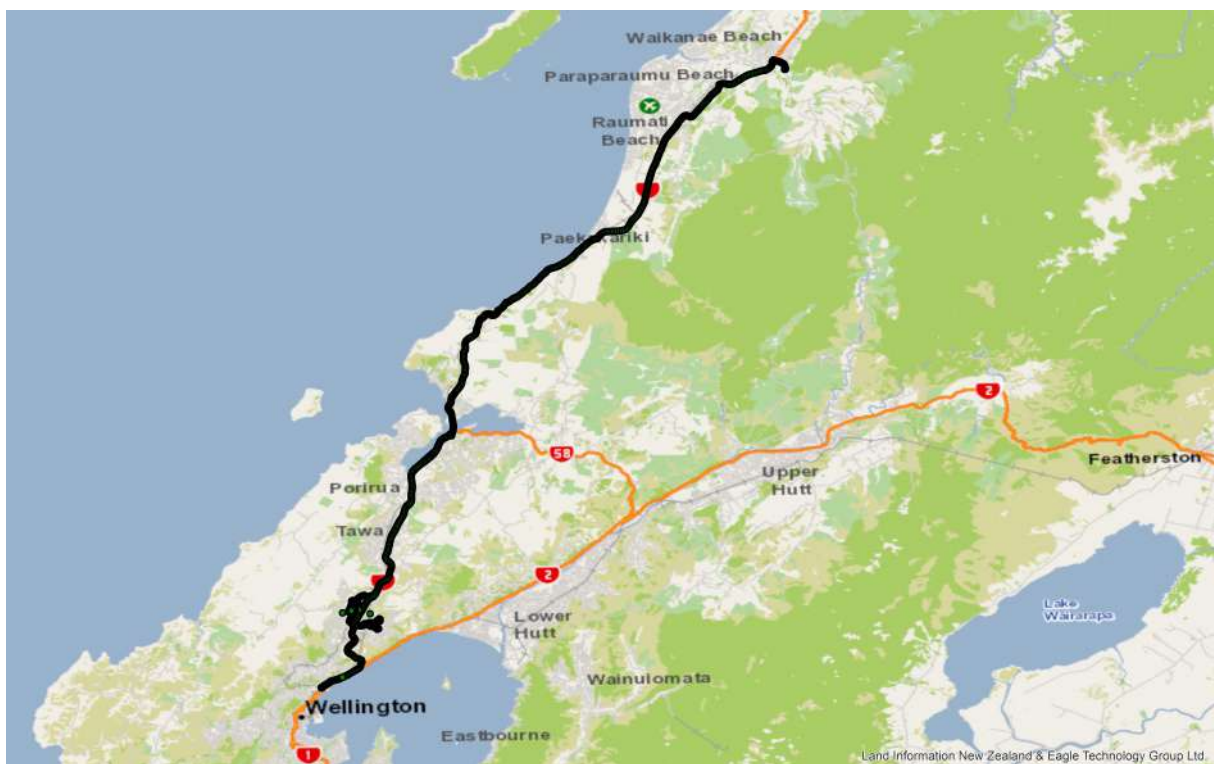


Figure 8A. Map of GPS data collected by student 8 on 21-24<sup>th</sup> August 2014



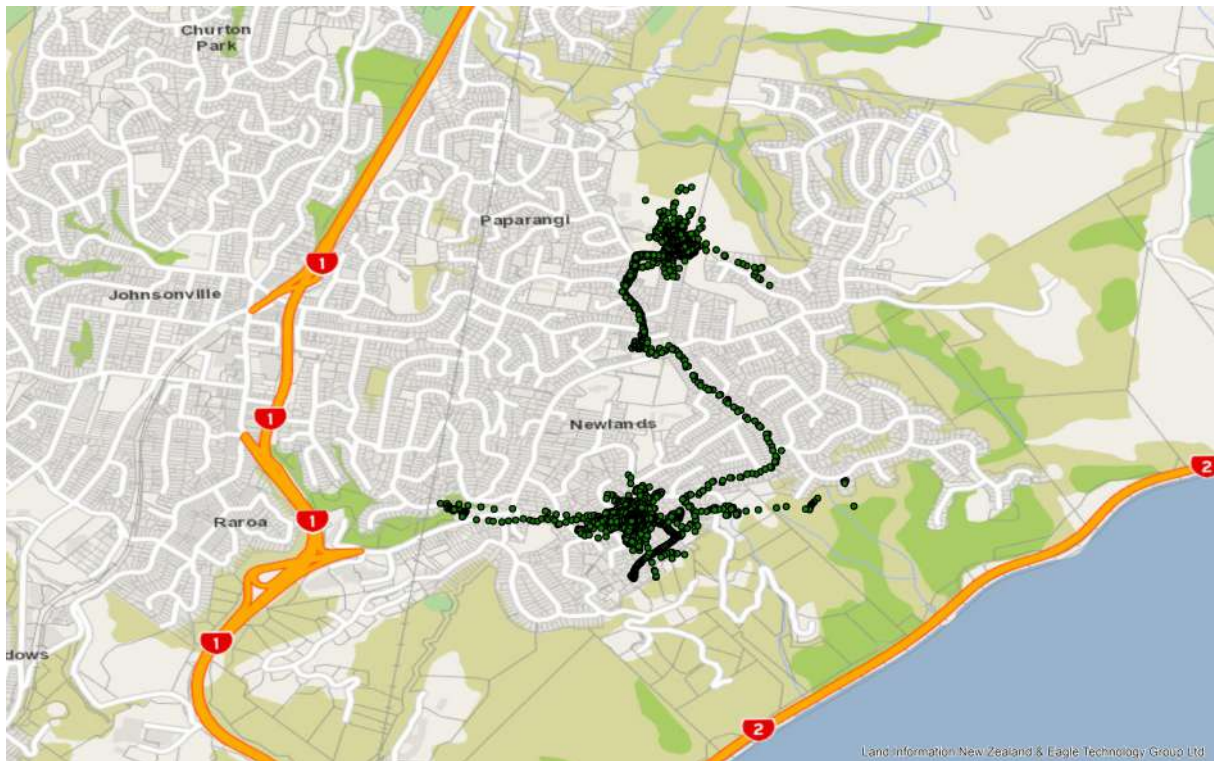


Figure 9A. Map of GPS data collected by student 9 on 21-24<sup>th</sup> August 2014

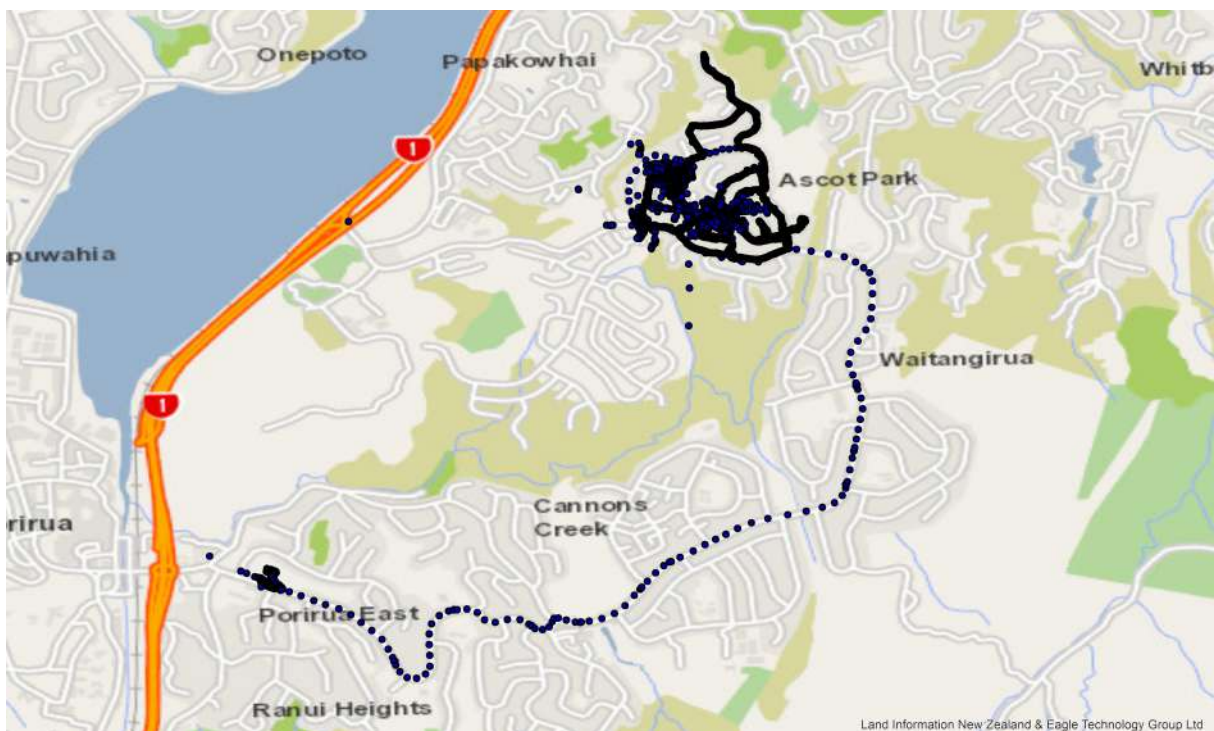


Figure 10A. Map of GPS data collected by student 10 on 14-17<sup>th</sup> August 2014

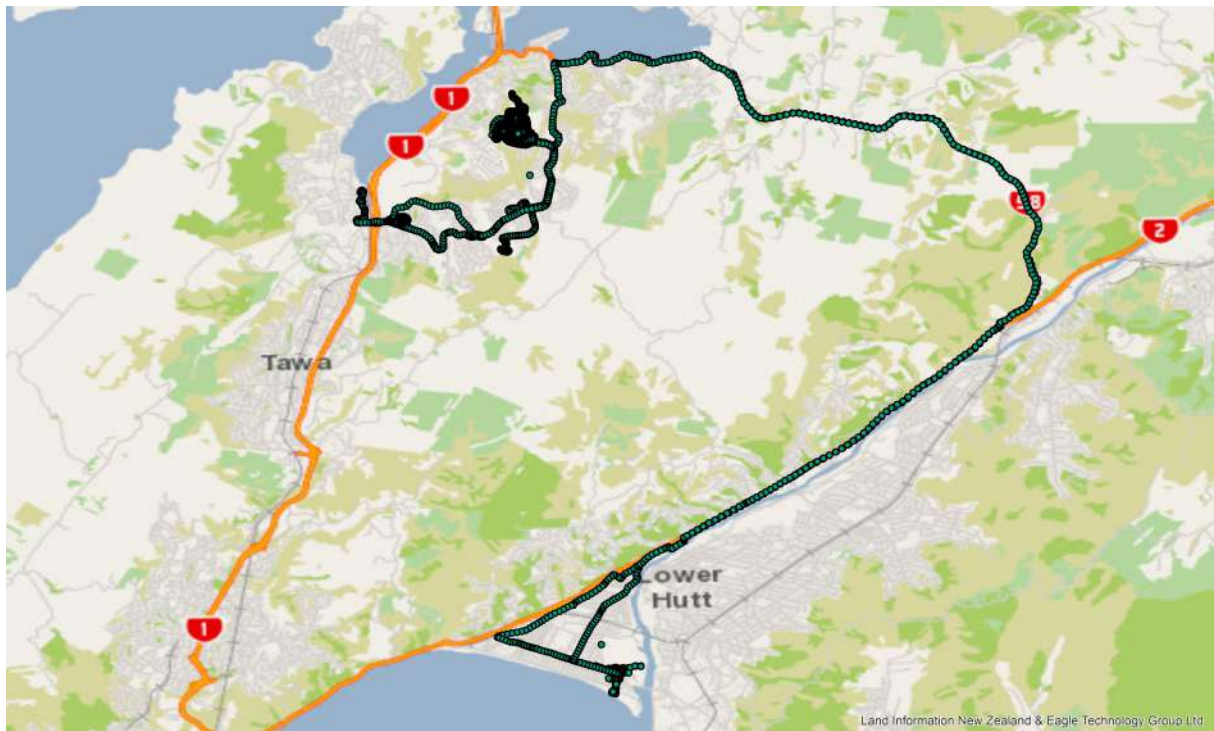


Figure 11A. Map of GPS data collected by student 11 on 14-17<sup>th</sup> August 2014



Figure 12A. Map of GPS data collected by student 12 on 14-17<sup>th</sup> August 2014



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