

Hi Viz: The Way to G(I)o?

*An Investigation of Motorcycle Rider Use of and Attitudes Towards
High Visibility Gear*



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ABSTRACT

Introduction

The use of and attitudes towards high visibility gear (HVG) among motorcyclists is a pressing issue. There are a disproportionate number of motorcycle deaths and crashes (last year in New Zealand there were 50 and 1300 respectively) compared with other vehicles. There is some evidence that high visibility gear decreases the risk of motorcycle injury, but the current attitudes towards high visibility gear in the motorcycling community is mixed. There is currently no legislation regarding HVG and motorcycles in New Zealand.

Methods

A literature review was carried out looking at previous quantitative and qualitative data around this subject. Quantitative data collection included roadside observation of motorcycle apparel, and on-the-street and online surveys. To gather qualitative data, we carried out an analysis of an online motorcycle forum, and had face-to-face interviews with key informants.

Results

We found that the use of HVG among motorcyclists was not widespread. From observation data, it was seen that 38% of motorbike riders and 33% of scooter riders wore no form of HVG on their helmet or jacket. The survey found that 50% of motorbike riders and 42% of scooter riders never wear any HVG. Some of the attitudes towards HVG from motorcyclists were positive, however the common barriers to wearing HVG identified were image, cost, practicality and availability. There was also a prevailing attitude that HVG does not improve safety and it is the other road users who are at fault.

Conclusions

There is some evidence that shows that HVG can improve motorcyclists' safety, but the use of HVG is currently low. The most important barriers to wearing HVG that motorcyclists identified were cost, image and practicality. These need to be considered when designing new gear. For a change to occur, an attitudinal shift is required before any legislation is introduced. Further research is needed to determine how effective HVG is, and to look at any alternate options for improving motorcycle safety.

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INTRODUCTION

A New Zealand study recently indicated that low motorcycle conspicuity might increase the risk of motorcycle crash related injury (1). Recent changes to the New Zealand legislation have influenced the visibility of the motorcycle itself (headlights must be permanently on for bikes manufactured after 1980). Wearing High Visibility Gear (HVG) while motorcycling could assist in making motorcyclists easier to see, thereby enhancing motorcyclist safety and reducing death and injury.

In 2011 the New Zealand Transport Agency (NZTA) identified potential approaches to improve rider safety gear use (2). This included promotion and education by agencies and motorcycle groups on the importance of protective gear to both sellers and buyers (e.g. high visibility jackets, lighter coloured helmets). However, before a strategy to encourage behaviour change is implemented, a greater understanding on the use of and the attitudes towards HVG will help to ensure interventions are successful. A review of the qualitative and quantitative literature on HVG and motorcyclists highlights our current knowledge and forms the background of this study.

AIMS AND OBJECTIVES

The aim of the study was to investigate the current use of and attitudes towards HVG in Wellington motorcycle riders. There is some evidence that HVG decreases the risk of crash injury (see introduction), and current guidelines in New Zealand advise that it be worn. However, the use of HVG amongst motorcyclists was thought to be low. We intended to quantify the use of HVG in Wellington motorcyclists. Furthermore, we intended to investigate the attitudes that motorcyclists have towards different types of high visibility clothing, and identify the main barriers that prevent the widespread use of HVG. In the process we hoped to find a 'tipping point': the level of 'high visibility' that motorcycle riders would be happy to wear, which would ultimately improve HVG uptake and rider conspicuity.

BACKGROUND

Quantitative Literature

Road traffic injury contributes a significant proportion of the total burden of disease in New Zealand (3). It is the second highest cause of years of life lost in New Zealand males – second only to ischaemic heart disease (3). In relation to comparable countries, New Zealand has one of the highest road traffic death rates per capita. Motorcyclists comprise between 10% and 15% of all road injuries and deaths (3) and, therefore, bear a disproportionate burden of injury on New Zealand roads.

Motorcyclists are a vulnerable group in terms of road fatalities and injuries. There were 50 motorcyclist deaths and 1,300 injuries in road crashes in New Zealand during 2010 which equates to 13% of all deaths and 9% of all reported injuries on our roads (4). This is disproportionately high given Motorcycles account for only 5% of New Zealand's licensed vehicles (5). Motorcyclists have been shown to be 23 times more likely than car drivers to be involved in a crash causing fatalities/injuries in New Zealand (4).

Similar statistics have been found in other countries. In the United States, motorcyclists accounted for 13% of total traffic fatalities in 2007, even though motorcycles make up only 3% of all registered vehicles and contribute to only 0.4% of all vehicle miles travelled (6). In the United Kingdom, motorcyclists make up less than 1% of traffic, yet they suffer 14% of total deaths and serious injuries on the roads (5). This makes them 28 times more likely to be killed or seriously injured than car drivers.

From our literature review we gained some information on how Maori motorcyclists compare with their rates of fatalities and injuries. The Ministry of Transport does not do any population standardisation. The ethnicity recorded on crash report forms is police reported (and therefore, may not always be self selected) and is limited to one category, so may not be directly comparable to population data. However from the data we received we could do some rough comparisons. The data shows that Maori form a bigger proportion of motorcycle deaths (19% of those with known ethnicity) than they do for serious (11%) or minor accidents (9%). The high figure for fatal crashes indicates that Maori are likely over represented, whereas for injuries they may even be a little under represented. To comment properly we would need to know the percentage of motorcycle riders that are Maori. Nonetheless, this pattern of Maori

making up a higher proportion of deaths compared to injuries is also true for road crash casualties generally.

Several studies agree that the majority of motorcycle accidents involve collisions caused by another vehicle violating the right-of-way of the motorcycle at an intersection, usually by turning left in front of the oncoming motorcycle. (5)(7)(8). In most situations it has been determined that the vehicle driver did not see the motorcyclist (5)(6)(7)(9)(10). This has been termed the 'looked-but-did-not-see phenomenon', when there is no explanation as to why the driver did not see the motorbike (5)(11). It has been shown that about half of motorcycle accidents are due to a road user failing to see the motorcycle (8)(10). Of these accidents, 72% were caused by drivers failing to detect the motorcycle and 20% were decision errors where the motorcycle was detected, but they decided to proceed due to errors of judgment relating to speed/distance (8). There seems to be a distinctive problem with other road users seeing motorcyclists, particularly at intersections and this has been linked to conspicuity of motorcyclists by many studies (5)(7)(11)(8)(9). It is believed that motorcycle conspicuity can be increased by a few different mechanisms, such as turning headlights on during the day and wearing high visibility and brightly coloured clothes and helmets (7)(11)(12). Numerous studies have proven that high visibility gear can improve conspicuity (8)(13)(7)(10).

Other studies are more ambiguous. A study performed in Israel indicated that rather than just wearing bright colours and high visibility gear it was more important to wear something that provided contrast with the background in order to maximise chances of being seen (13). It was found that reflective and white outfits increased visibility in urban areas where the background was more complex and multi-coloured. However, black clothing had an advantage on inter-urban roads where the background was solely bright sky. This suggests that conspicuity can be improved by wearing appropriate clothes that will distinguish the rider from the background environment (13). Other studies have suggested that wearing gear that contrasts with the background environment is a good way of manipulating conspicuity (12). Most motorcycle injuries and fatalities in New Zealand occur in urban areas (4032); however rural injuries and fatalities are also very significant, with 2335 from 2006 to 2010. New Zealand's rural environment is obviously very different from that of Israel's, so it is important to look at data from studies carried out in New Zealand. One such study, by Wells et al (1), showed

that motorcycle riders wearing reflective or fluorescent clothing had a 37% lower risk of motorcycle crash related injury than other riders. Wearing a white helmet was also associated with a 24% lower risk compared with black helmets. Self reported light coloured helmet versus wearing a dark coloured helmet had a 19% lower risk (1). No association was found between risk and frontal colour of drivers' clothing or motorcycle in this study, however another study by Hurt et al (7) found that using upper torso garments of a high visibility colour could contribute to conspicuity.

Even when riders are wearing high visibility gear, accidents can still occur; over 12% of cases in one study (5). However given the range of evidence it seems that encouraging motorcyclists to wear bright, fluorescent and reflective gear may be a cheap and effective way to decrease injuries and fatalities on our roads. Nevertheless, this safety measure was found to be uncommon, compared with having daylight headlights on, in a study performed in England (5). Only 14% of the respondents always or frequently chose to wear bright and/or reflective clothing with 15.6% stating that being visible was the least important factor to prevent accidents. Only 9.8% believed that being visible was the most important factor (5). It would be very useful to find out about the opinions of New Zealand riders towards high visibility gear.

Qualitative Literature

There is a growing understanding in road user safety research, policy and practice of the importance of attitudes, values and beliefs in determining how people perceive risk on the road and hence their road user safety behaviour (14). In a study from the UK, motorcyclists tended to admit that motorcycling was a risky activity. In psychometric studies "Risk takers" and "Sensation seekers" are the groups correlated with negative safety attitudes (15). However in the UK study motorcyclists stated that they had acquired skills to deal with the risk and felt it was both a calculated and controllable risk (14). Motorcyclists also noted that safety was a high priority and this was part of their identity (14).

Although it has been demonstrated that the safety awareness among motorcyclists is high the use of HVG is thought to be low (16). In a Swedish study only 10 % said that they always use a high visibility vest, a third uses the vest sometimes and just over half said that they never use a high visibility vest. Even if the respondents did not use high visibility vests on a regular basis, a majority believed that a high visibility

vest makes a motorcycle rider more visible and therefore believe that the high visibility vest is good for road safety.

Themes such as image, cost, availability and practically have all been voiced as potential barriers to the adoption of high visibility gear with motorcyclists (17)(5). Another theme is the belief that other factors that cause crashes may be more important such as even if high visibility gear was worn that other road users would not see the motor cyclists (5). Motorcyclists are believed to have a strong social identity and autonomy especially when it comes to authority figures, such as the police and the government (14). It is thought that safety consciousness is mainly created and shaped in the motorcycle community and engaging bikers could facilitate a positive behaviour change (16).

DEFINITIONS

There are some key terms that need to be defined in our research. We defined high visibility gear (known from now as HVG) using criteria developed from the American National Standard for High-Visibility Safety Apparel and Headwear (18). The American National Standards Institute, Inc constructed these guidelines. We developed a modified set of criteria that was used in the survey and observation parts of the study. These criteria were based on the colour of the jacket and helmet, and the presence of reflective material (with a cut-off of 20cm² between 'some' or 'widespread' reflective material). HVG was anything that was not 'dark/black' as defined by the criteria (see Figure 1 and 2- on the following page).

Another important definition is that of 'motorcyclists'. In this study, we defined a motorcyclist as either a 'scooter rider' or a 'motorbike rider'. A scooter was defined by the presence of a footboard (as opposed to separate foot rests) and the lack of a continuous central body (as seen in motorbikes).

Given the restricted timeframe we think that this study works best as a *pilot study*, which gives insight into current attitudes and barriers towards and use of HVG by motorcyclists. Our findings could be used to inform further, more definitive research.

Figure 1 – Criteria for visibility of jacket

Category	A	B	C	D	E	F	G	H	I
Background material	Dark /Black	Dark/Black	Dark/Black	Light/Bright	Light/Bright	Light/Bright	Fluorescent	Fluorescent	Fluorescent
Reflective material	None	≤20cm ²	>20cm ²	None	≤20cm ²	>20cm ²	None	≤20cm ²	>20cm ²

Figure 2 – Criteria for visibility of helmet

Category	J	K	L	M	N	O
Background material	Dark /Black	Dark/Black	Light/Bright	Light/Bright	Fluorescent	Fluorescent
Reflective material	None	Present	None	Present	None	Present



Figure 3 Pictorial Examples of the Visibility Scale

GENERAL STUDY METHODS

Ethics Approval

Before we began researching we obtained ethical approval from the University of Otago Human Ethics Committee. The application (in Appendix 5) outlined our aims, methods and had a discussion of potential problems we might face with our data collection.

Literature Review Method

The qualitative and quantitative literature review used the key search terms 'high visibility', 'motorcycle', 'accident', 'conspicuity', 'attitudes', 'quantitative' and 'qualitative' to identify studies published up until 2012. The electronic databases used were MEDLINE/PubMED and Google Scholar. Inclusion criteria were studies of any design that evaluated or presented data on the use of and attitudes towards high visibility and motorcycling as well as motorcycling accidents. There were no exclusion criteria. For the study selection two researchers screened titles and abstracts received from electronic searches against inclusion criteria. Two researchers worked independently on the separate 'qualitative' and 'quantitative' arms of the study to extract relevant data.

QUANTITATIVE STUDY METHODS

Observation Methods

We observed traffic flow at five different locations, with seven observation periods total. These were: Adelaide Rd, Tuesday 4:30-6pm and Friday 4:30-6pm; Vivian St, Thursday 8-9:30am; Customhouse Quay, Friday 8-9:30am; Paterson St, Tuesday 4:30-6pm and Thursday 8-9:30am; and Cable St, 4:30-6pm. These arterial roads were chosen to cover the major entrances and exits to the Wellington CBD, while also maximising sample numbers to produce useable data. These times were chosen as they are commuter times; therefore maximizing sample size. A maximum of seven observation periods were possible due to the time constraints of the project.

We collected data using two observers simultaneously grading the traffic, and then conferring on the result. Any results that could not be agreed upon were removed from the data set. The motor vehicles were assessed for the following characteristics: motorcycle or scooter; jacket visibility; helmet visibility. Jacket and helmet visibility (See Figures 1 – 3) were assessed using the scale developed for this study. This scale

was piloted in this study (see Aims and Objectives). Information was assessed for each session by weather conditions, graded as sunny, cloudy or wet.

Survey Methods

We collected part of the project's quantitative data through surveys, in which we aimed to gather information on motorbike and scooter rider's use of and opinions surrounding HVG. We distributed the surveys in two ways: to the riders using survey monkey on Kiwibiker (an online biker forum for bikers New Zealand wide) and also face-to-face in Wellington CBD. Posting the survey on the on-line forum enabled us to gather opinions from bikers around New Zealand (not just the Wellington region) in a time-efficient manner. The face-to-face surveys involved us approaching motorbike and scooter riders in Wellington CBD in the morning between 8 and 9am and again between 4.30 and 6 pm (targeting the rush hours). This took place mainly at motorcycle parking stands as riders got on and off their motorbikes/scooters. This was the best opportunity to talk to the greatest number of riders and ask them to fill out a physical version of the survey. We also completed surveys at an organized motorcycle charity ride gathering at midday on Waitangi Day.

The survey included questions on the rider's background details: age, gender and bike description (scooter, motorbike <600cc, motorbike >600cc). With regards to current use of HVG, we asked participants to evaluate what best represented their current usual riding attire. In the face-to-face surveys this was done getting the participant to compare their attire against an exemplar photo chart. This chart showed jackets and helmets on a graduated range from completely black to black with reflective parts to white attire and eventually to completely fluorescent. The online survey prohibited the use of the photos so instead we described the same options in words. For example: dark / black with no reflective material, or light / bright with minimal reflective material (<20cm squared), or fluorescent with reflective material (>20cm squared). For the full scale see the appendices. We asked how often they used HVG (never, occasionally, half of the time, most of the time, all of the time) and which description (online) or photo (in person) best represented the extent or 'tipping point' of which they would be willing to wear. Finally, we asked participants what they considered were the main barriers to wearing HVG, with suggested options including cost, retail availability, image, awareness, culture and practicality. We also had an "other" option that allowed participants to list barriers we had not thought of.

QUANTITATIVE RESULTS

Observation Findings

There was a sample of 542 motorcycles and scooters, collected over 7 observation sessions lasting 90 minutes each. The observation locations are shown below.



Figure 4 Locations of and Motorcycle Numbers Observed

Of the 542 vehicles observed, 247 were motorcycles (45%; 95% CI: 41.4% - 49.8%) and 295 scooters (55%; CI: 50.2% - 58.6%). Tables 1 and 2 show the breakdown of jacket and helmet types respectively (for letter meaning, see Figures 1 - 3 that define our 'high visibility' scale).

Table 1 - Visibility of jackets worn by motorcyclists

TOTAL	A	B	C	D	E	F	G	H	I
MOTORCYCLE	149	35	11	20	6	1	3	0	22
% of MCs	60%	14%	4%	8%	2%	0%	1%	0%	9%

SCOOTER	174	15	9	66	3	2	4	1	21
% of S's	59%	5%	3%	22%	1%	1%	1%	0%	7%

Table 2 - Visibility of helmets worn by motorcyclists

TOTAL	J	K	L	M	N	O
MOTORCYCLE	146	14	69	13	2	0
% of MCs	59%	6%	28%	5%	1%	0%
SCOOTER	178	9	93	10	2	2
% of S's	60%	3%	32%	3%	1%	1%

Due to a methodological error, only 342 of the 542 data points could be analysed in terms of both jacket and helmet. Therefore the data with information regarding both jacket and helmet is from a pool of 342 riders.

We found that the percentage of motorbike riders and scooter riders who wore both a black unreflective helmet and a black unreflective jacket were 38% (CI: 30.4% - 46.6%) and 33% (CI: 26.6%-39.3%) respectively. Reflective material present on either helmet or jacket was observed in 32% (CI: 24.9% - 40.6%) of motorbike riders and 22% (CI: 16.6% - 27.9%) of scooter riders. Both motorcyclists and scooter riders had similar rates of wearing fluorescent apparel, at 10% (CI: 6.0% - 16.3%) and 11% (CI: 7.0% - 15.5%) respectively. In addition, we found that scooter riders wore coloured apparel more frequently (62% CI: 55.4% - 68.6%) than motorbike riders (48% 95% CI: 40.2% - 56.9%), a result that was statistically significant (RR = 1.28, p = 0.01).

In terms of changes in apparel pattern with weather, there was an increase in wearing of fluorescent, reflective jackets during sunny days (10% [95% CI: 6.8-13.3%] versus 4% [95% CI: 2.0-7.4%] on cloudy days; RR = 2.36, p = 0.014). There was also an increased rate of wearing reflective clothing during the morning than the evening (23% [95% CI: 16.3-31.6%] versus 14% [95% CI: 10.1-19.2%] respectively; RR = 1.64, p = 0.03).

Survey Findings

On The Street Survey

In response to approaching people on the street and asking them to complete the survey, we gathered 62 surveys in total. Note that the data on those who ride >600cc and <600cc was grouped together as “motorbike riders” because of minimal data on the <600cc group (only 7 respondents in this group, compared to 33 on >600cc motorbike and 22 on scooter).

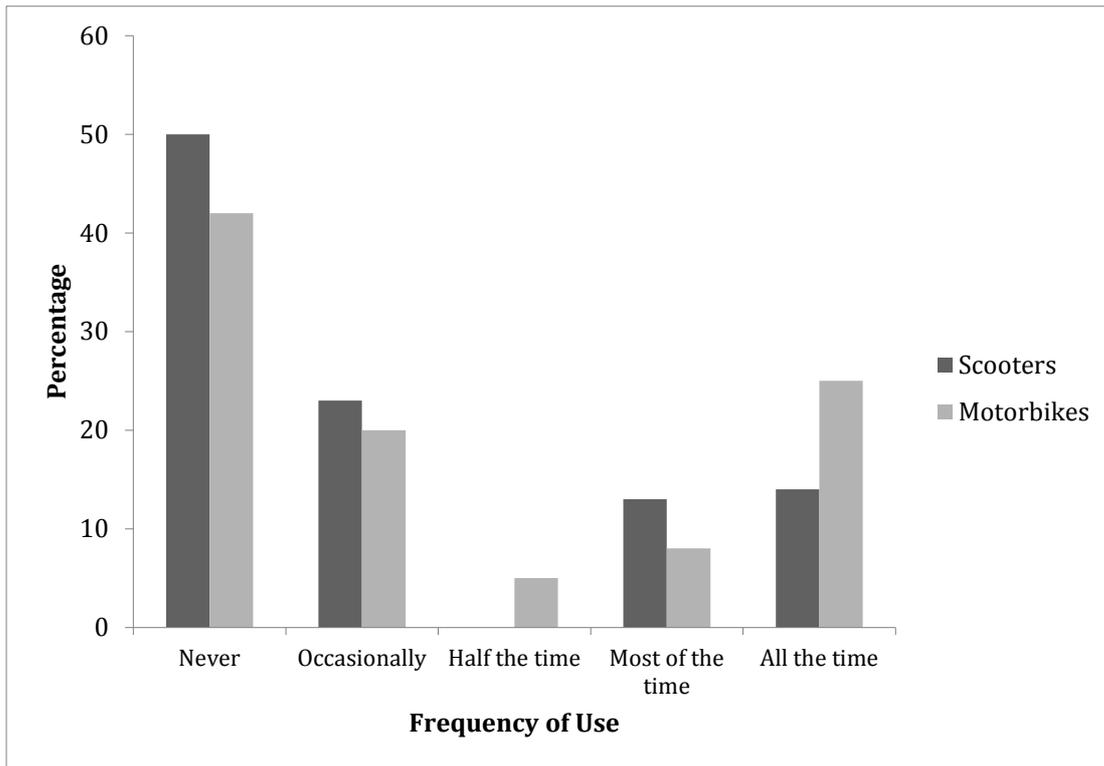


Figure 5 Current Use of HVG by Scooter and Motorbike Riders

Figure 5 compares the current use of HVG between scooter riders and motorbike riders surveyed on the street. The greatest numbers of riders in both groups “never use HVG” (50% for scooters and 42% for motorbikes). Interestingly, the next greatest number of responses for motorbike riders was that they wear HVG “all the time”. A larger proportion of motorbike users use HVG “all the time” than scooter users, who appear to favour wearing HVG more “occasionally”.

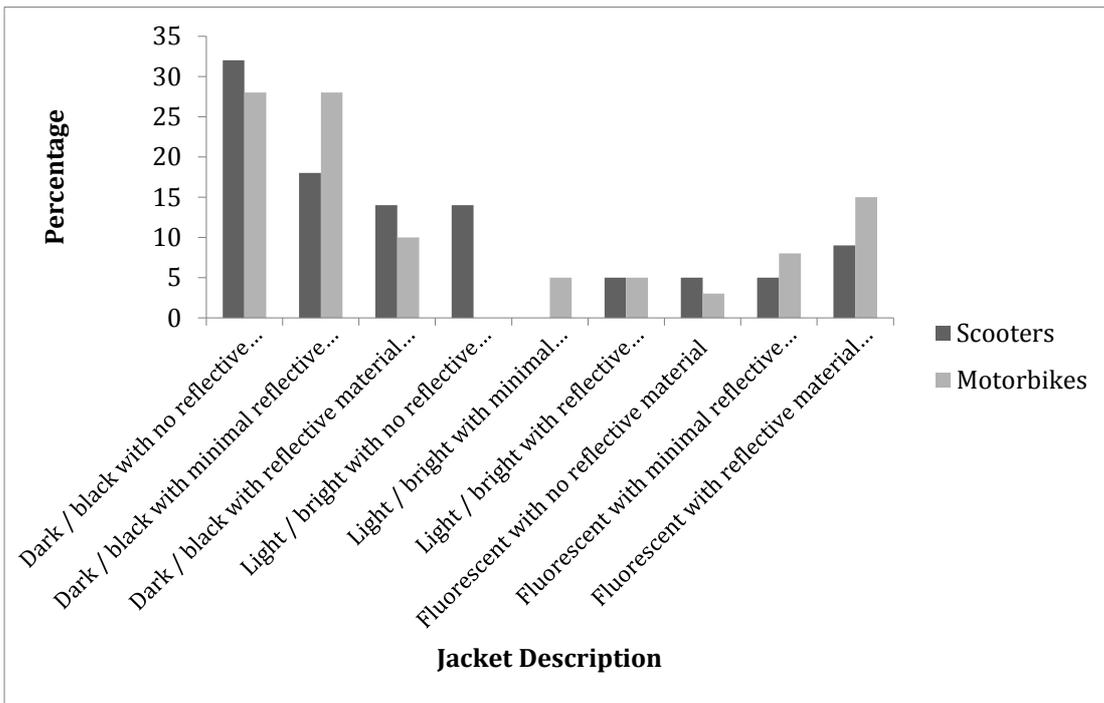


Figure 6 Current Jacket use by Scooter and Motorcycle Riders

Figure 6 shows what jackets riders are currently wearing as a gradient from all black to completely fluorescent, comparing scooter riders with motorbike riders. The greatest number of responses was for dark black clothing with no reflective material.

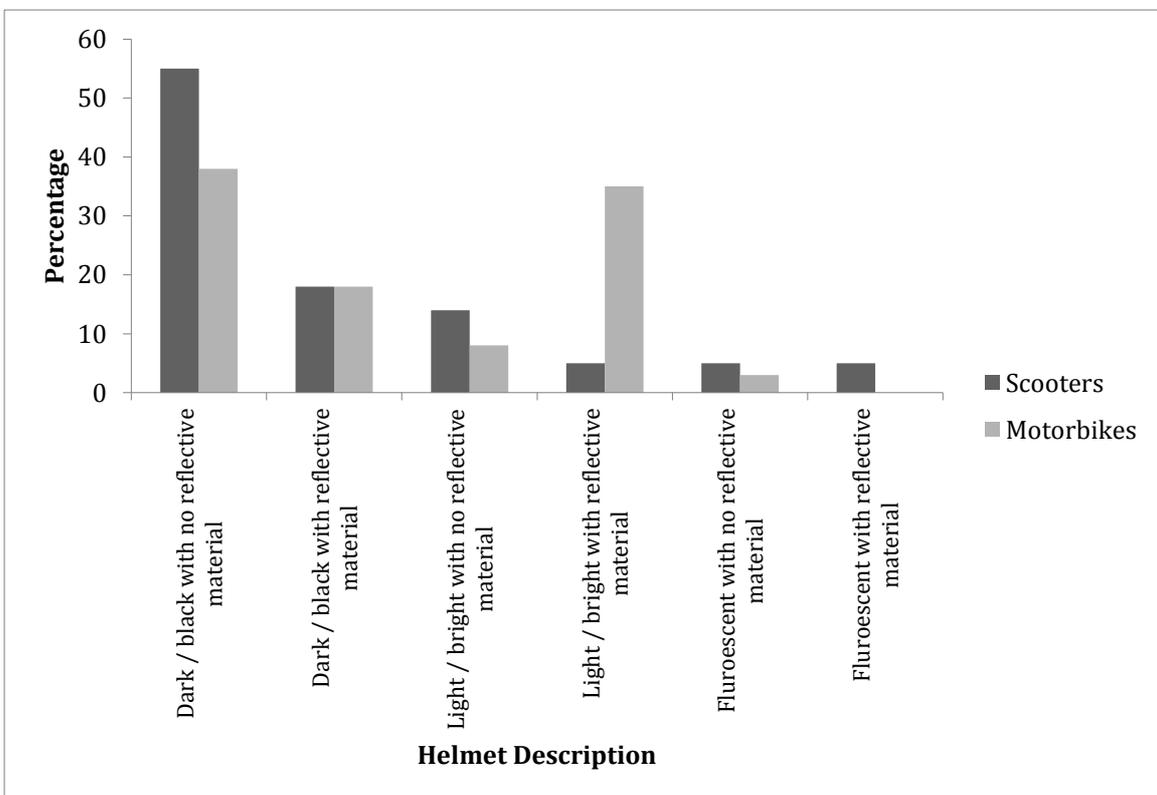


Figure 7 Current Helmet Use by Scooter and Motorcycle Riders

Figure 7 shows what helmets riders are currently wearing (from all black to completely fluorescent), comparing scooter riders with motorbike riders. The most commonly worn helmet in face-to-face surveys was dark black with no reflective material.

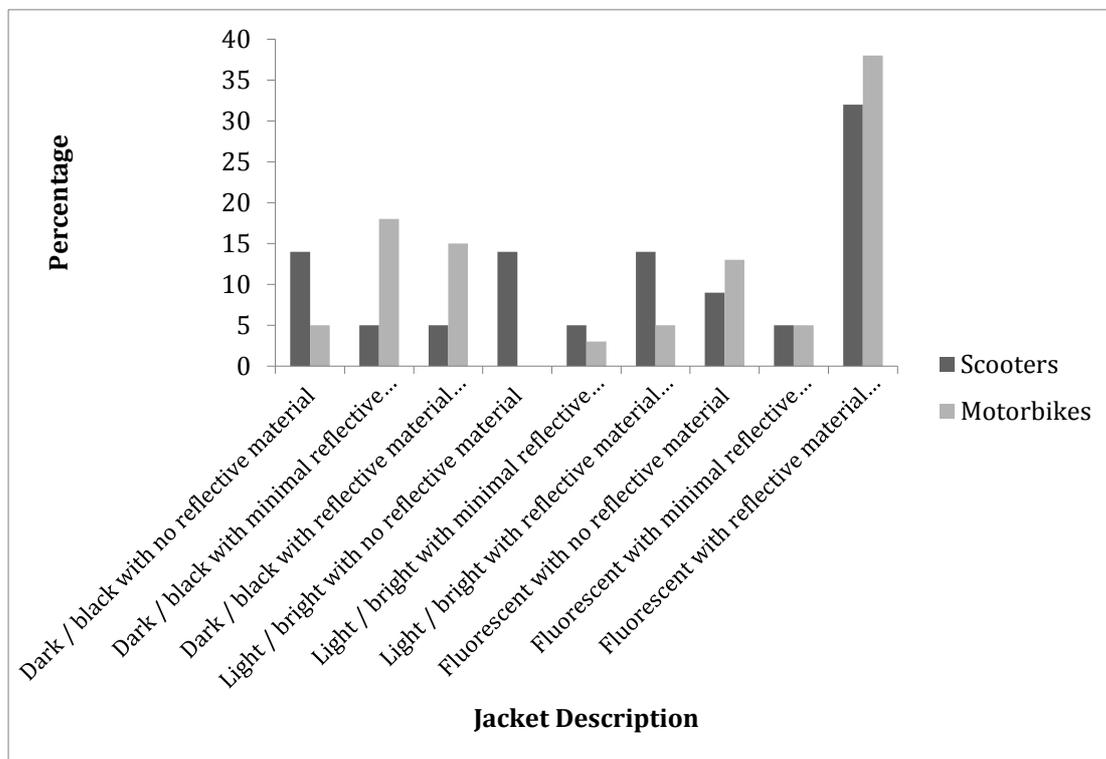


Figure 8 Jackets that would be considered by Scooter and Motorcycle Riders

Figure 8 shows what jackets riders would consider wearing as a range from all black to completely fluorescent, comparing scooter riders with motorbike riders. This is the “tipping point”, meaning what they consider to be the maximum amount of high visibility gear that the riders would use. Fluorescent with reflective panels (the “most” high visibility item) was the most popular item with both groups.

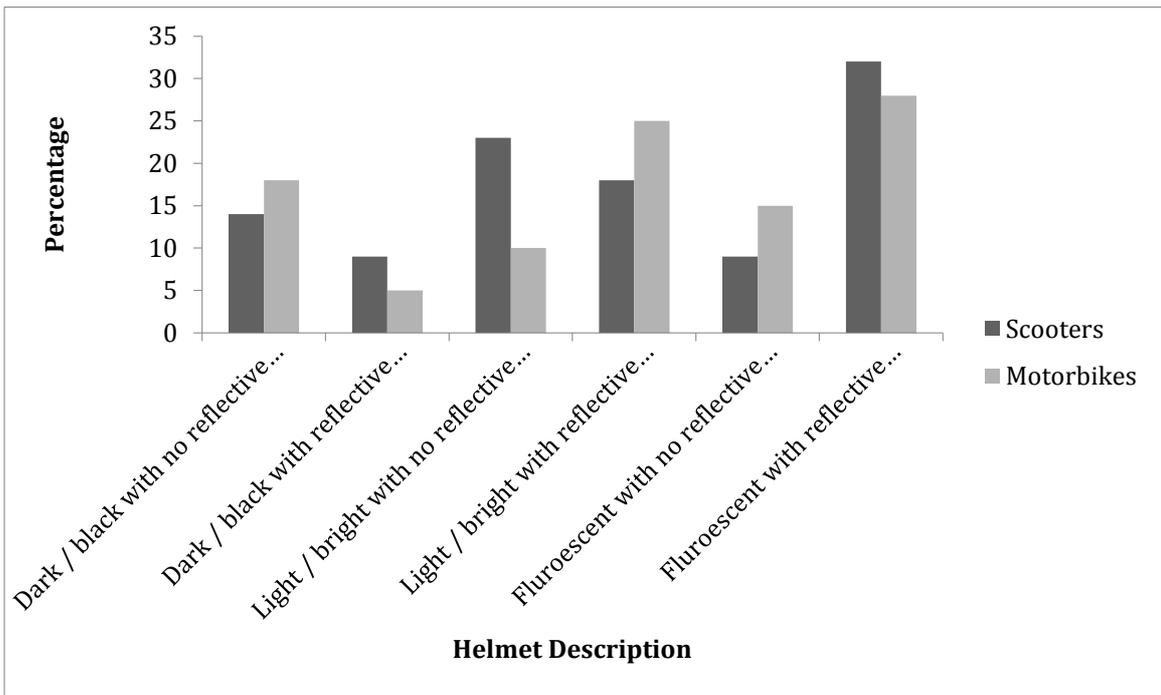


Figure 9 Helmets that would be considered by Scooter and Motorbike Riders

Figure 9 shows what helmet riders would consider wearing as a range from all black to completely fluorescent, comparing scooter riders with motorbike riders. The most popular “tipping point” for what helmets riders would opt to wear was the fluorescent helmet with reflective aspects.

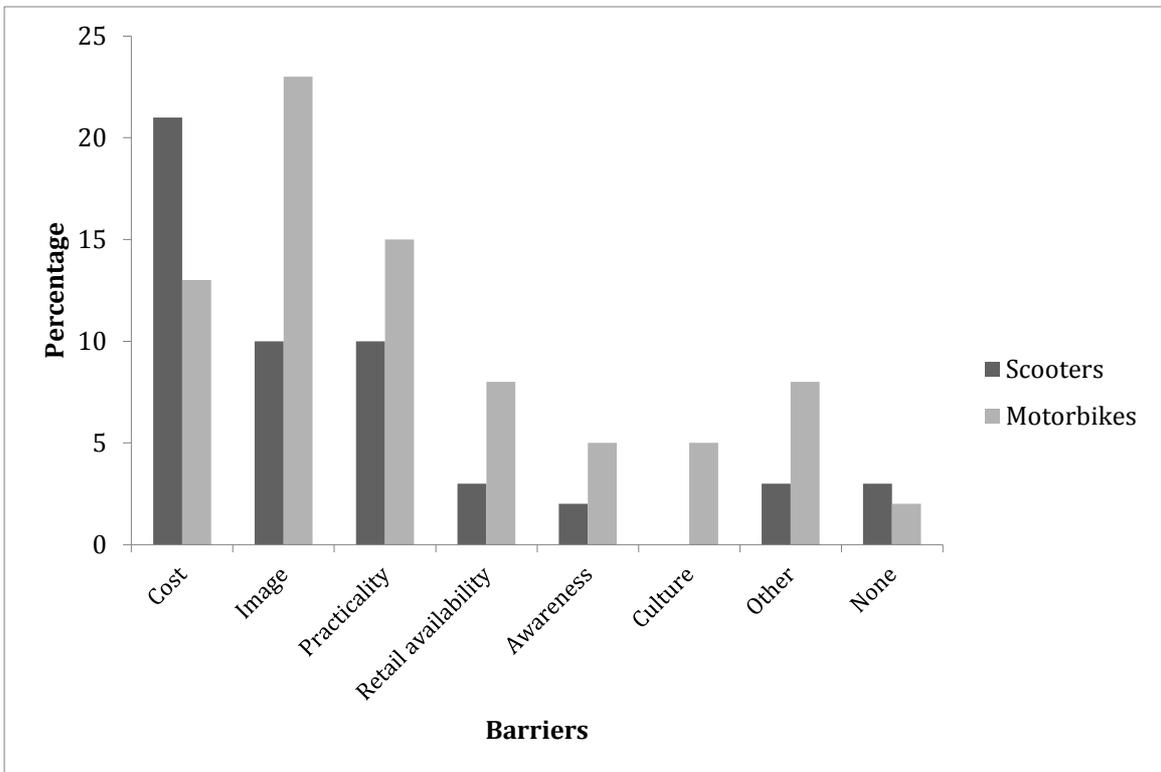


Figure 10 Barriers to the use of HVG in Motorcyclists

Figure 10 shows the barriers identified by riders as possible reasons to not use HVG. The largest identified barrier for scooter users was cost, whereas this rated third most popular amongst motorbike riders. Motorbike riders rated image as the main barrier, followed by practicality. Note that participants in both the on-the-street survey and the online survey were encouraged to select as many barriers as they considered applicable.

Comparing male and female data from on-the-street surveys we discovered a few trends (refer to Appendices for figures 11 - 16). Current use of HVG between male and female are relatively similar, however females have a slightly higher rate of wearing HVG all the time, whereas males have a higher rate of never wearing HVG. Breaking that down into more detail, both male and female mostly wear jackets and helmets that are dark black with no reflective material. Overall, males have a higher rate of considering to wear the “most” high visibility option with the fluorescent jacket with reflective material (>20cm²). Identified barriers to wearing HVG seemed to differ between males and females. Females rank image and cost as their first and second greatest barriers respectively, whereas males rank cost and practicality as the greatest barrier towards use of high visibility gear.

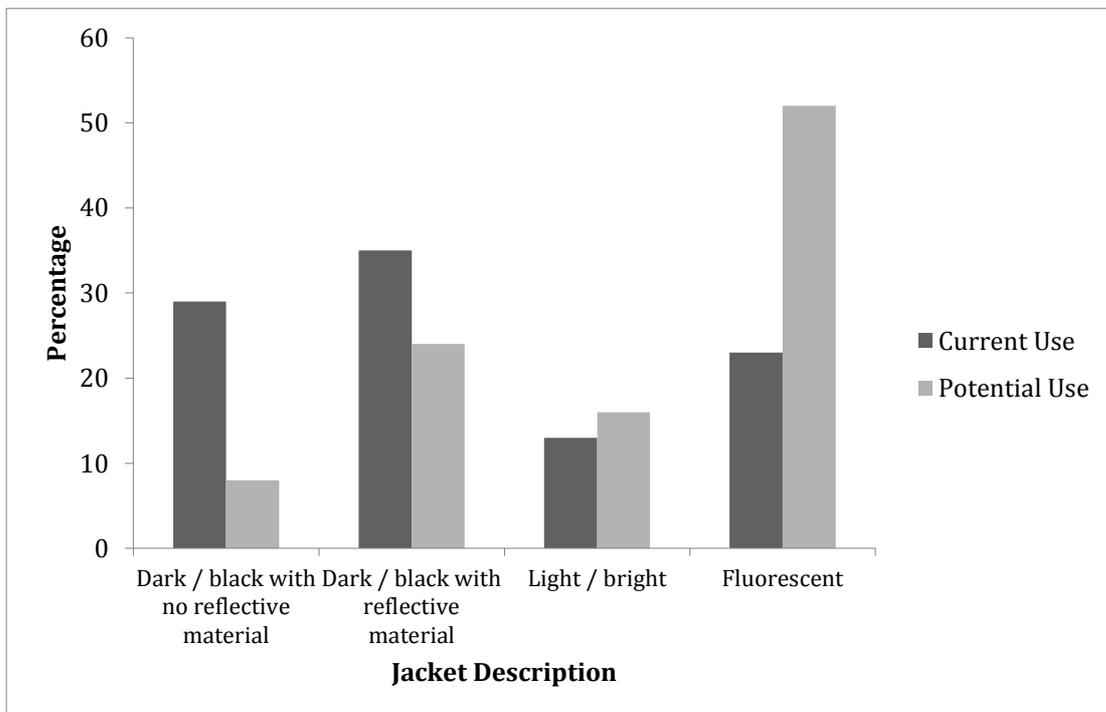


Figure 17 Comparison of What Riders in the Street-Survey Currently Wear, and What They Would Consider Wearing (with grouped options)

Figure 17 shows a comparison of what riders currently wear and what they would consider wearing, but uses the grouped clothing options: dark / black with no reflective material, dark / black with reflective material, bright / light, and fluorescent. The graph shows that the majority of riders currently wear dark / black with reflective gear, with dark / black with no reflective gear being the second most commonly worn option. Interestingly, over 50% of riders would consider wearing a fluorescent option. A smaller proportion of riders still would not consider wearing any light/bright or reflective options.

Online Survey

From the online survey through Survey Monkey we received 423 responses in total. A table containing all of the data we obtained is in Appendix 3. Due to our means of gathering information via Survey Monkey and our level of sign up for this program, we were unable to separate out the data into different groups. For example: scooter riders from motorbike riders, or males and females, which is what we were able to do with the data from on-the-street interviews. Therefore we chose to use the data from this group to show a comparison of what motorcyclists currently use and what they consider potential options for future use.

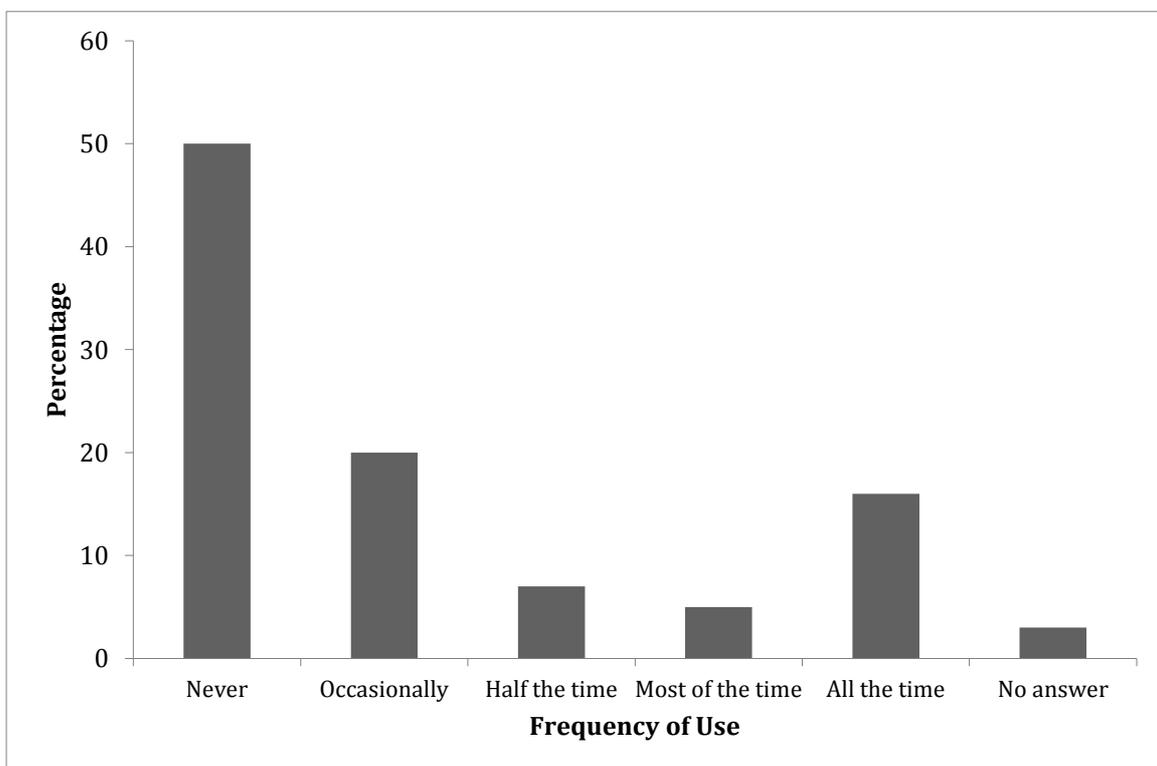


Figure 18 Rates of HVG use amongst Motorcyclists

Figure 18 shows the rate of use of high visibility gear amongst motorcycle users recorded in the survey poster online in the Kiwi Biker Forum. The large majority (49%) claim to never wear high visibility gear.

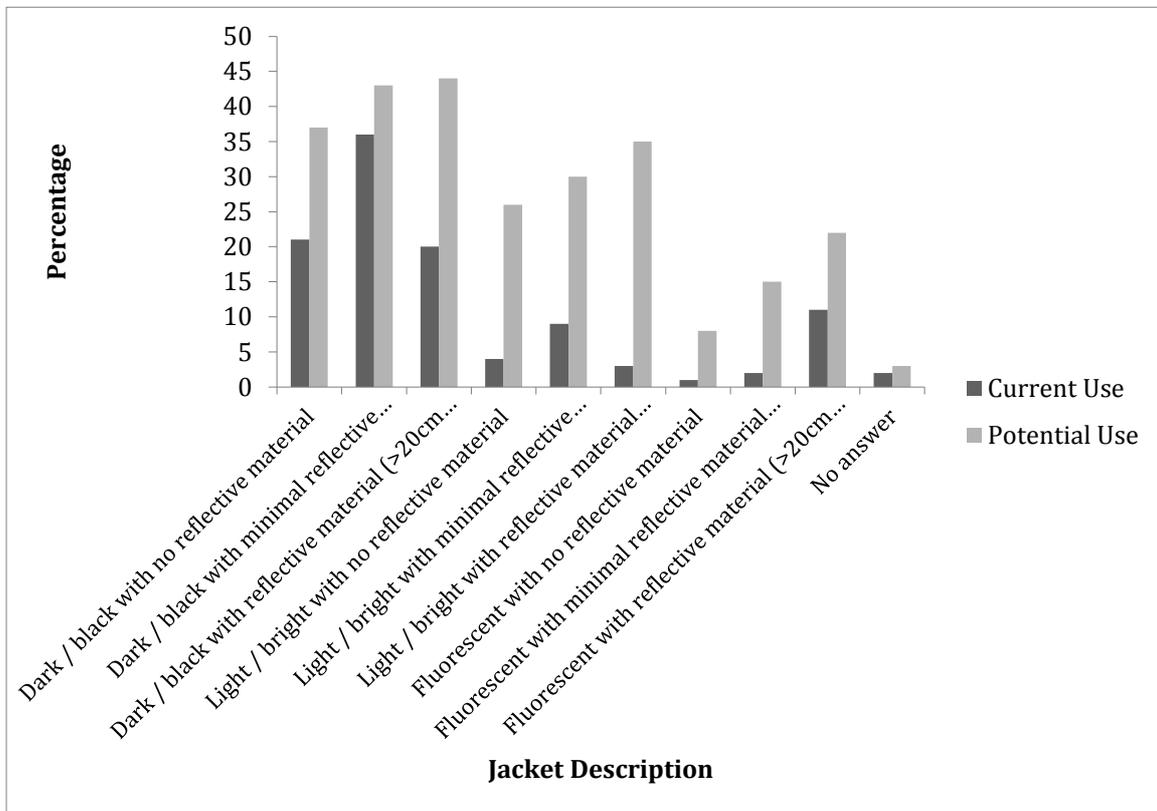


Figure 19 A Comparison of What Jacket Online Survey Riders are Currently Wearing With What They Would Consider Wearing

Figure 19 shows a comparison of what riders say best fit their description of what they currently wear, with what they say they will consider wearing in terms of HVG. The large majority would mainly consider wearing black with reflective parts. Note that participants were allowed to answer more than one answer to the later question about what they would consider wearing.

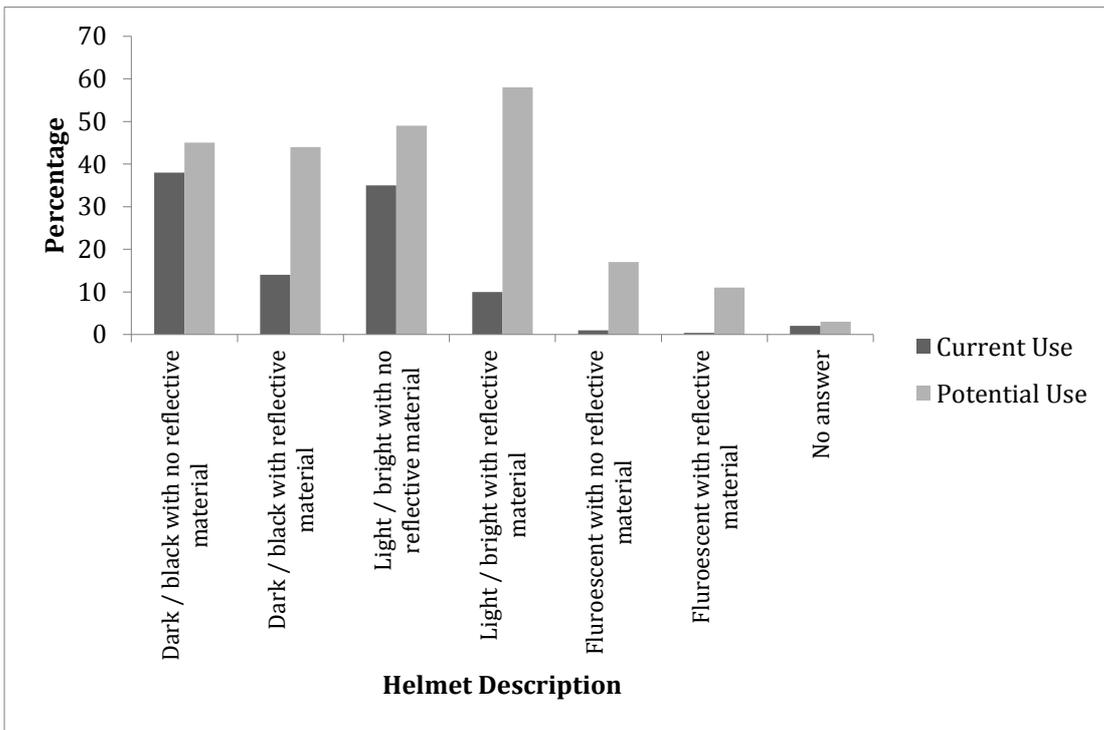


Figure 20 A Comparison of What Helmets Online Survey Riders are Currently Wearing With What They Would Consider Wearing

Figure 20 shows a comparison between the best description of what riders currently wear and what they would consider wearing. Most would consider wearing a light bright helmet, with or without reflective material.

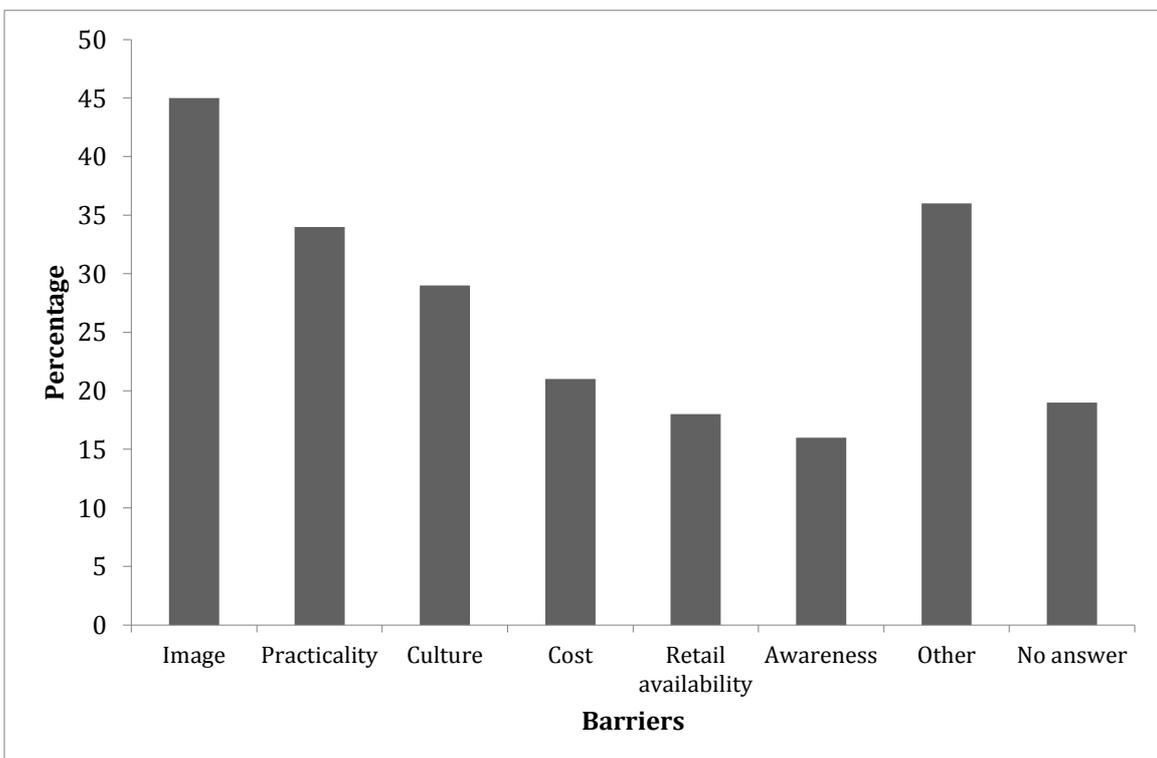


Figure 21 Barriers Against Wearing HVG

Figure 21 shows the barriers identified. The most commonly selected option was image at 21%. The next most popular choice was other (17%) where most riders expressed their views about the ineffectiveness of high visibility gear.

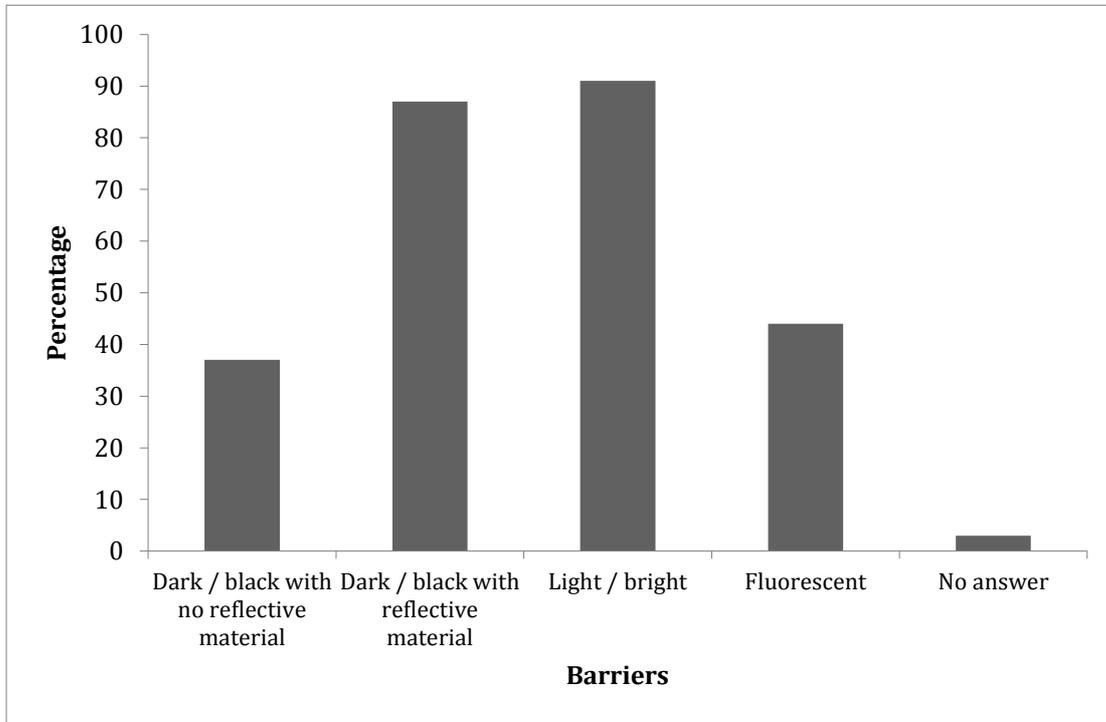


Figure 22 The "Tipping Point" of What Motorcyclists in the Online Survey Would Wear (grouped options)

Figure 22 shows the "tipping point" of what motorcyclists in the online survey would consider wearing but with the groups options of dark / black with no reflective gear, dark / black with reflective gear, light / bright, and fluorescent. The light/bright group had the most responses.

Table 3 Common Responses to the "OTHER" option to Barriers in the Online Survey

Barrier	No. of Responses
Don't believe it works	92
Mention that it is the car's fault if something happens	27
Gets dirty easily / doesn't keep well / flaps	16
Should be a choice	11
No barriers	9
Doesn't fit the look	6
Gives a false sense of security	6
Bike is bright enough	5

Table 3 shows a tally of the common results that were written as free text in the online survey as 'other' barriers to wearing HVG. The large majority of the results mentioned something about how they do not believe HVG works and how there is a lack of evidence. The next most frequent response included stating that they believed that most accidents are the fault of others drivers. The reference to it being a "choice" refers to the remarks made against the idea of making high visibility gear part of road legislation.

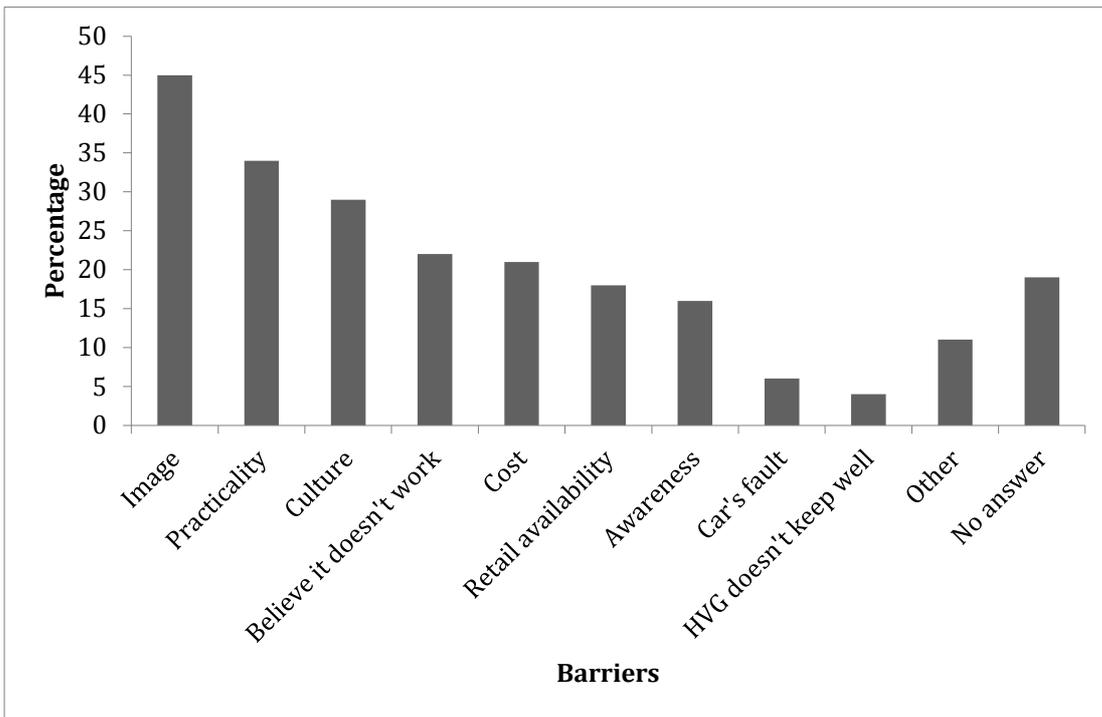


Figure 23 Barriers Against Wearing HVG including the Main "Other" Responses

Figure 23 shows the main barriers identified in the online survey but with main points identified in the "other" results included. The two main additional barriers given were that it was the cars fault (and therefore motorcyclists should not have to wear HVG), and that HVG does not keep well.

A Comparison of Observation and Survey Results

Comparing the use of HVG from the observation results and the survey results, we saw some similarities and differences. The number of people in the survey who 'never' wear HVG was 50% and 42% in motorbike riders and scooters respectively, while through observation it was seen that 38% of motorbike riders and 33% scooter riders wore no HVG. This disparity may have been due to the confusion over the definition of HVG, or a difference in the people in each sample group. We observed that approximately 10% of motorcyclists wore fluorescent clothing, while in the survey the prevalence was higher, at approximately 25%. This difference is likely to be due to social desirability bias. In general however, the observation and survey results were correlated.

QUALITATIVE STUDY METHODS

Forum Thematic Analysis Method

The forums on Kiwi Biker were chosen as, upon conducting numerous Google searches, it was the only website found deemed suitable for the studies purpose. All other websites featured either no forum section, were only for specific brands of motorcycle or dealers, were not specific to NZ or had a combination of these factors. We decided that if another forum could not be found by extensive searching, a member of the public was unlikely to put in the same effort and so the search for further forums was ended.

In order to focus the analysis on the most relevant threads, the searches were undertaken of all the forums for the key words “high-viz”, “high-vis” and “fluoro”. From the results of this search 9 forum threads were identified as relevant to the research, having HVG as the main focus of the thread and being posted no later than January 2011.

The posts on these threads were then read through separately and themes extracted for each individually. These results were then compared across all the threads, allowing for further judgment on the frequency of the themes to be made.

Semi-Structured Interview Method

Semi-structured interviews were conducted during April and May 2012. Four researchers interviewed nine key informants. The key informant interviewees were selected through non-probability/purposive sampling from a list as suggested by the research supervisor. We interviewed four motorcyclists, two of which work for authority bodies, a public health physician, a health promotion researcher, an occupational physician, a psychologist, and a researcher with experience of HVG design for forestry workers.

The interviews explored the attitudes and barriers towards HVG, current patterns, demographic factors, potential strategies to promote HVG uptake and alternative options.

Thematic analysis was carried out and we extracted common themes. Then the team focused on connecting themes and finding links in the data through collaborative

analysis that were appropriate to the aims of the study. We then reread the data and assigned excerpts that illustrate the final themes.

QUALITATIVE RESULTS

Forum Thematic Analysis Findings

All the comments derived from the forums may be considered under the following themes:

The Evidence For and Against HVG:

The evidence expressed by people in favour of or against the use of HVG falls under the categories of either personal experience or research.

A few commented on how current studies support the use of HVG. Several also expressed a belief that any research showing a benefit to HVG implementation was confounded by the nature of the riders wearing it, with safety conscious riders being more likely to wear HVG and less likely to be involved in an incident.

More people spoke negatively of the current research, believing that there is currently no evidence to support HVG use or accepting that evidence so far suggests it provides no benefit. Some also commented on a distrust of the available evidence, believing that statistics can be manipulated or are speculative only.

“With hi-vis they have a hunch at best (more like a spinnable story) and a profit interest”.

Some supported a belief that it is not possible to conduct a study that will definitively prove any benefit to wearing HVG, so no statistical evidence is forthcoming.

Overall, any evidence presented with opinions was most frequently derived from personal experience. Several commented on how they have worn HVG and noticed a difference, either they have had no accidents or fewer close calls, have noticed other vehicles give them greater clearance, have felt safer or, conversely, have felt a reduction in confidence. A few commented on how while wearing HVG they have noticed no benefits, either with the behaviour of other drivers or that had been in accidents. Several commented on how they experienced no change in attitude or riding style while wearing HVG.

Some also commented from the perspective of being a driver witnessing a rider wearing HVG and noting either that they had seen them sooner because of it, or that they noticed other aspects (such as lights) before they noticed the HVG. Others commented on occasions as a driver when they had not seen someone and remarked that HVG may have helped in that situation.

The Role of the Rider and Driver:

Many comments alluded to a locus of control beyond the influence of high visibility clothing, placing emphasis instead on the role of the riders themselves and of the drivers of other vehicles.

A strongly supported belief on this subject was a need for better training for riders and/or drivers. For drivers, methods proposed increasing the awareness of motorcycles or altering the licensing system. Many believed that motorcycle accidents are more a problem with bad drivers, and that wearing HVG would be pointless.

“There is nothing that will make them see if they don’t look. That is a large part of the problem.”

Several emphasised a need for riders to always assume they have not been seen or are invisible as a safer approach. These were reinforced by comments on how the onus is on the rider to take care of themselves and that it is better to rely on observation skills and riding skills than HVG. Again, it was thought that this could be improved with better rider training or altering the licensing system.

Several noted that wearing HVG might undermine this approach, giving riders a false sense of security. It was felt riders wearing HVG may be more inclined to assume they have been seen by other motorists or alternatively that there may be a subconscious response leading to more complacency in their riding.

There were also negative effects upon the driver that are believed may arise from wearing HVG. Several subscribed to a “*target fixation*” theory, based on the idea that “*you steer with your eyes*”, that wearing HVG makes a rider more of a target. A few stated that, if many take the measure up, drivers might become reliant upon HVG to see riders.

Perceived Effects of HVG:

Numerous people commented on how they believed that visibility is just one component of rider safety, and that while addressing this issue may have its uses, there

are many factors it won't address. Some continued this by criticising that HVG is being used as a quick fix to more complex problems.

Similarly, several people noted that HVG would exact only a small effect. Many continued by saying that even in light of this, since in their opinion it causes no harm, they are willing to use it as they are any means to improve their chances,

"I am also well aware that it will NOT save me, however I am also well aware that anything that will help me be seen by other road users in traffic will not harm my chances of not being run over... again".

Numerous people held the belief that the benefits of HVG are situational, with it being most useful in low visibility conditions such as heavy rain and at night, and similarly remarking on reflective strips. Some however furthered this by stating that they believed that during the day HVG just becomes "*another colour*".

People were skeptical over how much benefit HVG may provide over other safety measures currently being applied. This includes other measures around visibility such as a perceived already prominent use of reflective material on motorcycle gear, bright coloured (for example red or white) or patterned gear and the compulsory use of headlights

"(I) don't see how they will save lives if the drivers can't even "see" your headlights."

Others thought that sound may be used as a more effective measure, utilised by the use of horns or of louder engines.

Several commented on what they considered were the potential practical limitations of HVG clothing. Some explained that its effects would be minimal given that such clothing cannot be seen from the front (due to the riders position, windscreen or headlight) or from behind (due to backpacks or other luggage). Hence they believed it could only be of value when viewed from the side, yet that here it is then viewed too late to prevent any collisions.

Some pointed to a widespread use of HVG detracting from its potential benefits. HVG was believed by some to be synonymous with road workers or traffic cones and felt there was a potential to be mistaken by drivers at first glance for these relatively stationary objects when wearing one. A few people indicated that if all riders were to wear HVG that it would cease being unique and its effect would be lost. The current use of HVG was also implicated as evidence that it fails to work, with one stating that while it

is applied to road cones, construction vehicles and other large vehicles people still collide into these.

The relationship between HVG and speed was raised further in other areas. Some prescribed to a theory of “*motion camouflage*”, whereby it is harder to judge the speed at which someone is travelling if they are wearing HVG. Another person stated that he did not believe HVG was apparent when worn by someone travelling at speed; therefore claiming it was pointless to wear it while on his motorbike, yet worth wearing while travelling on his scooter.

Several people spoke in favour of black clothing over HVG for increasing visibility or safety. Some noted that in certain situations black might stand out against some backdrops better. One claimed that it is part of our human natural instincts to look out for shadows, therefore black is more noticeable. Numerous people however took the view of “*intimidation theory*” that people wearing black gear are perceived as more of a threat and hence gain more attention from other drivers.

“I wear black on a black bike in a black helmet, you fluro wearing pussies are the ones that will get smashed up by a SMIDSY! I look mean and they wont want to hit me or they will get smashed up”

[SMIDSY = “sorry mate I didn’t see you”]

Some extended upon this by claiming that if someone was wearing HVG in a way that emulates police officers that this would have a similar effect.

Accessibility

The main themes that arose around the issue of accessibility were of availability, practicality and social acceptability.

Several people noted the importance of the quality of HVG. Typically it was claimed that available options were poor fitting, which causes it to flap and vibrate when travelling at speed, causing a potentially dangerous distraction. Some claimed that this was a problem of even the well-fitted products. One mentioned how he had taken to wearing high visibility pants instead of a jacket, as this minimised the distraction it caused. Available options were also considered to not be durable enough, this argument typically applied to the construction worker style vests rather than products specifically

designed for motorbike riders. Poorer fitting and less durable styles were noted to be cheaper than custom designed HVG.

Comments on practicality tended towards being in favour of how easy HVG is to apply. Some however believed that wearing HVG presented an extra hassle, either due to the design flaws noted above, or in it requiring another item of clothing be put on and taken off.

Several people commented on the unattractive or uncool image of HVG.

“Of course it makes a difference. I wear hi-viz and I look like a knob. I don’t normally look like a knob. Voila, that’s the difference.”

For the majority however this was not the sole element of their argument, rather it was implied as a factor by the language used in their descriptions.

Some people however commented on an improvement in the opinion of its appearance, or were able to point out products designed specifically for motorcycle riders that incorporated HVG and were considered to have a better image.

“The image of the fluoro vest has sure changed around here. Young guys swagger around the streets in fluoro gear ... it’s the new tough image. It means you have a job, a job working with the Bro’s, on road construction, building construction etc”

Whether HVG Should Be Made Compulsory:

For many the opinion on HVG was debated within the context that it may become a compulsory safety measure, this often being considered negatively. The vast majority of comments advocated for the right to choose, whether they believed HVG provides a benefit or not.

“Why should I be penalised because I believe that the most important piece of protective gear lies between my ears?”

This was also extended to helmets, with some wishing to reclaim the right to choose whether they wear a helmet or not (none within this group however stated that given the option, they would choose not to wear a helmet).

Some thought that if HVG confers only a small benefit (and causes no harm), that it is only with a population wide approach that a life may be saved. One argued to this however that he would rather have the choice than sacrifice his liberty for the sake of saving one life. For a few, the fact that ACC funding covers the healthcare costs of those that do have an accident infers the right to make any potential health measure

mandatory. Some commented on how uptake of HVG may be increased if it was made a more attractive option by measures such as reducing the ACC levy for those that wear it, or increasing penalties to those who have an accident while not wearing it. A few commented that even if it were to be made mandatory, they would still refuse to wear it.

Key Informant Interview Findings

Several common themes arose in key informant interviews. These surrounded the attitudes and barriers of riders to HVG, demographics of riders who wear HVG, public health strategies that could potentially moderate or enhance the use of HVG and alternatives to the use of HVG.

Attitudes and barriers to wearing HVG

i) Image

All interviewees reported that a threat to the motorcyclist image is the most significant barrier to wearing HVG. HVG was described as “*uncool*” and “*non-professional*”. Motorcycle riders explained that conventional black leather gear portrays a “*bad boy*” image and is appropriate to the spirit of riding where “*part of the persona is not following a crowd*”. Furthermore, HVG is not thought to be socially acceptable,

“Just because it is good and highly visible doesn’t make it okay to wear”.

An analogy given was that wearing HVG for a motorcyclist can be compared to asking a girl to wear an evening dress covered with fluorescent strips out to a restaurant.

ii) Availability, Affordability, Practicality

A need for HVG that is easily available, affordable and practical to wear, are also common themes. Interviewees have noted an improvement in the availability of gear with the internet; however this is often too costly and impractical. The gear does not meet the diverse needs between different motorcyclist groups. A motorcyclist explained that HVG might be more likely to be worn if it is close to hand – for example if it can be contained in the rider’s pocket and then attached to their jackets when riding.

iii) Primary vs Secondary Protection

Motorcyclists and an occupational physician felt that it is more important to protect the riders from an accident than preventing an accident from happening. They

believed that even with HVG, accidents would still occur due to the camouflage vision, which is the phenomenon that the car drivers may “*look, but not see*”:

“Kiwi rail paint their trains yellow at the front and people still hit them”

These interviewees felt that there should be more emphasis on investing in high quality armour that would minimise the harm from an accident instead of focusing on HVG.

iv) Demographics

There is no strong consensus on the demographics of riders who are more likely to wear HVG. Some common themes were that younger and leisure riders are less likely to wear HVG, while women are more likely.

Strategies Discussed That Might Improve HVG Use:

i) Legislation

All interviewees agreed that legislation was not the best approach towards increasing HVG use. Motorcyclists strongly opposed legislation, as it would be detrimental to the already strained relationships between motorcyclists and authority bodies. Interviewees emphasised that HVG has not been proven to prevent motorcycle-related accidents. Researches acknowledged that while legislation would improve numbers using HVG, the long-term benefits lie in improving voluntary uptake. A health promotion researcher commented,

“legislation is not an easy answer until 80% of the population take up the action anyway.”

ii) Improving Image

Interviewees recommended that HVG design should be compatible with the desired image and need of the riders. There is much diversity between motorcycle groups, for example people who commute to work on a motorcycle versus Harley Davidson riders. It is important to foster the differences in group identity and needs when designing gear. A health promotion researcher explained that this requires a “*multi-disciplinary multi-strategy approach*” between the manufacturers and injury prevention groups. A design researcher who worked for the forestry industry explained the success of designing HVG that appealed to forestry workers. The HVG incorporated elements of a rugby league jersey, including fluorescent horizontal strips to appear more

masculine and also team numbers. Gear should therefore be developed that allows riders to maintain their identity while improving their visibility on the roads.

iii) Retailers

It has also been suggested that cooperation between the manufacturers and retailers could improve the availability of HVG. An expert from ACC explained that approximately 80% of customers enter retail outlets without preformed ideas on gear choice. This is an area of opportunity to promote HVG. Cooperation with retailers, including incentives could be given to them to motivate and promote sales of HVG to this target population.

iv) Cost Reduction

Interviewees suggested that reducing the cost of HVG would increase its uptake. This could be achieved through financial incentives such as direct reduction in prices, reduced ACC levies, and government subsidies for riders who wear HVG.

v) Social Marketing of HVG

Appropriate and effective social marketing strategies should acknowledge the diversity in the motorcycle community. It should provide compelling evidence to support HVG while not taking a paternalistic approach.

vi) Alternative Options

Safety gear was identified as an area that requires attention. Currently, no legislation exists regarding minimal standards of safety gear that must be worn, with the exception of helmets. A common stance encountered was that focus on safety gear should have priority over HVG,

“If the government was to force something on me I would rather they forced gloves and protective clothing rather than high-vis, simply because it doesn’t work”.

Alternative safety measures, such as the pulse break lights, high intensity discharge lamps and ultra bright lights have been suggested. Interviewees also suggested that improving safe riding practices and educating drivers to better identify motorcyclists.

DISCUSSION

Part 1: Quantitative

The quantitative part of our study provided us with useful information both on the current use of HVG of motorcyclists in the Wellington area and of the amount of HVG New Zealand motorcyclists would be prepared to wear. There are no previous studies that have looked at the proportion of HVG worn by either the Wellington or New Zealand motorcycle population. However, other countries have found that HVG usage is low. A study in London found that only 14% of their participants always or frequently chose to wear bright and/or reflective clothing (5). The observational part of our study showed that only about 10% of riders wore fluorescent gear. Use of reflective material was somewhat higher at 32% for motorbike riders and 22% for scooter drivers. Roughly half of the motorcyclists wore some form of colourful apparel. However, roughly 30 – 40% of riders wore both a black unreflective helmet and jacket. Both surveys showed about half of respondents never wore HVG and roughly 20% occasionally wore it, with low numbers (no more than 25%) wearing HVG all or most of the time. These results showed that there is plenty of room for improvement. We also found that many participants were willing to consider wearing more HVG.

By collecting information on the main barriers that prevent riders from wearing HVG, we have identified areas that need to be addressed in order to increase the use of HVG to correlate with the “tipping point” of maximum HVG usage we discovered. The main barriers participants reported were image, cost and practicality. By reducing the effects of these barriers, we may be able to improve HVG usage in New Zealand motorcyclists. There is evidence from a study carried out in England that good public health campaigns have the potential to improve motorcyclists’ behaviours in regards to increasing their conspicuity (19).

Observation

Our method of observing the use of HVG in motorcyclists in the Wellington region had some limitations. The cut-off between the levels of reflective material was 20cm². The distinction between the upper level and lower level was very hard to judge on the roadside, so we made an estimate and conferred about which level to place the rider in. In addition, reflective material can be mistaken for normal bright material in the

daylight, which meant that some reflective outfits might have been judged as non-reflective during the observation. This would skew the results towards a lower prevalence of reflective gear.

There were also some limitations in the choice of locations for observation. To ensure we had a large sample size, we chose to observe at areas of high traffic flow (generally main arterial routes). In addition we chose to observe at peak traffic times (8:00am to 9:30am, 4:30pm to 6:00pm). These two factors meant that our sample may not fully represent the scooter and motorcycle population of Wellington. It is likely that we sampled a higher proportion of commuter traffic, which may have a different prevalence of HVG than other riders. We felt that obtaining a large sample of motorcycles and scooters was more useful, especially considering our timeframe, than a more representative group of riders that may be too small to reach conclusions from. If there was more time to carry out observation, a larger variety of times and locations could be sampled, which would make the sample more representative. The data we collected is only representative of riders in Wellington, who were riding in the locations observed and at the times of sampling. This means that the data may not be applicable to wider Wellington riders and indeed New Zealand riders.

We chose not to look at the colour of the motorcycles or scooters, even though this is an aspect of rider visibility (1). To do so may have compromised our ability to accurately identify the other high visibility factors (jacket and helmet).

The samples were taken during cloudy and sunny weather only, so there is no data indicating use of high visibility gear in wet weather. Additionally, the data was only collected in hours of daylight and dusk; rider visibility at night was not looked at. It has been suggested that HVG contributes less to conspicuity during the night-time, when headlights provide a stronger contrast to the environment (13).

Surveys

On-the Street Surveys

The majority (40%) of those surveyed are not currently wearing any form of HVG. Also, while 27% are wearing it all of the time, it is likely (if relying on the “other” responses supplied) that the remaining 33% who fall in between wear the HVG in certain circumstances like weather conditions.

When questioned about what they would consider wearing, the majority opted for the maximum amount of fluorescent, particularly males. The same result was found for helmet use, the majority would opt to wear a more light/visible helmet than they already had (most had black helmets).

We identified that one of the major issues with our survey design was the scale we used and the pictures that accompanied it. It seemed that participants would pick the jacket that they liked the best, rather than viewing it as a scale of increasing 'visibility'. For example, someone would pick jacket I (fluorescent with reflective material (>20cm²)) over jacket G (fluorescent with no reflective material) based on how the picture looked rather than the amount of reflective gear on it. We therefore decided to group the options into four rather than twelve to compensate for this. The categories were dark / black with no reflective material, dark / black with reflective material, bright / light, or fluorescent. Our results showed that over half of the motorcyclists interviewed on the street would consider wearing fluorescent gear, yet only just over 20% claimed to currently wear it. There was also a higher percentage of interviewed people that would consider wearing light/bright gear than those that currently wear it. Although roughly 30% of participants currently wear dark/black with no reflective material, less than 10% stated that category as being the most HVG they were prepared to wear. These are promising results as they show that many people would consider increasing their use of HVG.

Online Survey

Those who answered the online survey were less open to the idea of HVG than those we questioned on the street. The most common response to the question "what would you consider wearing" is the dark / black jacket with reflective material (>20cm²).

Like the data from the surveys taken on the street, the results from the online survey were grouped into the same categories of HVG in order to find the tipping point of HVG that the participants were prepared to wear. Only 17% of participants would consider wearing fluorescent gear, with light/bright being the most popular option at 35%. Dark/black with reflective material was also ranked highly at 33%. When you compare these results with those obtained from the street surveys, the difference between the responses in the groups is quite different. Street survey respondents were more likely to choose fluorescence as their "tipping point" than online survey

respondents. This supports the idea brought up earlier in the discussion that social desirability bias may have affected our results.

Part 2: Qualitative

The majority of the themes that came across in the forums were presented with solidarity, repeated and reinforced by several members. This is reassuring that the results represent the opinions of this group well. However it is important to note that this group is a unique subset of the biking population.

Finally it is important to note that some people featured multiple times throughout the forums, expressing the same view multiple times, which may have led us to weight certain opinions higher than was truly felt by the group. Those that felt more strongly on the topic were also more likely to comment. However the effects of this are minimised given that all opinions, no matter how little mention they received, were included in the results.

The context in which these views were expressed we believed were also influenced by other recent changes to legislation relating to bikers, in particular the recent increase in ACC levy for motorcyclists.

Barriers

The semi-structured interviews and forum analysis provided in-depth knowledge on the barriers and attitudes towards wearing HVG among motorcyclists. All interviewees identified image as a significant barrier to wearing HVG. Within the forum thematic analysis however the issue of image featured less prominently. Other emerging themes from the interviews and forum included availability, cost and practicality.

The finding that image is likely to prevent motorcyclists from wearing HVG is supported by New Zealand research on the behaviour and opinion of NZ riders (18). It was suggested that the discrepancy between opinions and behaviour regarding the use of HVG could be due to a lack of appropriate gear that was acceptable to the users. Also consistent with our research, this research highlighted image and cost as contributing barriers, and recommended a need for development of product design, manufacturing and promotion in this area (18).

Both previous New Zealand research (18) and our findings highlight a need for co-operation between HVG manufacturers and the motorcycle safety authorities. Gear

should be designed to incorporate the broad spectrum of needs and identities of the different groups of motorcyclists. Practical issues such as fading, soiling and the quality of the fit would also need to be addressed.

Our findings indicated that an increase in the availability of appropriate HVG might enhance its demand, which in turn would reduce the current financial burden for motorcyclists. Other financial incentives such as that by ACC or to promote HVG sales by retailers may initiate an increase in the popularity of such safety gear in the retail industry.

HVG Effect on Visibility

Another theme that emerged from both the interviews and the forums was how HVG may not increase rider conspicuity; a driver may still fail to register the presence of a motorcycle regardless of how visible they are. Within the forum, many also expressed doubt as to whether HVG increases a rider's visibility to begin with. A UK study investigated accidents caused by poor observation on part of road users; 43% of respondents indicated that one of the main causes of motorcycle accidents was 'other road users failing to see riders' (5). It is also believed that HVG is unlikely to help in cases when drivers fail to see motorcyclists due to the camouflage phenomenon (20). In light of this, a consensus from both arms of the qualitative study was that the visibility of riders would be better addressed through both rider and driver training.

Another issue raised in this area from both the interviews and the forum was the current lack of consensus that HVG will improve visibility, stemming from a lack of convincing anecdotal or study derived evidence to this point. We feel this ambiguity forms a major barrier to any future efforts in promoting the use of HVG.

Change From Within the Biker Community

All our interviewees believed that legislation alone was not the optimal approach to promote HVG use. Resistance was also strong within the forums towards HVG becoming a compulsory measure, with many supporting the need for a 'right to choose'. Reeder *et al's* New Zealand study investigated the perceptions of the effectiveness of heightened conspicuity as a general crash prevention strategy (18). The study found that 87% of riders agreed that increasing visibility to other road users could improve motorcyclist safety, however only 55% favoured compulsory use of HVG at all times.

This apparent lack of keenness for mandatory HVG wearing is something inherent to being a 'biker'. Motorcyclists have a strong social identity, which stems from being both a minority and a vulnerable road user (15). Such a strong identity creates an in-group versus out-group distinction and an example of an out-group would be an authority figure, such as the police and the government (15). Other results show that safety consciousness is mainly created and shaped in the motorcycle community (17).

The Ottawa Charter identifies many potential areas where changes can be made to promote health, including strengthening community action. It is therefore important to support road safety work that is already done within the motorcycle community and to work together with the motorcycle community to disseminate road safety messages, as opposed to action through inflicting policies on the community externally.

STUDY STRENGTHS

One of the main strengths of our study was the multi method approach that we used. We collected both qualitative and quantitative data using a range of methods including direct observation, online and street surveys, key informant interviews and thematic analysis of online forums. This helped with triangulation and improved the validity of our results. It made it easier to consider the effects of limitations from the different study methods, as we were able to compare results generated in different ways.

A major strength of the online survey was the response rate. Receiving 423 responses from the online survey giving us a large sample size gave the study a higher power. This should give our study the power to ascertain the attitudes and barriers of many motorcyclists in Wellington and New Zealand. Because of this, we feel that despite the flaws in our survey design, we still managed to gather a good representation of what the current use and attitudes are towards HVG.

Another strength was the large number of motorcyclists observed (a total of 542). These high numbers give us confidence in our results, and mean that our study had more power to detect real trends. Observation was the most objective type of data collection, and for that reason invaluable.

Using the Kiwibiker forum for both the online survey and for thematic analysis allowed us to access attitudes and barriers that are relevant a wider population than just Wellington. Being a New Zealand wide forum, it gave us information on motorcyclists nation-wide that we could not have otherwise have reached in our short five week project.

Finally, interviews covered a thorough discussion with each interviewee, which allowed for this complex health issue to be explored in depth. The findings provide useful insights into individuals' personal experiences, attitudes and beliefs, which could only be achieved with this study technique.

STUDY LIMITATIONS

Observation Limitations

Observation was only done at limited locations and times of day. The times selected were more likely to identify those who use their motorcycles for commuting, which may represent a only a subset of the motorcycling population. Furthermore, the gear that was worn by motorcyclists was sometimes hard to judge from a distance and there was room for error.

Survey Limitations

Over the course of our survey collection and analysis we discovered several flaws in our method. We did not explicitly define the term "high visibility" to the participants, and this lead to some confusion. Furthermore, the term "high visibility" had unprecedented negative reactions with participants assuming we exclusively meant HVG such as fluoro vests and day-glo. With the on-the-street surveys we were able to discuss the matter with the participants, however online participants were left to their own devices. Subsequently, it may have been beneficial to have a definition of high visibility that is inclusive of "light, bright and reflective" as well as fluorescent on the Kiwibiker forum with the survey. Furthermore, we may have been able to achieve a clearer definition of HVG from wider consultation with key informants and some preliminary qualitative work with bikers. This would have allowed us to find out how they interpreted the term "high visibility." Unfortunately, given the limited time we had to complete the study, this was not possible.

A second limitation with the survey was that the high visibility chart shown to participants was difficult to interpret. While the groups (being dark, coloured and fluorescent) were well displayed, an appropriate gradient between these was not achieved. We did try to standardise the images with differing levels of visibility by basing them on the American National Standard for High-Visibility Safety Apparel and Headwear (19). Our study was limited somewhat as we could only explore types of gear in a categorical way, and not within these categories. We would recommend that future studies draw on riders' own jackets for such images rather than using images found on the internet, as we did.

Selection bias may have distorted our results. Participants of this study were not randomly selected as we chose three stations within town to survey bikers. Also, the bikers surveyed on Anzac Day were more likely to be involved in biking culture as they were taking part in an organised Ulysses event. Therefore they were perhaps not representative of the New Zealand biking population.

There may also have been some social desirability bias in our study as we thought the people we surveyed face-to-face may have been more inclined to overestimate the HVG they said they would consider wearing. The existence of social desirability bias is supported by the fact that our results from the observational part of our study indicate that less people are wearing HVG than our self reported surveys show. The online survey was anonymous, so respondents may have answered this question more freely. Also, the people on the street may have felt more rushed to answer, whereas those who completed the survey online may have felt more relaxed and taken their time. On the other hand, there was an overwhelmingly negative reaction to the term "high visibility" on the online forum where the survey was posted, and this may have informed some of the negative attitudes given in the survey too.

Volunteer bias may also have affected our study. The online survey was done on a volunteer basis therefore the people who took part were those feeling passionate about the subject. They may not have given responses representative of the general population. Also, on the online survey there was no limit to the number of times one rider could take part. Some people may have completed the survey several times, especially if they felt passionate about the topic, biasing the results obtained.

One difficulty we encountered with those undertaking the online survey was that we were not able to explain the aims of the research. When we approached people on the street it was easy to clarify what we were investigating. Although we posted information with the survey on Kiwi Biker, from some of the negative feedback we were getting, it seemed like many people were not reading what the aim of the survey was. We wanted the survey to be short and easy so that lots of people could do it without taking too much time. However, we received feedback that it was too short and did not give enough opportunity for participants to talk about their opinions on HVG.

Forum Thematic Analysis Limitations

A key limitation of the forum analysis lies within the definition of HVG, as this varied among those commenting in the forums. Many did not consider reflective material under this heading, taking HVG to mean fluorescent colours only. This is shown by the results, with responses towards reflective material being largely positive compared to the negative responses to HVG. Reflective material was largely accepted as beneficial under certain conditions; the debate was instead over the evidence supporting fluorescent colours.

Key Informant Interviews Limitations

Due to the nature of key informant interviews many limitations affected the research. Interviews were subject to information bias. Four different researchers completed the interviews. Variation in researchers own opinion and perception of the interviewees' points will add bias to the study. Interviewers were not blinded to each interviewees' status. This may have influenced the way the interviews were conducted and the ways the questions were asked may differ between different interviews. Interviewees' also had their own perception of meaning, which will have influenced results. For example it was noted that how interviewees defined HVG varied markedly. Using the semi-structured interview format helped to reduce this problem by creating some consistency between interviews..

Recommendations and Further Study

Our study has identified that more motorcyclists are currently wearing HVG than in the past, but rates could still be improved. Interestingly, most of those who are not wearing HVG report to be willing to wear some more.

How to increase HVG uptake

Our study found that although motorcyclists are not currently wearing much HVG, a decent proportion of people would consider wearing it. Our results also highlighted that many bikers would consider wearing HVG if certain barriers were removed (especially image, cost and availability). If these barriers can be acknowledged, addressed and then minimized, HVG use may increase among New Zealand motorcyclists. Factors that should be taken into account are:

- Reducing cost can increase uptake. This could be achieved through financial incentives such as direct reduction in prices, reduced ACC levies, and government subsidies for riders who wear HVG. HVG might be more likely to be worn if it is close to hand
- There is much diversity between motorcycle groups, for example commuters on scooters versus Harley Davidson riders. Gear should be designed to incorporate the broad spectrum of needs and identities of the different groups of motorcyclists.
- Cooperation between manufacturers and retailers may increase retail availability. Incentives could be given to retailers to motivate and promote sales of HVG to the target population.
- An increase in the availability of appropriate HVG might enhance its demand and popularity.
- Collaboration between manufacturers of HVG and injury prevention groups might improve the uptake of HVG amongst the more safety-conscious riders.

Future research is needed

Our study should be considered as a pilot study. Therefore, we would recommend that a study similar to ours is repeated, with an improved method that corrects the modifiable limitations we encountered. As we had a limited time frame and resources, we were only able to look into a small part of overall rider conspicuity and use of HVG. Future studies into the ways to overcome the barriers we identified would be very useful. Further research to show more definitively whether HVG works may encourage those who do not believe in its efficacy to consider wearing HVG more often.

Our aim was to determine a cut off point where riders would find HVG suitable to wear. Although our study struggled to determine a specific point, it did provide valuable information on the current use of HVG, barriers to wearing HVG and gave us an indication of the sort of HVG bikers would consider wearing. Specifically, HVG needs to be easy to maintain, and convenient to use. One idea would be fluoro and reflective strips that could be easily attached when riding, and kept in the rider's pocket when not in use.

More research could reduce disparities

The Ministry of Transport publishes ethnicity data on motor vehicle crashes in New Zealand. However there is no published data on Maori versus non-Maori motorcycle accidents. This reflects the need to investigate whether or not there is a disparity between the two groups. Nonetheless, we asked the Ministry of Transport for any data they might have on Maori motorcycle deaths, and they provided us with some raw data. Their data shows that Maori form a bigger proportion of motorcycle deaths than others with a known ethnicity. This indicates a disparity may exist and warrants further investigation, followed by the development of a prevention strategy specifically for Maori by a framework such as TUHANZ (21)

Alternative ways to make motorcycling safer

Another interesting option for further study would be to look at alternate methods of preventing motorcycle accidents. This may include other techniques to increase conspicuity (pulsating headlight, for example) as well as any other issues that could be looked at, such as the road layout and legislation. One option is to introduce methods that will increase the awareness of motorcycles amongst drivers, as many motorcyclists considered accidents are associated with poor driving skills. Better training for drivers and riders throughout the licensing system may reduce accidents that HVG may not.

Legislative action? Not yet...

Introduction of legislation surrounding the use of HVG should not be considered in New Zealand yet. This is because compulsory safety measures can be viewed negatively within the motorcyclist community and place further strain on relationships between motorcyclists and authority bodies. Although a population wide approach might lead to more lives saved, change originating from within the community is believed by key informants to be more effective.

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Categories of jacket visibility

Category	A	B	C	D	E	F	G	H
Background material	Dark /Black	Dark/Black	Dark/Black	Light/Bright	Light/Bright	Light/Bright	Fluorescent	Fluorescent
material	None	≤20cm ²	>20cm ²	None	≤20cm ²	>20cm ²	None	≤20cm ²

Categories of helmet visibility

Category	J	K	L	M	N	O
Background material	Dark /Black	Dark/Black	Light/Bright	Light/Bright	Fluorescent	Fluorescent
Reflective material	None	Present	None	Present	None	Present

APPENDIX 2

Data Collected from the Surveys Conducted on the Street (n=62)

	No. of Respondents
Male	44
Female	18
Age Group	
<20	3
20-30	9
30-40	9
40-50	12
>50	29
Best Description of Bike	
Scooter	22
<600cc Motorbike	7
>600cc Motorbike	33
Best Description of Current Motorcycle Gear	
Dark / black with no reflective material	18
Dark / black with minimal reflective material (<20cm ²)	15
Dark / black with reflective material (<20cm ²)	7
Light / bright with no reflective material	3
Light / bright with minimal reflective material (<20cm ²)	2
Light / bright with reflective material (<20cm ²)	3

Fluorescent with no reflective material	2
Fluorescent with minimal reflective material (<20cm ²)	4
Fluorescent with reflective material (<20cm ²)	8
Best Description of Current Helmet	
Dark / black with no reflective material	27
Dark / black with reflective material	11
Light / bright with no reflective material	6
Light / bright with reflective material	15
Fluorescent with no reflective material	2
Fluorescent with reflective material	1
Current Use of HVG	
Never	28
Occasionally	13
About half the time	2
Most of the time	6
All of the time	13
"Tipping Point" that would consider for Jacket	
Dark / black with no reflective material	5
Dark / black with minimal reflective material (<20cm ²)	8
Dark / black with reflective material (<20cm ²)	7
Light / bright with no reflective material	3
Light / bright with minimal reflective material (<20cm ²)	2

Light / bright with reflective material (<20cm ²)	5
Fluorescent with no reflective material	7
Fluorescent with minimal reflective material (<20cm ²)	3
Fluorescent with reflective material (<20cm ²)	22
“Tipping Point” that would consider for Helmet	
Dark / black with no reflective material	10
Dark / black with reflective material	4
Light / bright with no reflective material	9
Light / bright with reflective material	14
Fluorescent with no reflective material	7
Fluorescent with reflective material	19
Barriers to Use of HVG	
Cost	21
Practicality	15
Retail Availability	7
Culture	3
Image	20
Awareness	4
Other	7
None	3

APPENDIX 3

Data Collected from the Online Survey (n=423)

Do you consent to taking part in this short survey?	No. of Respondents
Yes	418
No	5
Gender	
Male	352
Female	64
Skipped question	7
Age group	
<20	6
20-30	37
30-40	70
40-50	146
50-60	105
>60	52
Skipped question	7
Best description of motorbike	
Scooter	13
<600cc motorbike	69
>600cc motorbike	361
Skipped question	7
Best description of current usual motorcycle outfit	

Dark / black with no reflective material	90
Dark / black with minimal reflective material (<20cm squared)	151
Dark / black with reflective material (>20cm squared)	84
Light / bright with no reflective material	15
Light / bright with minimal reflective material (<20cm squared)	39
Light / bright with reflective material (>20cm squared)	14
Fluorescent with no reflective material	3
Fluorescent with minimal reflective material (<20cm squared)	9
Fluorescent with reflective material (>20cm squared)	46
Skipped question	8
Best description of current usual helmet	
Dark / black with no reflective material	162
Dark / black with reflective material	60
Light / bright with no reflective material	148
Light / bright with reflective material	44
Fluorescent with no reflective material	5
Fluorescent with reflective material	2
Skipped question	10
Current use of HVG	
Never	210
Occasionally	85
About half the time	28

Most of the time	23
All the time	66
Skipped question	13
“Tipping Point” that would consider for Jacket	
Dark / black with no reflective material	157
Dark / black with minimal reflective material (<20cm squared)	183
Dark / black with reflective material (>20cm squared)	186
Light / bright with no reflective material	111
Light / bright with minimal reflective material (<20cm squared)	127
Light / bright with reflective material (>20cm squared)	148
Fluorescent with no reflective material	32
Fluorescent with minimal reflective material (<20cm squared)	62
Fluorescent with reflective material (>20cm squared)	92
Skipped question	14
“Tipping Point” that would consider for Helmet	
Dark / black with no reflective material	189
Dark / black with reflective material	187
Light / bright with no reflective material	207
Light / bright with reflective material	245
Fluorescent with no reflective material	72
Fluorescent with reflective material	45
Skipped question	13

Barriers to Use of HVG	
Cost	87
Practicality	144
Retail availability	76
Culture	124
Image	192
Awareness	67
Other	153
Skipped question	80

APPENDIX 4

Figures 11 – 16 Comparing Male and Female Survey Data

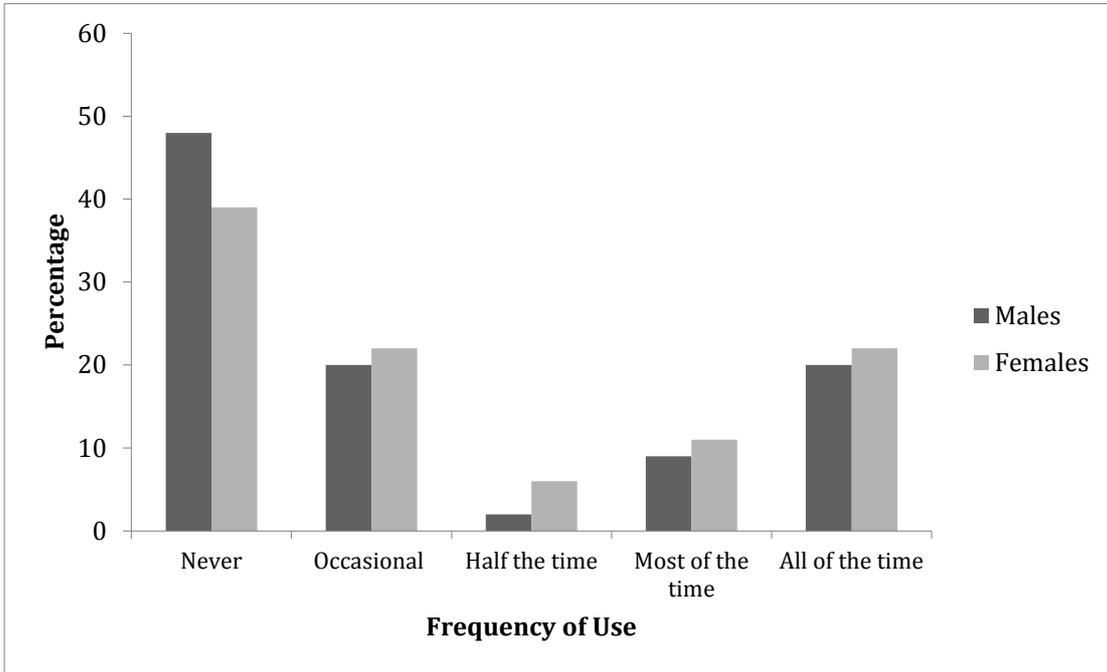


Figure 11 Current Use of HVG by Male and Female Motorcyclists

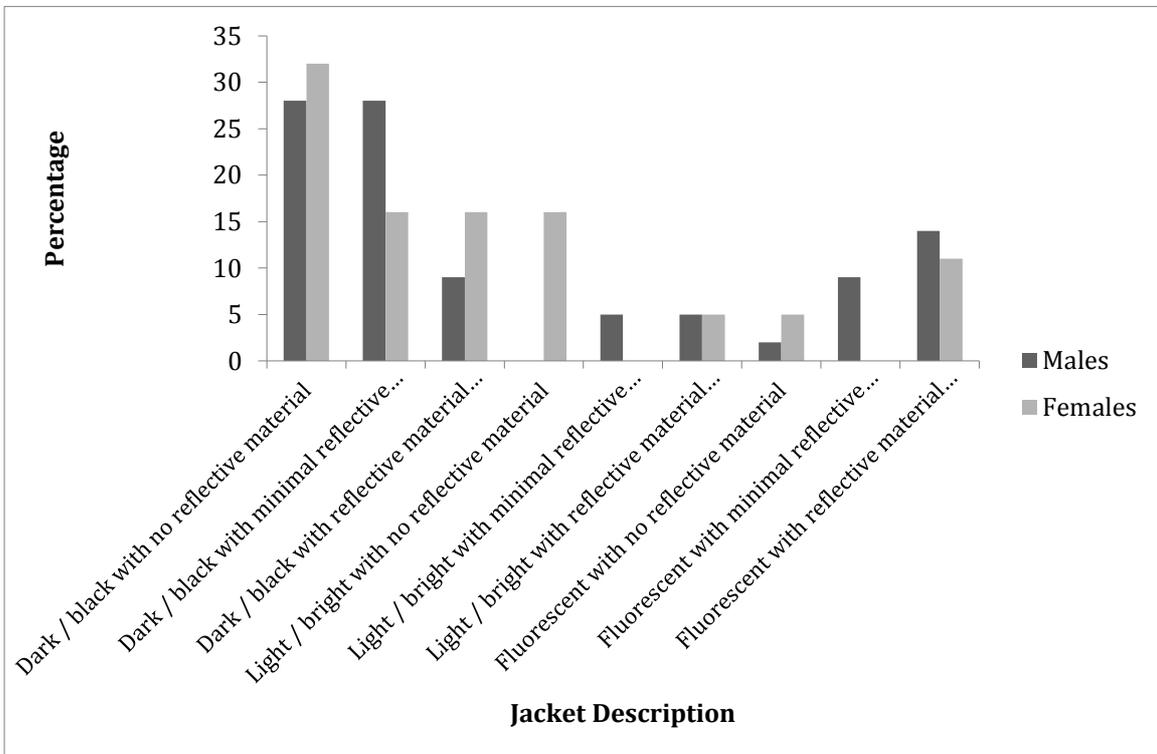


Figure 12 Current Description of Jacket use by Male and Female Motorcyclists

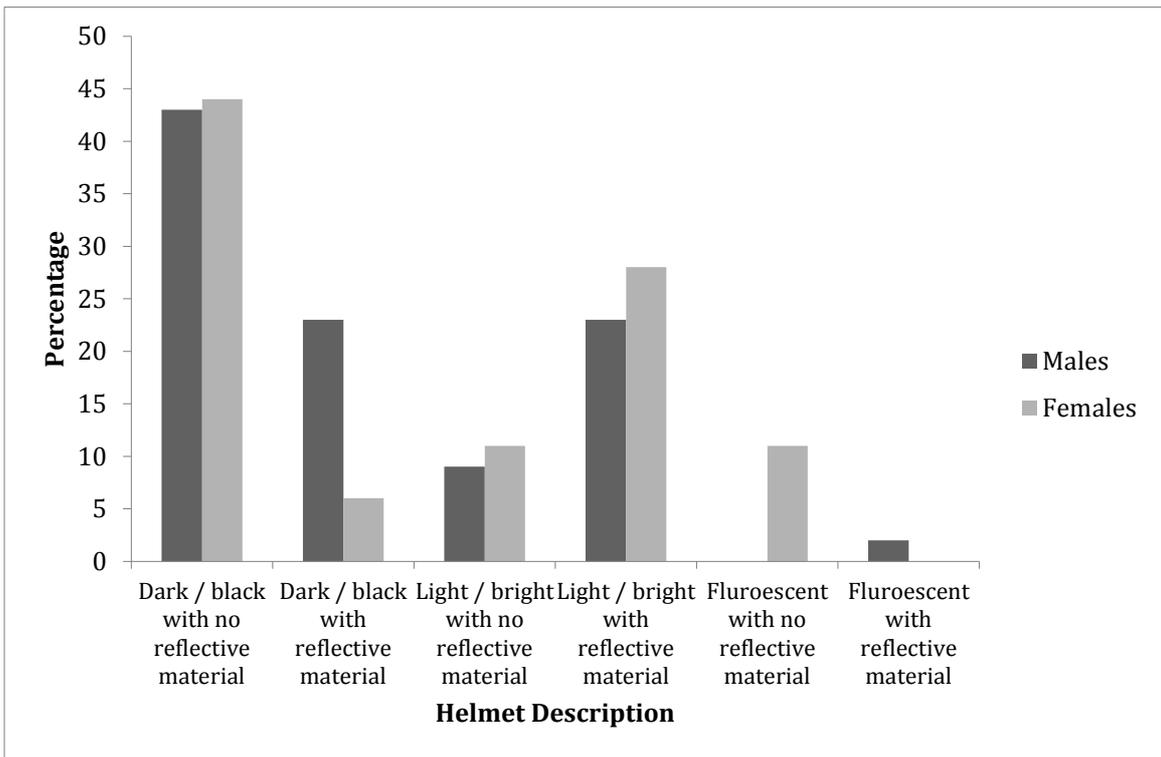


Figure 13 Current Helmet use by Male and Female Motorcyclists

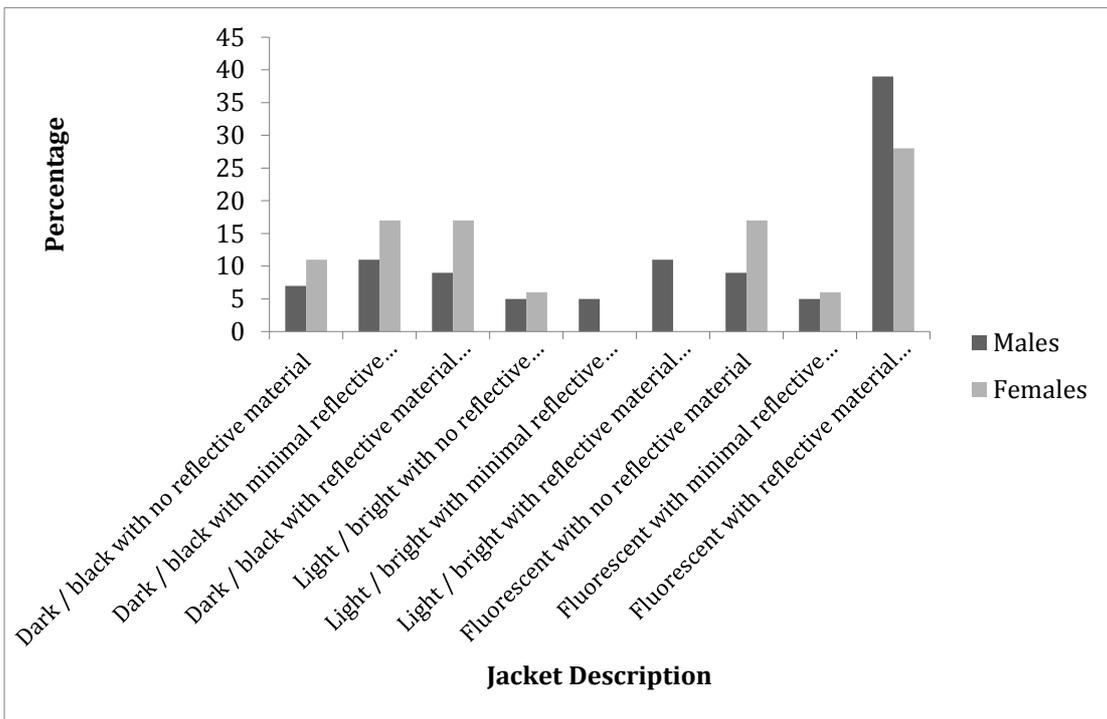


Figure 14 Jackets that would be considered by Male and Female Motorcyclists

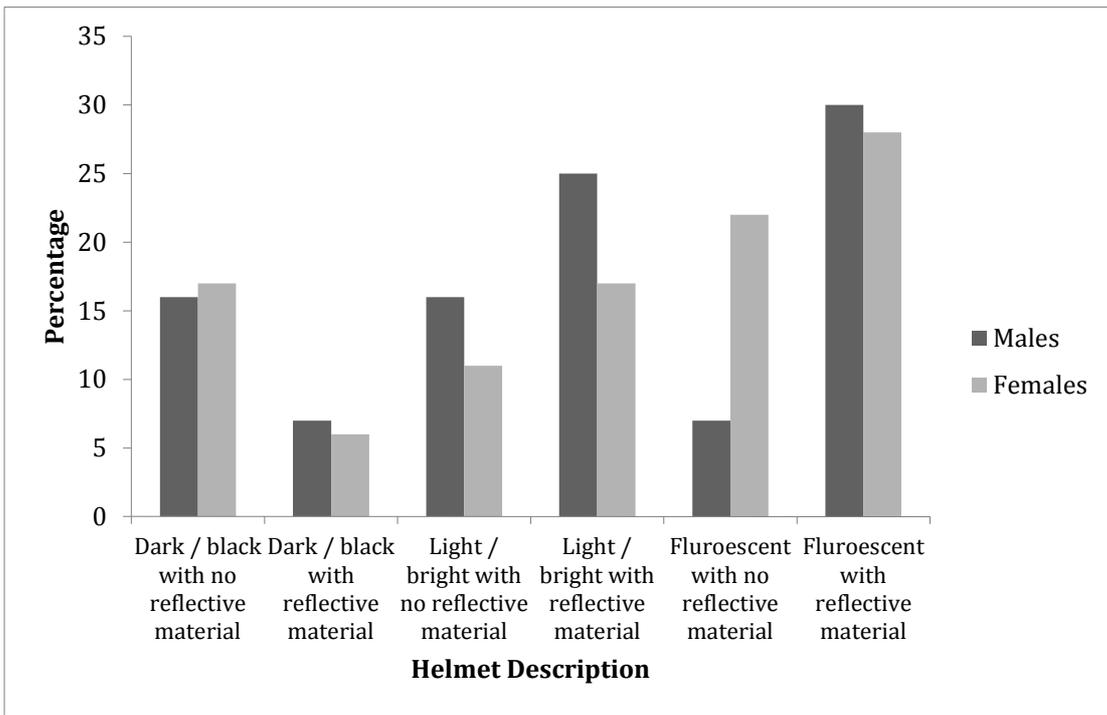


Figure 15 Potential Helmet use by Male and Female Motorcyclists

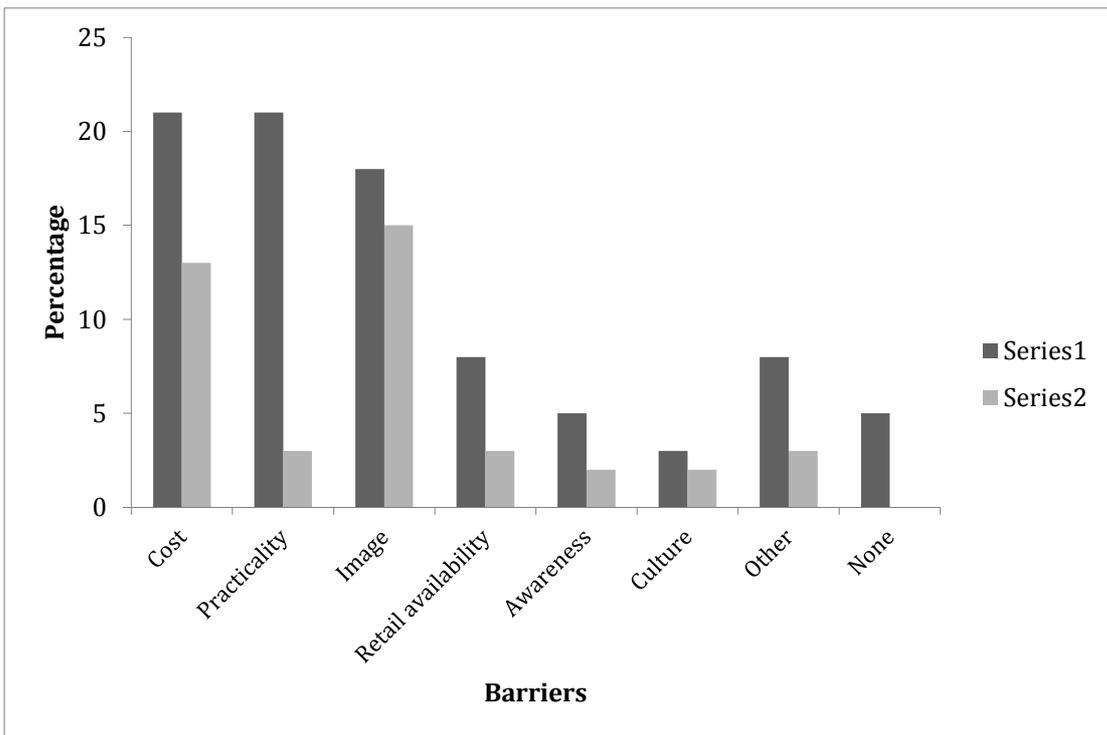


Figure 16 Barriers to HVG use by Male and Female Motorcyclists