

# Traffic Related Air Pollution

## Perceptions in Wellington



# Authors

Lavan Sivaraja<sup>1, 3</sup>, Alana Chamberlain<sup>1</sup>, Yaechan Ju<sup>1</sup>, Tommy Loeffen-Gallagher<sup>1</sup>,  
Hamed Al-Busaidi<sup>1</sup>, Fabian Barrett<sup>1</sup>, Lily Boothman-Burrell<sup>1</sup>, Francesca Dalzell<sup>1</sup>,  
Jordan Felderhof<sup>1</sup>, Albert Hailes<sup>1</sup>, Catherine Midgley<sup>1</sup>, Nicholas On<sup>1</sup>, Mike Peebles<sup>1</sup>,  
Holly Pittar<sup>1</sup>, Ali Sarfarazi<sup>1</sup>, Nikeeta Unka<sup>1</sup>, Laura Upton<sup>2</sup>, Kavindu Weerasekera<sup>1</sup>,  
Hope Yuan<sup>1</sup>

1: 4th Year Medical Student, Department of Public Health, University of Otago,  
Wellington, New Zealand

2: 3<sup>rd</sup> Year Pharmacology Student, Faculty of Biomedical Sciences, University of  
Bristol, United Kingdom

3: Project Lead

*Artwork by Nikeeta Unka*

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# Table of Contents

1. Introduction and Literature Review:	6
1.1. Transport related air pollution	6
1.2. Health effects of TRAP	7
1.3. Exposure to TRAP	9
1.4. Public perceptions of TRAP	10
1.5. Closer to home – TRAP in Wellington, New Zealand	12
2. Aims:	13
3. Methods	14
3.1. Intercept survey	14
3.2. Statistical analysis	15
3.3. Key informant Interviews	16
3.4. Media Discourse analysis	16
3.5. Policy analysis	16
4. Results	17
4.1. Intercept surveys	17
4.2. Key informant interviews	24
4.3. Media discourse analysis	26
4.4. Policy analysis	26
5. Discussion	28
5.1. Survey demographics	28
5.2. Views on TRAP	29
5.3. Key informant interviews	30
5.4. Policy	30
5.5. Communications	31
Reference List:	32
Appendices	
Appendix A: Survey Information and Consent Form	37
Appendix B: Survey Questionnaire	40
Appendix C: Key Informant Information and Consent Form	43
Appendix D: Key Informant Full Results	48
Appendix E: Media Analysis	55
Appendix F: Policy Analysis	63

## **Abstract:**

*Introduction:* Plans for urban transformation and renewal are currently big topics of consideration throughout New Zealand, and the world. In Newtown Wellington, the Wellington City Council has plans to intensify and add apartments to Adelaide Road, and get 2000 more people into the city. Missing from many of these discussions however, is the increased impact of Traffic Related Air Pollution (TRAP) on the urban population. TRAP is well established to have many negative effects on health, affecting respiratory, and cardiovascular health, and increasing all-cause mortality. In this context, TRAP is clearly an issue; though evidence also suggests that it is not well understood by the public, or well covered by the media. We therefore sought to discover what the perceptions were towards TRAP in Wellington.

*Methods:* We asked the public their views on TRAP using a short street intercept survey, gauging their views on air pollution, factors affecting their views, and how to respond to the issue. We also carried out 10 interviews with key stakeholders and decision makers in Wellington to elucidate an in-depth view of air pollution, and the challenges of responding to it as an issue. We also conducted a media analysis of all media sources available in Wellington to gauge the discourse around TRAP. Finally, we looked into overseas policy options to reduce TRAP that might be successful in Wellington.

*Results:* Participants generally considered TRAP to be an issue of moderate importance, that the council should respond to, but felt that there was not much information available. Key informants identified five key challenges to responding to TRAP; being a perceived lack of information, a perception of it not being a serious issue, a lack of political will, lack of coordination between organisations, and the state of transport in Wellington. There was little discourse or information available about TRAP in the media.

*Discussion:* TRAP is generally acknowledged as an issue, but is not broadly considered an important issue that needs to be addressed imminently. There is a degree of dissonance in many people's attitudes towards TRAP also. To respond to TRAP will require an informed, activated public, and political courage from the politicians, informed by systemic policy analysis to promote effective policies. This may be able to be achieved through campaigns utilising modern forms of communication, such as digital and social media.

## **1. Introduction and Literature Review:**

For many reasons related to the environmental determinants of population health, councils and developers in NZ are interested in developing inner city areas or inner city suburbs to reduce urban sprawl and live in compact cities where community amenities are closer and which reduce carbon emissions. However often the only areas available to renew and intensify are areas near busy roads. Close to home Adelaide Road in Newtown, Wellington has been identified as an urban transformation zone [1, 2], with the intention that nearly 2000 more people will live there in the coming decades. The dominant feature of this area is the busy four lane road transecting the area. Air quality modelling has shown that air quality could well be affected by the increased use of diesel buses and the street canyon effect created by apartments [3].

In spite of this, air pollution is not an issue that seems to have been considered greatly amongst the plans for urban transformation. It also is not an issue that is much discussed in New Zealand. We therefore aimed to find out what the Wellington public think about the issue of air pollution, and also to seek the views of key stakeholders in the region.

### *1.1. Transport related air pollution*

People are exposed to air pollution every day. With well-documented evidence of its acute and chronic health effects, and no safe level or threshold below which adverse health effects do not occur, it is a significant environmental health hazard with a growing body of evidence identifying the burden of disease. [3]. Traffic is an important contributor to air pollution, particularly in urban areas. Traffic contributes a complex mix of pollutants to the air, numbering in the thousands. The most widely studied combustion products include particulate matter (PM), black carbon (BC), nitrous oxides (NO<sub>2</sub>), carbon monoxide (CO) and benzenes. Further, secondary by-products, such as ozone, are formed by chemical transformation of these pollutants in the atmosphere. Increasing levels of these pollutants have been shown to have significant health effects in epidemiological and toxicological studies [3, 4].

## *1.2. Health effects of TRAP*

Several studies have found that exposure to TRAP leads to an increase in all-cause mortality. The 2010 Health Effects Institute report found that there was evidence to suggest a causal association between TRAP and all-cause mortality [5]. The WHO found that exposure to pollutants NO<sub>2</sub>, PM<sub>2.5</sub> and O<sub>3</sub> are all associated with an increased risk of mortality [3, 4]. A study looking at short-term NO<sub>2</sub> exposure and mortality in 204 time-series studies found that a 10 µg/m<sup>3</sup> increase in 24hr NO<sub>2</sub> was associated with a 0.71% increase in the risk of death from all causes along with statistically significant increases in mortality from respiratory and cardiovascular diseases, further adding to this body of evidence [6]. A recent NZ study, which was not specifically looking at TRAP, found that for every 10 µg/m<sup>3</sup> increase in PM<sub>10</sub> exposure, there was a 7% increase in the odds of all-cause mortality in adults aged 30-74, and a 20% increase among Māori [7].

### *1.2.1. Effects on Respiratory health*

There is a large body of evidence that consistently has established a strong association between TRAP, asthma in children [8-10], and with reduced lung function [5]. In particular, associations have also been shown between asthma incidence and particular pollutants black carbon [9], and NO<sub>2</sub> and PM<sub>2.5</sub> [8]. The HEI report concluded that evidence is sufficient to infer a causal link between TRAP and asthma exacerbations [5].

TRAP has also been linked with lung cancer [11-15]. Hamra et al found that for every 10 µg/m<sup>3</sup> increase in NO<sub>2</sub>, there was a 4% increase in the incidence of lung cancer, and that proximity to major roads increased the risk for lung cancer [11, 12]. A 2014 meta-analysis found a similar increase in incidence for PM<sub>2.5</sub> [11]. In 2013 the International Agency for Research on Cancer classified PM<sub>2.5</sub> as a Group 1 carcinogen [14].

There is also some evidence linking respiratory infections with TRAP. A 2014 study that followed 16,059 children across ten European cohorts also found “consistent evidence for an association between traffic-related air pollution and pneumonia”,

during the first two years of life [16]. Several studies have also found that TRAP exacerbates upper and lower respiratory infections in early life [17, 18].

### *1.2.2. Effects on Cardiovascular health*

The HEI review suggested an association between overall cardiovascular mortality with short and long term TRAP exposure [5]. A further review from the WHO was consistent, concluding long term exposure to PM<sub>2.5</sub> affected cardiovascular mortality [3]. A 2013 review examined the association between air pollution and heart failure, and found that heart failure mortality was associated with increases in CO, SO<sub>2</sub>, NO<sub>2</sub> and particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>) [19]. The effect from PM<sub>2.5</sub> was particularly strong [19].

Further reviews have found positive associations between TRAP and the induction of atherosclerosis [3, 20, 21]. Campen et al concluded that acute TRAP exposure leads to altered heart function, BP regulation and fibrinolysis, and that the greatest effect was with combinations of TRAP particles rather than individual sources [21]. Furthermore, in a controlled exposure study where volunteers with a history of myocardial infarct were exposed to diesel exhaust for an hour during rest and exercise, subsequently showing increased cardiac burden and a reduction in the release of endothelial tissue plasminogen activator [22]. Additionally animal model research has shown exposure to inhaled diesel exhaust compared with filtered air induced atherosclerotic plaques in mice, through oxidative stress [23]. Evidence is mixed about whether TRAP affects carotid artery atherosclerosis progression [24]. Gan et al found no significant differences of any atherosclerotic markers were found between groups living close to and away from major roads [24].

Studies have also shown an association between the development of ischemic heart disease (IHD) and TRAP [25, 26]. Katsoulis et al showed an estimated hazard ratio (HR) of 1.5 for any cardiovascular event, for an increase in long term exposure to PM<sub>10</sub> in women [25]. Results showed correlations between PM<sub>10</sub> exposure (HR= 2.24) and NO<sub>2</sub> exposure (HR= 1.54) with IHD. Beckerman et al showed NO<sub>2</sub> exposure conferred an increased risk (RR=1.33) for the development of IHD, with no significant

differences between males and females [26]. Participants living close to main roads and motorways had an increased risk of IHD [26].

### *1.2.3. Other health effects of TRAP*

Other health outcomes have been linked to TRAP, such as childhood cancer and cognitive changes. A systematic review and meta analysis analysed the association between residential TRAP and childhood leukaemia [27]. An association was found between a postnatal TRAP exposure and childhood leukaemia (OR 1.53), with no association to prenatal exposure [27]. There has also been evidence linking TRAP exposure to cognitive functioning [28]. Clifford et al found links between TRAP exposure and neurodevelopmental delay in children, and cognitive decline in the elderly [28]

### *1.3. Exposure to TRAP*

The highest exposures to TRAP occurs in areas with proximity to high traffic volumes which can be up to 300-500m away from a highway or major road [5]. An individual does not necessarily need to be outside to be exposed; pollutants can migrate indoors through infiltration and ventilation. Outdoor black carbon levels have been shown to be highly correlated with indoor levels [3]. Thus, the populations at greatest health risk are those who live or work near busy roads, as well as those who spend a considerable time in traffic.

#### *1.3.1. Factors influencing the exposure to TRAP*

Arterial roads and motorways that experience traffic congestion are obviously major sites of high volume TRAP. The dispersion/spread of TRAP from its source may be up to 300-500m away from a busy road [5]. This suggests that residing or regularly spending time near busy roads increases exposure to TRAP.

Commuters are exposed to high concentrations of air pollution. For some, time spent in transit and heavy traffic conditions constitutes approximately 5-10% of the day [29]. A study conducted in the Netherlands that compared exposure levels between those

commuting by car, bus and bicycle, found that all commuters were exposed to higher levels of air pollution compared to urban background levels [30]. A similar study conducted in Auckland, NZ investigated CO doses received whilst commuting via different modes of transport, and concluded that exposure was similar between commuting by car or bus as compared to running and cycling [31]. Exposure on trains was found to be the lowest presumably due to the separate route away from traffic congestion. However, taking into consideration time taken for the commute and increased respiration due to exertion, the average dose of CO that cyclists and runners are exposed to when using heavy traffic roads is likely to be significantly higher [31].

### *1.3.2. Inequalities in exposure to TRAP*

There is evidence of inequalities in exposure to TRAP. The ‘triple-jeopardy’ hypothesis has been proposed: 1) lower socioeconomic groups are exposed to higher pollution, 2) these groups already suffer the burden of poor health due to social factors, and 3) the reduced health makes these groups disproportionately more susceptible to the health effects of air pollution [32]. Multiple studies have demonstrated that socially disadvantaged groups are often exposed to higher levels of pollution than other groups in society [32-34]. Indeed, in Christchurch, air pollution has been shown to be higher in more deprived areas [35].

### *1.4. Public perceptions of TRAP*

Despite the well-established effects of TRAP, public knowledge is required to lead to action. Understanding sources and forms of public knowledge about air pollution, public perceptions of air pollution and drivers/obstacles to behaviour change are important in formulation and implementation of effective health promotion strategies and health policy.

A general realization exists that air pollution impacts negatively on health. Day found in a 2006 study on the perceived health risks of TRAP in areas of London, that people made associations between air quality and certain symptoms (eg asthma, eczema) in themselves or people close to them [36]. Badland and Duncan’s 2009 survey also revealed that half of all participants felt that exposure to pollutants in transit negatively affected their overall health [37].

However, in spite of knowledge of the risks of air pollution, perception of risk can be varied. Risk perception is influenced by a mixture of environmental and contextual factors and is crucial in public response in mitigating risk, and can have effects on the way plans are made [38]. With particular respect to air pollution, seeing or smelling exhaust fumes, or seeing traffic congestion led to a heightened perceived risk [36, 38]. Yet, Day identified that there is still some uncertainty about whether air pollution alone is a significant risk factor [36]. Such uncertainty can be used as a justification for inaction. Badland and David found that in spite of many participants believing that air pollution negatively affected their health, 82% of participants were reliant on private motor vehicles for transport [37]. This indicates a degree of cognitive dissonance, a logical disconnect, around TRAP.

#### *1.4.2. Communication of health information*

With the advancing digital environment, it can be overwhelming for public health practitioners to choose the most efficient way to communicate important public health messages such as TRAP [39]. Traditional media, such as TV, radio and newspaper remain effective ways to communicate messages, and are perceived to be informative, trustworthy and entertaining. However, they are comparatively expensive, are seeing a reduction in users [39].

In comparison, newer marketing tools such as social media, internet websites and mobile phone applications are increasing in popularity. For example, Facebook was rated the fourth most popular means of communicating health information in the UK [40]. They are relatively cheap, allow for a two-way communications stream and enable end users to engage with the information. Also they provide various tools for immediate evaluation of effectiveness of engagement [40]. In the context of TRAP, the use of internet based systems would allow an efficient means to provide dynamic air quality information as they could receive feeds for changing air quality information.

### *1.5. Closer to home – TRAP in Wellington, New Zealand*

A report on air pollution by the Greater Wellington Regional Council, found that overall, the Wellington region has concentrations of PM<sub>10</sub>, CO and NO<sub>2</sub> generally within national and WHO guidelines [41]. However there is only one air quality monitoring station in Wellington and trends at this station are difficult to interpret due to major changes to State Highway 1 in 2008 and recent changes in site and data collection. The report did not separate TRAP from other sources. Even though air quality falls within guidelines, it is important to remember that there is no threshold that is considered ‘safe’ for levels of air pollution, therefore these levels still contribute toward the health of the population [3].

In 2014, the mean PM<sub>10</sub> in Wellington was 13.1µg/m<sup>3</sup> compared to the national air quality guideline of 20µg/m<sup>3</sup>. However, there is evidence from the NZTA showing there may be more focal areas with poorer air than that at the monitoring station [42]. Their report included monitors closer to the roadside and included areas where surrounding buildings might increase confinement of emissions.

Nationally, air pollution health effects have been assessed by the Health and Air Pollution in New Zealand study [43]. They concluded that anthropogenic (human-caused) air pollution was associated with 1175 annual premature deaths in adults and babies, and 1.49 million restricted activity days (RADs - days on which people could not do what they could have otherwise in the absence of air pollution). Of these, traffic contributed 256 deaths and 352,000 RADs. They calculated the total social cost to be \$4.28bn per year, with \$934 million associated with traffic.

## **2. Aims:**

### *2.1. To determine the views and attitudes of Wellingtonians about TRAP*

The negative health impacts of TRAP are clear, even if there is some ambiguity about what the precise effects of pollution are. However overseas evidence also suggests that the public are not well informed on what the health effects of TRAP are, and do not consider it a serious issue. We therefore aimed to find out what Wellingtonians know and think about TRAP already, in order to determine how to act on this issue.

### *2.2. To determine the views and attitudes of policymakers and key stakeholders in Wellington towards TRAP*

The burden for providing evidence for action on issues of public concern often falls to policy analysts, who then inform politicians, as well as the general public. We aimed to elucidate the views and attitudes of these stakeholders to investigate the importance of this issue amongst decision makers.

### *2.3. To determine the discourse and disclosure of information around TRAP in the Wellington region*

Public knowledge and perception of TRAP is heavily influenced by what information they are provided with through the media, and various governmental, and non-governmental organisations. We investigated what the current discourse of TRAP is in the media, and what information is provided to the public.

### *2.4. To investigate policies that can mitigate and reduce TRAP*

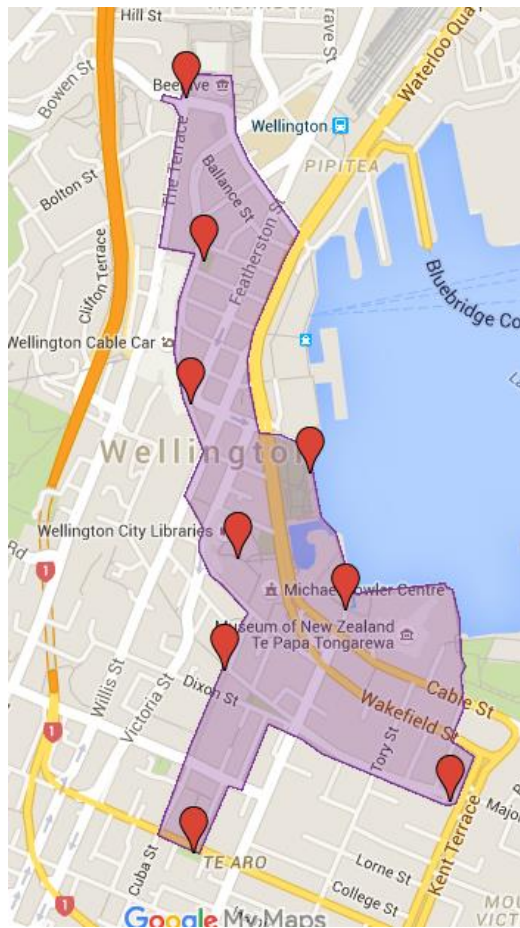
As Wellington moves towards policies of urban intensification and renewal, air pollution is likely to become an increasingly important issue for the city. We investigated what policies are used overseas to reduce emissions and mitigate the effects of TRAP.

### 3. Methods

The methods used in this department all underwent ethics approval before their use. Category B departmental ethical approval was obtained from Professor Diana Sarfati, Public Health Department, University of Otago, Wellington on 7th July, 2016.

#### *3.1. Intercept survey*

A street intercept survey was performed by the researchers to find out the views on TRAP amongst Wellingtonians. Researchers went out in pairs to one of nine pre-allocated areas (Figure 1) within our pre-defined CBD area (purple shading, Figure 1), to complete 3-5 minute face-to-face street surveys (*Appendix B*). Questions either required a discrete answer, or for participants to rate the importance of a statement on a scale of 1-5 (1 being unimportant, 5 being very important). A variety of locations were chosen to access a wide variety of participants. There were no exclusion criteria for participants. Researchers approached potential participants to ask them if they would like to do the survey using a set opening line. If the participant agreed to do the survey, the information sheet was given to them and the consent form completed, before the survey was completed with the student. Researchers followed pre-defined instructions to ensure consistency of delivery. The answers from the survey were recorded anonymously. The time of the survey was noted to the nearest hour.



**Figure 1 – Map of Wellington showing survey sites**

**Purple shading refers to our pre-defined Central Business District, Red tags show survey sites**

Non-participation was recorded if participants were asked to complete the survey, but declined. The target was 300-400 people, which was based on the 2013 census Wellington population with a desired 95% confidence interval. Surveys were completed on both weekdays and weekend days. Data were recorded digitally using *Google Forms*.

### *3.2. Statistical analysis*

Statistical analysis was performed using the *StatPac Statistics Calculator*. Survey data were tested using the Pearson's chi squared test for goodness of fit. Significance was set at a *P*-value of 0.05. To determine whether the sample was representative, a z-test for One Proportion was performed.

### *3.3. Key informant Interviews*

Participants for key informant interviews were recruited via a snowball sampling method. Interviews were conducted organically in an open-ended manner, with the floor left open to the interviewers to interpret, and add questions as they saw fit. An overview of the content of the interviews can be found in the consent form (*Appendix C*). Interviews were recorded, and transcribed afterwards for thematic analysis. Direct quotation was permitted in the consent process.

### *3.4. Media Discourse analysis*

We carried out our media analysis by searching various media websites (eg Dominion Post and Radio NZ) using keywords “Wellington”, “Air Pollution”, “Air Quality”, and, “Transport related air pollution” during July 2016. We also used Google searches of these keywords to find any articles we had missed. Finally, we also looked at social media sites (eg Facebook) to investigate the discussion around Air Pollution. To be eligible for analysis, an article or a post had to mention air pollution, make reference to the effects on health and also accessible in Wellington. We looked at whether there was any direct reporting of TRAP data, or information campaigns from various governmental and non-governmental organisations. We looked for Apps that showed air pollution levels from the Apple and Android store, and directly contacted Land Air Water Aotearoa (LAWA), National Institute of Water and Atmospheric research (NIWA), Greater Wellington Regional Council, Wellington Greens, and Generation Zero. We excluded reports from these organisations as these were determined to be inaccessible to the general public, but did include billboards, brochures, or similar mediums.

### *3.5. Policy analysis*

A review was undertaken looking at policies used to combat air pollution both within New Zealand, and internationally. Literature on air pollution policy was also reviewed.

## 4. Results

### 4.1. Intercept surveys

#### 4.1.1. Demographics

The total number of people surveyed was 482, across nine locations over one week. Of the participants 54% were male and 46% female. Our proportion of 20-29 years old sampled was high – 39% of all participants (Figure 2). 72% of participants identified as being NZ/European or Pakeha, 8% identified as being Māori, and 9% identified as being Asian (Figure 3). All three groups well reflected Wellington demographics (Māori  $P=0.0715$ ).

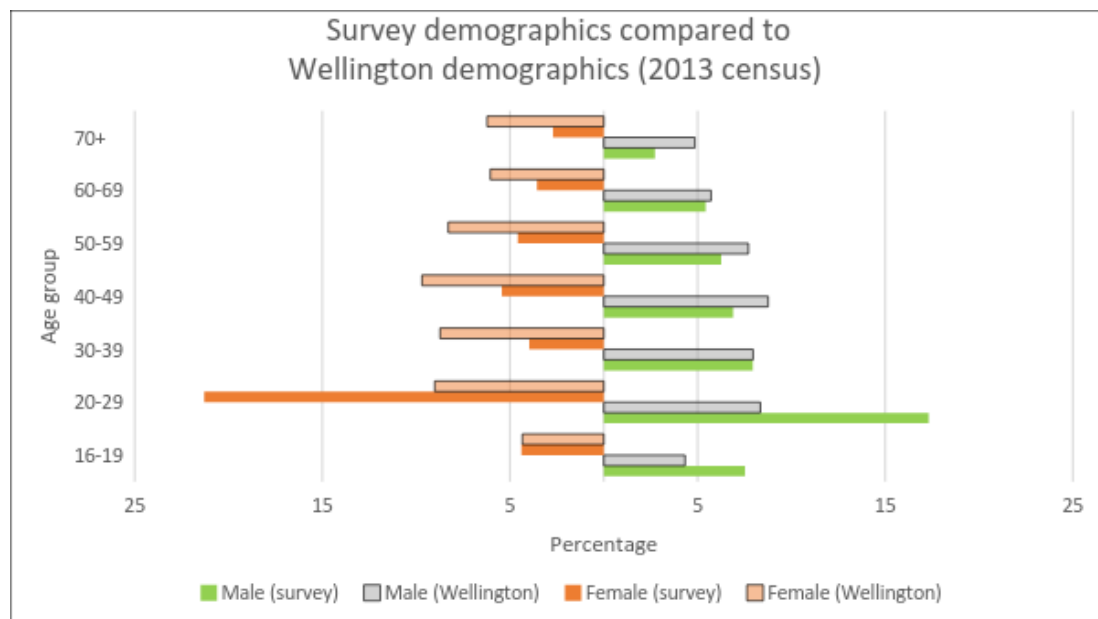
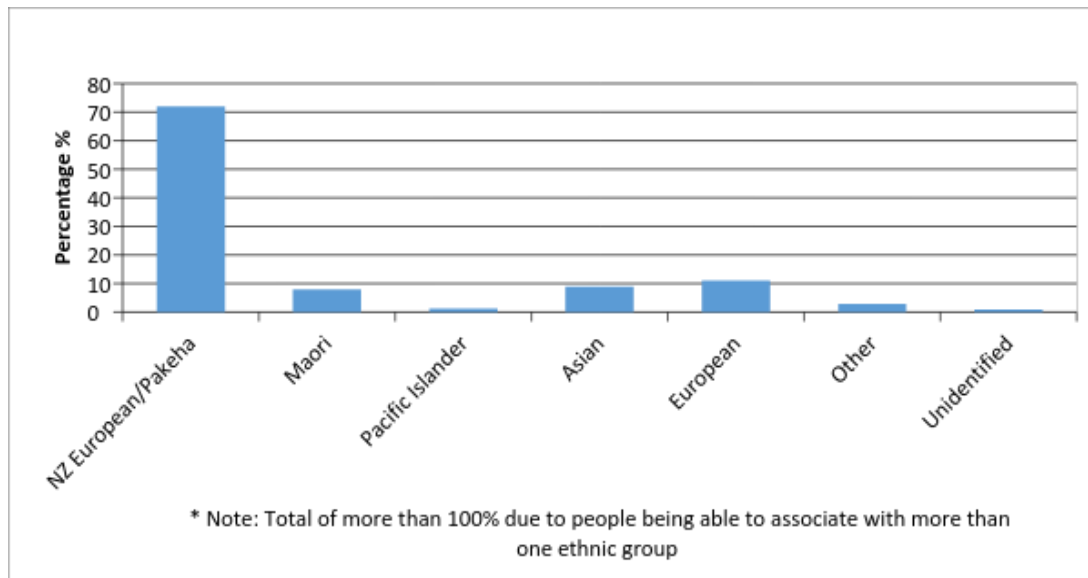
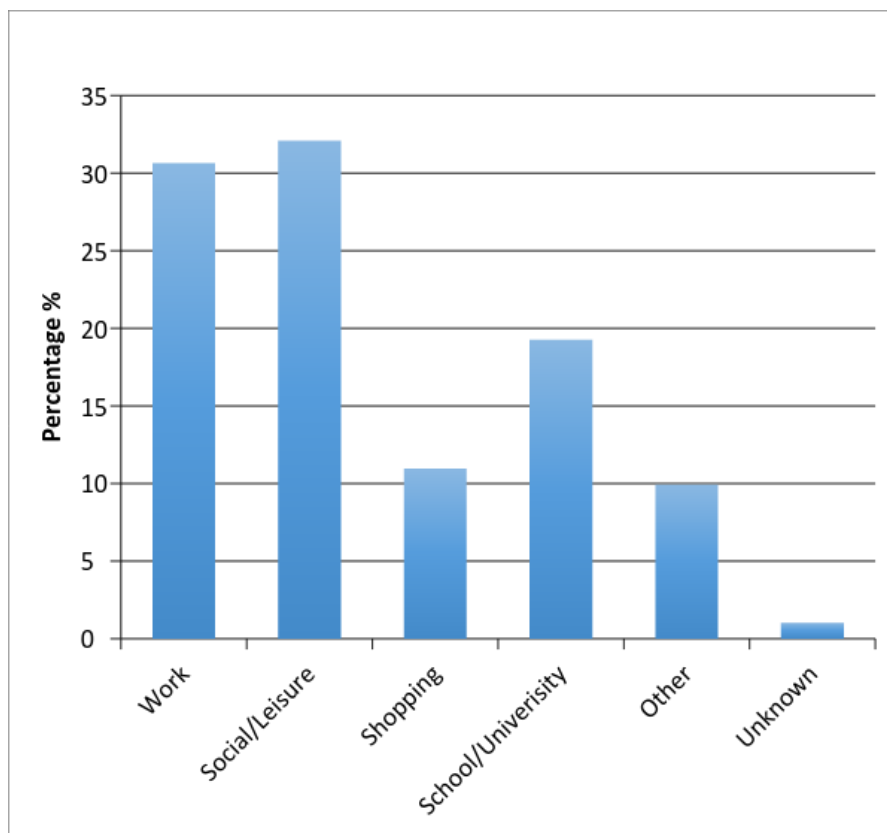


Figure 2 – Ages of survey participants, compared to Wellington census data



**Figure 3 – Ethnicity of survey participants**

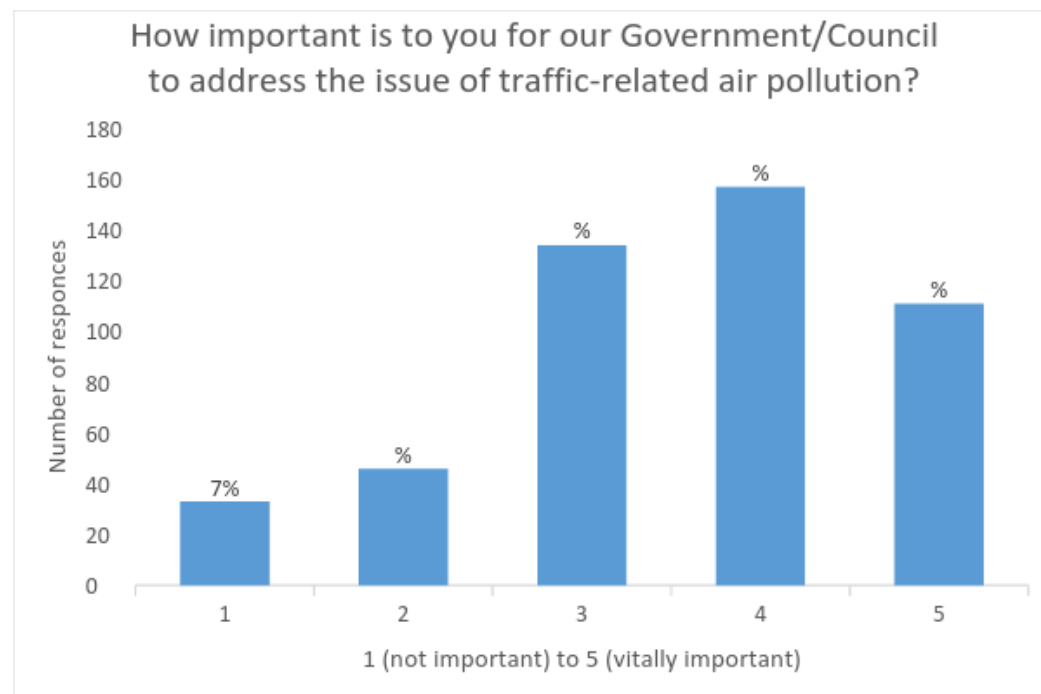
31% and 33% of people were in Wellington for work or social/leisure respectively. 19% were there for study and 10% for shopping, the remainder were other or did not answer (Figure 4).



**Figure 4 – Purpose of visit to CBD**

#### 4.1.2. Opinions on TRAP

23% of participants thought that TRAP was vitally important (a 5 on a scale of 1 to 5) that our Government/Council should address the issue of traffic-related air pollution. 33% ranked the importance of government action at 4/5, 28% ranked the importance at 3/5 and 17% ranked the importance at 1/5 or 2/5 (Figure 5). The mean was 3.6/5. The data were stratified by whether participants identified themselves as being personally affected TRAP, and this showed a significant difference ( $P<0.00001$ ).



**Figure 5 – Answer to question “How important is it to you for our Government/Council to address the issue of TRAP?”**

The most popular answer selected by those who considered themselves personally affected was 5/5 (39%), and 4/5 (32%) for those who considered themselves not (Figure 6). The mean rating by those considering themselves affected was 4/5, and for those not affected it was 3.4/5.

The data was stratified by mode of transport to get into the city. There was a significant difference between those who used personal motor transport, and those who used public transport or non-motor transport ( $P=0.0226$ ). The most popular answer from those that used personal motor transport was an importance rating of 3/5 (29%), and among public

transport, or non-motor transport users the most popular answer was 4/5 (36%) (Figure 7). The mean rating for personal motor transport users was 3.4/5, and for public transport and non-motor transport users was 3.6/5.

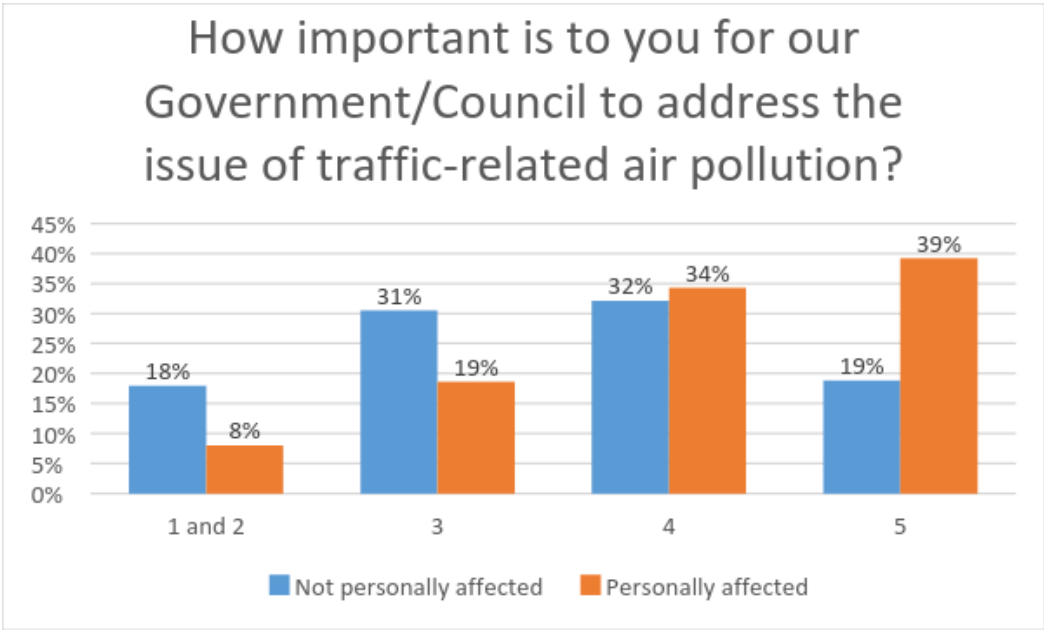


Figure 6 - Answer to question “How important is it to you for our Government/Council to address the issue of TRAP?”, stratified by exposure to TRAP

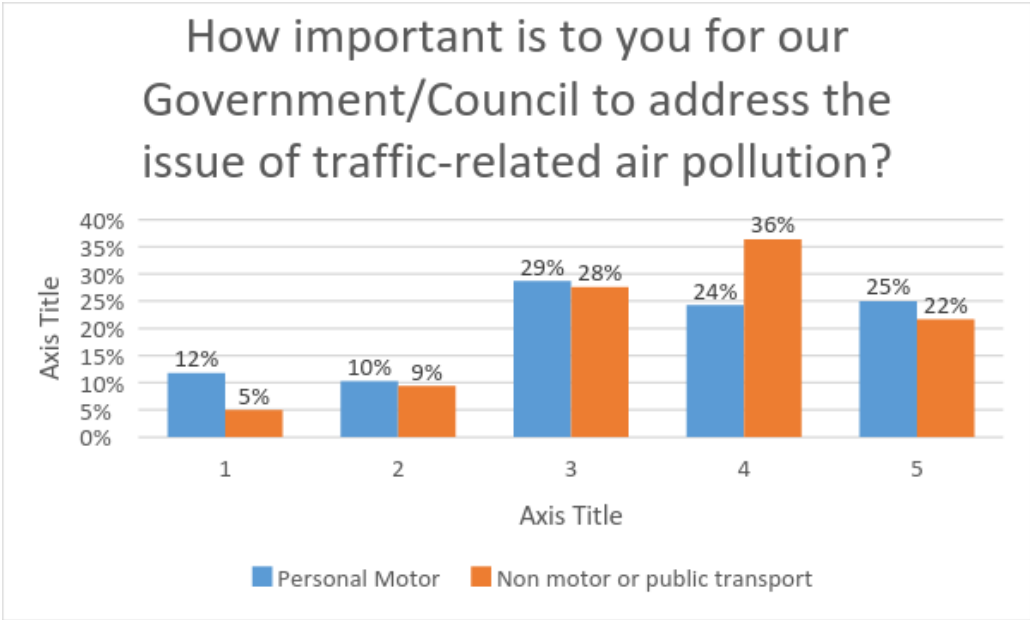


Figure 7 - Answer to question “How important is it to you for our Government/Council to address the issue of TRAP?”, stratified by mode of transport

There was a significant association between people who believed that they were affected by TRAP, and considered TRAP presented a high level of concern for

Wellington, compared to those who did not consider themselves affected. Those who were personally affected rated their level of concern at 3.7/5, while those that did not consider themselves affected rated their level of concern at 2.8/5 ( $P<0.0001$ ).

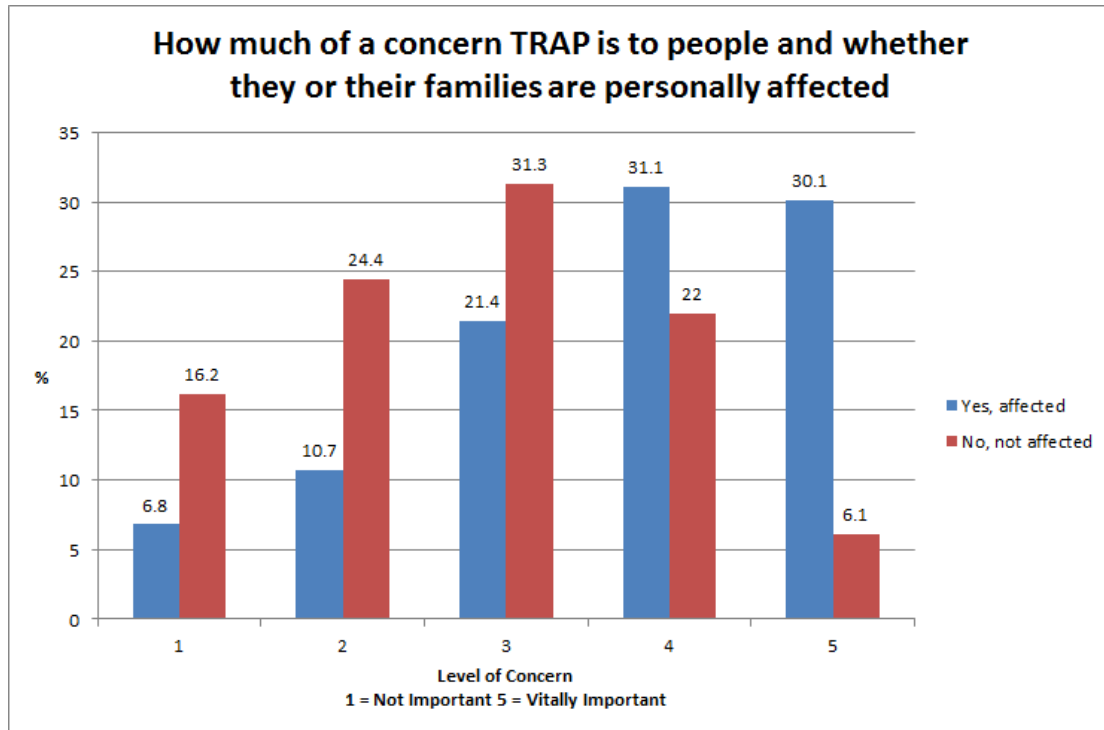


Figure 8 – Answer to question “How much of a concern is air pollution from traffic in Wellington to you?”, divided into whether participant identified as being affected by TRAP

#### 4.1.3. Opinions of Māori

Māori reported a slightly increased level of concern about TRAP in Wellington compared to Non-Māori people in our survey, but there was less variance in their response. Māori rated their concern about TRAP at 3.13/5, compared to 2.95/5 by Non-Māori. This difference was trending to significance ( $P=0.053$ ).

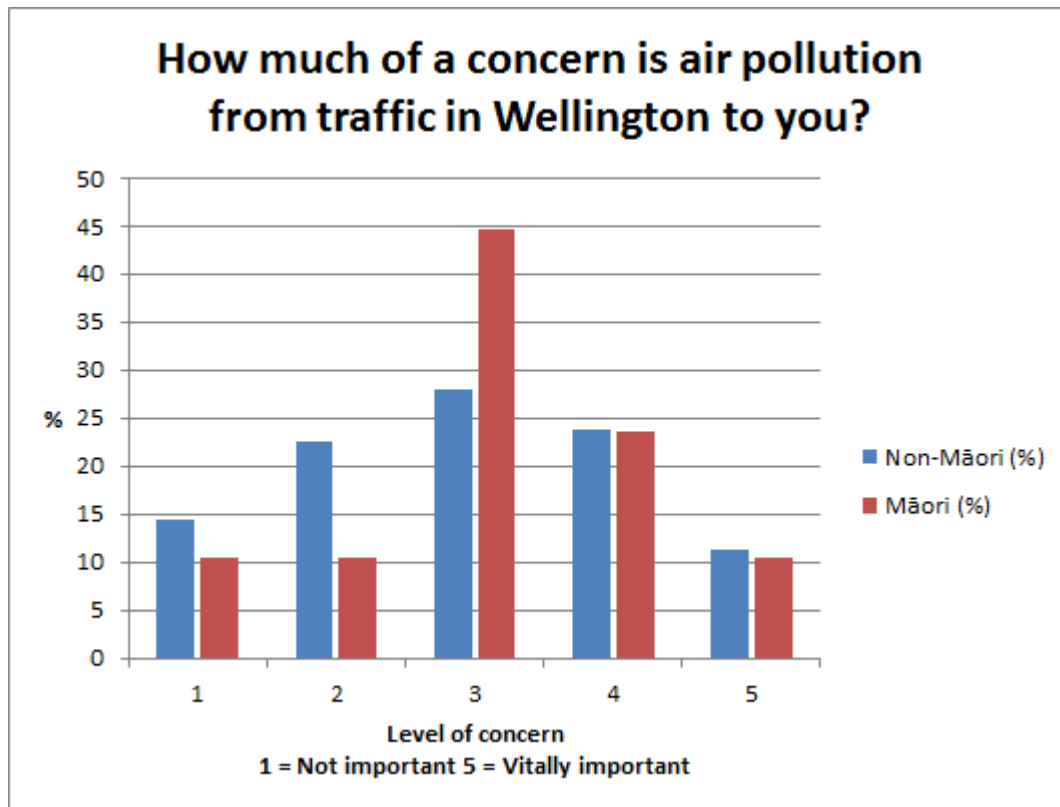


Figure 9 – Answers to question “How much of a concern is air pollution from traffic in Wellington to you?”, divided into Māori and non-Māori

#### 4.1.4. Communication of TRAP

Participants were asked whether they thought that more information on traffic-related air pollution would be useful. 74% of participants thought that more TRAP-related information would be useful (Figure 10).

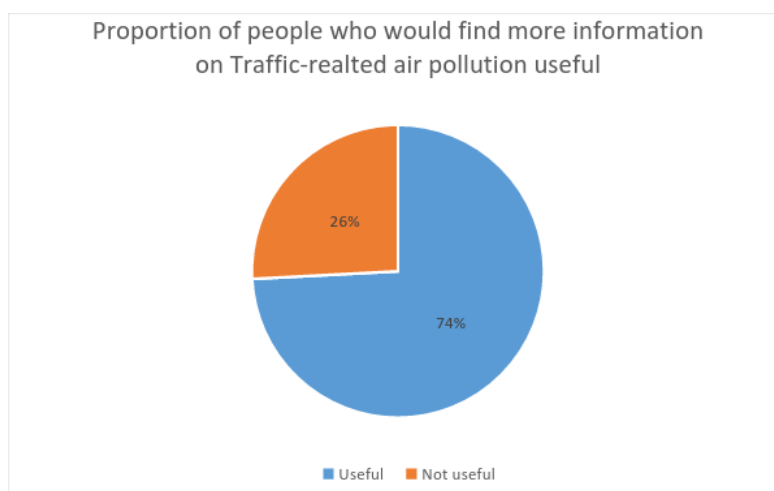
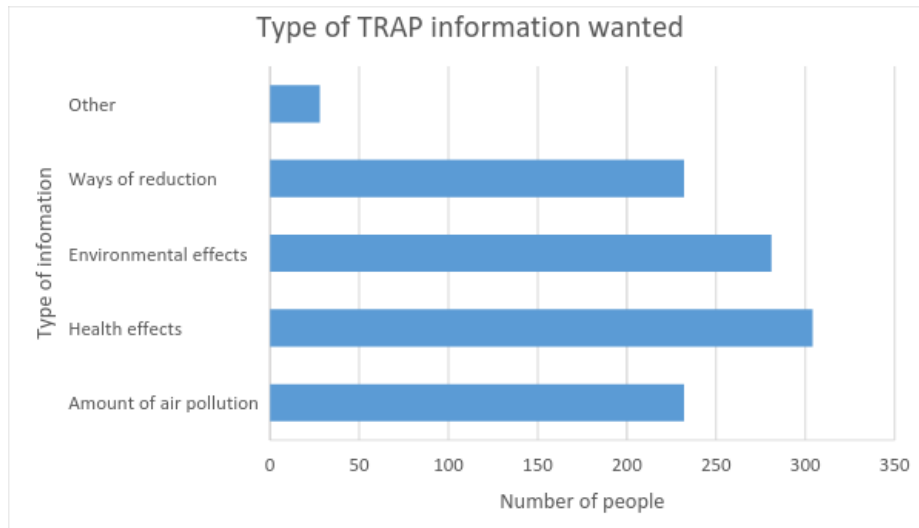
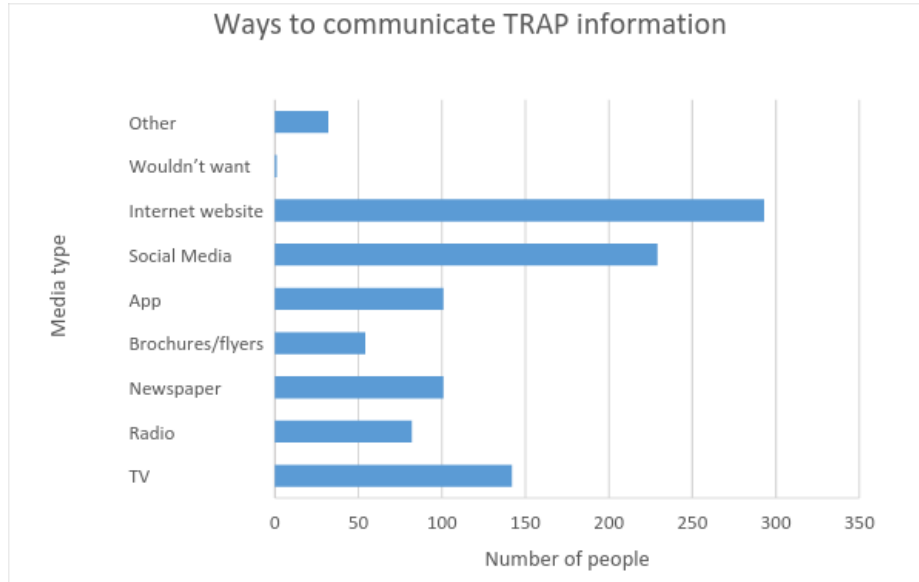


Figure 10 – Proportion of participants who would find more information on TRAP useful or not-useful

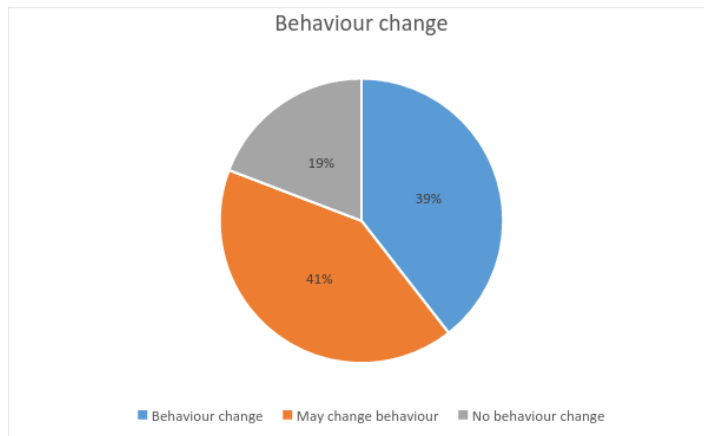
Participants identified what sorts of TRAP information they would like (Figure 11), and which forms of communication they would like TRAP information communicated to them by (Figure 12). They generally identified that they were amenable to behaviour change if more TRAP information was provided (Figure 13).



**Figure 11 – Type of TRAP information wanted by survey participants**



**Figure 12 – Preferred means of communication of TRAP information by survey participants**



**Figure 13 – Potential for behaviour change from participants with more information**

#### *4.2. Key informant interviews*

Five major themes resonated across the ten key informant interviews. Firstly, the informants felt there was a lack of focused research available on the subject of specific health impacts. Particularly in the context of an environment like Wellington's this was seen as a serious hindrance to their ability to address the issue. This is seen as a difficult obstacle to remedy, as air pollution is intrinsically a complex public health problem, encompassing a large number of confounding factors. This lack of knowledge is problematic for policy makers and politicians alike, making it difficult to put the issue to the public. *"We'll never be able to tell people what a safe level for long term exposure is because so many other things happen to you in your life while you're being exposed to that, so who knows what caused it (...). You can't give them a number, you can only give them a level of probability based on the average healthy human being of a certain age"*.

Lack of knowledge amongst specialists and researchers was thought to contribute to the low public perception and lack of public pressure surrounding this issue. In the absence of both absolute health information and visible consequences, Wellingtonians were said to be on the whole unconcerned by air pollution. One participant pointed to this as the basis of the public's complacent attitudes: *"It's really sad but people seem to need to see the consequences of something before they take action. It means that we're just waiting for someone to die – because they will at some point."* Another participant added that even if people were to acknowledge TRAP as an issue elsewhere,

it would be brushed off in the capital based on *“the very real perception of wellington (is) that we don’t have air quality issues because of the wind.”*

An overall unwillingness to take action to reduce air pollution in Wellington was both observed and admitted to by the key informants. Policy makers at multiple levels of responsibility described air pollution as a secondary issue to the public, and not one that would be central to their agendas. A lack of public interest and engagement was the most significant reason given for this lack of political will. *“concerns of the public are going to be what drives things and again, air pollution and climate change probably are not things that are going to come up”*. For central government, a second cause for this political unwillingness was proposed: *“[It stems from a desire to not] be seen to be as anti economic development and anti-business”*.

Another major recurring theme was the current transport situation in Wellington, and potential future improvements in this area. The majority of public transport usage in Wellington is for commuting trips, which only make up 30% of total trips. Therefore, the remaining 70% of travel comes from people driving private motor vehicles. One participant commented *“the most effective way to reduce CO2 emissions in the city or in the region isn’t to run less buses, it’s actually by running better public transport to get people out of their cars.”* They also told us that over the next years they will be aiming to reduce emissions by *“changing the bus network [i.e. changing the routes and frequencies], reducing the number of buses and then reducing the emissions profile of the bus fleet”*. Another participant hoped to encourage greater use of car sharing organisations such as Cityhop. They hoped to spread the message that *“you think you have freedom when you own a car, you don’t know freedom until you don’t own a car,”* and eventually get more people onto public transport, hence reduce emission from private vehicles. The combined approach of reducing both public and private vehicle emissions will hopefully improve air quality in Wellington significantly.

The fragmentation between various responsible sectors was identified as a key obstacle in addressing TRAP. Another participant commented that *“fragmentation is a big problem (...) and there isn’t anybody pulling it together and providing a strategic overview as to how we get results.”* Each responsible sector has its own priorities and concerns. As the organizations cannot easily reach agreement on their priorities, the

final decision falls into the hands of the organization with the bulk of the resources. Another participant pointed out that the Greater Wellington Regional Council receive half their funding from NZTA, “a road-building organisation” who are “not particularly interested in funding sustainable transport (...). When deciding to give approval to a particular project they’re less interested in the sustainable transport programs and that’s a frustration for us.” It seems that the fragmentation of the system is due to the lack of collaboration and communication between responsible sectors.

Our full key informant interview results can be found in *Appendix D*.

#### *4.3. Media discourse analysis*

Our search turned up 28 articles or posts. These were broken down into eight print news articles, seven websites, four social media pages, four radio articles, three smartphone applications, one TV news article, and one physical billboard. 16 framed air pollution as a problem while 12 framed air pollution as not a problem. 18 Included pollution data, 12 included health effects, eight included ways of reducing pollution, and seven included environmental effects. Media that did not frame air pollution as an issue tended to infer that bad air pollution in Wellington only happened during uncommon weather events, or that and that because other cities were worse than Wellington that it was not a concern in Wellington. For a more detailed analysis, see *Appendix E*.

#### *4.4. Policy analysis*

Internationally, policy and regulations have been noted to be the main drivers for effective action on urban air pollution reductions [44]. The majority of cities who have policies for air pollution reduction state that the motivation for these initiatives has been the objective of improving the health of their citizens [44]. The World Health Organization (WHO) supports the notion that it is the role of public health policy to reduce health impacts of urban outdoor pollution, because it is largely beyond the control of individuals [4]. It is their recommendation that the public health sector can lead a multi-sectorial approach at all levels of authority, be that regional, national or international. The European Union then has their own EU Clean Air Policy Package, setting out objectives for reducing the health impact of poor air quality, as well as

national emissions ceilings for Member States [45]. This package resulted in a 20% reduction in mortality associated with PM between 2000 and 2010, and the monetized benefits of the policy are expected to be 12-40 times higher than the cost [8, 46]. These are examples of international cooperation to achieve air pollution mitigation. Additionally we see national, regional and city initiatives for improved air quality [44]. City initiatives particularly focus on reducing transport related emissions, as cities accommodate the majority of people and carry a heavy burden of transport air pollution as a result [44].

It was evident from the literature reviewed that there are themes in which mitigation strategies could be stratified, though most of this was referenced implicitly. A large number of interventions can be examined within the four strategic themes used by Curran et al, Brauer et al, of (i) Land use planning and transportation management, (ii) reduction of vehicle emissions, (iii) modification of existing structures and (iv) behavioural change [47, 48].

More details about the sorts of policies, and examples of these policies can be found in our full policy analysis in *Appendix F*.

## 5. Discussion

We sought was to determine the views and attitudes of regular Wellingtonians, and Wellington policy-makers and stakeholders, about TRAP. We also sought to determine the current state of public discussion and debate about TRAP, and look at policy options that could mitigate its effects.

Overall, we found that many Wellingtonians consider TRAP a moderately important issue, and believe that some action should be taken on it. This was corroborated with findings from policy makers and stakeholders, who agreed that TRAP is an issue, but find barriers in the form of a lack of knowledge about the effects of TRAP, and a lack of political will to take action. Again, this fitted with our media analysis which found that air pollution is not an issue discussed frequently, or in depth by the New Zealand media, and that there is little information about TRAP available in Wellington. We also found that there are a wide range of effective policy options to tackle TRAP, but that these require political will and commitment to be implemented.

### *5.1. Survey demographics*

Our survey managed to capture a population that was representative of Wellington as a whole demographic in terms of ethnicity, though not in regards to age. In particular, the proportion of people aged 20-29, was 39% of participants compared to 17% of those living in Wellington. We captured a large sample (over 400 respondents), and had a high response rate (74%). While the over-representation of young Wellingtonians is a weakness of this survey, it might also reflect the population that is present in the CBD Wellington at times surveyed. This likely reflects a drawback of any street-intercept survey, and in spite of this we still have a relatively representative sample.

A large limitation of this study was that inclusion criteria was “anyone in the CBD” at the time we were conducting the surveys, however this meant that there were a number of tourists who were also included in the study. However, tourist perspectives about TRAP in Wellington may not have been representative of the views of Wellington residents, as they have less personal connection to the issue, and may be provided with different information about the issue. It may be beneficial in future studies to have more

exclusion criteria, and perhaps a small pre-survey questionnaire to determine eligibility to complete the survey, such as being a New Zealand citizen or resident.

## *5.2. Views on TRAP*

Our respondents generally felt that it was important that the council address TRAP in Wellington; with a quarter of participants considering it “vitally important”. Likely reasons for this are health impacts, environmental effects, and quality of life considerations. Anecdotally, many felt that it is the Government and Councils’ responsibility, and that it is important that we prevent New Zealand’s air quality from becoming damaged like in other countries. In spite of this, many participants still used personal motor transport as a primary means of transport, indicating a degree of dissonance in their attitudes towards TRAP. In a similar vein, the Wellington council does not regulate TRAP heavily by OECD standards, and does not release much information on this issue.

People who usually used a personal motorised vehicle (car, taxi or motorcycle) to get to the CBD, generally considered the importance of government responding to TRAP responding to TRAP to be less of an issue than those who used other methods. This is likely related to people who choose the more environmentally friendly methods of transport having more concern for the environment to begin with, or a greater awareness of the environmental or health effects of TRAP, and therefore place a higher importance on governmental action on the issue of TRAP. However, there was no difference between these groups with respect to how much of an issue they considered TRAP to be, which may suggest that there are other underlying factors. Potentially those who use personalised motor transport may perversely believe responding to TRAP is the responsibility of individuals rather than of government.

There was a trending association between Māori ethnicity and level of concern about TRAP. Our Māori participants were less likely to consider TRAP to be of no concern compared to the general sample. More research with more participants, or more in depth interviews may elucidate more information in this area. However potentially this difference may be related to traditional Māori culture placing great importance on the care of the environment and earth. Additionally, as we were unable to control for

socioeconomic status in our survey, there may be a degree of confounding from this factor, as Māori are overrepresented in lower socioeconomic status brackets in New Zealand. As we know, those in lower socioeconomic groups are more likely to be exposed to high levels of TRAP [32, 33]. Māori therefore need to be kept in the forefront of policy-makers minds when considering how to respond to TRAP.

### *5.3. Key informant interviews*

Our key informant interviews found that the main barriers to action on TRAP were perceived lack of knowledge about air pollution, a perception that TRAP is not an important issue, a lack of political will to act on TRAP, the state of Wellington's transport infrastructure, and a lack of collaboration on the issue. Like survey participants, they believed that there was not much scientific information about the effects of air pollution, which is not entirely correct. There was a general acknowledgement that TRAP is an important issue, but that it is very hard to get momentum and generate action on TRAP.

Our key informants represent the decision makers, and key stakeholders with respect to TRAP in Wellington. There were a lot of common themes with the survey data. The findings underscore the importance of ensuring that people are well informed on TRAP. A better understanding of TRAP would likely lead to greater clarity on how to respond, and it may also generate some political will to act on the issue. Our key informants identified a lot of challenges to tackling TRAP, and without solutions to these problems; it seems unlikely that steps forward will be made.

### *5.4. Policy*

There is a great deal of successful policy to reduce air pollution overseas, and many of these overseas examples prove excellent case studies. Experience suggests that in order to mitigate exposure and risks from TRAP, the issue must be addressed with diverse, coordinated policy [48]. Interventions with the greatest potential for effective reduction of TRAP focus on the pollutant source, such as reductions in traffic volume and air pollutant emissions [47]. Short term measures that target infrastructure and vehicles are likely to be most effective at reducing exposure because they operate at a population

level, with the most effective interventions adhering to the “polluter pays” principle [47]. Long term policies, such as the implementation of integrated land-use planning, and planning processes that incorporate health impact assessments can influence the siting of new buildings or roads, so that exposure of the public to TRAP is minimized [48]. There is clearly no shortage of good policy options to address TRAP; however they will require popular support before they are likely to be implemented.

### *5.5. Communications*

Most people spoken to in our study believed that TRAP was important, however they generally did not understand its effects. Air pollution was mentioned by the media in a small number of articles every year by each of the media organisations investigated, and even in those cases these articles were normally quite minor, implying that TRAP is not a significant issue. Articles generally acknowledged that air pollution has negative health effects, but did not detail what effects these were, and at what levels these effects become significant. Many articles played down the significance of air pollution in Wellington, implying that it is not a problem. There is also very little air pollution data available in Wellington.

A common theme throughout this project has been that responding to TRAP will require political courage from leaders, and an informed, activated public. A key step to this will be ensuring that both leaders, and the public are well informed on TRAP. The literature reviewed suggests that the public could be effectively informed through use of social and digital media [40]. It would also seem that making more air pollution data easily available – such as that produced by NIWA – would help to allow the public to be better informed on this issue. Making such information available may help to generate more media coverage on this issue, and thus a greater impetus for change.

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## Appendix A: Survey Information and Consent Form



### MEDICAL STUDENT RESEARCH

University of Otago, Wellington

### Traffic-related Air Pollution: Public Perception

## PARTICIPANT INFORMATION SHEET

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

### What is the Aim of the Project?

We are fourth year medical students running a study to understand Wellingtonians' perspective, interest and understanding of traffic-related air pollution as a major health issue. We are also interested in how you would prefer information about traffic-related air pollution communicated to you.

### Who are we looking for?

We are looking for anyone who is in the Wellington CBD. There is no direct benefit for you at present, but you will have access to the study results if wanted.

### What will participants be asked to do?

This project involves taking survey, which takes about 3 to 5 minutes. We would write the answers. There is no pressure on you to take part, and you can stop at any time.

### What information will be collected and what will it be used for?

We will be asking you about your gender, age, the suburb you live in, and your views on traffic-related air pollution, but nothing else. The information collected from you will be used to form a report and a presentation at the end of the study, and then not used for anything else. The data will be stored for only five years.

If you have any questions about our project, either now or in the future, please feel free to contact either:

**Professor Philippa Howden-Chapman**  
Department of Public Health  
University of Otago, Wellington  
(04) 918-6047  
[philippa.howden-chapman@otago.ac.nz](mailto:philippa.howden-chapman@otago.ac.nz)

**Dr Caroline Shaw**  
Department of Public Health  
University of Otago, Wellington  
(04) 918-5321  
[caroline.shaw@otago.ac.nz](mailto:caroline.shaw@otago.ac.nz)

This study has been approved by the Department of Public Health. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

## CONSENT FORM

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. The results of the project may be reported and published, and available in the Department of Public Health, University of Otago, Wellington but every attempt will be made to preserve my anonymity.
4. Data collected will be securely stored for at least 5 years

I agree to take part in this project.

.....  
(Participant's Signature)

.....  
(Date)

.....  
(Printed Name)



## Appendix B: Survey Questionnaire



## MEDICAL STUDENT RESEARCH

University of Otago, Wellington

### Traffic-related Air Pollution: Public Perception

## SURVEY QUESTIONNAIRE

**1) Which form of transport do you use to get TO Wellington city? (if multiple please rank with 1 being the most used)**

☐ Car      ☐ Bike      ☐ Bus      ☐ Walk      ☐ Train      ☐ Motorcycle      ☐ Other  
(please specify)

**2) Which form of transport do you use to get AROUND Wellington city? (if multiple please rank with 1 being the most used)**

☐ Car    ☐ Bike    ☐ Bus    ☐ Walk    ☐ Train    ☐ Motorcycle    ☐ Other  
(please specify)

**3) Are you in Wellington today for:**

☐Work ☐Shopping ☐Social visit ☐School/University ☐Other

4) How much of a concern is air pollution from traffic in Wellington to you?

Please circle:

1	2	3	4	5
Not important				Vitaly important

Why: ☐ Health effect

- ☐ Environmental effect

☐ Unpleasant☐ Other

**5) Does air pollution from traffic personally affect you or your family?**

☐ YES    ☐ NO

If yes, how? \_\_\_\_\_

**6) Have you ever accessed information about air quality ?**

☐ YES      ☐ NO

If yes, what information have you accessed?

Title: Traffic-related Air Pollution: Public Perception

Version 1

Version Date: July 2016

Page 1 of 3





## MEDICAL STUDENT RESEARCH

University of Otago, Wellington

### Traffic-related Air Pollution: Public Perception

**11) If you wanted to find out more about traffic-related air pollution in Wellington, how would you like that information to be communicated to you?**

Please circle:

- ☐ TV
- ☐ Radio
- ☐ Newspaper
- ☐ Brochures/flyers
- ☐ App
- ☐ Social Media
- ☐ Internet website
- ☐ Other \_\_\_\_\_

I wouldn't want this information

**12) Would this information change your behaviour?** ☐ Yes ☐ No ☐ Maybe

**If yes, how would it change your behaviour?**

---

**13) Is there anything else you'd like to add?**

---

What gender do you identify with:      Male      Female      Other

Age bracket (please circle):      16-19    20-29    30-39    40-49    50-59    60-69    70+

What suburb do you live in? \_\_\_\_\_

What ethnicity do you identify with? \_\_\_\_\_

## **Appendix C: Key Informant Information and Consent Form**

### **Information for participants**

Thank you for your interest in our project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

### **What is the aim of our project?**

We are a group of fourth year medical students from the University of Otago, conducting a public health project researching public opinion on traffic related air pollution (TRAP) in the context of health.

As part of this, we are particularly interested in the perspectives of influential policy makers and experts involved in this field and whether air pollution is taken into consideration when planning urban and transport development.

The interview would last between 20-40 minutes and take place in a private space that is convenient for both you and your interviewer, or over Skype if more convenient. Interviewees would have the right to not answer any questions that make them feel uncomfortable, and to stop the interview at any time. The conversation will be recorded on a password-protected smartphone or recorder, partially transcribed, and the content then deleted to maintain confidentiality.

You have the option to give permission for us to use your name and position in our final report, or to remain anonymous if you wish. The results of our research will be written up into a report, with the potential for publication in a scientific journal. The report will be sent to you before it is published.

Some of the topics that may be discussed during the interview are listed below:

- Your role
- Your view on the significance of TRAP
- Any current involvement with initiatives aimed at addressing TRAP
- Extent of consideration of TRAP in planning, development and/or research
- Your view of public perspective on this issue
- Views on potential future improvements
- Barriers to taking action on reducing the burden of TRAP
- Your view on communicating information about TRAP to the public

The precise nature of the questions that will be asked have not been determined in advance, but will depend on the way in which the interview develops.



You are warmly invited to attend the presentation we will be having for this project. It will be held in the Small Lecture Theatre at the Wellington School of Medicine, University of Otago on the 29th of July 2016 from 10:30 am to 12 pm

If you have any questions, or would like more information about this project, please feel free to contact any of the individuals below:

David Ju (Student researcher, 4<sup>th</sup> year medical student, Wellington School of Medicine, University of Otago): [juya3994@student.otago.ac.nz](mailto:juya3994@student.otago.ac.nz)

Professor Philippa Howden-Chapman (Supervisor, Department of Public Health, Wellington School of Medicine, University of Otago) : [philippa.howden-chapman@otago.ac.nz](mailto:philippa.howden-chapman@otago.ac.nz)

Caroline Shaw (Supervisor, Department of Public Health, Wellington School of Medicine, University of Otago): [caroline.shaw@otago.ac.nz](mailto:caroline.shaw@otago.ac.nz)

This study has been approved by the Department of Public Health. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.



## MEDICAL STUDENT RESEARCH

University of Otago, Wellington

### Traffic-related Air Pollution: Public Perception

#### Consent form for participants

I have read and understand the Information Sheet about this project. All my questions have been answered to my satisfaction. I understand that I am free to ask for more information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. I can decide to not answer any questions that make me uncomfortable;
4. The interview will consist of open questions about my role and opinions with regards to transport related air pollution (TRAP)

I agree to take part in this project:

\_\_\_\_\_ (Signature of participant)

I ☐ agree / ☐ do not agree (please circle one) for my name and position to be mentioned in the report created from this research, which may be published in a scientific journal

\_\_\_\_\_ (Date)

\_\_\_\_\_ (Printed name)

## Appendix D: Key Informant Full Results

### 1. Lack of knowledge

Difficulty around quantifying the health effects of traffic related air pollution (TRAP) was a view shared by many. Although it has been well established that TRAP has health harms, difficulty arises in quantifying its harms because air pollution is not a disease in itself, rather it is a contributing factor to other diseases. Dr Ian Longley, Project manager at NIWA puts it this way: *"one of the struggles we have is that people don't turn up at the hospital with air pollution disease. They have a worsening of their asthma, or they have bronchial problems, or maybe they have a stroke, and air pollution probably could have contributed to that but it's really hard to say definitively that's what happened. So it's actually really difficult to pin down what the health effects are."* Dr Stephen Palmer, a Medical Officer of Health for Wellington Regional Public Health, shared his frustration at the inability to quantify the health effects: *"One of the things is people accept that yes there is health harm from it, but it's almost become dogma in that to quantify that health harm is incredibly difficult almost impossible"*.

Lack of tangible evidence consequently lead to communication problems. Moana Mackey, sustainability manager at WCC expressed her views in regards to the barrier in communication of TRAP related health harms: *"We'll never be able to tell people what a safe level for long term exposure is because so many other things happen to you in your life while you're being exposed to that, so who knows what caused it. You can never isolate it and you can never give people an absolute answer, which is what they want. You can't give them a number, you can only give them a level of probability based on the average healthy human being of a certain age"*. Similarly, as a Medical Officer of Health whose role is to communicate the health harms of TRAP to those involved in planning of infrastructure, Dr Palmer stated: *"So that does make it quite difficult because the decision makers want concrete information and you can't come up with necessary concrete information around the health impact on air pollution."*

The inability to provide concrete quantifiable information of the health harms of TRAP has dire consequences in how much it is considered when planning infrastructure. Dr Palmer has been involved with air pollution issues with the Mt Cook school Buckle St underpass, where parents and teachers had strong views against the project due to the potential health effects due to TRAP. He states that there was no *"clear cut answer"* on what the children's levels of exposure would be. Dr Palmer who was also involved with the basin flyover recounted: *"a community group that opposed it was concerned among other things the air pollution from the TRAP but they [the community] only sort of basically raised that issue and said we don't have enough information or answers."* Concern from the public alone does not give TRAP enough weight to influence decisions around building infrastructure. It is only with solid evidence TRAP can become a crucial factor in planning rather than something that could be dismissed.

Lack of concrete evidence however, does not mean the health harms are not present. Although health harms are difficult to pin down, Dr Ian Longley firmly warns it should not be overlooked despite only having incomplete evidence: *"So we're in a situation where hard evidence is difficult to come by but incomplete evidence is there, sufficient that we need to take precautions until we pin down exactly what the impact is."* He expressed his concern about how TRAP is something that everyone in the country is exposed to: *"The thing about traffic air pollution is*

*that nearly everyone in the country is exposed to it, it's very hard to escape it. It affects rich or poor, everyone alike. So in that sense it's a serious risk, because you've got 4 million-odd people affected by it."*

In regards to information that is currently available, Dr Palmer stated: *"the only work that is helpful but then when you scratch under the surface, isn't quite so helpful is the HAPINZ study"*. It is a study whereby *"you take known figures for relative risk [of getting specific diseases due to air pollution] mostly from overseas and link them to the levels of air pollution in individual census area units and say, this is what we expect the premature mortality and heart disease to be"*. Dr Palmer was critical of the methodology and conclusions drawn from the study and commented that *"when you scratch under the surface there are mythological problems because the researchers used the definition of premature mortality which isn't a helpful definition. They made the assumption that, those living in census areas with higher levels of air pollution, their deaths were more likely to be linked to the higher levels of air pollution than anything else."* In addition Dr Palmer commented that the *"risk ratios from epidemiological studies in most cases are from other parts of the world which may not be applicable to NZ at all"*. This study provides predictions based on a model however yet again fails to provide quantifiable health harms associated with TRAP. The difficulty in communicating the meaning of the results can be best understood through Dr. Palmer's experience with the media who approached him in regards to the Regional Council annual report. The report misleadingly stated the HAPINZ study showed that a specific number of deaths were due to air pollution. The media wanted to know who and where these death were, simple questions to which the HAPINZ study had no answer to.

Views around barriers to further research were discussed by Dr Palmer and Dr Bennett. Dr. Palmer in his interview repeatedly mentioned *"the dots aren't connected"* and shared his concern that *"the scientists have not really dug down deep enough."* He expressed his views that scientists *"are making the assumption that these ultra finite particles are more harmful to health."* He believes that not enough research is being done to clearly link TRAP exposure to the resulting health effects: *"it really doesn't close the loop off because they look at the levels of exposure of UFP but they don't follow that through to look at what the adverse impact on health is."* He commented that the driver for the lack of research may be due to the consequence it would have on future funding if results showed minimal health impacts: *"Because they say that their pet interest is ascertaining levels of UFP, they want to get research funding for it and if there is minimal health impact then why spend the money on research air quality."* This is particularly troubling for Dr Palmer as without the association between TRAP and health impacts the information cannot be used to guide decisions in the real world: *"So when it comes to things like the basin reserve you don't have the information to connect the dots to the actual level of health harm and not having that is very unhelpful."*

On the other hand, Dr Bennett in her interview indicates funding as a barrier to her research. She emphasised how funding for air pollution research comes from science money rather than health. This stems from a view that air pollution is not as important as other health problems or not a health problem at all: *"I'd say the main problem will be funding. I think because air pollution hasn't been seen as a problem I guess there are a whole host of issues to be funded and air pollution is quite far down the list particularly in the health arena. So I think it's been sort of seen as a science rather than something that affects the health of people. So probably in the past funding has come from science money and I just think it hasn't been a priority."*

However Dr Bennett mentions the tide is slowly shifting with people starting to understand the health effects a lot more. The next funding she has applied for is from an organisation that is *“just starting to see the way that the building might interact with people. So they are actually just starting to see there actually is a bit of a health risk here which I guess we have been seeing in health for a bit longer, that the environment affects your health. Which is good to see, it's good to see that they are starting to think outside of the science and they're starting to think in terms public health and health.”* Change in the perception of those funding research to realise the health impacts of TRAP is a crucial step to driving research to definitely quantify health harms. It is only through concrete research communication can be effectively done to others down the line to allow TRAP to be given more weight when making decisions in infrastructure.

In conclusion, lack of knowledge around the health harms from TRAP make it difficult for those who are advocating against TRAP to communicate the risks to those who are involved in planning. Although solid evidence of the health harms of TRAP is hard to find it is crucial that those in power listen to the warnings of researchers and health professionals. TRAP must be taken into careful consideration in planning and research until the health harms of TRAP are quantifiable and understandable.

## 2. Public Perception

Public perception and pressure is a key driver of policy at both government and local levels. A clear theme that recurred in the thoughts of policy makers on the issue of traffic-related air pollution was the public's generalised ignorance of its significance. Thomas Davis, Bus Fleet Manager at the Greater Wellington Regional Council remarked that *“the majority of people probably are oblivious to it.”* Reasons behind this lack of awareness were numerous and varied.

The absence of acute physical evidence supporting the effects of TRAP, specifically in a health setting, shone through as a barrier to its public influence. Iain McGlinchy, Principal Advisor for the Ministry of Transport, recalled one discussion he had with a member of the public, *“he laughed at the likely health effects because people just don't see them and so you're always going to have this debate when you haven't got the absolute proof – it's not like a car crash where they know how many people crashed.”* Harriet Shelton, Regional Transport Manager at GWRC, pointed to this as the basis of the public's complacent attitudes, *“It's really sad but people seem to need to see the consequences of something before they take action. It means that we're just waiting for someone to die – because they will at some point.”*

In the context of Wellington, interviewees were quick to point towards the wind's influence on the public's mindset. Guy Salmon put it bluntly, *“most people think Wellington is basically a windy pollution free zone.”* This view was shared by Dr Ian Longley, Project Manager at NIWA, *“the very real perception of wellington is that we don't have air quality issues because of the wind. It's an assumption people make.”*

Along similar lines to the 'windy city' argument, it was also determined that the absence of visible pollution meant that TRAP was absent from public agenda. Moana Mackey, Sustainability Manager at the Wellington City Council spoke of this need for tangential evidence: *“we don't have the smog issues that some of the other cities have which leads to that perception that we don't have the problem. Like if you can't see it, it's not there.”* Mackey

carried on to suggest that even when TRAP has a visible presence, the public are still a hard press to convince, *“Even in cities like Christchurch, who’ve had big smog issues, I still think there’s a lot of scepticism in the general public around figures about how many people have been killed by air pollution. I think people just don’t believe it.”*

It was argued by some interviewees that children could be used as a focus when trying to reduce the impacts of TRAP through changes in motor vehicle behaviours. Shelton feels that pulling at the heartstrings has worked before and can work again, *“In Copenhagen back in the ‘70s their streets were completely clogged with traffic and there was a campaign based around the safety of children. There was a lot of stuff like ‘stop the child murder’. That was the line they took and clearly it was successful. So when you turn it around to look at the safety of our kids or the health of our kids, that’s what we have to base it around. Plus if people want to actually get healthy and reduce the rates of obesity in this country then this is also part-and-parcel of achieving that. We’re nowhere near getting people over the line on that one but I wonder if that’s the approach we need to take. Because if people care about the health and safety of their kids then maybe that’s the way to do it.”*

Dr Longley shared this perspective, *“We also did some work on schools near major roads; if you ask people what they think about traffic air pollution you get one answer, if you ask people what they think about their children’s exposure to TRAP at their roadside school you get a very different answer. People suddenly become sensitised to the issue.”*

It is apparent that the public’s perceptions on TRAP have been shaped by a lack of quality data to support the health and environmental claims. Accessibility and readiness of information, Dr Longley believes, is necessary to educate the public on TRAP, *“In NZ, the level of public interest is generally lower than elsewhere. That’s partly appropriate because our levels of pollution are generally lower than elsewhere, but I think the lack of available information is a major element. I talk on this topic in public a lot, and there’s definitely a demand for information and knowledge and there definitely concerns, but people find there’s nowhere to go to find out. The knowledge base is a lot weaker here, so what often happens is motivated people might go on the internet, google something, find some information from America and base an opinion on that. Then it’s easy for anyone to counter that by saying “Wellington’s not Los Angeles, it’s different here”. And there’s been a little bit of a stalemate.”*

It's not difficult to see why public concern for this issue is close to non-existent. Health effects are insidious, visible evidence is lacking and an overwhelming gap in data and research makes perception change especially challenging. While some of these influencers are immovable, education’s ability to empower the population cannot be understated. Quality research and data collection, delivered to the public through the right avenues could prove the easiest way forward. Without such public interaction with the issue of TRAP, policymakers are unlikely to take action. In the words of Dr Longley, *“Perhaps the missing element here is public pressure. These organisations will do more, will invest more, will try more if they feel there’s public pressure to do so. At the moment it’s very early stages – there’s a few people but it’s not coalescing into proper pressure just yet.”*

### 3. Lack of Political Will

Policy makers across multiple levels of responsibility described controlling traffic-related air pollution as a secondary issue, and not one that would be at the forefront of their agendas. Sustainability manager of the WCC Moana Mackey points to Wellingtonians' lack of interest in the issue as the reason behind this: *"concerns of the public are going to be what drives (the campaign) and again, air pollution and climate change probably are not things that are going to come up"*. Harriet Shelton from public transport at GWRC mirrors this sentiment, stating that air quality is *"probably not a key driver"* on its own, rather one of a number of considerations when planning a wider policy. *"Generally when we might be advocating for more walking or cycling we're doing that not just for better air quality but we're also doing that for public health or congestion relief or improved environmental amenity (...) it's wrapped up in what we do but it's not our reason for being."*

Such lack of will has been observed by Dr Stephen Palmer of the District Health Board in working with local government on the basin reserve proposal; an initiative aimed at improving transport infrastructure that was later rejected. In this proposal, the council was said to be *"quite happy to state that (they) would not further increase the level of TRAP, where I thought it is an opportunity to try and reduce that"*.

Guy Salmon advisor provided further insight on the possible causes of a more generalized lack of political will with regards to this issue. He proposed that opposition and lack of interest from people at the household level, in addition to a desire to keep cars cheap and widely available, is at the source of this reluctance to act decisively. In his words, *"there is a general view that this is politically sensitive and, you know – it's a windy city – who's going to worry too much about a bit of stuff flying around."*

This view is concurrent with those expressed by most of the key informants interviewed – that air quality is not a great concern to the people and hence shouldn't be of concern to the people's representatives. Air quality researcher Dr Julia Bennett suggested that the fact TRAP is a new and relatively obscure public health issue might account for this lack of public and political concern. *"I think (air pollution) just hasn't been on the agenda yet. It's just sort of in its early stages and hasn't been seen as a problem (...) people have to realise there is a problem first"*.

For central government, Palmer proposes that unwillingness to address the issue of air pollution – namely through national environmental standards – spurns from a desire to not *"be seen to be as anti economic development and anti-business"*. All the same, Palmer recognizes the importance of a thriving economy: *"in public health you are balancing the economic development because economic development leads to improvements in health and wellbeing, just as much as dealing with things that may be causal factors can (improve) health and wellbeing"*.

Some institutions are explicit about the source of their unwillingness: Ian McGlinchy from the Ministry of Transport pointed to lack of evidence as a reason for not pushing air pollution-related policies such as emissions testing. *"There's no evidence that if we actually did it there'd be cleaner air – there's no evidence that emissions testing works. It's very hard to justify a technology that doesn't actually achieve anything."* Palmer also evoked the lack of specific research linking cause to effect, in addition to the complexity of the issue, as a barrier for decision makers taking action: *"(they) want concrete information and you can't come up with the necessary concrete information around the health impact of air pollution."*

## 4. Transport

Another major recurring theme from the interviews was the current transport situation in Wellington, and potential future improvements in this area. Wellington rates of public transport usage are higher than some other major centres in NZ, likely due to the compact geographical nature of our CBD. However, there is still a significant amount of room for improvement; the majority of public transport usage in Wellington is for commuting trips, which only make up 30% of total trips. Therefore, the remaining 70% of travel comes from people driving private motor vehicles for commutes, shopping, social excursions, transporting kids etc.

This means that the key to reducing emissions and improving air quality is getting more people out of private vehicles and into public transport. Thomas Davis, Bus Fleet Transition Manager from the Greater Wellington Regional Council commented *“the most effective way to reduce CO2 emissions in the city or in the region isn’t to run less buses, it’s actually by running better public transport to get people out of their cars.”* Julie Bennett, a public health researcher, expressed the same sentiment; *“It’s only going to get worse if we have more cars on roads and it [air pollution] is only going to improve if we have more public transport options for people.”* This is further supported by Dr Ian Longley's point, that *“most of our vehicles are imported – they’re second-hand. So our vehicle emissions are what Japan’s were 10-15 years ago.”* This means that *“we’ve generally got dirtier vehicles, dirtier buses, dirtier trucks than they have in Europe and North America”* and therefore these dirtier, older vehicles are contributing massively to traffic-related air pollution.

However, emissions from public transport such as buses still contribute to Wellington’s air pollution problem. Thomas Davis told us that *“at the moment NZTA’s rule for urban buses says that new buses coming into NZ have to be Euro V or better, but they haven’t gone so far yet as to say they need to be Euro VI”*. These refer to European emissions standards, which define the acceptable limits of exhaust emissions from diesel engines and with which public transport vehicles must comply. If NZTA did opt to enforce the Euro VI standards (despite the increase in cost), there would be a noticeable improvement in emissions. Wellington council currently has a criterion based on emissions as part of their evaluation for new bus fleets, making them the only council in the country to have this. Mr Davis also told us that over the next years they will be aiming to reduce emissions by *“changing the bus network [i.e. changing the routes and frequencies], reducing the number of buses and then reducing the emissions profile of the bus fleet”*. This multi-faceted approach would hopefully reduce NOx and PM emissions by 37% and 65% respectively.

Moana Mackey, sustainability manager at WCC, was also a strong supporter of *“giving people choices so they can choose to give up their motor vehicle, making it easier for people to not own a car. Or making it easier for people to own cars that don’t have internal combustion engines.”* One of the innovative ways she is hoping to do this is by encouraging greater use of car sharing organisations such as Cityhop. These organisations allow members to borrow a car for as little or as long as they need, and charge an hourly rate which covers all the costs associated with owning a car such as insurance, petrol and registration. She is hoping to spread the message that *“you think you have freedom when you own a car, you don’t know freedom until you don’t own a car,”* and eventually get more people out of their cars and onto public

transport. Initiatives such as these will all contribute to reducing the number of private vehicle on the roads and help to bring down emissions.

Another important element is the introduction of electric vehicles. Harriet Shelton, Manager of Regional TP at GWRC, stated that *“in the long term we expect we will be running electric buses – as soon as the technology is suitable and affordable”*. Ian McGlinchy, Principal advisor to the MOT, told us that *“our minister has set a target for the uptake of 2% of the fleet by 2020”*, meaning that should the target be reached, 2% of all vehicles in NZ will be electric. Therefore, it is clear that the eventual goal is that the majority of both public and private vehicles will be electric.

## 5. Communication and allocation of resources

Another major theme identified from the key informant interviews was a lack of integration between various responsible sectors. Guy Salmon commented that *“fragmentation is a big problem (...) and there isn't anybody pulling it together and providing a strategic overview as to how we get results.”* Politicians are in turn presented with technical information that is perhaps difficult to appreciate or does not encompass the range of perspectives from the experts of different fields, therefore they are unable to make fully informed decisions.

Each responsible sector has its own priorities and concerns. Harriet Shelton pointed out that *“it's fairly well known that WCC think that they could do without the regional council full stop (...) But they don't take the regional view – they don't care about what happens in Kapiti, they don't care about Wairarapa. And this is where we come in.”* The fragmentation of the system is due to the lack of collaboration and communication. As the different institutions cannot agree on priorities, addressing TRAP is eventually put to the resource-holding organization.

The organization responsible for allocation of resource is generally a national body, and they do not necessarily have the extensive knowledge about local areas like the local councils do. As stated by Rob Hannaby, the environmental and urban design manager of NZTA, NZTA does take air pollution seriously: *“As we refine a transport solution/improvement initiative, we would undertake an appropriate assessment of environmental effects, that would include if air quality was an important consideration.”* However when it comes to ways of reducing TRAP in the long term, such as encouragement of public transport utilization and improvement of emission profiles of local bus fleets, these solutions fall under the responsibility of the regional council. Harriet Shelton pointed out that the Greater Wellington Regional Council gets half of their funding from NZTA, *“a road-building organisation and they're not particularly interested in funding sustainable transport (...) When deciding to give approval to a particular project they're less interested in the sustainable transport programs and that's a frustration for us.”* Ian McGlinchy also commented that *“the Ministry of Transport has no legal mandate to address air pollution”*. While resources are available for addressing the issue of traffic-related air pollution, these often do not lie with the organizations responsible for ways of reducing TRAP in the long run.

Harriet Shelton shared her thoughts on addressing the issue of TRAP: *“I don't know what goes on at WCC but clearly the councillors are not listening to the advice of their officers. What they*

*are listening to is their noisy voters out there in the suburbs who are saying “get rid of the cycle way” (...) I think it’s a combination of things because you need to have enlightened politicians who are prepared to be a champion for something”. A combination of public interest and knowledge of TRAP are key in raising the political interest of politicians, and therefore improve policies and interventions for improved air quality in the future.*

As research further reveals the risks of TRAP, air quality consideration may carry more weight in the future. Dr Bennett mentions the next funding she has applied for is from an organisation that is “just start(ing) to see the way that the building might interact with people. *So they are actually just starting to see there actually is a bit of a health risk here which I guess we have been seeing in health for a bit longer, that the environment affects your health. Which is good to see, it's good to see that they are starting to think outside of the science and they're starting to think in terms public health and health.*” Change in the perception of those funding research to realise the health impacts of TRAP is a crucial step to driving research to definitely quantify health harms. It is only through concrete research communication can be effectively done to others down the line to allow TRAP to be given more weight when making decisions in infrastructure.

#### INTERVIEWEES:

Dr Julia Bennett, Paul Bruce, Thomas Davis, Rob Hannaby, Dr Ian Longley, Ian McGlinchy, Moana Mackey, Dr Stephen Palmer, Guy Salmon, Harriet Shelton.

## **Appendix E: Media Analysis**

### *News Articles*

Most of the news articles we found identified air pollution as a problem, though they often did not attribute it as a major problem for Wellington. They contained a variety of different types of information on air pollution, with some articles talking about health effects and others environmental effects. However weather was hinted at as being the causal factor of poor air quality, while air quality in Wellington was deemed to not be an issue after comparing it to pollution levels to places in other places in New Zealand, such as Timaru.

### *Dedicated Websites*

The three main websites that published data on air quality were the Ministry for the Environment, The Greater Wellington Regional Council and LAWA (Land, Air, Water, Aotearoa). The information was most easily accessible from their websites, where they all gave comprehensive overviews of air pollution, along with environmental effects, health effects, ways of reduction, and pollution levels in New Zealand. The Regional Council also gave extensive advice on reducing TRAP. Together they addressed air pollution as a problem, though some of the wording from the ministry at times seemed to indicate that New Zealand does not have a serious problem with air pollution. LAWA does not publish air pollution information in any other medium and the other publishings of the ministry in the form of reports do not seem accessible to the average New Zealander. The regional council has before had radio ads and flyers for wood burning but not TRAP. NZTA also had a website that collated data from several sources such as surveys and focus groups in Wellington to create 12 principles going ahead with future projects. Two of these could relate to air pollution, with one being “accessible, healthy, and safe”. This would be achieved, “Through a transport system that meets the varied access needs of people of all demographics across the region, wherever they need to travel”. The other principle was “Clean and green”, achieved, “Through a transport system that respects nature and makes a positive contribution to environmental improvement”.

### *Social Media*

Only Wellington Greens (600 likes) and Generation Zero (12k likes) posted about Wellington air quality on facebook, with the Green Party also posting to twitter. Both of these organisations primarily posted links to their websites where they had articles or petitions addressing transport or pollution as issues in Wellington. They addressed pollution as a problem, with both of them at points focussing specifically on tackling transport related air pollution (though these were primarily for environmental reasons). Additionally there was one small Facebook group we found that discussed air pollution briefly. Nothing was found that fit our inclusion criteria on Youtube

### *Smartphone Applications and Tracking Websites*

Only two apple apps and one android app contained any data on Wellington’s air quality. All three of these had real time air quality information, though were internationally based apps that had included Wellington data. There were also two websites that performed a similar function. Because of this, the information was poorly tailored to Wellington as it compared levels to heavily polluted cities and so deemed air pollution levels in Wellington as very good, giving the impression to Wellingtonians that it is nothing to worry about. There were many other apps found though none of these included information pertaining to Wellington.

### *Television and Radio*

Reporting of Transport Related Air Pollution was generally low on television and radio news. In the past 18 months in New Zealand, One News had published and aired one, and NewsHub had published and aired two stories pertaining to TRAP (Kiwis living near motorways share health concerns, One News; Timaru worst in Oceania for air pollution, NewsHub; Cycling to work in traffic - good or bad for your health?, NewsHub). Similarly, the two major radio news outlets (Radio NZ and Newstalk ZB) had also only published and aired one story each relating to TRAP (Timaru has worse air pollution levels in Oceania - WHO, Newstalk ZB; NZ Air pollution updated in real time, online, Radio NZ). There was no reporting on TRAP on “entertainment” radio stations such as The Edge, or ZM. The stories generally acknowledged that TRAP has negative health effects, however did not provide any details on what these were. They all alluded to “safe levels” of air pollution. Only two stories (Timaru worst in Oceania for air pollution, Timaru has worse air pollution levels in Oceania - WHO) make reference to actual levels of air pollution also.

### *Physical Mediums*

The Wellington Regional council had one billboard on the side of the Wellington Air Quality monitoring station was found, which included health effects and stated “Air quality in Wellington is generally good ... meets national standards”. They did not have any other physical publications on TRAP, though they had previously produced flyers and radio ads on wood burning. NIWA and LAWA both said they did not publish anything apart from a magazine from NIWA, and Wellington Green and Generation Zero never replied to communications.

Type	Source	Summary	Date
Pollution Tracking Website	<a href="http://aqicn.org/city/new-zealand/wellington/williams-st/">http://aqicn.org/city/new-zealand/wellington/williams-st/</a>	Real time Information about air quality in Wellington. Pollution Amount. Does not specifically mention transport. Frames air pollution in Wellington as good. AQI up to 50 is “Good” NOT a problem	Retrieved July 2016
Pollution comparas	<a href="http://www.numbeo.com/pollution/city_result.jsp?country=New+Zealand&amp;city=Wellington">http://www.numbeo.com/pollution/city_result.jsp?country=New+Zealand&amp;city=Wellington</a>	Information about air quality in wellington. Pollution Amount.	Retrieved July 2016

on Website		Does not specifically mention transport. Frames air pollution in Wellington as very good NOT a problem	
Greater Well. Regional Council	<a href="http://www.gw.govt.nz/air-quality-4/">http://www.gw.govt.nz/air-quality-4/</a>	Regional Council website on it all Pollution Amount, Health effects, Ways of reduction  a problem	Retrieved July 2016
Stuff article	<a href="http://www.stuff.co.nz/national/81376578/Land-Air-Water-Aotearoa-website-monitors-New-Zealands-air-quality">http://www.stuff.co.nz/national/81376578/Land-Air-Water-Aotearoa-website-monitors-New-Zealands-air-quality</a>	Article on LAWA air quality data made available. Discusses the monitoring of air quality by the government. Pollution amount, causes, and health information. Does not include transport in the causes of PM10. Frames pollution a problem that is being addressed in niche areas of NZ NOT a problem	23rd June 2016
LAWA Website	<a href="https://www.lawa.org.nz/">https://www.lawa.org.nz/</a>	Land air water aotearoa. Pollution levels, education, ways of reduction, health effects, environmental effects. A realistic framing of air pollution A problem	Retrieved July 2016
MFE Website	<a href="http://www.mfe.govt.nz/air/overview-air-quality/air-pollution-and-new-zealands-air">http://www.mfe.govt.nz/air/overview-air-quality/air-pollution-and-new-zealands-air</a>	Overview of air pollution in NZ.  Mentions cities and high volumes of traffic as bad.  Frames NZ air quality as “relatively good”  All air quality data in NZ.  Pollution amount, health information  Does not specifically mention transport  NOT a problem	Retrieved July 2016
Stuff article	<a href="http://www.stuff.co.nz/national/health/81044773/nz-researchers-link-air-pollution-to-rate-of-strokes">http://www.stuff.co.nz/national/health/81044773/nz-researchers-link-air-pollution-to-rate-of-strokes</a>	Links air pollution to strokes.  Pollution Amount, Health Effects.  A problem	26th June 2016
Scoop article	<a href="http://wellington.scoop.co.nz/?p=90444">http://wellington.scoop.co.nz/?p=90444</a>	<i>Report released advocating against diesel buses.</i>  Environmental Effects Frames TRAP as bad A problem	July 8th 2016

Stuff article	<a href="http://www.stuff.co.nz/dominion-post/news/78652076/more-cycleways-less-cycleways-and-stop-the-greeny-dheads-wellington-traffic-website-up">http://www.stuff.co.nz/dominion-post/news/78652076/more-cycleways-less-cycleways-and-stop-the-greeny-dheads-wellington-traffic-website-up</a>	<p><i>Transport agency releases website for wellington public discussion. Highlights comments made by public saying pollution is bad. Only advocates better transport.</i></p> <p>A problem</p>	April 8th 2016
NZTA Website	<a href="http://www.getwellymoving.co.nz/">http://www.getwellymoving.co.nz/</a>	<p><i>Public feedback on where NZTA should go with Wellington transport. 12 “urban design and transport principles” created. “Healthy” “Through a transport system that meets the varied access needs of people of all demographics across the region, wherever they need to travel”: “Clean and green” “Through a transport system that respects nature and makes a positive contribution to environmental improvement”</i></p> <p>Does not specifically address health impacts of transport</p> <p>A problem</p>	Retrieved July 2016
Online article	<a href="http://www.vox.co.nz/business/5/255272">http://www.vox.co.nz/business/5/255272</a>	<p><i>Benefits of electric buses in Wellington.</i></p> <p>Environmental Effects, Ways of reduction,</p> <p>A problem</p>	22nd June 2016
NZ Herald article	<a href="http://www.nzherald.co.nz/wairarapa-times-age/news/article.cfm?cid=1503414&amp;objectid=11656866">http://www.nzherald.co.nz/wairarapa-times-age/news/article.cfm?cid=1503414&amp;objectid=11656866</a>	<p>Masterton air quality problem from wood burners a problem, requiring infringement notices.</p> <p>Pollution amount, Environmental effect, Ways of reduction</p> <p>Does not mention transport</p> <p>Frame air pollution as something the government is too paternal about.</p> <p>Not a problem</p>	June 15th 2016
NZ Herald article	<a href="http://www.nzherald.co.nz/wairarapa-times-age/news/article.cfm?cid=1503414&amp;objectid=11466376">http://www.nzherald.co.nz/wairarapa-times-age/news/article.cfm?cid=1503414&amp;objectid=11466376</a>	<p>Air quality notifications. Mainly in Masterton and Wairarapa. Hints air quality is at whim of wind. Compares to China.</p> <p>Pollution amount, Health effects.</p> <p>A problem</p>	June 17th 2015
NZ Herald Article	<a href="http://www.nzherald.co.nz/wairarapa-times-age/news/article.cfm?cid=1503414&amp;objectid=11454217">www.nzherald.co.nz/wairarapa-times-age/news/article.cfm?cid=1503414&amp;objectid=11454217</a>	<p>Masterton air quality, fault of wood burners and weather.</p> <p>Pollution amount, ways of reduction</p> <p>A Problem</p>	May 25th 2015
Apple App	Plume Air	<p><i>Real-time updates of air quality.</i></p> <p><i>Pollution amount, Environmental effect. Health advice</i></p> <p>Frames Wellington air as good most of the time.</p> <p>Not a problem</p>	Retrieved July 2016
Apple App	Global PM2.5	<p><i>Real-time updates of air quality. Poor UI</i></p>	Retrieved July 2016

		<p><i>Pollution amount.</i></p> <p><i>Says poses little or no risk.</i></p> <p>Not a problem</p>	
Android	Air Quality	<p>Real-time updates of air quality</p> <p>Pollution amount</p> <p>NOT a problem</p>	Retrieved July 2016
Twitter	<a href="https://twitter.com/NZGreens">https://twitter.com/NZGreens</a>  <a href="https://www.greens.org.nz/news/press-release/electric-buses-">https://www.greens.org.nz/news/press-release/electric-buses-</a>	<p>Green Party NZ @NZGreens</p> <p>“Electric buses will be excellent for Wellington’s air quality and for reducing our contribution to climate pollution”</p> <p>Links to a discussion about electric buses in wellington</p> <p>Ways of reduction</p> <p>A Problem</p>	21 april 2016
Facebook Page	<a href="https://www.facebook.com/WellingtonGreens/">https://www.facebook.com/WellingtonGreens/</a>	<p><u>Wellington Greens</u></p> <p>Running an event regarding air pollution in wellington from traffic.</p> <p>"There is no question that climate change is by far the most serious environmental issue we face. ... Urban areas are key to reducing global greenhouse gas emissions, particularly those from transport. We must plan and develop our cities so that they are low-carbon as well as affordable." Parliamentary Commissioner for the Environment on Environment Aotearoa, June 2016</p> <p>Discourse is strongly suggesting that traffic related air pollution is a current hazard.</p> <p>Released this press release - looking at the work the Greens are doing on traffic related air pollution in order to get seats in Wellington council.</p> <p><a href="http://www.scoop.co.nz/stories/PA1606/S00436/green-team-launches-wellington-local-government-campaign.htm">http://www.scoop.co.nz/stories/PA1606/S00436/green-team-launches-wellington-local-government-campaign.htm</a></p> <p>“Better and more affordable public transport is at the heart of what Green councillors will work to deliver for Wellington, including clean all-electric buses and light rail from the CBD to the airport,” said Wellington Regional Council candidate Sue Kedgley.</p> <p>“Wellington can become a low carbon and climate change-resilient city, by investing in clean transport and the infrastructure we need to deal with climate change,” Wellington Regional Council candidate Paul Bruce said.</p> <p>Environmental effect, Ways of reduction</p> <p>A problem</p>	Retrieved July 2016

Gen Zero Website and Facebook	<a href="http://www.generationzero.org/keepitclean">http://www.generationzero.org/keepitclean</a>	Generation zero petition to prevent scrapping electric buses. Includes articles on electric buses. There is also a facebook page Health effects, Environmental effects, ways of reduction A problem	Retrieved July 2016
Facebook Page	<a href="https://www.facebook.com/thepress/?fref=nf">https://www.facebook.com/thepress/?fref=nf</a>	<u>The Press</u> Posted Stuff's article regarding air pollution in NZ - and ranking cities including Wellington Pollution amounts A problem	Retrieved July 2016
Facebook group	<a href="https://www.facebook.com/MtVictoriaResidents/?fref=nf">https://www.facebook.com/MtVictoriaResidents/?fref=nf</a>	<u>Mt Vic Residents</u> group posted the following radio NZ article regarding exercise in cities and risk of ill health from air pollution. <a href="http://www.radionz.co.nz/news/national/306124/healthy-exercise-guess-again">http://www.radionz.co.nz/news/national/306124/healthy-exercise-guess-again</a> Pollution amount, health effects NOT a problem	Retrieved July 2016
One News Online	<a href="https://www.tvnz.co.nz/one-news/new-zealand/kiwis-living-near-motorways-reveal-health-concerns-6223959">https://www.tvnz.co.nz/one-news/new-zealand/kiwis-living-near-motorways-reveal-health-concerns-6223959</a>	<i>Kiwis living near motorways share health concerns</i>  UC study; ¾ of surveyed residents living near motorways have concerns about the health effects of these motorways. Piece focuses particularly on Sth Auckland. All about perceptions. Health effects General spin; air pollution bad, but no mention of details etc A problem	25 Jan 2015
Newshub	<a href="http://www.newshub.co.nz/environment/sci/timaru-worst-in-oceania-for-air-pollution-2016051812#axzz4EnxeIF9K">http://www.newshub.co.nz/environment/sci/timaru-worst-in-oceania-for-air-pollution-2016051812#axzz4EnxeIF9K</a>	Timaru worst in oceania for air pollution Timaru's air pollution exceeds WHO "safe levels" for PM10 and PM2.5. Auckland and Wellington below safe levels. Spin; Wellington safe, Timaru bad but improving. Health effects not referenced. Pollution amounts NOT a problem	18 May 2016
Newshub	<a href="http://www.newshub.co.nz/nznews/health/cycling-to-work-in-traffic---good-or-bad-for-your-health-2016050613#axzz4EnxeIF9K">http://www.newshub.co.nz/nznews/health/cycling-to-work-in-traffic---good-or-bad-for-your-health-2016050613#axzz4EnxeIF9K</a>	Cycling to work in traffic - good or bad for your health? Cycling to work good for health despite air pollution says article. Would have to be exposed to air pollution for 7 hours to be harmful. Pollution amounts, Health effects Spin: Air pollution not that bad. Auckland focus NOT a problem	6 May 2016
RadioNZ	<a href="http://www.radionz.co.nz/news/national/306568/nz-air-pollution-updated-in-real-time.-online">http://www.radionz.co.nz/news/national/306568/nz-air-pollution-updated-in-real-time.-online</a>	NZ Air pollution updated in real time, online Talks about LAWA's website talking about air pollution levels, and why being able to monitor air pollution levels is a good thing. Pollution amounts, Health effects A problem	16 June 2016

Newstalk ZB	<a href="http://www.newstalkzb.co.nz/news/national/timaru-has-worst-air-pollution-levels-in-oceania-who/">http://www.newstalkzb.co.nz/news/national/timaru-has-worst-air-pollution-levels-in-oceania-who/</a>	<i>Timaru has worse air pollution levels in Oceania - WHO</i> Timaru records 26 high pollution nights; over safe levels. However this is improving from previous years Pollution amounts A problem	18 May 2016
Willis St Station Posters	Willis st Air Quality monitoring station Wellington	Explains what the station is all about. Health effects “Air quality in Wellington is generally good ... meets national standards” NOT a problem	Retrieved July 2016

Phone Call with NIWA	04 386 0300	They only publish a magazine. Rangiora tried a social media campaign around facebook and twitter on wood smoke but it wasn't taken up.	19th July 2016
Email with Regional Council	Tamsin Mitchell	Linked a website, spoke of radio and flyers and the like for wood burning but not TRAP	21st July 2016

MFE Report	<a href="http://www.mfe.govt.nz/node/21225">http://www.mfe.govt.nz/node/21225</a>	Ministry for the environment publication. Pollution amount and health effects A problem	Retrieved July 2016
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Gov. Release	<a href="http://www.gw.govt.nz/assets/Our-Environment/Environmental-monitoring/Environmental-Reporting/Air-Quality-SoE-report.pdf">http://www.gw.govt.nz/assets/Our-Environment/Environmental-monitoring/Environmental-Reporting/Air-Quality-SoE-report.pdf</a>	<p>Report is long and probably not a suitable way to effectively disseminate air quality data efficiently to the public.</p> <p>Report on the air quality of the Wellington region - state and trends. Routine state of the environment monitoring at eight sites shows overall Wellington region has good air quality most of the time for these indicator pollutants: PM10, carbon monoxide and nitrogen dioxide. PM10 raised in the winter months in Masterton and Wainuiomata where National Environmental Standard for Air quality daily limit was approached or exceeded on some occasions, this was limited to cold, calm and clear nights which restrict the dispersal of particulate matter.</p> <p>Pollutant concentration measured at the long-term monitoring site in central Wellington city declined over 2004 to 2010.</p> <p>Despite full compliance with air quality guidelines at transport monitoring sites, a national screening programme carried out by the NZTA has shown that nitrogen dioxide concentrations may be elevated on some heavily trafficked local roads which are surrounded by buildings that interfere with the dispersal of pollutants. Emissions from domestic fires used for home heating are the major source of PM10 contributing to poor winter air quality in some parts of the region, including Masterton, Upper Hutt, Wainuiomata, Carterton, Featherston and Raumati South. On calm nights levels may exceed WHO guideline.</p> <p>Pollution Amount Blames air quality on weather Not a Problem</p>	Retrieved July 2016
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Total mediums	28
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Mediums saying air pollution is a problem	16
Mediums saying air pollution is NOT a problem	12
Mediums with pollution levels	18
Mediums with health effects	12
Mediums with environmental effects	7
Mediums with ways to reduce pollution	8

## **Appendix F: Policy Analysis**

Internationally, policy and regulations have been noted to be the main drivers for effective action on urban air pollution reductions [44]. The majority of cities who have policies for air pollution reduction state that the motivation for these initiatives has been the objective of improving the health of their citizens [44]. The World Health Organisation (WHO) supports the notion that it is the role of public health policy to reduce health impacts of urban outdoor pollution, because it is largely beyond the

control of individuals [4]. It is their recommendation that the public health sector can lead a multi-sectorial approach at all levels of authority, be that regional, national or international [4]. As air pollution is not limited within national borders, it is seen as matter of international concern [4]. The United Nations Framework Convention on Climate Change (UNFCCC) commits its 192 parties to internationally binding emission reduction targets through the Kyoto protocol [49]. The European Union then has their own EU Clean Air Policy Package, setting out objectives for reducing the health impact of poor air quality, as well as national emissions ceilings for Member States [45]. This package resulted in a 20% reduction in mortality associated with PM between 2000 and 2010, and the monetized benefits of the policy are expected to be 12-40 times higher than the cost [46]. These are examples of international cooperation to achieve air pollution mitigation. Additionally we see national, regional and city initiatives for improved air quality [44]. City initiatives particularly focus on reducing transport related emissions, as cities accommodate the majority of people and carry a heavy burden of transport air pollution as a result [44].

It was evident from the literature reviewed that there are themes in which mitigation strategies could be stratified, though most of this was referenced implicitly. A large number of interventions can be examined within the four strategic themes used by Curran et al and Brauer et al of (i) Land use planning and transportation management, (ii) reduction of vehicle emissions, (iii) modification of existing structures and (iv) behavioural change [47, 48].

### **Land Use Planning and Transportation management**

1. Separating traffic and residences or sensitive locations i.e. schools by increasing distances between them. Levels of TRAP approach background within 100-150 m
2. Speed reduction and roundabout or traffic circles to reduce stop-go traffic and idling. Enforcement of 80 KPH from 120KPH on an urban motorway resulted in an

average reduction of 8% PM10 and 30% NOX

3. Reducing traffic volume. When volumes exceed the free-flow capacity of a specific junction or roadway, congestion causes an increase in emissions in addition to that of simply having more emitting vehicles on the road

### **Reduction of Vehicle Emissions**

4. Fuel quality and decreased emissions. Fuel quality affects vehicle emissions and is traditionally regulated at a national level in New Zealand [50]. Increase in electric vehicle usage would greatly eliminate TRAP by replacing the internal combustion (IC) engine.

5. Routine emissions testing to remove or retrofit “super emitters” responsible for disproportionate pollution [48]. British Columbia’s program “Air Care” showed an 87% reduction in emission between 1992 and 2010 where an absence of the program would have only produced a 54% reduction [51].

### **Modification of existing structure**

6. Physical barriers (including vegetation) can dilute pollution levels by increasing mixing

7. Modification of buildings to reduce exposure. Positioning outdoor air intakes away from high-traffic roadways affects the concentration of traffic-generated pollutants within a building [52]. TRAP has been found to persist longer indoors than outdoors.

### **Behavioural Changes**

8. Education and social marketing to decrease vehicle miles travelled, including the promotion of alternative transit options and shared driving, and influencing personal choices about vehicle type and driving habits

Overall, the literature suggest that in order to mitigate exposure and risks from TRAP, the issue must be addressed with diverse, coordinated policy [48]. Interventions with

the greatest potential for effective reduction of TRAP focus on the pollutant source, such as reductions in traffic volume and air pollutant emissions [47]. Short term measures that target infrastructure and vehicles are likely to be most effective at reducing exposure because they operate at a population level, with the most effective interventions adhering to the “polluter pays” principle [47]. Long term policies including the implementation of integrated land-use planning that incorporates health impact assessments can influence the siting of new buildings or roads such that exposure is minimized [48].

One traffic reduction intervention that stood out during our research was the implementation of 200 Low Emission Zones (LEZs) in 12 European union countries [53]. LEZs restrict the entry of vehicles based on the emission standard of the vehicles, though restrictions vary considerably. LEZ’s in Germany restrict passenger cars as well as heavy duty vehicles and evidence suggests this has reduced PM10 and NO2 concentrations by a few percent. Since the implementation of the London LEZ, which restricts heavy duty vehicles (HDV’s) strong reductions of particle number concentration were seen. Ellison et al found that the LEZ in London had a significant effect on the composition of the vehicle fleet in London and reduced PM10 concentrations [54]. London also implements a London Congestion charge, which unlike the LEZ, only applies within peak times, in central London and applies to all vehicle types. It works to financially incentivise public and active transport use in peak times in order to decrease congestion and air pollution [55]. These international examples of could serve as models for policy and initiatives to be implement in New Zealand cities, namely Wellington.

Currently air quality in New Zealand is governed by the Resource Management Act 1991 (RMA), and involves a number of agencies. The Minister for the Environment is responsible for ensuring a set level of protection for the health of New Zealanders [56]. What is clear from reading the Ministry for the Environments Air Quality Compliance Strategy is that the process of monitoring air pollution, and implementing any attempts at change is a convoluted one, where responsibility falls on many shoulders. There is discussion within the strategy about vertical communication [44] and reporting between national and local governments, though whether this is done in practice is difficult to ascertain. There is also mention of a consultation process with iwi, industry groups and

local community in order to enable ‘buy in’ of the plan. But there is no mention of horizontal level stakeholder integration across environment and health sectors in the policy making process. This is said to be one the barriers to air pollution mitigation [44]. At this point in time TRAP policies are embedded within air quality management programmes. The recommended approach of integrating these policies into national and local climate action plans could result in driving effective, cost efficient, broad scale action to improve urban health [44].

Although health is the main catalyst for urban air pollution mitigation actions, the place of the health sector in creating policy seems unexplored [44]. A valuable and relevant resource left untapped. It may be that the health sectors involvement may be exactly what the field needs in order to spur political will in the direction of change.