IN THE HIGH COURT OF NEW ZEALAND **AUCKLAND REGISTRY**	**CIV-2021-404-1618**
I TE KŌTI MATUA O AOTEAROA **TĀMAKI MAKAURAU ROHE**	
UNDER	the Judicial Review Procedure Act 2016
IN THE MATTER OF	an application for judicial review
BETWEEN	**ALL ABOARD AOTEAROA INCORPORATED** Applicant
AND	**AUCKLAND TRANSPORT** First Respondent
AND	**THE REGIONAL TRANSPORT COMMITTEE FOR AUCKLAND** Second Respondent
AND	**AUCKLAND COUNCIL** Third Respondent

AFFIDAVIT OF ALISTAIR JACK WOODWARD
December 2021

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AFFIDAVIT OF ALISTAIR JACK WOODWARD

I, Alistair Jack Woodward, of Auckland, public health medicine specialist, swear –

1. I am Professor of Epidemiology & Biostatistics at the University of Auckland.

2. I make this affidavit in support of All Aboard Aotearoa Incorporated's application for judicial review of decisions made by Auckland Transport, the Regional Transport Committee for Auckland and Auckland Council concerning the Regional Land Transport Plan for Auckland 2021.

3. I confirm that I have read and complied with the Code of Conduct for Expert Witnesses in preparing this affidavit.

My qualifications and experience

4. I am a medical doctor (MB BS Adelaide 1976), with post-graduate qualifications in Community Medicine (MMedSci Nottingham 1981) and Epidemiology (PhD Adelaide 1989). I have specialist qualifications in Public Health Medicine (Fellow of the New Zealand College of Public Health Medicine 2008) and am registered as a medical practitioner with the New Zealand Medical Council.

5. I have clinical experience in hospital medicine (1977-1978) and general practice (1979-1983). For almost 40 years I have worked as a public health researcher, teacher and consultant, in Australia, the UK and New Zealand. I have led university Departments of Public Health in Adelaide, Wellington and Auckland. I was the first Head of the School of Population Health at the University of Auckland (2004-2012).

6. My research and teaching have concentrated mainly on environments and health. This includes a long-term interest in health impacts of transport, covering road crash injury, air pollution resulting from vehicle emissions, and effects of the transport system on the health of populations. I have studied climate change for 25 years, and was a co-recipient of the Nobel Peace Prize in 2007 (along with many other scientists) for my work with the Intergovernmental Panel on Climate Change (**IPCC**). I led the human health chapter in the 5th Assessment Report of the IPCC (2014) and am currently a lead author on the Australia and New Zealand chapter for 6th Assessment Report (to be published in 2022).

7. I have acted as a consultant on environmental health for international agencies such as WHO and UNEP, including climate projects in the Pacific (eg Kiribati, Samoa, Tonga), and have worked for a decade in China on climate impacts and adaptation in collaboration with colleagues at China Centres for Disease Control.

8. A full curriculum vitae is set out in schedule 2 to this affidavit. Schedule 1 contains a list of references.

Documents provided to me

9. I have been provided with the following documents:

   (a) The pleadings filed in the proceeding;

   (b) The Government Policy Statement on Land Transport 2021 (**GPS**);

   (c) The Regional Land Transport Plan for Auckland 2021 (**RLTP**); and

   (d) An Auckland Transport paper prepared for a meeting of the Regional Transport Committee on 18 June 2021 titled "How the draft RLTP 2021-2031 meets the requirements of section 14 of the LTMA" (**Auckland Transport Advice**).

Instructions

10. I have been instructed to address the following issues:

   (a) The effects of climate change on human health, including in New Zealand and Auckland;

   (b) The particular risks of climate change for Māori;

   (c) The effects that climate change will have on youth and future generations;

   (d) The effects of air pollution, and in particular air pollution caused by transport emissions, on human health;

   (e) The effects of the transport system on human health;

   (f) Auckland's road safety record; and

   (g) The four strategic priorities (and the associated primary outcomes) of the GPS, and how they support one another from a health perspective.

Summary of my evidence

11. In summary:

   (a) Climate change has direct health effects, such as injuries and illnesses caused by extreme weather like heat, fire, drought and storms, and leads less directly to health problems resulting from ecosystem disruption (eg hunger due to scorched or flooded food crops) or social disturbances (such as the health effects of forced migration, or conflict over diminishing resources). Water-borne infections, sensitive to increased variations in rainfall, are a particular challenge in New Zealand, as shown by the massive *Campylobacter* outbreak in Havelock North in 2016.

(b) In the Māori world-view, good health for people and populations requires an environment that is in balance and thriving. A damaged environment, such as one affected by climate change, undermines identity and well-being of iwi and whanau. Māori are at higher risk of impacts on physical and mental health because they presently experience a disproportionate burden of many health issues that are affected by climate (such as childhood diarrhoeal diseases and chronic lung disease).

(c) As climate change continues, extreme weather events will become more common and more severe. It has been estimated that new-borns across the globe will on average live through 2.6 times more droughts, 2.8 times as many river floods, almost three times as many crop failures, and twice the number of wildfires as people born 60 years ago.

(d) Local air pollution in New Zealand causes about a thousand premature deaths a year and about a quarter of these deaths result from transport emissions, bringing a social cost of about $940 million a year.

(e) Transport systems provide access to vital services and amenities, but a car-dominated arrangement, such as that in New Zealand, also causes injury, a reduction in the amount of physical activity undertaken by the population, increased noise, and disrupted social connections and mental well-being.

(f) Road safety in Auckland compares poorly with comparable cities overseas, particularly in regard to the safety of pedestrians, cyclists and motorcyclists. In the last five years, the situation has deteriorated. There were some signs of recovery after 2017, but the 2021 statistics are most disappointing. Most of the deaths and serious injuries on Auckland roads occur amongst road users who are not vehicle occupants. Improvements in road safety in Auckland require changes on our roads and streets, and especially to protect those who walk and wheel.

(g) Done well, it is plain that the strategic priorities for the GPS very much support one another from a health perspective. For instance, more compact cities with high quality spaces for walking and cycling lead to less driving, which leads to better air quality, fewer greenhouse emissions, fewer road crash injuries, more active populations and increased well-being.

The effects of climate change on human health

Global

12. Climate change caused by increasing levels of greenhouse gases in the atmosphere declares itself in two ways: steadily rising average temperatures and sea-levels and long-term changes in rainfall; and increasing frequency of extreme weather (eg heatwaves, droughts and floods).

13. Both long-term change and acute extremes influence human health, and the effects may be direct or indirect. In the first category are the injuries and illnesses that result directly from heat, fire, drought and storms. In the second category are health problems resulting from ecosystem disruption (eg hunger due to scorched or flooded food crops) or social disturbances (such as the health effects of forced migration, or conflict over diminishing resources).

14. All living things adapt to fit climatic niches. Humans respond through physiological changes (more active sweat glands in hotter environments, for instance), personal behaviors (eg choice of clothing) and social organisation (such as work schedules and building regulations). If the climate changes, and the human habitat moves out of the Goldilocks 'not too hot, not too cold' sweet-spot, then health and well-being may be compromised. Two things follow: the risk of harm follows closely the speed and extent of change; and the features of hazardous weather are in the main local (unusual heat is not the same in Bluff as in Brisbane, though both carry health risks).

15. So it matters greatly that the rise in average global temperatures is occurring more rapidly than at any time in the geological record, to our best knowledge. In many parts of the world unprecedented sea-level rise threatens the livelihoods and well-being of hundreds of millions of people (eg in coastal cities in south Asia). Higher temperatures and long-term changes in rainfall patterns (eg drying in southern Australia) now advance too quickly for ecosystems to respond, with serious consequences for human populations (eg the increase in extent and severity of Australian bushfires in recent decades).

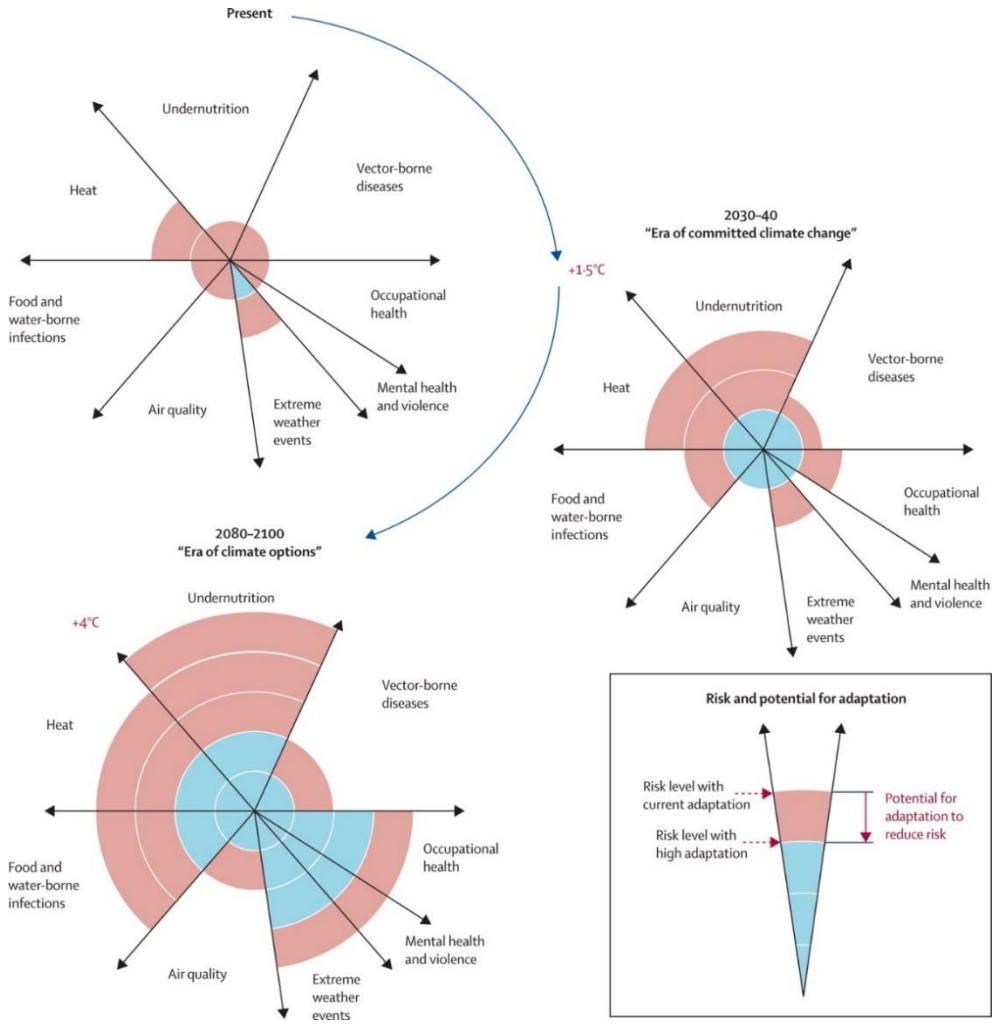
16. There are limits to adaptation, and the faster and further that climate change proceeds the more likely these limits will be breached. For instance, once the wet bulb temperature (a measure that combines heat and humidity) reaches around 37.2°C, human core body temperature will rise, even at rest, in the shade. This is essentially the edge of liveability. Such hostile conditions are seldom experienced at present, but will become more common in the near future. In many places around the Persian Gulf, for instance, by mid-century it may be physically impossible for people to spend time outdoors in the warmest months of the year. Some important cereal crops are close to their limits already. Failure of the rice crop in southern China due to heat stress might rise from a 1 in more-than-100-year event to become a 1 in 10-year event under a scenario of 2–3°C global warming and a 1 in 4-year event in the case of 5–6°C global warming.

17. Global warming now amounts to about 1.2°C above pre-industrial temperatures. It appears that major interventions are required to prevent warming continuing beyond 1.5°C. With present policies in place, it is projected temperatures will rise by 2.5–3°C on average by 2100. If international commitments that have been made are not honoured, and if existing policies are weakened or are not implemented, then warming may exceed 4°C by the end of the century.

18. The 5th Assessment Report (**AR5**) of the IPCC (published in 2014 but still the most current) concluded that:

> Until mid-century, climate change will act mainly by exacerbating health problems that already exist [very high confidence]. New conditions may emerge under climate change [low confidence], and existing diseases (e.g. food-borne infections) may extend their range into areas that are presently unaffected [high confidence]. But the largest risks will apply in populations that are currently most affected by climate-related diseases. Thus, for example, it is expected that health losses due to climate change-induced under-nutrition will occur mainly in areas that are already food-insecure. (Woodward et al, 2014)

19. The figure below is taken from the chapter on human health in AR5 (Woodward et al 2014), and illustrates the major categories of health effects of climate change at three points in time: the present, mid-century (+1.5°C) and around 2100 (+4°C). The size of each slice shows our best judgement of the magnitude of the impact of climate change. Where it is forseeable that adaptation could reduce climate risk, we estimated the 'net' effect, and this is shown in blue.



20. Since 2014, global temperatures have risen faster than anticipated, and extreme weather events have become more common. Most of these extreme events (eg heatwaves, fires, floods) would very likely have not occurred without human-induced climate change. For instance, extraordinary heat in Canada and the north-west of the USA (2021), the largest ever and hottest bushfires in Australia (2019/2020), and

unprecedented flooding in Germany and Belgium (2021) each carried the 'fingerprint' of climate change and each caused hundreds or thousands of deaths and billions of dollars of damage.

21. The 2021 report of the Lancet Countdown on health and climate change found:

> an unabated rise in the health impacts of climate change and the current health consequences of the delayed and inconsistent response of countries around the globe—providing a clear imperative for accelerated action that puts the health of people and planet above all else. (Romanello et al, 2021)

New Zealand

22. In the last hundred years, annual average temperatures in New Zealand have increased by about 1.25ºC. If global greenhouse emissions continue to rise at close to the current rate, air temperatures in the country will rise by another 2.5ºC to 5.0ºC by the end of this century. Sea temperatures are projected to rise by about 3ºC. The frequency of severe storm events, drought, flooding and coastal inundation has increased since 2000, and these trends are projected to continue. Annual average rainfall is expected to fall by about 10% in the east and north of the country, with a two to three times increase in the frequency of significant droughts. Extreme heavy rainfall events are projected to become more frequent in most parts of the country. Sea levels around New Zealand have risen by approximately 200 mm in the last century; this trend is expected to accelerate, leading to rises of 300–400 mm in the next 30–40 years, and up to a metre in 2100 above late 20th century levels. (RSNZ, 2017)

23. A Royal Society of New Zealand (**RSNZ**) report on health and climate change published in 2017 (which I discussed in this interview: https://www.royalsociety.org.nz/media/show/7) referred to the building blocks for health, and explained how climate change acts to undermine these foundations. For instance, social ties are fundamental to good health, but may be disrupted if settlements are abandoned or re-located. This is already a serious prospect for low-lying areas in south Dunedin, for example, and will become more common if climate change proceeds. Rising sea-levels and more frequent intense rain-fall mean that extreme sea level events that presently occur once in a hundred years or more may be experienced every year in many coastal regions by 2100. Other climate-sensitive prerequisites for good health that are described in the RSNZ report include safe food, moderate temperatures and clean water.

24. If greenhouse emissions continue at close to current levels, many parts of New Zealand will experience more than 80 days a year above 25ºC, whereas currently most parts of the country typically see 20-40 days per year of such high temperatures. In one study, the number of heat-related deaths in Auckland was projected to rise more than six-fold if global average temperatures rise by 3ºC (RSNZ, 2017).

25. Water-borne infections are a particular challenge in New Zealand, where rates of gastroenteritis are already relatively high compared with other high-income countries. In part this may be traced to the prevalence of untreated drinking water supplies, large numbers of livestock, and high rainfall. In 2016 about 8,000 people in Hawke's Bay in the North Island

became ill due to contamination of the Havelock North drinking water supply with the bacteria *Campylobacter*. Forty-two people were admitted to hospital and there were four deaths. This was the largest reported campylobacteriosis outbreak worldwide, and illustrates both the significant disease burden caused by water-borne outbreaks, and the confluence of land use hazards, infrastructure vulnerability and extreme weather (figure below). The infection in this instance was traced to sheep faeces washed into an underground aquifer that fed the town water supply. The water supply was not treated and the precipitating event was an extraordinarily heavy rainfall that followed a long dry spell. It is projected that intense rainfall events will occur more frequently over much of New Zealand under climate change, and without more robust protection of drinking water supplies the risk to human health will increase.

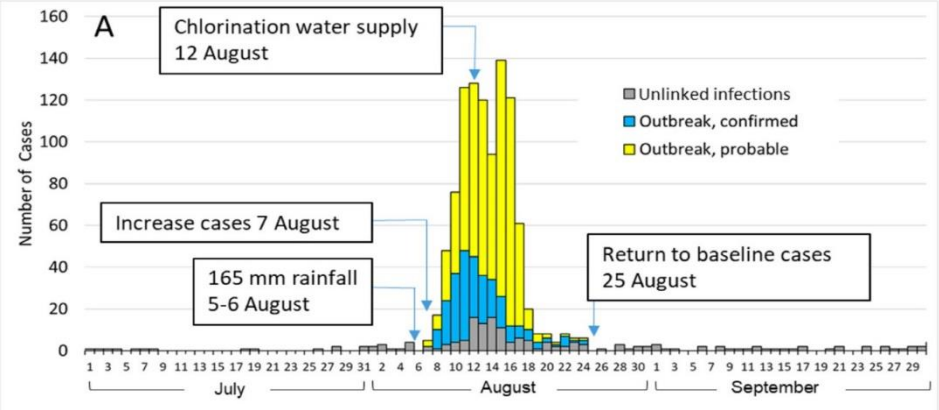


Figure. Reported cases of campylobacteriosis in Hawke's Bay July-September 2016. (Gilpin et al 2020)

26. Many food-borne infections are sensitive to temperature. In New Zealand in a 40 year period (1965-2006) a 1°C increase in monthly average ambient temperature was associated with a 15% increase in salmonellosis notifications within the same month. Higher temperatures may increase the number of microorganisms present on foods pre-harvest, and may also increase risk of contamination during transport, storage and preparation. Similar risks apply to marine foods – sea surface temperature is directly related to micro-organisms and biotoxins in seafood, and New Zealand studies show that heavy rains have caused contamination of shell-fish beds with pathogenic organisms. Changing environmental conditions may also lead to increased levels of heavy metals in the food supply. For example, higher temperatures increase the rate of toxic methyl mercury formation by micro-organisms in marine waters and sediments, resulting in larger amounts of mercury accumulating in the food chain. This is important in New Zealand given that fish is a major source of mercury in the national diet.

27. New Zealand also experiences flow-on effects of regional impacts. Many Pacific island states are susceptible to damage and loss caused by climate change, due to location (in the tropical storm belt), geography (low-lying), economic concentration (on tourism and agriculture) and infrastructure weaknesses (building design, health services). In 2015 Tropical Cyclone Pam caused losses in Vanuatu that amounted to two-thirds of the national GDP. New Zealand provides aid and emergency relief (as was required

after Cyclone Pam), depends on immigrants to work in key industries (horticulture, for example), and has particular constitutional responsibilities for the Cooks, Niue and Tokelau. There is no evidence that climate impacts are currently a significant driver of migration to New Zealand, but this may change in the future due to rising seas, higher temperatures and changes in rainfall and storm activity.

28. Health may be affected by responses to climate change, so-called transition risks and co-benefits. An example of a transition risk would be sudden introduction of a large carbon price on dairy products causing severe economic losses and social disruption. Or the floods and landslips that might result from clearing steep hillsides to plant carbon-saving exotics. Conversely, there is the potential for co-benefits: in New Zealand, it is estimated that a 5% shift in light vehicle kilometres travelled on short journeys to cycling would each year save about 50,000 tonnes of CO_2 and lead to 5.6 fewer deaths from diseases caused by traffic pollution. It was estimated that the increase in physical activity that resulted from moving only 5% of trips to a more active mode would save about 109 deaths each year. (Lindsay et al, 2011)

The particular risks of climate change for Māori

29. Māori concepts of health incorporate spiritual, intellectual, physical, social, and emotional dimensions, and include relationships with the natural environment. In the Māori world-view, good health for people and populations requires an environment that is in balance and thriving. A damaged environment, such as one affected by climate change, undermines identity and well-being of iwi and whanau. (Jones et al, 2014)

30. In terms of the effects on physical and mental health, Māori are at risk because they presently experience a disproportionate burden of many health issues that are affected by climate. Examples of health problems that are more common among Māori include childhood diarrheal diseases (which are sensitive to heavy rainfall), and non-communicable diseases such as chronic lung disease that make it more likely people will require hospital care during heatwaves. The large number of Māori who receive low incomes and live in socially disadvantaged communities means that climate impacts will be more difficult to prepare for and a greater challenge to recover from. It is also important to note the salience of indigenous relationships with the environment: there may be particular risks associated with customary practices such as collection of kai moana.

31. There are important implications for the economic determinants of health. The Māori economy is heavily invested in climate-sensitive primary industries; and policy responses that place extra financial burden on low-income families without counter-balancing measures would exacerbate Māori experience of poverty and poverty-related diseases.

32. In response to climate change, it has been pointed out there is need for better indicators to monitor climate-sensitive outcomes for Māori – many of the measures now in place track whole of population average trends. Improvements are needed also in the mechanisms that enable active and informed participation in priority setting and decision-making, which would be helped greatly by wider use of Māori framings and values in environmental assessments.

33. Mitigation and adaptation measures, if well-chosen and thoughtfully implemented, can improve health equity. For instance, the health gains for Māori from mode shift to cycling, per kilometre, are estimated to be roughly twice those for non-Māori (due principally to a greater prevalence of health conditions that are improved by regular physical activity). (Bassett et al, 2020)

The disproportionate effects of climate change on youth and future generations

34. The life expectancy at birth of children born in New Zealand in 2020 is estimated to be 80 years for males, and 84 years for females. The median age at death is higher than the average, so more than half the children born this year in New Zealand are expected to be alive in 2100. In other words, those who will experience the climate of the 22nd century are with us now. They are our children and grandchildren.

35. As climate change continues, extreme weather events will become more common and more severe. It is not surprising therefore that climate change will have disproportionate effects on those who were born recently, and on future generations. It has been estimated in a recent paper in *Science* (Thiery et al, 2021) that even if 2021 climate policies are applied, as promised, new-borns across the globe will on average face seven times more heatwaves during their lives than their grandparents. They will on average live through 2.6 times more droughts, 2.8 times as many river floods, almost three times as many crop failures, and twice the number of wildfires as people born 60 years ago.

36. One of the co-authors of the *Science* paper said: “we lay bare the fundamental injustice of climate change across generations, as well as the responsibilities of today's adults and elders in power”.

37. Importantly, the above numbers are global averages. It is projected that the climate change multipliers for children in low-income countries in equatorial regions will be much greater, and within countries, poverty and racism mean that children in groups that are already disadvantaged will be more affected by future climate change.

The effects of air pollution on human health

38. Air pollution caused by motor vehicles results mainly from tail-pipe emissions, added to by dust due to wear and tear of brakes and tyres. The health effects of this pollution are caused by particulate matter (**PM**), oxides of nitrogen (especially NO_2), ozone, and to a lesser extent by other gases such as CO.

39. Although air quality is generally good in New Zealand compared with many other countries, there are sites in Auckland where pollution exceeds WHO standards. For instance, NO_2 monitoring in Canada Street, in central Auckland, from 2007 – 2016 reported annual averages that exceeded the WHO guideline of 40µg/m3. (Talbot & Lehn 2018) Long-term monitoring in Queen Street has shown exceedances of the 200 µg/m3 hourly average figure, set internationally as the minimum reasonable standard of air quality. Levels of black carbon and particulate matter in central Auckland, which like NO_2 are closely related to the volume of motor vehicle traffic, also spike above international air quality guidelines. (Talbot & Lehn 2018)

40. Air quality guidelines help to identify pollution hot spots. But they do not distinguish between what is 'safe' and what is 'unsafe'. Epidemiological studies in New Zealand (and elsewhere) have found evidence of increased rates of illness and premature death even when exposures are less than the WHO standards.

41. The Health and Air Pollution in New Zealand (**HAPiNZ**) 2012 study (Kuschel et al, 2012) was based on exposure to particles less than 10 µm in size, and estimated each year anthropogenic air pollution caused 1,175 premature deaths, 607 extra hospital admissions for respiratory and cardiac illnesses, and 1.49 million restricted activity days, nationally. The total social costs were calculated to be $4.28 billion per year. On the basis of source apportionment studies, it was estimated that 22% of the health burden (ie about 258 premature deaths per year, or $940 million in social costs) was due to motor vehicle emissions.

42. The HAPiNZ study was updated in 2020/2021 with more extensive air quality measurements, including exposures to NO_2 as well as very small particles (PM2.5). The full findings have not yet been published, but it is clear the health effects of NO_2 are substantial, and independent of the effects of particulate matter. This is important because there are many sources of PM, but oxides of nitrogen are derived mostly from vehicle emissions. A very recent epidemiological study of the New Zealand resident population found for an increase of 10 µg/m3 in annual average exposure to NO_2, all cause deaths increased by 10%, and admissions of children to hospital with asthma increased by 18%. (Hales et al 2021)

43. On these grounds, it appears likely the 2012 study under-estimated the effects of motor vehicle emissions on health in New Zealand. While the efficiency of engines has increased, and tail-pipe emissions of PM and NO_2 per vehicle have reduced on average, the continued growth in the number of light vehicles, compounded by the popularity of heavier vehicles, many of which are diesel-powered, means that the population continues to be exposed to health-damaging air pollution.

The effects of the transport system on human health

44. I have already referred to ways in which transport affects human health via climate change (transport is responsible for about 21% of greenhouse gas emissions nationally, and the transport share is growing faster than that from any other sector) and local air pollution.

45. Transport systems provide access to health care, education, employment and other important services and amenities. But car-dominated transport arrangements such as those in New Zealand have many negative effects, including injury, a reduction in the amount of physical activity undertaken by the population, increased noise, and disrupted social connections and mental ill-health.

46. Road crash injury is the best-known cause of health-loss due to transport. In the last five years there have been about 350 road crash deaths per year nationally. This is similar to the number of deaths each year in New Zealand from melanoma, the most aggressive skin cancer. Serious injuries from road crashes far outweigh deaths – there are about 4,300 admissions to hospital each year. Many of these injuries lead to persistent impairment and disability: it is estimated that between 21% and 57% of car occupants admitted to hospital following a motor vehicle crash will experience health problems in the long term (Ameratunga et al., 2004). Most affected are males and young adults, and Māori rates exceed non-Māori. Internationally, New Zealand fares poorly in rankings of road safety. The death rate in this country (averaged over 2017-2020) was 7.1 per 100,000 population per year, compared with 3.7 and 2.0 per 100,000 in Victoria (Australia) and Norway respectively. (Howard, 2021)

47. The health effects of foregone physical activity exceed those of injury – about two-thirds of preventable mortality and morbidity due to our land transport system can be attributed to lost opportunities for physical activity in car-dominated settings. (Lindsay et al, 2011; Randal, 2021) As the number of motor vehicles has increased in New Zealand, and the design and operation of the transport system has given priority to moving more cars faster, the proportions of trips undertaken by walking, cycling and public transport have dwindled rapidly. This means fewer people getting around under their own power.

48. In England, a study of child mobility over three generations found that the home range, the distance children are permitted to roam unattended, reduced by 90%, and in the same period motor vehicle traffic on neighbourhood streets multiplied 10-fold. (Woolley and Griffin, 2015) Active transport is recognised to be one of the most effective ways of meeting the basic requirements for physical activity, without which populations experience higher rates of cardiovascular disorders, some cancers, mental health problems and other exercise-related diseases. We estimated that shifting just 5% of short urban trips in New Zealand from car to bike would save about 120 premature deaths per year, due to the beneficial effects of increased physical activity. (Lindsay et al, 2011)

49. A study led by the University of Otago Wellington aimed to quantify health loss and inequities caused by the current land transport system in New Zealand through the pathways of road injury, air pollution and physical inactivity. A multi-state life table model was used to estimate the future health impacts and changes in health system costs from these pathways. It found that the negative impacts of transport on health, in total, are of similar magnitude to the effects of tobacco and obesity. (Randal, 2021) Māori are disproportionately affected, due in particular to higher road crash injury rates: improvements in transport will materially improve health equity.

50. Another study comparing the effects of transport on health in New Zealand cities chose Wellington as the reference (since it has the highest level of active transport). If Auckland had the same transport mode share pattern as Wellington, it was estimated the city would have each year 57.3 fewer premature deaths, 1,311 fewer premature years of life lost, and 1,582 fewer lost disability-adjusted life years. It would also save 20% of the CO_2 currently emitted by the light vehicle fleet. (Shaw 2018)

51. Traffic noise is the main source of environmental noise pollution in Auckland's neighbourhoods and is seldom recognised as a substantial health issue. But noise tends to activate alarm and threat-detection arousal systems in the human body. Recent research showed that noise pollution is a significant source of annoyance within our cities, with about a third of Aucklanders reporting that they were 'very' or 'extremely' annoyed by road traffic noise (Allan, AECOM, Humpheson, & Tonkin & Taylor Ltd, 2019). Chronic traffic noise stress has also been shown to affect sleep, psychological health, and child development and learning (Evans, Lercher, Meis, Ising, & Kofler, 2001).

52. This fits with what we know about the effects of aircraft noise on stress responses, mental health and cognitive performance (Haines et al., 2001). In general, environmental sources of noise (including vehicle traffic) are not well or consistently monitored in Aotearoa (Briggs, Mason, & Borman, 2015). It is estimated that approximately 600,000 New Zealanders experience road traffic noise at levels that damage health, according to noise guidelines set by the WHO (Allan et al., 2019), and according to one study there may be 59 cardiovascular deaths each year attributable to noise pollution resulting from motorised vehicle use (Briggs et al., 2015).

53. Mental health has received little attention in relation to transport. However, a recent investigation, the first ever of this kind in New Zealand, concluded that our transport system, with high levels of driving, is contributing:

> …to the rise in levels of psychological distress in our communities, including increased noise pollution and neighbourhood severance, and declining levels of active transport use resulting from a rise in private car use. International evidence also suggests that the changes in our commuting conditions – in particular, the increase in commute times for car and bus journeys and the increase in travel in 'high impedance' congested conditions – is likely leading to elevated levels of commuting stress in our larger cities. Finally, ongoing issues with transport poverty and inaccessible environments are also likely to be a source of psychological distress for low-income households and people living with disability in Aotearoa." (Wild et al, 2021)

Auckland's road safety record

54. A 2018 review commissioned by Auckland Transport recommended that Auckland benchmark its road safety performance against Melbourne, given the similarities between the two cities. By this standard, Auckland does poorly – in recent years, the rate of deaths and serious injuries from road crashes was 40% greater than in Melbourne. (Howard, 2018)

55. Road safety in Auckland has generally followed the pattern in the country at large, improving over time from a peak in deaths and injuries in the early 1970s. However, a sharp deterioration in 2017 reversed the long-term trend. In that year there was an almost 80% increase in fatalities in Auckland (compared with an increase of 23% in the rest of the country)

relative to 2014, leading to the 2018 review cited above, which was conducted by Australian consultancy Whiting and Moyne.

56. The major findings of the 2018 review were:

(a) Increases in population and motor vehicles in Auckland explained only a small part (about 15%) of the rise in the number of road crash casualties;

(b) Internationally, when cities are compared, Auckland is middle of the pack in terms of road fatalities, behind cities like Melbourne;

(c) Auckland ranks very poorly in the safety of so-called 'vulnerable road users'. Out of 29 cities studied by the International Transport Forum in 2017, Auckland had the 2nd highest pedestrian fatality rate, the 6th highest cyclist fatality rate and the highest motorcyclist fatality rate, per distance travelled;

(d) The deterioration in Auckland road safety is 'unacceptable'; and

(e) Investment in the Auckland Transport infrastructure safety programme scarcely changed in the five years following 2012/13, and in 2018 made up less than 1% of total expenditure ($11.5 million out of $1.47 billion).

57. According to the review, Auckland Transport needed to:

(a) Act more energetically on speed limits;

(b) Work with Auckland Council to improve place and amenity;

(c) Resolve internal tensions in the organisation that affect safety;

(d) Embrace Safe System principles and thinking; and

(e) **Deliver safer infrastructure through all Auckland Transport programmes** (emphasis added).

58. A follow-up in 2021, by the same consulting firm (Howard, 2021), found that there had been many improvements in Auckland Transport policy and operations, especially with the roll-out of speed restrictions. Deaths and serious injuries fell between 2017 and 2020, though it was noted the COVID-19 disruptions of 2020 led to fewer trips, and it was too soon to tell when the report was written (April 2021) whether the improvements would continue in 2021 (the author noted year to date deaths in the first quarter were double those for the same period the year before).

59. Although road safety measures (such as the star rating scheme) have traditionally focussed on the safety of vehicle occupants, the majority of road crash casualties in Auckland involve road users who are not in vehicles. In 2020, 27% of fatalities and serious injuries were pedestrians, 22% were motorcyclists, and 8% were cyclists. Between 2019 and 2020 there was a 24% reduction in the number of motorcyclist deaths and serious injuries (**DSI**), and the number for cyclists stayed much the same, but there was a sharp increase in pedestrian DSI (from 73 to 94). (The lack

of up to date information on distance travelled means it is not possible to convert these numbers into rates, so it is unclear how much of the change in casualties is due to changes in time or distance at risk.)

60. Between 2015 and 2017 the numbers of deaths and serious injuries in Auckland that were associated with vans and utes increased by 41%. This is likely to be related to changes in the make-up of the vehicle fleet. In 2010 none of the biggest-selling new vehicles were utes, but in 2019 eight of the top 10 were truck-like vehicles, including five double-cab utes and three Sports Utility Vehicles. Double-cab utes made up one in 5 new vehicle sales in New Zealand in 2019. Large vehicles of this kind, with design features such as high, vertical front ends and a rigid ladder chassis, are more hazardous to other road users than the light cars they have replaced. An Auckland study found pedestrians are twice as likely to be killed if struck by a ute compared with a car travelling at ≥50 kph. (Woodward et al, 2021)

61. The recommendations of the 2021 Whiting Moyne report include the following:

    (a) 'AT needs to fully embrace and apply Safe System, with linkage to broader transport outcomes, to achieve access, efficiency, green mobility and enhanced place outcomes';

    (b) AT must 'deliver improved pedestrian (and other vulnerable road user) safety across the arterial and other roads in the network' (note this was #4 of 31 recommendations, ranked in order of importance and urgency); and

    (c) In conjunction with partners, AT should 'accelerate the safer urban infrastructure treatment programmes'.

62. Since the second Whiting Moyne report was published, it has become evident the improvement in safety in 2020 has not been sustained in 2021 (see table below). Indeed, the number of road deaths for the year to date in 2021 (for the Auckland region), despite the lengthy COVID lockdown in the second half of the year, are broadly similar to what was reported in 2017. Two caveats: the 2021 numbers to date are likely to be an undercount, as it may take months for road crash deaths to be officially recorded. Serious injuries (meaning those requiring hospital admission) give a fuller picture of road safety performance (especially road crashes affecting pedestrians and cyclists), but these data are not yet available for 2021.

Road deaths by region - year to date (01 January - 02 December)

Region: Auckland

Type of user by region - year to date

Type of road user	2017	2018	2019	2020	2021
Driver	24	20	16	8	21
Passenger	15	8	6	2	18
Motorcycle riders	10	6	5	8	7
Motorcycle pillions		1	1		
Pedestrian	9	13	4	9	6
Cyclist	1	2	4	3	3
Total	59	50	36	30	55

Table. Road crash deaths in the Auckland region, year to date, 2017-2021. From the Ministry of Transport (downloaded 4 December 2021) https://www.transport.govt.nz/statistics-and-insights/safety-road-deaths/

63. In summary, road safety in Auckland compares poorly with comparable cities overseas, particularly in regard to the safety of pedestrians, cyclists and motorcyclists. In the last five years, the situation has deteriorated. There were some signs of recovery after 2017, but the 2021 statistics are most disappointing. Most of the deaths and serious injuries on Auckland roads occur amongst road users who are not vehicle occupants. These are 'vulnerable road users' because of the ways in which the present transport system is designed and operated. Improvements in road safety in Auckland require changes on our roads and streets to protect all road users, and especially those who walk and wheel.

The strategic priorities of the Government Policy Statement on Land Transport 2021

64. The strategic priorities of the GPS are:

(a) Safety;

(b) Better travel options;

(c) Improving freight connections; and

(d) Climate change.

65. For each strategic priority, the GPS emphasises there are co-benefits. In other words, if the responses to the strategic priorities are carefully chosen there will be gains across the board. Transport improvements can be 'win-win', having positive effects on multiple outcomes. Co-benefits are not guaranteed, obviously. One could imagine policies that might deal with one priority, and have no effect, or indeed cause harm, in other areas. But there are plenty of counter-examples. I describe a number below.

Safety

66. The safety priority seeks a transport system in which no-one is seriously injured or killed. Changes to city streets to provide safer spaces for cyclists and pedestrians is an obvious response to this, and is particularly relevant in Auckland. In addition to reducing deaths and serious injuries, safer streets provide people with more choice in how they get around. For those who do not drive or own a vehicle, there will be more opportunities to be mobile, and therefore better access to facilities and services. Here are co-benefits for **better travel options** and **climate change**: travel on foot or by bicycle is carbon-frugal. Life cycle emissions per trip may be up to 30 times lower for a bicycle than those associated with a fossil fuel car, and 10 times less than an electric car (Brand 2021). Well-designed transport networks mean less disruption due to road crashes, and more reliable travel times, both of which support **economic productivity**, including for freight itself.

67. In an Auckland study we found that the combination of e-bikes and safe routes (such as the North-Western Bike Path) improved health and well-being, family life and economic productivity, due to fewer unplanned late arrivals at work, and less stress and road rage on the commute (Wild & Woodward, 2018).

68. Land use planning and transport are policy twins – in cities particularly, the two are inseparable. Compact settlements that permit mixed land use make alternatives to the private motor vehicle more attractive. Shorter trips tend to encourage walking and cycling. Greater population densities enable public transport to be well-patronised, and freight to be moved more efficiently. This scenario might reasonably be expected to reduce car use, cut vehicle kilometres travelled, increase physical activity and reduce road crash injury. Here are co-benefits for **safety**, **climate change**, **better travel options** and **improved freight connections**.

Better travel options

69. Better travel options are framed in the GPS in terms of inclusive access – increasing the opportunities for everyone to travel as they need to, and improving the quality of choices. Our work on mental health and transport described the damaging effects of travel poverty – many people in the present transport system do not have good choices of how and when they travel. Social isolation, unemployment, depression and other mental illness: these are documented in our report (Wild et al., 2020). Better and more diverse travel options (eg low cost, high quality public transport) makes the transport system more **inclusive**, and promotes **economic prosperity** and **health and safety**. When these options substitute for car travel (eg low emissions public transport instead of taxis) these interventions also support the **climate change** priority in the GPS.

70. High-quality mass transit systems in cities increase travel options and reduce car trips, thereby reducing pressure on the road network, and permitting more reliable movement of freight, as well as reducing local air pollution, greenhouse emissions and noise.

71. Better streets for walking and cycling help with climate change and safety. They also provide better travel options for people who presently find it difficult to use a hectic, high-speed, vehicle-dominated transport system. In

our study of transport and mental health (Wild et al., 2021), we learnt that lower-stress environments for pedestrians were seen as a key way to support the mobility needs of tāngata whaiora (those suffering from mental distress).

Improving freight connections

72. The primary goal here is a resilient transport system that moves freight efficiently, reliably and safely. One way of doing this is to develop alternatives to movement of freight on the roads, such as rail and coastal shipping options as well as e-cargo bike couriers. This brings the potential to **lower greenhouse emissions**, cut local air pollution (eg in central city areas), and reduce the risk of injury to other road users (truck/bike crashes on crowded city streets are a particular concern). In these ways better freight connections would bring co-benefits for **health and safety**, environmental sustainability and **resilience** (thanks to more mobility options and alternative connections in the event of disruptive events such as earthquakes and floods).

Climate change

73. It is important to understand the background to this aspect of the GPS. The Climate Change Response (Zero Carbon) Amendment Act 2019 sets a target of zero net carbon emissions by 2050, which will be impossible without substantial changes in the next ten years. Indeed, at the recent Glasgow Conference of the Parties, our government pledged a 50% reduction in net greenhouse gas emissions by 2030 from gross 2005 levels.

74. Progress on climate change in New Zealand requires large reductions in land transport (which contributes about 90% of all transport emissions). The urgency of this shift is recognised in the GPS, and in other key documents. For instance, the discussion document on the first national Emissions Reduction Plan, released by the Ministry for the Environment in October 2021, foreshadowed deep cuts in transport, including a 20% reduction in vehicle kilometres travelled by 2035.

75. The climate change priority in the GPS aims to support emission reductions consistent with national commitments, while improving **safety** and **inclusive access**. Done well, low-carbon transport systems can meet the other three strategic priorities (better freight connections, road safety, and better travel options). The Nordic countries provide many examples of win-win interventions, both in cities (eg high mode share for cycling, extensive public transport, safe walking) and in rural areas (eg bicycle 'super-highways' between towns, rapid rail connections and comprehensive coach networks). Low-emission transport systems are likely to be good investments economically, in the long-term, given the rising costs of fossil fuels and rapid improvements in alternative, low emission vehicles.

76. The GPS discussion of co-benefits points to the potential for higher density, mixed use and transport-oriented development to help meet **climate change** goals, provide better travel choices, and improve health and safety, by making public and active transport more feasible.

77. Greater population density in cities, done well, reduces the distances that must be travelled to facilities, education and employment, and increases the vitality and attractiveness of urban environments. Shorter distances make walking and cycling more attractive options. Increased concentrations of city dwellers support rapid, high quality public transport and more efficient freight movements. In combination, these changes result in less driving, better air quality, fewer greenhouse emissions, fewer road crash injuries, more active populations and increased well-being. Shifting freight from trucks to trains, coastal shipping or e-cargo bikes is another route to cutting greenhouse emissions, while simultaneously improving local air quality and reducing the frequency of road crash injury.

78. Done well, it is plain that the strategic priorities for the GPS very much support one another.

SWORN at Auckland this 23rd day of December 2021 before me:

A. Woodward

Alistair Jack Woodward

A solicitor of the High Court of New Zealand

Chloe Ann Barker
Solicitor
Hornabrook Macdonald
Auckland

CAB
AW

SCHEDULE 1 – REFERENCES

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SCHEDULE 2 – ALISTAIR WOODWARD CV

Curriculum vitae: Alistair Woodward

I am a medical graduate with qualifications in public health and epidemiology and have more than 35 years' experience as a public health scientist working in New Zealand, Australia and the UK. These include more than 25 years as a Head of Departments and Schools of Public and Population Health.

I have been advisor and consultant for international agencies including WHO and UNEP and have worked closely for almost two decades with the Intergovernmental Panel on Climate Change (IPCC). I was one of the recipients of the Nobel Peace Prize that was awarded in 2007 to the IPCC. My international experience is mainly in Asia (China in particular) and the Pacific.

Current Position:

Professor, Epidemiology and Biostatistics, School of Population Health, Faculty of Medical and Health Sciences, University of Auckland

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web page: https://unidirectory.auckland.ac.nz/profile/a-woodward

Educational Qualifications:

1988	Ph.D.(Adelaide)
1981	M.Med.Sci. (Community Medicine) (Nottingham)
1976	M.B.,B.S.(Adelaide)

2010	Fellow of the New Zealand College of Public Health Medicine
1990	Fellow of the Australasian Faculty of Public Health Medicine
1982	Member of the Faculty of Public Health Medicine (Royal College of Physicians, UK)

I am registered with the Medical Board of South Australia, the General Medical Council of the UK and the Medical Council of New Zealand

Previous Positions:

2016-2019	Head of Epidemiology and Biostatistics, School of Population Health, University of Auckland
2013-2015	Director, Postgraduate Public Health Programme, University of Auckland
2004-2012	Head, School of Population Health, Faculty of Medical and Health Sciences, University of Auckland
1995-2003	Professor of Public Health and Head of Department, Wellington School of Medicine & Health Sciences, University of Otago
1990-1993	Senior Lecturer, Department of Community Medicine, University of Adelaide (*1989 -1994)* and Department Chair

1983-1988 Lecturer, Department of Community Medicine, University of Adelaide

1982-1983 Senior Research Officer, National Health & Medical Research Council Road Accident Research Unit, University of Adelaide

1980-1982 Registrar in Community Medicine, Nottinghamshire Area Health Authority, England

1979-1982 General Practitioner, Nottingham (part-time)

1978-1979 General Practitioner, Denham, Buckinghamshire, England

1977-1978 Intern and Resident Medical Officer, Royal Canberra and Woden Valley Hospitals, Australian Capital Territory

Professional Activities Outside the University (since 2010):

Editorial roles

2019-present Editorial advisory board, Global Transitions

2017-present Editor, International Journal of Epidemiology
Commissioning Editor 2020 – present
acting Editor-in-Chief 2019

2017-present Editorial advisory board, Bulletin of the World Health Organisation

2017-present Member of editorial advisory board, Environmental Health Perspectives

2009-2014 Editor, Australian and New Zealand Journal of Public Health

2008-present Associate Editor (Secondhand Smoke), Tobacco Control

Professional bodies

2018-2021 Councillor for Asia and Pacific, International Society for Environmental Epidemiology

2017-2018 Examiner, New Zealand College of Public Health Medicine

The Intergovernmental Panel on Climate Change

2019-present Lead Author (regional impacts), 6th Assessment Report

2011-2014 Coordinating Lead Author (human health), 5th Assessment Report

Research Reviews

2018 Chair, mid-term review of National Science Challenge “Ageing Well”

2018 & 2012 Member, Assessment Panels for Medicine and Public Health, New Zealand Performance Based Research Funding

2017-2018 Chair, HRC Explorer Grants Assessing Committee

2016-2017	Member, external review of Section of Environment and Radiation, International Agency for Research on Cancer
2012 & 2013	Chair, Project Assessing Committee, National Health & Medical Research Council of Australia
2009 & 2010	Chair, Partnership Projects Grant Review Panel, National Health & Medical Research Council of Australia

Other external appointments

2019-present	New Zealand representative, Asian Academies and Societies of Science Association Working Party on Climate and Health
2014-present	Member, New Zealand Cycling Safety Panel
2013	Internal reviewer, Lancet series on Land use/transport for health and development
2011-present	Chair, Scientific Advisory Committee, national research programme on climate change and health, University of Shandong, China
2021-	Chair, Monitoring and Evaluation Group, Healthy Environments and Lives (HEAL) Research Network, The Australian National University

Invited Presentations (last 5 years):

“What if transport was an urgent public health issue?", Transport Knowledge Hub, Wellington November 2019

“Disruption, risk and opportunity – climate change and health”, Global Transitions Conference, Beijing October 2019

"Climate change and the Pacific", Pasifika Medical Association Annual Meeting, Niue September 2019

“Environment and health”, chair and rapporteur for a special session of the Pacific Parliamentary Forum, Fiji August 2019

“Climate change: What is it? Why is it so difficult? What can be done?” ANZ Journal of Surgery Lecture, Royal Australasian College of Surgeons Annual Congress, Bangkok May 2019

“Measuring the benefits of climate action”, Re-City Science Symposium, Barcelona November 2018

“Health in AR5. How to do better in AR6?”, ISIMIP Health, Barcelona November 2018

“Can the bicycle save the city?”, New Zealand Centre for Sustainable Cities, Wellington September 2018

“Air pollution and travel medicine”, Annual Conference New Zealand Society for Travel Medicine, Queenstown August 2018

“Living Longer. The Data”, Grand Round, Whangarei Hospital, August 2018

“Climate change: disruption, risk and opportunity” 2018 William Redfern Oration, Royal Australasian College of Physicians Annual Congress, Sydney May 2018

“Ten weeks extra life every year. Why?” University of Auckland Open Day, April 2018

“The bicycle and public health”, University of California San Diego I-House Public Lecture Series,

March 2018

“Building health system resilience under climate change" Ministerial Roundtable, WHO South East Asia Region, Maldives, September 2017

"Air pollution, heat and humidity: health risks and advice to travellers" International Society of Travel Medicine, Barcelona, May 2017

"The way we move, live and settle - social and environmental determinants of rural health" 14th World Rural Health Conference, Cairns, April 2017

"Global environmental change - threats, opportunities and links to the Sustainable Development Agenda" WHO Health in All Policies Conference, Adelaide, March 2017

“The Healthy Country? A History of Life and Death in New Zealand”, University of the 3rd Age, St Heliers October 2016

“Optimising health co-benefits models”, Workshop on Health Co-Benefits of Policies and Technologies to Reduce Greenhouse Gas Emissions, University of Washington, Seattle September 2016

“Health, development and climate action” Universitas 21 Global Health Workshop, University of Maryland, Washington April 2016

“Health inequalities in New Zealand. Always like this?” Royal Australian College of Medical Administrators annual conference Auckland September 2015

“Climate change and health – the IPCC findings”, Urban Resilience and Climate Change conference, Hong Kong November 2014

“Climate change and health – the latest IPCC report”, Climate Change and Health Forum, Shandong University, Jinan, China October 2014

“Environmental health priorities in our region”, Global Health Workshop, Asia Pacific Rim Universities Annual Meeting, Taipei, Taiwan September 2014

“Climate change and health – the science”, Inaugural WHO Conference on Climate Change and Health Geneva, August 2014

“The risks of climate change exceeding the limits of adaptation”, London, World Bank Understanding Risk Conference July 2014

“Climate and health”, NHMRC Think Tank, Brisbane, July 2014

“Environmental change in the Asia Pacific region and what this means for health”, Asia Pacific Travel Medicine Conference, Ho Chi Minh City, Vietnam, May 2014

Research:

Areas of expertise

Epidemiology
Environmental Health
Social Determinants of Health
Tobacco

Current research projects

2020-2023	Seeking the Transport Sweet-spot: Health, Equity and Zero Carbon (Health Research Council of New Zealand)
2020-2022	Multi-Country Study on Health Effects of Bushfire Air Pollution (Australian Research Council)
2019-2020	Transport and mental health (NZ Transport Agency)
2018-2021	Health and Air Pollution in New Zealand 3.0 (Ministry for the Environment)
2014-2024	Te Ara Mua Future Streets – the Re-design of City Streets to Reduce Pollution and Increase Health and Safety (MBIE, HRC, National Science Challenges)
2011-present	China National Climate Change and Health Program (China Science Foundation)

Publications

Books

McMichael, A. with **Woodward, A**. Muir, C. (2017). *Climate Change and the Health of Nations*. Oxford University Press.

Woodward, A., & Blakely, T. (2014). *The healthy country? A history of life and death in New Zealand*. Auckland: Auckland University Press. Retrieved from http://www.press.auckland.ac.nz/

Chapters

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Examples of commentaries, blogs, reviews

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Woodward A, Blakely T. Faster mortality decline, slower population ageing – how could that be? https://blogs.otago.ac.nz/pubhealthexpert/2015/05/21/faster-mortality-decline-slower-population-ageing-how-could-this-be/

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Teaching:

2013-2016 Academic Director, Postgraduate Public Health Programme, University of Auckland

Course coordinator

2019 Global health POPLHTH 715

2019 Principles of Population Health POPLHTH 760

2013-2019 Introduction to Environmental Health POPLHTH 211

2013-2020 Environmental Health POPLHTH 725

Taught on short courses and summer schools (since 2010)

2020 WHO Western Pacific Region Webinar Series Climate Change & Health

2012-2017 Wellington Summer School

2011-2012 European Epidemiology Programme Florence

2012 University of Chile Summer School

2011 Summer School Umea University

2010 National Short Course in Environmental Health (Adelaide)

Recent postgraduate students:

2016 BMedSci (Hons), David Bassett, Characterising seasonal variations in cardiovascular disease endpoints

2015 BMedSci (Hons), Rennie Qin, Interaction of heat and air pollution in Hefei, China

2015 BHSc (Hons), Bea Enriquez, Who lives close to Auckland motorways?

2014 BHSci (Hons), Selena Lal, Effects of urban intensification on exposure to noise

2014 BHSci (Hons), Hasthika Ekneligoda, Outcomes of green health care

2012 BHSci (Hons), Kahar Razman, A history of New Zealand birth-weights 1908-1980

MPH, Mia Wisniewski, The promotion of Sports Utility Vehicles (underway)

2019 MPH, Hannah Cooper, Uses of pharmaceutical data to extend surveillance of acute gastrointestinal illnesses

2018 MPH, Jane Ullmer, Footpath cycling

2018 MPH, Phuong Tran, The relation between the home environment and childhood eczema and skin infections

2018 MPH, Benjamin Harrison, Carbon pricing and its impact on public health in New Zealand

2017 MPH, Tharaphi Tharaphi, Tobacco control in Myanmar

2017 MPH, Raphael Pereira, Arboviruses in New Zealand

2014 MPH, Julianna Lees, Eye outreach clinics in the Pacific

2014 MPH, Karen Wright, Impact of the Central Rail Link on levels of physical activity

2014 MPH, Abdulai Yansaneh, Tuberculosis in West Africa

2012 MPH, Billy Wu, Integration of diabetes eye care services in Fiji

2012 MPH, Garth McLeod, Modelling the health effects of shifting trips from cars to buses

2012 PhD, Alex Macmillan, Health effects of the trip to work

2014 PhD, Sandar Tin, Cohort studies of bicyclists

PhD, Jamie Hosking, Low-carbon routes to health equity, underway

PhD, Tessa Pocock, Healthy ageing in place – Future Streets, underway

PhD, Ed Randal, Active transport interventions, underway

PhD, Mehrdad Rafiepourgatabi, Exposure to air pollution on the route to school, underway

Recent Academic reviews

External examiner:

- University of Otago
- Melbourne University
- University of Hong Kong
- Heidelberg University

2018 Member, Review of Te Kupenga Hauora Māori, University of Auckland

2016 Course reviewer, Environmental health, University of Otago

2015 Member, Review of the Masters in Public Health, University of Queensland

2015 Member, Review of Masters in Health Sciences, University of Auckland

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