Energy Efficiency (2018) 11:1617–1626
DOI 10.1007/s12053-017-9538-z

ORIGINAL ARTICLE

The road code: encouraging more efficient driving practices in New Zealand

Michelle Grace Scott · Rob Lawson

Received: 28 November 2016 / Accepted: 11 June 2017 / Published online: 22 June 2017

Abstract Road transport contributes a significant amount towards New Zealand's carbon emissions, mostly from light vehicles. These emissions could be partly reduced by an increase in more efficient driving practices, and reductions of 10–20% of fuel are possible without increasing trip times significantly. This study was conducted to understand whether people knew how to drive efficiently, whether they actually ever drove in an efficient manner and what ways there could be to influence people to drive more efficiently. Focus groups were conducted across New Zealand in urban and rural areas with groups of students, young professionals, parents and older people in order to cover different lifestyles and environments. These focus groups covered a wide range of topics including knowledge and practices of efficient driving, learning to drive, infrastructure and aspirations. Our results show that most people reported knowing the things they could do to be more fuel-efficient, however, despite this knowledge, they very rarely engaged in these practices. When they did consider fuel efficiency, it was almost always linked to saving fuel costs and environmental aspects were not considered. There is a clear lack of connection between carbon emissions and driving when people are in their cars. Better messages could be presented to drivers linking their driving practices to carbon emissions and therefore climate change. There are a range of other options where more efficient practices and choices could be encouraged depending on context, the driver and their way of life.

Keywords Transport · Energy efficiency · Behaviour · Efficient driving

M. G. Scott (✉) · R. Lawson
Centre for Sustainability, University of Otago, PO Box 56, Dunedin 9054, New Zealand
e-mail: michelle.scott@otago.ac.nz
URL: http://www.otago.ac.nz/csafe/

Introduction

Energy is one of the highest contributors to New Zealand greenhouse gas emissions producing 39.8% in 2014 of total emissions. Within this 39.8%, road transport was the largest contributor at 39.7% of energy emissions. For comparison, public electricity and heat production was the second largest, contributing 13.1% to energy emissions (Ministry for the Environment, New Zealand's Greenhouse Gas Inventory 1990). Most of these emissions from road transport come from light vehicles. There are around 3.2 million vehicles on New Zealand's roads, with over 90% of those being light vehicles such as cars, vans and light trucks. Car ownership is high, with almost one vehicle per licenced driver in the country. New Zealand also has one of the oldest vehicle fleets in the developed world, in 2015, the average age of the light vehicle fleet was 14.2 years and has been increasing in recent years. Older vehicles are likely to have higher controlled pollutant emissions and be less efficient than younger vehicles (Ministry of Transport, New Zealand Vehicle Fleet Annual Statistics 2015). Consequently, this is an area where there is

significant potential for better energy efficiency and a reduction in emissions. One option for reducing these emissions would be an increase in more efficient driving practices also known as eco-driving.

Eco-driving techniques can be separated into different stages of pre-trip, during the trip and post-trip (Wengraf 2012). Pre-trip techniques comprise actions such as trip planning, vehicle maintenance and removing roof racks and unnecessary weight. Driving efficiently during the trip consists of actions such as smooth driving, anticipation of what is ahead, avoiding hard braking and reducing unnecessary idling. Studies have shown that 10–20% of fuel and carbon savings are possible by driving more efficiently without a significant increase in trip time (Barth and Boriboonsomsin 2009). Post-trip techniques involve reviewing the trip data, this can be done via feedback presented on smartphone apps or on satnavs.

Driver training

Countries such as Japan, Austria, Sweden and the Netherlands have run eco-driving programmes. These programmes were made up of different activities such as information campaigns and driver training. Reductions of between 5 and 50% fuel in the short term (less than 3 years) and 3–10% reductions in the medium term (more than 3 years) were found (Kojima and Ryan 2010). The authors recommend that eco-driving initiatives incorporate information campaigns, driver training and in-car equipment. A recent large-scale Australian study (Jeffreys et al. 2016) compared over 800 drivers who received eco driver education with 200 drivers as a control group and tested their real-world fuel use. Their interventions consisted of variations of an online tool, the tool plus classroom time, the tool plus a driving lesson and the tool plus a workshop. Fuel use was measured 6 weeks prior to the intervention and 12 weeks after. On average, the authors found a statistically significant 4.6% reduction in fuel use; the intervention that included a half-day workshop showed a higher reduction of 7.4%.

However, other works have shown that even when people know many of the things they can do to be more fuel efficient, they do not take these actions. Data on driving behaviour was collected in a real-world, long-term driving study conducted in Lisbon, Portugal (Rolim et al. 2016). An on-board device was installed in 40 light-duty vehicles over a period of 6 months and collected indicators such as excess speeding, engine speed, acceleration, fuel cut-off, brakes and accelerations. The drivers were split into two groups, an experimental and a control group. In the experimental group, the drivers went about their daily activities as normal for 3 months, then, for the second half of the study, they were given post-trip feedback on their driving behaviour. Despite receiving weekly reports on their driving behaviour that included improvement recommendations, the drivers in the experimental group actually increased fuel consumption and CO_2 emissions over 5%.

Safe driving often overlaps with efficient driving but other authors have noted that driver safety programmes are not effective because drivers are not motivated by safety concerns but rather by obtaining their licence (Mayhew and Simpson 2002). One study asked drivers what motivated them to be safe drivers and the avoidance of negative consequences such as accidents was more highly rated as motivational factors than different types of driver training (Williams et al. 1995).

New Zealand currently has some measures in place to encourage more safe and fuel-efficient driving; however, most people will not take advantage of these initiatives. The average light vehicle driver in New Zealand will learn to drive through relatives or friends rather than via formal lessons. For bus and truck drivers, the Safe and Fuel Efficient Driving New Zealand (SAFED NZ) is a driver training course developed by the Ministry of Transport and the New Zealand Transport Agency. This programme states it has trained over 5000 drivers with fuel savings of around 7.5% for trucks and 5% for buses (Safe and Fuel Efficient Driving New Zealand 2017) The Accident Compensation Corporation (ACC) published a policy document encouraging safe driving at work in New Zealand (Accident Compensation Corporation 2010), this policy has several "must haves" that are minimum recommendations for company safety and some "could haves" that are not necessary but are recommended additions. Efficient driving is within the "could haves" section and includes advice on how to drive efficiently as well as vehicle maintenance and trip planning.

Driver feedback

Eco-driving feedback is one application of feedback to reduce fuel consumption. Receiving timely feedback is key to motivating behaviour change since people need

to be aware of their behaviour in order to change it. Fischer (Fischer 2008) found the most successful feedback was given frequently, clearly presented, used computerised tools and allowed historic or normative comparisons. Devices such as smartphones can be easily incorporated into vehicles and can be used to measure fuel efficiency. They are a feasible mechanism to provide drivers with fuel efficiency feedback.

There are a number of free driving efficiency apps currently available for smartphones; however, many apps come and go as time passes and they are no longer updated. One example currently available is Flo (https://www.driveflo.com/). Flo is a Dutch app that operates a freemium model where the basic app is free but there is a premium version with extra options. It uses GPS to track trips, allows you to enter the make and model of your car, logs all trips driven and gives feedback about the driving style at the end of trips. All feedback is logged allowing comparisons with past trips. Flo gives you a numerical score at the end of each trip as well as allowing you to check your trip on a map. Flo's score is broken down into acceleration, braking, speed and cornering where smiley faces show positive or negative feedback that contributes to the overall score. However, there is little literature at the moment testing such eco-driving feedback apps over the long term. A recent study (Bar et al. 2011) focused on encouraging fuel-efficient driving with real-time feedback but focused on simulator driving and short-term rather than long-term change.

New Zealand transport policy

New Zealand does not currently have any fuel efficiency standards for vehicles; the current policy document (New Zealand Transport Agency 2007) regulates emissions harmful to human health but not carbon dioxide emissions. Vehicles are not tested when they enter the country as to whether they comply with this emission standard. This means there is no way of knowing the vehicle's current emissions performance. New Zealand does have a labelling requirement to show a purchaser information about the fuel economy of the vehicle (New Zealand Legislation 2007), but this is the only fuel efficiency requirement. Japanese and European fuel economy tests use different conditions; vehicles tested to a Japanese standard have their values adjusted to the equivalent European value for the fuel economy label (New Zealand Transport Agency 2017).

There has recently been policy announced to encourage the uptake of electric vehicles (EVs) in New Zealand (Ministry of Transport, Electric Vehicles Programme 2016). The government aims to double the amount of EVs on the road to 64,000 by 2021. Currently, EV owners are exempt from road user charges (levy towards upkeep of the roads) and this benefit will continue until EVs make up 2% of the fleet. They also have the added benefit of being able to use bus lanes. The government is investigating bulk purchase of EVs and is committed to spending $1 million annually to promote EVs. New Zealand is particularly suited for EVs because around 80% of electricity generated is from renewable sources (Ministry of Business, Innovation & Employment, Energy in New Zealand, 2016).

The energy cultures framework

This framework (Stephenson et al. 2010; Stephenson et al. 2015) was developed as a model to integrate multidisciplinary perspectives on energy behaviour. For researchers working across different disciplines, the framework enables contextually rich understanding of such behaviours and the ability to see where their discipline can contribute to this understanding. The development of the framework was partially influenced by practice theory. Practice theory is interested in how the wider context and structures of society influence everyday activities such as energy behaviour. The role of objects is emphasised as fundamental to any practices and is just as important as the body and mental activities (Reckwitz 2002).

The energy cultures framework offers a contextualised framing of energy-related behaviour, suggesting that it is strongly shaped by an individual's or household's own energy culture and that this in turn is shaped by external influences over which they have little control. The framework (Fig. 1) proposes that an energy culture can be characterised as the interactions between norms, material culture and practices, which give rise to self-reinforcing patterns of behaviour that can be difficult to change. On the other hand, where one element does change, it can have flow-on effects on other elements. For example, a change in material culture can lead to changes in everyday energy practices, which can reset aspirations, and thereby lead to a transformed energy culture.

In analysing the focus groups, we use elements of the energy cultures framework—norms, practices and material culture—to explore how driving behaviour was

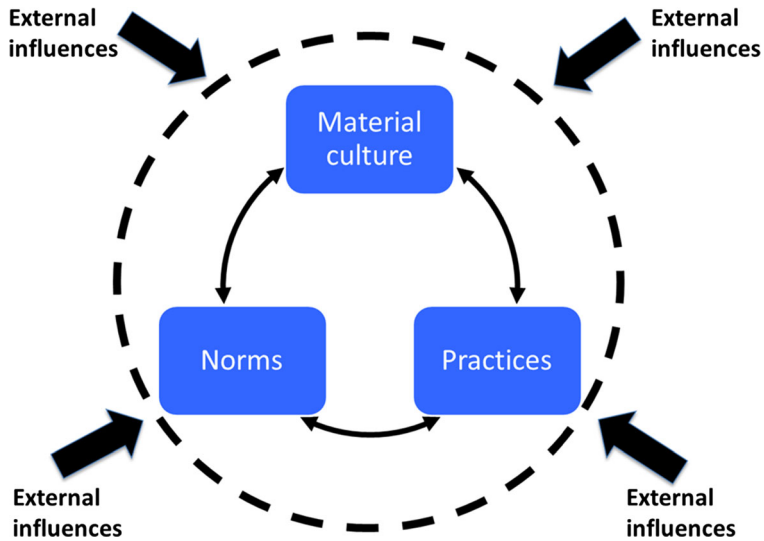

Fig. 1 The energy cultures framework

influenced by both the participant's and their household's personal circumstances. Norms are how people expect and/or desire to live their lives; in this context, an example would be whether they aspire to have greater control over their fuel use, or perhaps to drive less. Practices include both repetitive activities and less frequent actions such as the acquisition of new vehicles, recognising that such behaviours are strongly shaped by people's social and cultural context. Material culture consists of the physical apparatus of everyday life—within the context of this study, material culture would mainly consist of the vehicles people drive. External influences that are beyond an individual's control, such as government policy and infrastructure of the roads, are also accounted for in the framework. A household's "energy culture" is the outcome of interactions between these internal and external influences.

In using the energy cultures framework for analysis, we sought to identify the norms, practices and material culture of the interviewees that might be relevant to driver behaviour and any external influences on that behaviour.

To encourage more efficient driving practices over the long term, it is necessary to understand what currently motivates people to drive the way they do and what current levels of knowledge exist. Previous work has tended to focus on larger vehicles or short-term interventions. In trying to understand driver behaviour, we conducted in-depth focus groups around New Zealand with drivers from across a range backgrounds and ages.

This research focused on two main questions related to efficient driving:

1. Do drivers know what efficient driving is and do they practice it?
2. What influences might assist in shifting drivers towards driving more efficiently?

Method

New Zealand has a population of around 4.6 million with a significant proportion of approximately 1.5 million people living in the largest urban area of Auckland. Dunedin has a much smaller population of around 126,000. The focus groups were conducted in Dunedin, Auckland and rural areas to cover different lifestyles and driving environments.

Fourteen focus groups were conducted with a total of 96 participants averaging around seven people per group. Each participant filled out a demographics form at the beginning of the focus group and all the groups were recorded and fully transcribed. There were 47 female participants and 44 male participants with the remaining five choosing not to answer. The participants' ages ranged from 19 to 86 with an average age of 47 and were across groups of students, young professionals, parents and older people. Figure 2 shows the average age of each focus group. Sixty-seven participants owned their home, 27 rented their homes with four in other

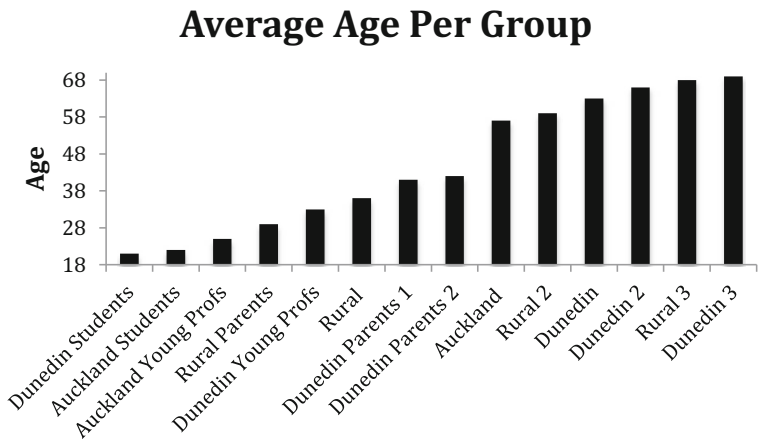

Fig. 2 Average age of participants in each focus group

housing situations, such as living with parents. Figure 3 shows the spread of household income in bands across the focus groups. Forty-six of the participants were in full-time employment, 21 were in part-time employment, 13 were retired, eight were students and seven reported they were not currently employed. Political affiliation was an open-ended question with responses ranging across a wide political spectrum from left through to right. The majority of participants identified as being of European descent with the remaining nine identifying as Maori, two as Pacific Islander, one African and one who identified as other.

The focus groups were semi-structured and covered a wide range of topics. Our main interest was in efficient driving and this topic encompassed knowledge, awareness, practices and aspirations of efficient driving. The other main topics that were covered were learning to drive, infrastructure and public transport and ideal transport situations.

Results

Material culture

Almost all of the participants owned a car and these vehicles ranged in age and size depending on their household circumstances. Several participants stated that they relied on the vehicle itself to be fuel-efficient and that it was a consideration when buying a new vehicle.

> I rely on the vehicle to be efficient [agreement] more than I do myself. Yeah, well when you're buying a vehicle now, that's important isn't it; you look at the fuel efficiency. They claim that their cars are more efficient so you know we rely on that I suppose to take care of the efficiency for you. **Rural group**

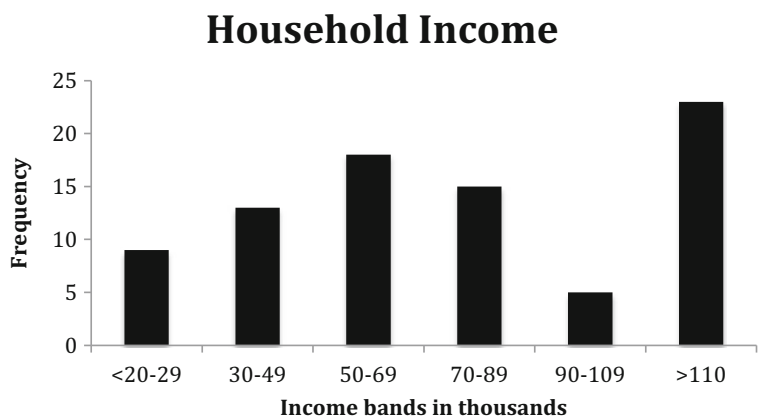

Fig. 3 Household income across the groups

Efficient driving practices and knowledge

In every one of the 14 focus groups, the participants reported knowing various things they could do to drive fuel-efficiently. These included actions while driving, as well as vehicle maintenance and planning trips. The participants stated that they had learned this knowledge through a variety of ways including when they were learning to drive, through friends or family after getting a licence and via television with some participants not sure where they learned it.

> Consistency. No rapid change in speed, or decrease. Not being erratic. Planning, route planning's very efficient 'cause you can go the wrong way and cost yourself a fortune. Make sure your tyres are pumped up. **Rural group**

> [regarding efficient driving knowledge] Something that I picked up along the way, yeah. **Auckland group**

However, despite this knowledge, almost none of the participants engaged in these practices on a regular basis. When they did consider fuel efficiency, it was almost always linked to saving fuel costs.

> If petrol is cheaper I tend to not even think about it. Or if you are a student, but now I don't think about it at all. **Dunedin group**

In the case of driving in Auckland in a busy urban environment, efficient driving was perceived as not possible.

> I think it's really hard to be an efficient driver in Auckland, either traffic makes it really difficult 'cause like how this morning was some stop start, stop start, stop start and you don't get your revs to a steady stage or you're not motorway driving. **Auckland group**

Some participants had experienced vehicles with fuel efficiency feedback; these participants were far more engaged with efficient driving practices than those who did not have this type of feedback. In some cases, the feedback encouraged competition with themselves and members of their family, which led to changes in driving behaviour to a more efficient style.

> And it does make you really focus on it in the sense that you think 'Gosh you know that trip was a higher one. Why was that?' You start thinking about the reasons for it. **Dunedin group**

None of the participants reported considering the connection between burning petrol while driving and carbon emissions. When asked directly about an environmental aspect of driving, some participants acknowledged they felt they should think about emissions while driving but when actually driving somewhere, it did not cross their minds.

> Like when you think about oh yeah I should drive less because it is bad for the environment but when I am driving I never put the two together, because it is like, I need to get somewhere, I need to do this, you know. **Student group**

When listing the qualities of a good driver, no participants stated fuel-efficient driving as an attribute that good drivers display.

Driving norms and aspirations

Owning and using a car was seen as essential, especially in Auckland, in rural areas and for parents but many of the participants were unhappy with their current travel situation. Unhappiness was especially prevalent in Auckland where large amounts of time can be spent in traffic during the daily commute.

> I lived in London for four years and didn't have a car and I didn't miss it but I didn't have children. I wasn't time poor. I was under my own steam; you know my own timetable for the day. But now I'm here and there and back and forward. Sometimes I think my neighbours must just see me do this all day in my car. And I feel terrible. **Dunedin group**

> [regarding driving in Auckland] No I hate it, I absolutely, I would rather catch public transport than drive, yeah. **Auckland group**

Access to mobility with the potential of driverless cars was also mentioned as making up part of an ideal travel situation.

> I think we wanna ring up, a driverless taxi arrives at the door, drops you off at the station and doesn't have to be parked before it goes off to find someone else. **Auckland group**

In six of the focus groups, the participants discussed that they drive differently in different vehicles with a few mentioning that if they have a sporty car, they were more inclined to drive less efficiently.

> Well if you're buying a sports vehicle, you've gotta drive it like a sports vehicle at some point. **Rural group**

Public and active transport

Across all of the focus groups, there was a desire for better infrastructure and more convenient public and active transport. At the moment, many participants, especially those in Auckland and rural areas and those participants with children, did not feel public transport was a reasonable option for them. This was either due to public transport taking more time than driving, being more expensive or the lack of access in their area. When describing their ideal travel situation, often, this included newer, more fuel-efficient vehicles, along with a mix of convenient and modern public transport and the option for active transport.

> Oh there is none. It's just having busy kids and doing lots of activities and yeah there's no other option really…it's cheaper to drive my car into town than it is to catch a bus. Busses are more expensive. And it's time consuming as well to go on a bus. **Dunedin group**

> I'm conscious of the time it takes me to get in the car somewhere and what I could've been doing in that time, 'cause I'm time poor you know because of distance and long working hours. So I think, for instance if they brought back the train service in this area. Oh I'd love the train, I would love the train. **Auckland group**

> Even though I drive a car I would say public transport would be the ideal way and then like less cars on the road and more public transport rails and stuff. So you go more places. **Auckland group**

> I enjoy driving but I would still rather walk to work every day if I could, I would still try and find somewhere to live that involves walking to work. I would love to walk to work every day. **Dunedin group**

Although there were aspirations of cycling more, many participants had serious safety concerns about cycling. Parents especially wanted their children to be able to cycle more but increasingly felt less safe about children being on the road along with traffic.

> I'd love for the kids to be able to ride to school but I stupidly once took the kids [cycling to school]… It was a nightmare. I don't know how my son didn't die that day. **Dunedin group**

> I wouldn't mind if it was safer for me to cycle, I would cycle to work but I would never cycle home…because you have got to cross the motorway to get through, I would never do it. I would cycle if it was safer. **Dunedin group**

Learning to drive

Most New Zealanders learn to drive from family members or friends rather than from formal professional lessons. The practice of learning to drive has a large influence on driving norms; habits and knowledge from the instructor can potentially affect driving practices for many years. In 11 of the focus groups, the participants displayed a desire for learning new driving skills, such as driving under adverse conditions. When discussing how their driving had changed over the years, many people stated that they had become more lax at following the road code since passing their test. Rather than learning by doing, some people would be more comfortable with affordable advanced classes that encouraged on-going learning of skills. Having these classes provided at low cost, or with incentives such as demerit

point removal from licences or lower insurance were stated as ways to motivate people to take part.

> I think they're a good idea. Fantastic, I'd love to do an advanced driving course. **Rural group**

> Well it probably would be good to have a refresher. Yeah I couldn't say I could pass a road test now…more awareness about every day sort of occurrences for drivers, you know like kids running out on the street and driver skill rather than the rules. When you come along on a push bike, giving them 5 feet of room if you can rather than 6 inches and you know, just things like that. **Rural group**

When most participants had themselves learned to drive, efficient driving was not a skill that was taught, many of the practices of efficient driving overlap with safe driving but this was incidental.

Many participants felt that the driving test was not comprehensive enough to enable people to deal with the varied situations drivers face. Defensive driving courses are offered to reduce the amount of time it takes to get a full licence, but these are theoretical only with no practical component.

> Maybe people need to be taught on different road surfaces 'cause it's not something you've done when you go to get your driver's licence, it's just straight on tar seal. And different road conditions as well. **Rural group**

> Right now the kids go on a defensive driving course and they don't sit in a car while they're doing it, it means they can go to their full licence three months earlier and it's absolutely ridiculous and they're not better off for it. **Dunedin group**

External influences

Many participants were frustrated at elements of the transport network that they felt were outside their control. Aucklanders particularly expressed unhappiness with the infrastructure, including perceived never-ending road works and the lack of public transport. These feelings contributed to the general exasperation drivers in Auckland felt about their long commutes and traffic problems.

> The population's increased...and the city's so sprawled out, it's essential to have effective transport. It's unbelievable a city of this size, like you go to any other city in the world and there'll be some sort of infrastructure in terms of like trams, subway, trains, at least like a bus exchange or something. **Auckland group**

There was also concern about the general road infrastructure, especially in the South Island which was perceived as not getting as much investment as Auckland and surrounding areas.

> We get a pretty raw deal down here generally, you know 'cause the amount of gravel roads we get, it's hard on vehicles...and the tar seal's not that great. We're still paying the same in tax for road users and for fuel but generally we get a pretty crap deal. Our roads around here are shocking and not just talking Council rates here, we're talking State Highway 1, it's a shocking road. **Rural group**

Discussion

In every focus group, there was knowledge and discussion about what efficient driving practices are; however, these practices were rarely engaged in. It seems clear that the lack of knowledge or having incorrect knowledge about efficient driving is not a reason people drive inefficiently. The authors of an International Energy Agency report (Kojima and Ryan 2010) suggested information campaigns as an effective way to encourage more efficient driving. However, this does not seem as if it would be appropriate in New Zealand due to the high levels of knowledge discussed within the focus groups. It is necessary to know the levels of knowledge within the target group first before creating and implementing campaigns.

When driving efficiently was considered, it was usually linked to concerns about fuel cost or saving money rather than environmental reasons. If fuel prices become

higher, there is a greater likelihood of people taking an interest in driving more efficiently. There was a clear lack of connection between carbon emissions and driving practices. An opportunity exists to better present messages to drivers that their driving practices have a significant effect on carbon emissions and therefore on climate change. This change in message delivery at a policy level could motivate people to think about driving differently.

Another potentially effective way to motivate more efficient driving is through in-car feedback, the participants reported engaging with this type of feedback when it was available in their vehicles and that it drove competition. This competition led to changes in driver behaviour to a more efficient style. The Flo (https://www.driveflo.com/) smartphone app described earlier is an example of freely available post-trip in-car driving feedback. There is an opportunity for individual drivers and also fleet managers to learn more about their driving style in an affordable way. Bar et al. (2011) tested efficient driving advice in a simulator and there is a need for further "in the wild" research in this area to understand ways people respond to this type of feedback and to potentially motivate long-term change.

There seems to be a significant opportunity to provide specialised or advanced driving classes to drivers of all levels. The idea of additional training was received very positively across the groups, especially if it was incentivised by removing demerit points or reducing insurance costs with the feeling that a driver's licence alone does not equip one with the varied skills necessary to be a confident driver. A recent Australian study showed the largest increases in efficiency where their driver feedback was included with a half-day driver training workshop (Jeffreys et al. 2016). Efficient driving could be included in a more general advanced class that included dealing with adverse weather conditions or attaching a trailer to a car. Alternatively, classes could be designed to be modular where people pick and choose the specific skill they want to learn or re-learn. This may encourage efficiency where people have had little change to their driving practices or where people feel that their driving skills have lessened over the years.

When describing an ideal travel situation, a lot of participants aspired to drive less and use more public and active transport where possible. New Zealand has a lot of cars (Ministry of Transport, New Zealand Vehicle Fleet Annual Statistics 2015), which in itself could be demotivating for people considering active and public transport. However, in spite of this, it appears that New Zealanders would like other options to complement their car ownership. Parents especially would like to cycle more with their children. Creating more public transport or safe cycle ways could be difficult due to the large area of the country with a comparatively small population. However, policy makers should take into account the desires of the population to spend less time in a car where they can.

One of the shortcomings of this study is that it was conducted in New Zealand, which has a lot of space with a relatively small population leading to high car ownership and less capability to have frequent intercity public transport. New Zealand's fleet of cars are also older than those of other developed countries, which may affect behaviour. As Reckwitz (2002) states, objects and infrastructure have a profound impact on practices. In-depth qualitative work in other countries could be conducted to compare similarities and differences in the behaviour of other populations with high car ownership to increase the applicability of the findings.

Conclusion

Even though New Zealand has some unique characteristics, there are several findings from this study that are applicable in other countries. Clearly, where the level of knowledge around efficient driving is high, rather than trying to inform people about how to drive efficiently, the focus should be on messages that link driving to carbon emissions. To encourage change in someone who has been driving for a while, they may benefit from advanced classes or in-car feedback. For someone who is learning to drive, efficient driving can form part of lessons and the driving test. More satisfaction and happiness in day-to-day transport could be partly enabled by more support for public and active transport. Overall, our findings show that rather than a one size fits all solution to encourage more efficient driving, there are a range of flexible points where more efficient driving practices or choices may be encouraged.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

Accident Compensation Corporation (2010) *Your safe driving policy*. Retrieved from: http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_ip/documents/publications_promotion/wpc089713.pdf.

Bar, T., Kohlhaas, R., Zollner, J.M. and Scholl, K. (2011). Anticipatory driving assistance for energy efficient driving. *Integrated and Sustainable Transportation System (FISTS), 2011 I.E. Forum on* (pp. 1–6). IEEE.

Barth, M., & Boriboonsomsin, K. (2009). Energy and emissions impacts of a freeway-based dynamic eco-driving system. *Transportation Research Part D: Transport and Environment, 14*(6), 400–410.

Fischer, C. (2008). Feedback on household electricity consumption: a tool for saving energy? *Energy Efficiency, 1*(1), 79–104.

Jeffreys, I., Graves, G., and Roth, M. (2016). Evaluation of eco-driving training for vehicle fuel use and emission reduction: A case study in Australia. *Transportation Research Part D: Transport and Environment (in press).*

Kojima, K., & Ryan, L. (2010). *Transport energy efficiency: implementation of IEA recommendations since 2009 and next steps (Vol. energy efficiency series)*. Paris: International Energy Agency.

Mayhew, D. R., & Simpson, H. M. (2002). The safety value of driver education and training. *Injury Prevention, 8*(suppl 2), ii3–ii8.

Ministry for the Environment, *New Zealand's Greenhouse Gas Inventory* 1990–2014. Retrieved from: http://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/national-inventory-report-2016.pdf.

Ministry of Business, Innovation & Employment, Energy in New Zealand (2016). Retrieved from: http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/publications/energy-in-new-zealand/energy-in-nz-2016.pdf.

Ministry of Transport, Electric Vehicles Programme (2016). Retrieved from: http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/Factsheet-Electric-Vehicles-Programme-Overview.pdf.

Ministry of Transport, *New Zealand Vehicle Fleet Annual Statistics* (2015). Retrieved from: http://www.transport.govt.nz/assets/Uploads/Research/Documents/Fleet-reports/The-NZ-Vehicle-Fleet-2015-final.pdf.

New Zealand Legislation (2007) Energy Efficiency (Vehicle Fuel Economy Labelling) Regulations. Retrieved from: http://www.legislation.govt.nz/regulation/public/2007/0398/latest/DLM1106963.html.

New Zealand Transport Agency (2007). Land Transport Rule: Vehicle Exhaust Emissions. Retrieved from: https://www.nzta.govt.nz/resources/rules/vehicle-exhaust-emissions-2007/.

New Zealand Transport Agency (2017). *Fuel economy ratings*. Retrieved from: http://rightcar.govt.nz/economy-ratings.html

Reckwitz, A. (2002). Toward a theory of social practices: a development in culturalist theorizing. *European journal of social theory, 5*(2), 243–263.

Rolim, C., Baptista, P., Duarte, G., Farias, T., & Pereira, J. (2016). Impacts of delayed feedback on eco-driving behavior and resulting environmental performance changes. *Transportation Research Part F: Traffic Psychology and Behaviour, 43*, 366–378.

Safe and Fuel Efficient Driving New Zealand (2017) Retrieved from: http://safednz.govt.nz/

Stephenson, J., Barton, B., Carrington, G., Gnoth, D., Lawson, R., & Thorsnes, P. (2010). Energy cultures: a framework for understanding energy behaviours. *Energy Policy, 38*(10), 6120–6129.

Stephenson, J., Barton, B., Carrington, G., Doering, A., Ford, R., Hopkins, D., Lawson, R., McCarthy, A., Rees, D., Scott, M., & Thorsnes, P. (2015). The energy cultures framework: exploring the role of norms, practices and material culture in shaping energy behaviour in New Zealand. *Energy Research & Social Science, 7*, 117–123.

Wengraf, I. (2012). Easy on the Gas. The effectiveness of eco-driving. Retrieved from: http://www.racfoundation.org/assets/rac_foundation/content/downloadables/easy_on_the_gas-wengraf-aug2012.pdf.

Williams, A. F., Pack, N. N., & Lund, A. K. (1995). Factors that drivers say motivate safe driving practices. *Journal of Safety Research, 26*(2), 119–124.