

Vehicle emissions and consumer information in car advertisements

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Abstract

Objective: To examine the content and trends of greenhouse gas emissions and air pollution-related information in light passenger vehicle advertisements.

Methods: Content analysis of the two most popular current affairs magazines in New Zealand for the five year period 2001–2005 was undertaken (n=514 advertisements). This was supplemented with vehicle data from official websites.

Results: The advertisements studied were poor at providing information on fuel type (52%), engine size (39%), fuel efficiency (3%), and emissions (4%). Over the five-year period the reported engine size increased significantly while fuel efficiency did not improve. Of the vehicles advertised, many were not at the fuel efficient end of the range (ie, 37% of advertisements were for SUVs and other four/all wheel drive vehicles).

For the vehicles advertised, for which relevant website data could be obtained, the average greenhouse rating was 5.1 with a range from 0.5 to 8.5 (on a scale for CO₂ emissions, with 10 being the best and 0.5 being the most polluting). This compares poorly with less polluting European fleet-wide levels. The air pollution rating for the advertised vehicles was similar at 5.4 (for the same scale). The yearly averages for the greenhouse or air pollution ratings did not change significantly over the five-year period. One advertised vehicle had a fuel consumption that was under half the average (4.4 versus 9.9 L/100km), as well as the best greenhouse and air pollution ratings.

Conclusions: To enhance informed consumer choice and to control greenhouse gas and air pollution emissions, governments should introduce regulations on the content of vehicle advertisements and marketing. Similar regulations are already in place for the marketing of many other consumer products.

Introduction

Motor vehicles produce both air pollutants that have local impacts and greenhouse gases that are implicated in global climate change – an important emerging threat to international health [1]. For New Zealand, vehicle emissions comprise 12.0% of the country's total greenhouse gas emissions [2]. As a Kyoto Protocol signatory, this country is committed to reducing its emissions, though progress to date has been fairly slow [3] and proposed policies still have deficiencies [4].

A wide range of hazardous air pollutants are emitted by vehicles. One estimate from the Auckland Air Emissions Inventory for 2004 reported that vehicles produce 47% of all particulates (PM10), 85% of the carbon monoxide, 83% of nitrogen oxides (NOx), and 51% of volatile organic compounds [5]. The latter are a range of hydrocarbons, which include benzene, toluene, xylene, 1,3-butadiene, polycyclic aromatic hydrocarbons (PAHs), formaldehyde and acetaldehyde. At a national level, vehicle emissions cause significant health problems, with the best annual estimates for New Zealand being: 500 excess deaths, 541 cases of bronchitis, 163 acute respiratory admissions, 83 acute cardiac admissions, 22 cancers and 671,000 restricted-activity days (all in those aged >30 years) [6].

The advertising of vehicles has been studied previously, due to concerns that it may adversely influence safety-related behaviours [7-11]. However, there are no published Medline-indexed articles where such advertising has been analysed in terms of greenhouse gas emissions or other air pollutant emissions. To determine the current situation in this area of marketing, we undertook a content analysis of light passenger vehicle advertising in New Zealand magazines.

Methods

Magazine selection and search strategy: As detailed elsewhere in a separate road safety analysis using the same sampling frame [12], the two highest circulation monthly current affairs magazines specific to New Zealand were selected (ie, *Metro* and *North & South*). All the issues for the five-year period from 2001 to 2005 were hand-searched on a page-by-page basis and if the vehicle advertisement took up more than a quarter of the page, then it was included in the study and photocopied. Only the advertisements that dealt with a specific model of car, sports utility vehicle (SUV) or similar light vehicle (primarily for passengers, with fewer than eight seats), were considered.

Data for the content analysis: Data were collected from the advertisements on: the make, whether the vehicle was a SUV, whether the vehicle was “four wheel drive” or “all wheel drive” (4WD/AWD), engine size, type of fuel (unless mentioned it was assumed to be petrol), fuel efficiency and emissions profile (if reported) or any features related to these. Vehicles were classified as SUVs if they were specifically defined in the advertisement as being a SUV, recreational vehicle (RV), or all-terrain vehicle (ATV), or if they were defined as a SUV on vehicle manufacturers' websites.

For each vehicle model found in the advertisements (determined by different vehicle company, make and engine size), additional data for fuel efficiency were sourced using an official government website (www.fuelsaver.govt.nz). Fuel efficiency was considered, as poorer efficiency is directly associated to increased emissions of air pollutants and greenhouse gases per kilometre travelled. Emissions data (in the form of “Greenhouse” and “Air Pollution” ratings) for each different vehicle were also sourced using an official Australian website (www.greenvehicleguide.gov.au) as there was no local (New Zealand) equivalent. Each vehicle website detailed in the advertisements was collected and accessed. From these websites, fuel efficiency and emissions data were collected.

Data collation and analysis: Data were analysed using EpiInfo (CDC, Atlanta). To best approximate the advertisement impact on consumers exposed to the magazines, the unit of analysis was a particular advertisement in a particular issue (ie, this meant a larger contribution in the results from advertisements that were repeated in subsequent issues or appeared in both magazines).

Validation study: As only a single person (AM) classified the advertisement content, a validation study using another person was conducted (see the acknowledgements). It included a 5% random sample of all advertisements (n=26), and a 15% random sample of those advertisements classified by AM as portraying speed imagery (n=21) (as part of another study [12]). The inter-rater reliability was at least 94% for key variables relating to this analysis (ie, SUV (94%), 4WD/AWD (94%), fuel efficiency (96%), and emissions data/quotes (96%)).

Results

Overall advertising patterns: A total of 514 relevant advertisements were identified for the five-year period (n=279 for *Metro*, n=235 for *North & South*) (Table 1). This was made up by a total of 149 different vehicles (determined by vehicle model and engine specifications).

Emissions and fuel efficiency aspects: Of the vehicles advertised, 22% were SUVs and another 14% were 4WD/AWD vehicles. The advertisements for SUVs and for 4WD/AWDs combined peaked in 2003 and 2004 respectively (Table 1). There was a sharp reduction in the proportion of these vehicles being advertised in 2005 relative to 2004 (eg, for SUVs the rate ratio was 0.59, 95% CI: 0.36, 0.95).

Overall, 53% of advertisements supplied some indication of the type of engine fuel. Of all advertisements, the fuel type mentioned was: petrol (46%), diesel (3%), both petrol/diesel (2%), liquid petroleum gas (LPG) (0.6%), and hybrid (electric/petrol) (0.4%) (Table 2). There was a general decrease in advertisements not specifying the engine fuel type, from 59% in 2001 to 44% in 2005.

Only 39% of advertisements gave specific engine capacity values (Table 3). The average engine capacity across all these advertisements was 2.74 litres (range 1.4 to 5.7 L). The lowest average engine capacity was 2.37 L in 2002, and this increased

each year over the next three years, with this pattern being statistically significant ($p = 0.014$ on Kruskal-Wallis test).

Only 3% of advertisements gave specific values for fuel efficiency (either L/100km or km per tank of fuel), with the average fuel efficiency value being 5.7 L/100km (Table 3). Very few (4%) made reference to having improved fuel efficiency in the advertised vehicle and only 4% made reference to having reduced emissions or included specific carbon dioxide (CO₂) data, specific features, or specific guidelines.

Where provided on the official website (www.fuelsaver.co.nz), the average fuel efficiency for the advertised vehicles was 9.9 L/100km, and this ranged from 4.4 to 18.6 L/100km. The fuel efficiency did not change significantly over the five-year period (Table 3).

For the vehicles advertised for which data could be obtained, the average greenhouse rating was 5.1. This ranged from 0.5 to 8.5 (on a scale for CO₂ emissions, with 10 being the best and 0.5 being the most polluting). The average air pollution rating for the advertised vehicles for which data could be obtained was 5.4, and this ranged from 0.5 to 8.5. This was on a scale for the level of air pollutant emissions allowable under the Australian standard to which the particular vehicle has been successfully tested for, with 10 being the best and 0.5 being the most polluting. The yearly averages for the greenhouse or air pollution ratings did not change significantly over the five-year period. One advertised vehicle (the Toyota Prius) had the lowest fuel consumption (under half the average), and the best greenhouse and air pollution ratings.

Vehicle company websites: Although 89% of advertisements had websites listed, there were only a total of 29 separate vehicle manufacturers and websites involved. Most of these websites provided fuel efficiency data for the advertised vehicles (66%) and 41% provided emissions information (but often using vague terms such as meeting “emissions criteria”).

Discussion

Interpretation of the major results: The advertisements were poor in supplying much of the basic data on which consumers could use to make informed vehicle purchase decisions (eg, fuel type, engine size, engine efficiency and emissions). There was also little advertising for vehicles using fuels associated with lower greenhouse gas and other exhaust emissions per distance travelled (ie, diesel, LPG and electric/petrol mixes). Even vehicle manufacturer websites were poor at supplying data about fuel efficiency and, in particular, emissions information. This is despite having very in-depth detail about engine specifications and performance data.

Given that much of the use of light passenger vehicles in New Zealand is for only one or two passengers [13], the advertising of vehicles using as much as 18.6 litres per 100 km is counter to the achievement of the Government’s stated climate change and economic goals. The significant increase in average engine size, where the size was given in the advertisements, is also problematic for this reason.

The average “greenhouse rating” was 5.1, where a score of five equates to an average CO₂ emission level of 241-260 g/km [14]. In comparison, the fleet-wide average for European car makers in 2006 was 160 g/km [15]. Furthermore, the European Commission has a target of 120 g/km (for all new cars sold by 2012) – though this may be revised to a less rigorous 130 g/km [16]. Therefore the vehicles advertised in this study appear to be, on average, far more polluting than the current European ones and especially the proposed new European target. This again suggests that the advertising of vehicles with poor greenhouse and air pollution ratings (of as low as 0.5) appears to be counter to the achievement of the New Zealand Government’s environmental and economic goals.

Where found in official websites, the average “air pollution rating” of the vehicles advertised was 5.4 out of 10 (with 10 being best or least polluting). While being slightly better than the current Australian emission standard for petrol-fuelled vehicles of 5, the 5.4 average falls just short the standard for new vehicles in Europe from 2005 [14].

Limitations: This study was limited to a modest sample of print media containing light passenger vehicle advertisements (albeit the two major monthly current affairs magazines with a wide readership). Nevertheless, given the absence of other similar studies in New Zealand or elsewhere, it does provide some initial baseline information on this topic. The advertisements are likely to reflect new vehicles and more expensive vehicles relative to the current vehicle fleet in New Zealand. Indeed, it has been estimated that nearly 50% of the New Zealand car fleet is more than 10 years old, and only 20% is less than five years old [17]. Nevertheless, we selected this five-year time period of advertisements to reflect what were available in terms of current vehicle technologies, and how these were marketed during a period of heightened concern about both greenhouse gases and air pollution.

There were also some problems gaining actual data about fuel efficiency and emissions data. There was a New Zealand website but up to 25% of the emissions data for the vehicles advertised was unavailable. Because the emissions data that we used was sourced from an Australian Government website, there was a small possibility of differences with New Zealand data.

One issue not explored by this article is how some vehicle advertising may also promote driving behaviour that exacerbates the production of pollutants. However, we have described elsewhere that this same set of advertisements frequently contains imagery of speed, power references or acceleration data [12]. Another limitation may relate to the validity of the ratings used. For example, one study in *Consumer Reports* found that around 90% of vehicles tested failed to achieve the stated US Environmental Protection Agency fuel efficiency ratings [18].

To address some of these limitations, future research could expand the sampling of advertisements to a wider range of magazines, newspapers and to televised car advertisements. It could also collect more denominator background on trends in expenditure on vehicle advertising in different media.

Possible implications for policy makers: Further research on vehicle advertising and emissions is highly desirable, along with expanding the work on advertising and vehicle safety issues [7-12]. Nevertheless, given the importance of the international threat of climate change and from the substantive health impact from localised air pollution in many countries (including New Zealand [6]), there is a need for improvements in the content of vehicle advertising now. Such regulation is also justified on consumer rights grounds alone.

To ensure this information is provided, governments may wish to regulate the emissions-related aspects of vehicle advertising (and potentially other health-related aspects such as safety). Currently, some countries (including New Zealand and Australia) have regulations that require energy efficiency ratings on whiteware appliances, along with other information requirements in the marketing of many other consumer goods (eg, pharmaceuticals, tobacco, processed food etc). Indeed, information that includes striking picture warnings of health consequences are mandatory on all tobacco packaging in New Zealand from February 2008. Governments also have a role in helping a country address national or regional issues such as meeting international treaty obligations on climate change (the Kyoto Protocol), improving energy security, and reducing air pollution. Given these issues, governments may wish to regulate to require vehicle advertisements to detail key emissions and pollutant information (in both symbols and text) and to restrict other content that promotes speed and fast acceleration.

If such regulations around advertising are not politically achievable in the short term, then nations also have the option of improving regulation of the physical components of vehicles themselves to reduce emissions (eg, tighter mandatory fuel efficiency standards and mandatory emissions standards with regular testing). They also have the option of levying taxes on fuel, on vehicle engine size and even on CO₂ emissions – with the latter used in the United Kingdom [19]. The range of other strategies include: limiting hazardous components within fuel (eg, sulphur and benzene), promoting public transport, and promoting active transport such as walking and cycling. Active transport has the potential to improve health and equity as well as reducing emissions [20].

Conclusions

Most of the light passenger vehicle advertisements in the magazines in this study were not informative in terms of greenhouse gas emissions and other air pollutants. To address these issues, governments should regulate the content of such advertisements, as is already done with the marketing of many other consumer products such as tobacco, pharmaceuticals and appliances.

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Authors' contributions: Three of the authors contributed to the protocol (NW, AM, GT). AM undertook the content coding and both AM and NW undertook analyses. All authors contributed to revising drafts and preparing the final manuscript.

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References

1. Campbell-Lendrum D, Pruss-Ustun A, Corvalan C: How much disease could climate change cause? In: McMichael AJ, Campbell-Lendrum D, Corvalan C, Ebi KL, Githeko AK, Scheraga JS, et al, editors. *Climate change and health: risks and responses*. Geneva: World Health Organization, 2003.
2. Ministry for the Environment: *National Inventory Report: 1990-2004*. Wellington: Ministry for the Environment, 2006. <http://www.climatechange.govt.nz/resources/reports/nir-apr06/index.html>.
3. Wilson N, Melhuish M: **Addressing the threat of climate change: is New Zealand lagging behind?** *N Z Med J* 2007, **120**:U2479.
4. Wilson NA, Edwards R, Mansoor O: **Economics can be good for health: need for rational policy without the influence of vested interests.** *N Z Med J* 2007, **120**:U2757.
5. Auckland Regional Council: *Auckland air emissions inventory: 2006 Update. Technical publication 292*. Auckland: Auckland Regional Council; 2006.
6. Fisher G, Kjellstrom T, Kingham S, Hales S, Shrestha R: *Health and air pollution in New Zealand (HAPiNZ)*. Wellington: Health Research Council of New Zealand, Ministry for the Environment, Ministry of Transport, 2007. <http://www.hapinz.org.nz/>.
7. Ferguson SA, Hardy AP, Williams AF: **Content analysis of television advertising for cars and minivans: 1983-1998.** *Accid Anal Prev* 2003, **35**:825-31.
8. Tamburro RF, Gordon PL, D'Apollito JP, Howard SC: **Unsafe and violent behavior in commercials aired during televised major sporting events.** *Pediatrics* 2004, **114**:e694-8.
9. Shin PC, Hallett D, Chipman ML, Tator C, Granton JT: **Unsafe driving in North American automobile commercials.** *J Public Health (Oxf)* 2005, **27**:318-25.
10. McGwin G, Modjarrad K, Reiland A, Tanner S, Rue L: **Prevalence of transportation safety measures portrayed in primetime US television programs and commercials.** *Inj Prev* 2006, **12**:400-3.
11. Sheehan M, Steinhardt D, Schonfeld C: *A content analysis of Australian motor vehicle advertising*. Canberra: Australian Transport Safety Bureau, 2006. <http://www.atsb.gov.au/publications/2006/pdf/CR228.pdf>.
12. Wilson N, Maher A, Thomson G, Keall M: **Smooth handling: The lack of safety-related consumer information in car advertisements.** *Inj Prev* 2007, **13**:304-6.
13. Keall M, Povey L: *Travel survey highlights*. Wellington: Land Transport Safety Authority; 2000.
14. Australian Government: *Green Vehicle Guide. Information on Green Vehicle Guide ratings and measurement*: Australian Government, 2006. <http://www.greenvehicleguide.gov.au/gvpublicui/Staticcontent/ratings.aspx>.
15. TE Bulletin: **'120 by 2012 must stay,' say MEPs** TE Bulletin [News from the European Federation for Transport and Environment]. (September 2007) No. 161, p1. http://www.transportenvironment.org/docs/Bulletin/2007/2007_09_bulletin_161.pdf.
16. European Federation for Transport and Environment: *Europe set to weaken key climate target for new cars. (7 February)*. Brussels: European Federation for Transport and Environment, 2007. <http://www.transportenvironment.org/Article355.html>.
17. Ministry of Economic Development: *Petrol and diesel – delivering quality: A review of the Petroleum Products Specifications Regulations*. Wellington: Ministry of Economic Development; 2001.
18. ConsumerReports.org: *Fuel-economy claims need a reality check*: Consumers Union of US, 2005. <http://www.consumerreports.org/cro/aboutus/mission/viewpoint/fueleconomyclaimsneedarealitycheck1005/index.htm>

19. Ministry for the Environment: *Discussion paper on measures to reduce greenhouse gas emissions in New Zealand post-2012*. Wellington: Ministry for the Environment; 2006.
20. Woodcock J, Banister D, Edwards P, Prentice A, Roberts I: **Energy and transport**. *Lancet* 2007, **370**:1078-88.

Table 1: The number and percentage of advertisements and type of vehicle by year from the magazines surveyed (2001-2005)

Year	SUV ^a		Other 4WD & AWD ^b		Other vehicles		All vehicles	
	%	N	%	N	%	N	% ^c	N
2001	19.1	13	19.1	13	61.8	42	13.2	68
2002	11.5	7	21.3	13	67.2	41	11.9	61
2003	29.5	31	12.4	13	58.1	61	20.4	105
2004	27.6	45	14.7	24	57.7	94	31.7	163
2005	16.2	19	8.5	10	75.2	88	22.8	117
Total	22.4	115	14.2	73	63.4	326	100.0	514

^a Vehicles were classified as SUVs if they were specifically defined in the advertisement as being a SUV, recreational vehicle (RV), or all-terrain vehicle (ATV), or if they were defined as a SUV on vehicle manufacturers' websites.

^b The category "Other 4WD and AWD" included all relevant vehicles where the advertisements mention they are either 4WD or AWD capable (and excluded all SUVs as defined above).

^c Total percentages in this column are out of all the years, whereas other percentages in this table are the composition *within* years (ie, across the row).

Table 2: Type of engine fuel mentioned in the vehicle advertisements (n=514) by year (2001-2005)

Year	Petrol ^a		Petrol or diesel ^b		Diesel		Electric/ petrol (hybrid)		LPG		No fuel information given ^c	
	%	N	%	N	%	N	%	N	%	N	%	N
2001	25.0	17	7.4	5	5.9	4	0	0	2.9	2	58.8	40
2002	52.5	32	0.0	0	0.0	0	0	0	0	0	47.5	29
2003	50.5	53	1.0	1	4.8	5	0	0	0	0	43.8	46
2004	49.1	80	0.6	1	1.2	2	1.2	2	0	0	47.9	78
2005	47.9	56	2.6	3	5.1	6	0.9	1	0	0	43.6	51
Total	46.3	238	1.9	10	3.3	17	0.6	3	0.4	2	47.5	244

^a Advertisements with engine information were assumed to be petrol unless otherwise stated.

^b Advertisements of vehicles with both petrol and diesel options.

^c Advertisements with no information about fuel type or engine specifications.

Table 3: Engine size, fuel efficiency and emissions data for advertised vehicles by year and magazine (2001-2005)

Year / magazine	Engine size ^a		Fuel efficiency ^{b c}		Greenhouse rating ^{b d}		Air pollution ^{b d}	
	Mean capacity (L)	N	(L/100 km)	N	Mean rating	N	Mean rating	N
2001	2.51	23	9.9	66	5.1	43	5.5	45
2002	2.37	25	9.3	59	5.5	39	5.5	39
2003	2.76	37	10.0	103	5.0	77	5.1	77
2004	2.77	64	10.1	161	5.0	124	5.5	124
2005	2.98	51	9.8	117	5.3	99	5.4	99
<i>Metro</i>	2.64	98	9.8	277	5.2	213	5.4	214
<i>North & South</i>	2.84	102	10.1	229	5.0	169	5.3	170
Total	2.74	200	9.9	506	5.1	382	5.4	384

^a“Engine size” taken from actual advertisements.

^bData were collected for all different vehicles (n=149) and then extrapolated to the advertisements shown in the magazines.

^c“Fuel efficiency” for the advertised vehicles was obtained from an official New Zealand website (www.fuelsaver.govt.nz).

^d“Greenhouse” and “Air Pollution” ratings are on a scale from 0.5 (worst, most polluting) to 10 (best) based on their CO₂ emissions and other air pollutant emissions. These were obtained from an official Australian website (www.greenvehicleguide.gov.au).