The use of marked vs unmarked road policing vehicles

Nils van Lamoen

New Zealand Police

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Summary of Findings

1. Existing unmarked and marked highway patrol cars were compared on a range of measures with the Equinox (unmarked SUV) patrol vehicles. Both types of unmarked cars averaged a higher number of offences detected in all categories, with the unmarked SUV cars being most productive.

2. Unmarked SUV patrol cars issued 43% more infringement notices per day in operation when compared to marked cars. The unmarked SUV cars were particularly productive for, seat belt (+161%) and hand-held mobile phone (+179%) offence detection per day. Unmarked sedans detected 23% more offences per day on average compared to marked cars.

3. Unmarked UHPs outperformed the levels of detected offences in all categories except for excess alcohol infringements.

4. Overall, the data suggests that unmarked cars are more efficient in detecting offences, and furthermore the Unmarked SUV cars are more productive in offence detection than Unmarked sedan patrol cars per day of service.

Introduction

The use of marked versus unmarked (or covert) has attracted ongoing discussions about issues such as police legitimacy and visibility, however in some settings they were also found to decrease crime and increase deterrence [1]. In the context of road policing specifically, mobile unmarked patrol vehicles have no local speed reduction effect (presumably unless lights are activated), while there is some evidence of a local effect on speeds involving stationary unmarked patrol vehicles [2, 3].

Covert traffic enforcement is likely more effective in detecting traffic offending, such as speeding, non-seatbelt use, and hand-held mobile phone use [4–7]. Greater compliance may additionally be generated when detection cannot be easily anticipated [8]. High visibility speed enforcement is also effective in producing local reductions in speeding, and have in a number of studies been shown to produce a similar or greater local reduction in speed [9, 10]. Covert, or difficult to anticipate speed enforcement is, however, better at producing a general effect on speeding and crash risk across a wider area [11–14].

A study comparing enforcement undertaken overt versus covert with immediate or delayed feedback found that covert enforcement combined with immediate feedback (apprehension) was most effective in reducing speeding [15]. A road policing programme is likely more effective when it employs a combination of high visibility and inconspicuous patrol vehicles/methods [12, 16].

A number of studies have identified covert highway patrol vehicles as facilitating offence detection for speeding and texting while driving. However, the extent to which unmarked (or covert) patrol vehicles can facilitate traffic offence detection across a range of key offence types (e.g. speeding, non-seatbelt use, lane keeping, driving under the influence) is not immediately clear from existing literature.

Setting

New Zealand Police introduced unmarked highway patrol vehicles in November 2003, the objective of the unmarked highway patrol (UHP) cars was to facilitate the detection rate of unsafe driving offences [17]. The detection rate of such risky offences has long been prioritised for police services across jurisdictions [18, 19].

Over 2020-2022, New Zealand Police operated 57 standard unmarked highway patrol vehicles (largely Holden Commodore sedans). An additional 24 SUV unmarked highway patrol vehicles (Holden Equinox) were also introduced.

SUVs had not previously been used for covert highway patrol cars. This change was intended to have an additional concealing effect as SUVs are now commonplace in the New Zealand vehicle fleet.

The purpose of the current paper is to assess the relative standardised offence detection rates of marked highway patrol cars, unmarked sedan/station wagon patrol vehicles, and unmarked SUV patrol vehicles.

Method

Data and procedure

Traffic infringement data was collected over July 2020 to December 2021. This data contains the number plate of the issuing vehicle which was matched to the police vehicle data identifying the vehicle type (SUV or sedan) and livery (marked or unmarked).

Fifty cars with no value or had an equal number of 'patrol' and 'unmarked' entries for patrol vehicle type and were excluded from the dataset. These cars had a low number of infringements, with mean value of 2.5 per car and would have been excluded as being non-road policing cars.

The data was subsequently cleaned by excluding cars having one or more of the following attributes:

- Incomplete or incorrect vehicle plate (not owned by Police).
- Less than half of the recorded infringements were issued by road policing staff
- Low total number of speeding notices and/or low number issued by road policing staff
- More than 95% of service days with no infringement issued
- Any cars with operational days (number of unique days with an ION issued) below 2 days

One of the difficulties in apportioning offence detection per vehicle is the fact that cars across the comparison groups ('marked', and 'unmarked sedan') could enter and exit the fleet part-way through the comparison period. For example, older vehicles were retired or otherwise written off due to damage, and new vehicles entered service throughout the comparison period. To calculate the utilisation and service period of each car over the period under examination, the following variables were added:

i. Operational days were calculated as a unique day when at least one traffic notice was issued
ii. Days of service were calculated as a count of the days between the first date a notice was issued and the last date a notice was issued
iii. Utilisation was the number of operational days divided by the days of service

This would allow for the offence detection rate to be standardised for each patrol vehicle across the three groups of vehicles: marked, unmarked sedan, and unmarked SUV.

Objectives

To establish whether there is a discernible difference in the utilisation and offence detection rates of marked vs unmarked highway patrol cars and for SUV-type unmarked cars.

Results

Operational and service days of vehicles

The analysis period for this report was 6 July 2020 (first date of deployment for the new UHP cars) to 31 December 2021. There was a total of 543 days in this period. Table 1 contains the summary statistics of vehicle service and operational days.

Figure 1 shows that the 'Unmarked SUV' cars were, used more consistently that other road policing car types, and also had a slightly higher mean number of operational days than marked cars (+2.3%) 'Unmarked sedan' (+12.3%). A means comparison (ANOVA) found no significant difference between the groups ($p > .05$). The number of operational days did not vary significantly per vehicle type.

Table 1. Summary statistics of vehicle use and service by road policing vehicle category.

Vehicle category	Operational range (M)	Service days range (M)	Vehicles *n*
Unmarked SUV	104 - 362 (219)	381 – 543 (455)	24
Unmarked sedan	41 – 390 (195)	65 – 543 (402)	57
Marked	17 – 419 (214)	99 – 543 (482)	201

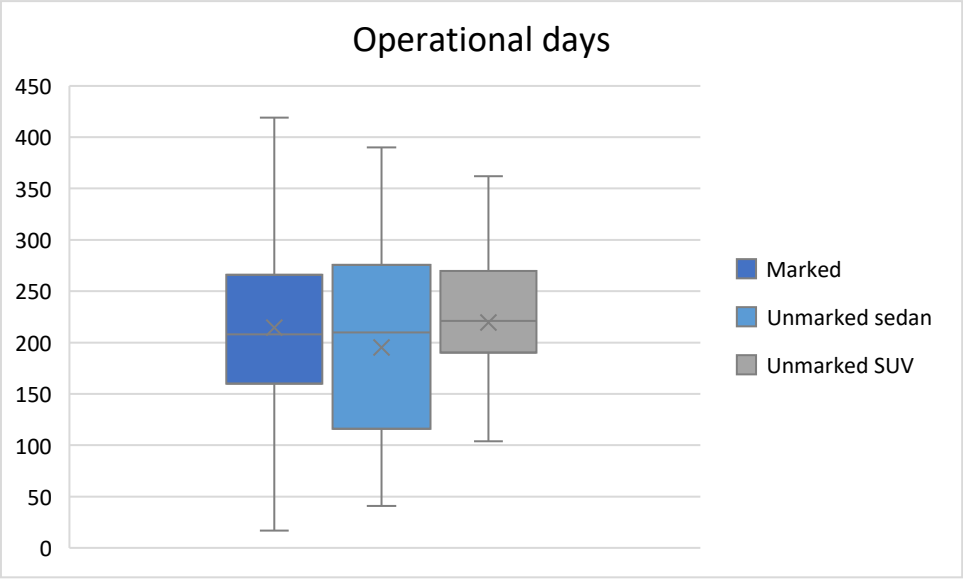

Figure 1. Vehicle operational days by road policing car category.

Days in service was calculated using the earliest and latest date an infringement notice was issued by each road policing car. The number of service days was more consistent for marked and 'Unmarked SUV' cars. Unmarked SUV cars were on average in service shorter than marked cars (-6.6%) but longer than 'Unmarked sedan' cars (+13.2%).

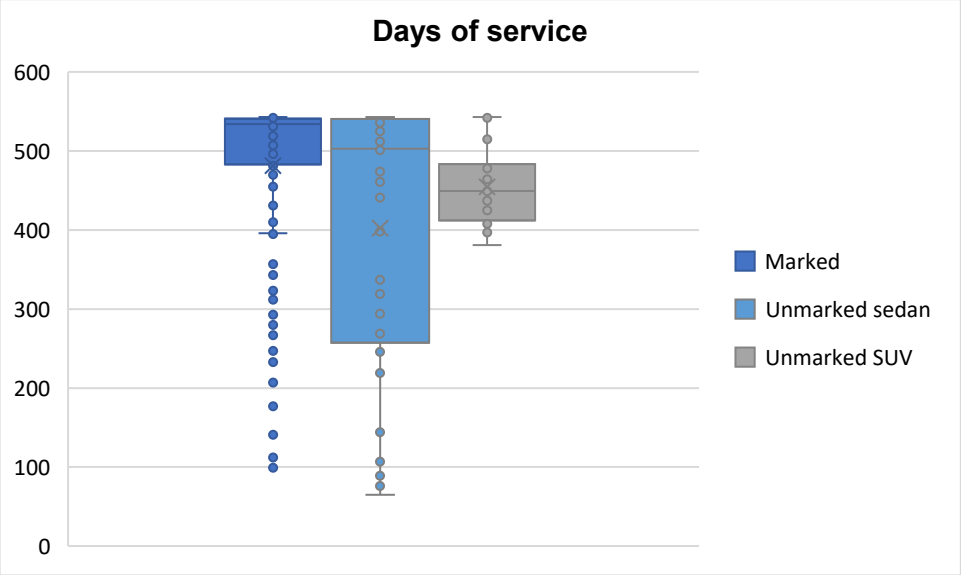

Figure 2. Vehicle service days by road policing car category.

Having established the operational days and the days in service, the utilisation rate of each car across the categories was calculated.[1] The utilisation is reported as the percentage of days operational days per day of service. The utilisation rate for the 'Unmarked SUV' cars was higher than marked cars (+6.7%), and below 'Unmarked sedan' cars (-5.9%).

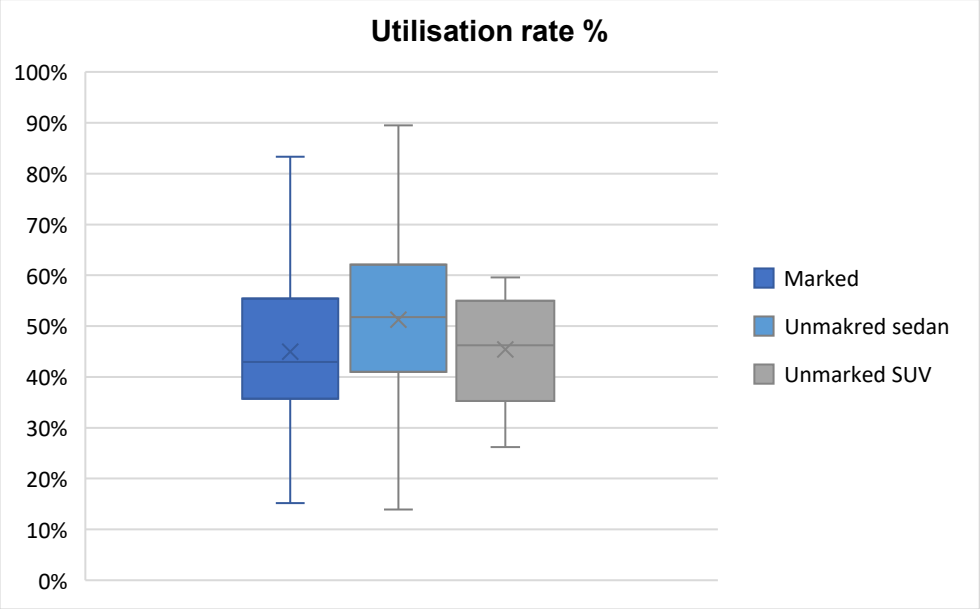

Figure 3. Vehicle utilisation rate by road policing car category.

A means comparison (ANOVA) indicated a significant difference between the utilisation rate between the marked cars and the combined unmarked cars ($p = .01$). A Post-hoc test (Tucky) revealed that 'Unmarked SUV' and 'Unmarked sedan' had a significantly higher utilisation rate than ''Marked'' ($p < .01$), but there was no significant difference between the two categories of unmarked cars ($p = .57$).

[1] *this calculation is unable to account for any days the vehicle may have been out of commission due to a breakdown, service requirements or repair/damage to the vehicle*

Offence detection

Total offences

A total of 575,660 IONs were detected using the patrol cars included in this sample over the period under examination. By vehicle category this equated to 65% of all offences were issued from 'Marked' cars, 22% from 'Unmarked sedan' cars, and 12% from the 'Unmarked SUV' cars.

Despite making up only 8.5% of the number of cars, and having a lower mean number of service days, the unmarked SUV cars were used to detect 12% of all offences (Table 2). This is partly due to having a more consistent number of service and operational days. When looking at the total monthly offences considering the number of cars active that month, both 'unmarked SUV' and 'unmarked sedan' car groups consistently outperformed the marked patrol cars (Figure 4).

A means comparison (ANOVA) showed a significant between group variation in offence detection between the three groups of cars ($p < .001$). This difference occurred between the 'Marked' cars and both the 'Unmarked' car groups, with a post hoc test revealing that the ''Unmarked SUV'' cars had significantly more offence detection ('Marked' vs 'Unmarked SUV' $p < .001$, 'Unmarked sedan' vs 'Unmarked SUV' $p = .016$).

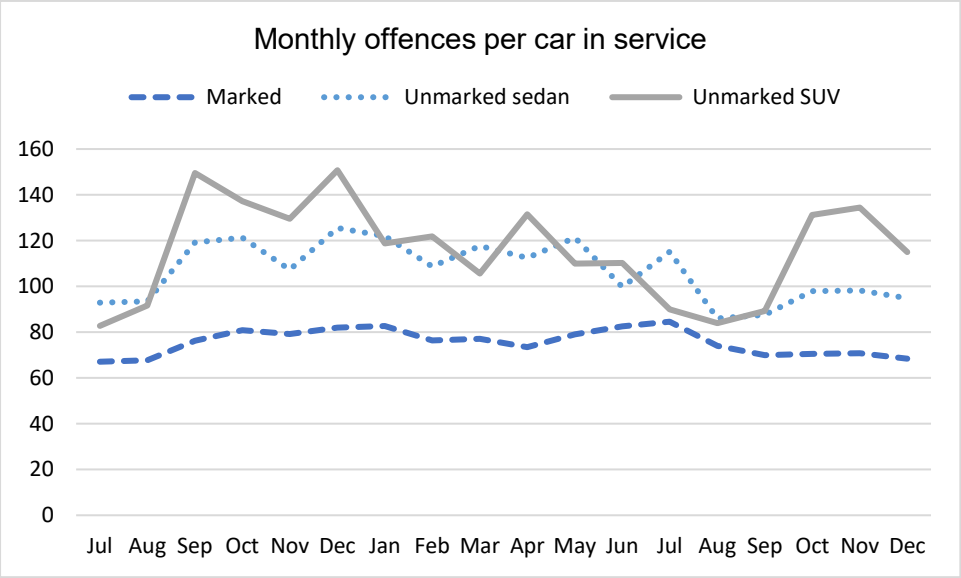

Figure 4. Offence detection per number of active vehicles by road policing car category.

Table 2. Total traffic offences detected by vehicle category.

Offences / service	Marked Cars	Unmarked sedan	Unmarked SUV
Total road policing	375,705	123,366	66,658
Average days of service	482	502	455
Proportion of all offences	65%	22%	12%
Proportion of vehicles	71%	20%	9%

Detection of significant trauma-promoting offences

The offence data previously presented includes all infringement offences detected. This section will focus on reporting on offence detection by category for those offences that pose the greatest risk, namely speeding, non-use of seat belts, handheld mobile phone use, and manner of driving and driver obligations (e.g. lane keeping, unsafe overtaking, intersection violations). While infringement offences for drink driving are included, this data excludes offences involving a court summons, such as excess breath alcohol >400 mc/L (which are more numerous than infringements) and dangerous driving.

Considering the number of cars in each vehicle category varied, the mean number of offences was calculated. Both types of unmarked cars averaged a higher number of offences detected in all categories except for alcohol infringements.

Table 3. Infringement offences detected per vehicle by car category.

Offence category	Marked	Unmarked sedan	Unmarked SUV
Drink driving	12	8	7
Manner of driving	59	74	67
Non-seatbelt use	70	115	187
Handheld phone use	61	89	175
Speeding	696	781	1021

Mean offence detection was also analysed by day of operation. The unmarked cars of both sedan and SUV type outperformed the levels of marked car-detected offences in all categories except excess alcohol infringements. The unmarked SUV outperformed the sedan weighted both by number of cars and number of operational days. The SUV unmarked car was particularly more efficient in promoting the detection seatbelt and mobile phone use, followed by speeding.

Table 4. Infringement offences detected per operational day (marked = 1.0).

Offence category	Unmarked sedan	Unmarked SUV
Drink driving	0.7	0.6
Manner of driving	1.4	1.1
Non-seatbelt use	1.8	2.6
Handheld phone use	1.6	2.8
Speeding	1.2	1.4

Overall, the data suggests that unmarked cars are more efficient in detecting traffic offences, and furthermore the unmarked SUVs are even more conducive for offence detection for seatbelt and hand-held mobile phone offences.

Conclusion

The unmarked SUV highway patrol cars had a more consistent number of service days and number of operational days during which enforcement activity took place. The utilisation rate was similar to that of unmarked sedan and marked road policing cars.

Monthly offence detection per number of active cars was similar for the unmarked SUV and unmarked sedan cars but consistently higher than the marked road policing cars.

Total traffic offence detection was on average highest for the unmarked SUV patrol cars, including per vehicle and per operational day. While the new UHPs made up 8% of the total road policing cars identified as part of this analysis, they issued 12% of all traffic infringement offence notices.

Of the high priority offences (speeding, seat belt non-use, mobile phone use, driver duties and obligations) offence detection was consistently higher for the unmarked SUV patrol cars. Alcohol and drug impairment could not sufficiently be assessed as neither breath tests, nor offences resulting in a charge are recorded against the vehicle.

Compared to marked cars, unmarked sedans were more effective at detecting speeding (+23%), non-seat belt use (+81%) and mobile phone offences (+58%) and manner of driving offences (+38%) per day of operation.

Compared to marked cars, unmarked SUVs were more effective at detecting speeding (+43%), non-seat belt use (+161%) and mobile phone offences (+179%) and manner of driving offences (+11%) per day of operation.

Unmarked patrol cars as a whole were more effective to detect risky traffic offences, the use of unmarked SUVs are particularly effective to detect hand-held mobile phone offences such as texting while driving, and non-seat belt use.

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