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Prevalence of unregistered driving and associated driver behaviours in Queensland.

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Background. The driving of unregistered vehicles undermines the integrity of the road transport system, with numerous studies identifying associations between this activity and illegal and unsafe driving behaviours.

Aims. A state-wide observational study was undertaken to ascertain the prevalence of unregistered vehicles on Queensland roads in both rural and metropolitan areas.

Methods. Over a four week period, 53,217 vehicles were observed parked in both on-road and off-road locations, and matched against the Queensland registration database. Building on previous research, this study contains an additional component exploring linkages between the driving of unregistered vehicles and other illegal driving behaviours. This facilitated an analysis of the traffic infringement and sanction histories of the most recent registered owner.

Results. The proportion of vehicles observed to be unregistered increased significantly from 2005 (1.81%) to 2010 (2.88%). Consistent with previous surveys, the majority of observed unregistered vehicles (52.50%) had been unregistered for more than two years. Unregistered vehicle owners were generally more likely than the owners of registered vehicles to have committed driving offences (59.90% vs. 55.80%) and to have had a sanction applied to their driver licence (30.70% vs. 10.60%). Unregistered vehicle owners were also more likely to be unlicensed at the time of the observational survey (6.30% vs. 0.80%), and to have previously committed unlicensed and unregistered driving offences.

Contribution to the field. As the extent of unregistered vehicle usage and the prevalence of unlicensed driving can be difficult to ascertain, the current study adds to the understanding of these behaviours and their linkages to other traffic infringements.

Key words: Unregistered vehicles, unlicensed driving, driver behaviour, vehicle surveys

1. Introduction

Vehicle registration is a central component of the management of the road transport system. The driving of unregistered vehicles can undermine the integrity of this system in a number of ways. In addition to issues relating to loss of revenue to the State and the presence of uninsured vehicles on the road, this behaviour negates the deterrent effect of automated policing activities such as speed and red-light cameras. However a key concern is the potential impact on road safety. Unregistered vehicles may not meet safety requirements considered necessary for use on public roads. Unregistered vehicle usage has been associated with a range of other unsafe and illegal driving behaviours, including fatigue (Armstrong, Smith, Steinhardt, & Haworth, 2008), drink driving (Haworth, Smith, Brumen, & Pronk, 1997; Haworth, Vulcan, Bowland, & Pronk, 1997) and motorcycle use (Blackman, Veitch, & Steinhardt, 2008; Haworth, Ozanne-Smith, Fox, & Brumen, 1994; Haworth, Smith et al., 1997). There has also been some degree of association found between the driving of unregistered vehicles and an increased risk of crash involvement, with evidence indicating

that unregistered vehicles are over-represented in serious and fatal crashes (Haworth, Smith et al., 1997; Haworth, Vulcan et al., 1997). It is also understood that there may not be a direct link between unregistered vehicle use and related vehicle crashes, and that increased risk is not due to the act of driving an unregistered vehicle per se, but may reflect other high-risk behaviours, such as drink driving (Haworth, Vulcan et al., 1997).

Unlicensed driving also remains a serious problem for road safety, despite ongoing improvements in traffic law enforcement practices and technology. Evidence indicates that unlicensed driving is associated with a cluster of high-risk driving behaviours (Harrison, 1997; Watson, 1997 & 2000, Griffin & DeLaZerda, 2000). Findings from other jurisdictions suggest that unlicensed driving is associated with a higher crash risk than legal driving (FORS, 1997; Griffin & DeLaZerda 2000; Siskind, Steinhardt, Sheehan, O'Connor & Hanks, 2011) with suspended drivers found to be over-represented in fatal crashes (DeYoung, D. J., Peck, R. C., & Helander, C. J. 1997). Evidence from Queensland shows unlicensed drivers generally have a higher risk of crashing and that the crashes in which they are involved tend to be more severe than those involving licensed drivers (Watson 2004; Watson, Armstrong, Watson, & Barraclough, 2011). Furthermore, a small number of studies have been undertaken which tend to indicate a positive association between unregistered vehicle use and unlicensed driving. Findings in three Australian states revealed that between 16% and 24% of drivers convicted of unlicensed driving were also convicted of driving an unregistered vehicle at the same time (Watson, 2003; Hoel & Freiberg, 2008; The Audit Office of New South Wales, 2003).

Research to estimate the prevalence of unregistered vehicles on Queensland roads was commissioned by Queensland Transport in 2000, 2003, and 2005 (AC Nielsen 2001, 2003, & 2005). Observational studies of vehicles parked in on and off street public parking locations were conducted throughout the State, with approximately 50,000 vehicles surveyed in each study. The number plates on the vehicles observed were cross checked against Queensland Transport's Registration On Line System (ROLS) and Transport Registration and Integrated Licensing System (TRAILS) databases and the number of unregistered vehicles observed on Queensland roads was then estimated. This study builds on the previous research, providing trend data on unregistered vehicles in Queensland. For this reason, the methodology utilised during this research replicated that of the previous three studies. An additional component examined the links between unregistered driving and other illegal driving behaviours, such as unlicensed driving. This level of analysis was not undertaken in the previous studies.

In Queensland an unregistered vehicle is defined as one which: has an expired registration; has a cancelled registration; has never been registered; is driven contrary to permits or conditional registrations; or is driven despite not being permitted to be used on a road under the *Transport Operations (Road Use Management—Vehicle Registration) Regulation 2010*. In Australia, the term unlicensed driver tends to be used as the generic description for all those who drive or ride a motor vehicle without a valid licence. Specifically those drivers who have; let their licence expire; have had their licence disqualified or suspended; hold an inappropriate class of licence for the vehicle they drive; drive outside the restrictions of a special licence; don't currently hold a licence; or have never held a licence. Driving while unaccompanied on a learners licence has not historically been classed as unlicensed driving in Queensland, but is considered a licence sanction.

2. Method

The observational study of number plates and registration labels affixed to vehicles involved no direct interaction with participants. Vehicles sampled were from both rural and metropolitan areas, and included those parked in both on-road and off-road locations. The locations sampled for this study were restricted to destinations (e.g. shopping centres, hospitals, airports and park-and-ride facilities) rather than residential areas, and a variety of destinations were sampled. These location types were chosen as they provide a high probability that vehicles captured in the survey are being driven on a regular basis

(Younglove et al., 2004). Approval was sought from the owner/operators of parking facilities prior to undertaking data collection.

The geographical areas in which observations were undertaken were chosen to provide a mix of small towns, regional centres and metropolitan locations. This was done to provide consistency with the previous surveys undertaken in 2000, 2003 and 2005, so meaningful comparisons could be made across observational periods. Surveys were conducted across all four Department of Transport and Main Roads (TMR) regions, these being South-east, Southern, Central and Northern Queensland.

Consistent with the sample size of the previous studies, approximately 50,000 vehicle observations were conducted. Observations were undertaken between the hours of 8:30am and 7:00pm. These times were chosen to ensure consistency with the previous studies, and also to reduce the risks associated with the data collection staff working after dark. The previous studies also found that in practice it is more difficult to record vehicle details without natural light. Data collection was scheduled so that potential confounding effects of vehicle movement due to holiday periods were minimised. For safety reasons observers worked in pairs, however observations were conducted individually by each observer.

Unregistered vehicles were recorded by location, make of vehicle, day of the week, time of day and the length of time unregistered. The types of vehicles included in the sample were cars (including station wagons and wagons), four-wheel drives, utilities, vans, mini-buses, motorcycles, scooters and mopeds). Heavy vehicles of greater than 4.5 tonnes, buses, trailers and mobile machinery were not recorded.

Only vehicles with standard or personalised Queensland number plates were included in the sample. To be consistent with the previous studies, interstate, defence force, and other special registration vehicles were not included. Duplicate observations of the same number plate were removed, leaving only the most recent observation. Again, in line with previous surveys, vehicle number plates and make and/or model codes not matched on the registration database were treated as an error occurring during the observation or data entry phases and were also removed. This cleaned data file was then presented to TMR for matching with the TRAILS database.

A new data set was drawn from the TRAILS database, consisting of de-identified driver licence details, traffic infringement and sanction histories for the registered owner (or last registered owner) of all vehicles observed during the survey. The driver licence details provided were limited to level, class and whether or not the licence was valid at the survey date. Infringement and sanction data¹ was limited to the period from April 2005 to May 2010. After removing duplicate observations and non-valid entries, the new total was utilised as a denominator in the calculation of the unregistered rate. Records of all vehicles registered to organisations or businesses were not included in the subsequent analysis of driver infringement histories.

Comparisons were made between the registered owners of vehicles on the basis of whether or not the observed vehicle was registered at the time of the observation phase of the study. Chi-square tests for independence were conducted in cases where the assumptions for the test were not violated.² Data analysis was undertaken on the full sample of vehicles (cars, light commercial vehicles, minibuses and motorcycles) observed during the survey.

Due to the nature of the data collection method employed, it was not possible to verify the individual who had last driven and parked the vehicle at the location where it was observed.

¹ It should be noted that some sanctions do not involve licence loss (e.g., Good Driving Behaviour condition and a Work licence).

² No more than 20% of cells with expected counts less than 5, and no cells with a zero observed value.

Therefore, this study reviewed the status of the vehicle and offence history of the currently registered, or in the case of unregistered vehicles, the last registered owner of the vehicle.

3. Results

3.2 Sample size

The original sample comprised 59,862 observed number plates. After the removal of all duplicate observations ($n = 5,498$) and non-valid entries (those vehicles not matched on the registration database, $n = 1,147$) the sample comprised 53,217 vehicles. This figure was used as the denominator to calculate the overall prevalence of unregistered vehicles in Queensland. The infringement histories of all vehicles registered to organisations ($n = 5,157$) were then removed, with the final sample of 48,060 individuals forming the basis for the analysis of the driver history component.

The unregistered vehicle rate increased significantly from the 2005 (1.81%) to the 2010 (2.88%) surveys, $z = 11.10$, $p < .001$. The prevalence of unregistered vehicles was found to be similar across the four TMR regions. The highest unregistered rate was observed in the Central region (3.18%), while the lowest was observed in the Southern region (2.66%).

3.3 Period of time unregistered

Consistent with the previous surveys, the majority of unregistered vehicles (52.5%) had been unregistered for more than two years. As shown in Table 1, this figure is consistent with the 2000, 2003, and 2005 surveys (AC Nielsen 2001, 2003, & 2005).

Table 1: Number of unregistered vehicles by length of time unregistered (2000 to 2010)

Length of time unregistered	Vehicles Unregistered				% of unregistered vehicles			
	2010	2005	2003	2000	2010	2005	2003	2000
< 1 month	66	11	232	121	4.31%	1.30%	9.81%	6.08%
1 to 2 months	52	10	64	52	3.40%	1.18%	2.70%	2.61%
2 to 3 months	63	10	41	69	4.11%	1.18%	1.73%	3.47%
3 to 6 months	119	21	105	116	7.77%	2.48%	4.44%	5.83%
6 to 12 months	157	40	186	123	10.25%	4.72%	7.86%	6.18%
1 to 2 years	174	44	323	176	11.37%	5.19%	13.65%	8.84%
> 2 years	804	268	1,415	1,334	52.51%	31.60%	59.81%	67.00%
Unknown*	96	-	-	-	6.27%	-	-	-
Unreconciled plates**	-	218	-	-	-	25.71%	-	-
Registration classification unclear***	-	226	-	-	-	26.65%	-	-
Totals	1,531	848	2,366	1,991	2.88%	1.81%	5.19%	4.05%

* Vehicles with registration recorded as expired or cancelled on the TMR database but no end date is recorded in the database.

** No record of registration for these vehicles held by the then Department of Transport, so a time frame unable to be calculated.

*** Refers to disparities between the observed registration date and the then Department of Transport's registration date, so a time frame was unable to be calculated.

3.4 Unregistered vehicle rate by day and time

The unregistered vehicle rate was observed to be highest on Tuesdays (3.28%).³ This differs from the previous surveys, which found the prevalence of unregistered vehicles was highest on weekends. The present study observed that the lowest rates of unregistered vehicles occurred on Mondays (2.21%). Observation times over the entire week were binned into half-hour time periods. Two time periods, 9:00am to 9:29am and 5:00pm to 5:29pm, show a higher rate of unregistered vehicles. The lowest rate of unregistered vehicles was observed in the period from 6:30pm to 7:00pm; however there were only a total of 81 unregistered vehicles observed (valid observations) during these times.

The unregistered rate across the days of the week was separated into day and afternoon/evening time periods. This allowed direct comparisons with previous survey results to be made. Consistent with the 2005 survey, a higher rate of unregistered vehicles were observed on Saturdays before 3pm. However, in contrast with the 2005 survey this was not the time period in which the highest unregistered rate was recorded. The present study found this occurred on Tuesdays after 3pm (4.18%).

Comparison with the previous surveys shows that, in contrast to the 2000 and 2005 surveys, the unregistered rate was found to be lower after 6pm. The difference between the unregistered rate before and after 6pm was found to be not statistically significant.

3.5 Sanction/ Infringement History Analyses

It is important to note that it was not possible to verify the individual who had driven and parked the vehicle at the time of observation, given the method of data collection employed. This study examined the registration status of the vehicle and the offence history of the currently registered, or in the case of unregistered vehicles, the last registered owner. No findings of note were obtained in relation to unregistered driving and vehicle make or model.

An analysis was undertaken examining the number of registered owners who had at least one recorded sanction or infringement in the period from April 2005 to May 2010. Over 10% (11.1%) of the sample had experienced some sort of sanction on their driver licence during this period. The most common sanction experienced was a State Penalties Enforcement Register (SPER)⁴ suspension (4.7%) followed by a Good Driving Behaviour (GDB) option (4.3%). More than half of the sample had committed an infringement in the period, with speeding being the most common (55.8%). Analysis of licence sanctions in place *at the time* of the observational survey, found that approximately 2% of all individuals had a current sanction on their licence with the most common being a Good Driving Behaviour licence. Almost 1% of the individuals were on a licence sanction and were therefore effectively *unlicensed* at the time of the observational study (Disqualified, SPER, Demerit Suspension, Immediate Licence Suspension, or High Speed Licence Suspension).

3.6 Comparison of driver sanction histories

Comparisons of driver licence sanctions recorded against the registered owner (or last registered owner) of the vehicles were conducted, on the basis of registration status at the time of the observational survey. This analysis showed that unregistered vehicle owners

³ While this paper does not seek to explain why higher rates of unregistered vehicles were observed on a Tuesday, it is noted that two public holidays occurred during the survey period, both falling on a Monday. It is possible that vehicle usage at some locations (such as shopping centres) is greater on days following a public holiday.

⁴ The State Penalties Enforcement Register allows for the suspension of a driver's licence for unpaid fines. These can be vehicle related (e.g., parking etc) or non-vehicle related (e.g., dog registration).

were more likely to have experienced a sanction on their driver licence (30.7%) in the period from April 2005 to May 2010 in comparison to registered vehicle owners (10.6%), and this difference was statistically significant. This pattern was found to be similar for all the types of driver licence sanctions (see Table 2). However, it was not possible to test whether the difference was statistically significant for the high speed and immediate suspension types or for the hardship licence, as the small numbers of individuals with these types of sanctions resulted in violation of the chi-square test assumptions.

Table 2: Comparison of sanction and infringement history (April 2005-May2010) between individuals with unregistered vehicles and registered vehicles (N = 48,060)

	Unregistered (%) <i>n</i> = 1,097		Registered (%) <i>n</i> = 46,963		Significance
	Yes	No	Yes	No	
Any Sanction	30.7	69.3	10.6	89.4	$\chi^2 = 441.69, p < .001, \Phi = .10$
Disqualified	8.9	91.1	2.4	97.6	$\chi^2 = 184.23, p < .001, \Phi = .06$
Demerit Suspension	8.3	91.7	2.7	97.3	$\chi^2 = 122.50, p < .001, \Phi = .05$
SPER	20.0	80.0	4.4	95.6	$\chi^2 = 577.02, p < .001, \Phi = .11$
High Speed	0.5	99.5	0.3	99.7	*
Immediate	1.3	98.7	0.2	99.8	*
Late night	2.6	97.4	1.4	98.6	$\chi^2 = 12.87, p < .001, \Phi = .02$
Work Licence	1.3	98.7	0.5	99.5	$\chi^2 = 10.55, p = .001, \Phi = .02$
Hardship	0.5	99.6	0.2	99.8	*
GDB	8.9	91.1	4.2	95.8	$\chi^2 = 57.82, p = .001, \Phi = .04$
Any Infringement	59.9	40.1	55.8	50.4	$\chi^2 = 7.45, p = .006, \Phi = .01$
Unlicensed	6.7	93.3	1.6	98.4	$\chi^2 = 163.91, p < .001, \Phi = .06$
Unregistered	12.3	87.7	3.8	96.5	$\chi^2 = 198.19, p < .001, \Phi = .06$
Drink Driving	7.7	92.3	2.2	7.8	$\chi^2 = 144.91, p < .001, \Phi = .06$
Speeding	50.1	49.9	52.0	48.0	$\chi^2 = 1.92, p = .166 (ns)$
Seatbelt/Helmet	6.0	94.0	2.0	98.0	$\chi^2 = 82.12, p < .001, \Phi = .04$
Mobil Phone	5.7	94.3	3.3	96.7	$\chi^2 = 19.86, p < .001, \Phi = .02$
Other Infringement	25.0	75.0	15.4	84.6	$\chi^2 = 75.07, p < .001, \Phi = .04$

* Some chi-square tests were not able to be calculated due to too many cells (> 20%) having expected counts less than 5.

Unregistered vehicle owners were more likely to have committed a traffic infringement (59.9%) in the period from April 2005 to May 2010 compared to registered vehicle owners (55.8%). While this difference was statistically significant, this result should be treated with caution as the effect size was very small. Unregistered vehicle owners were also more likely than registered vehicle owners to have committed unlicensed, unregistered, drink driving, seatbelt/helmet, mobile phone and other driving offences. For speeding infringements there was no statistically significant difference between the unregistered vehicle owners and registered vehicle owners. It is interesting to note that 12% of the unregistered vehicle owners had an infringement on their driver licence for an unregistered driving offence during the period from April 2005 to May 2010. Proportionately this was four times as many as the registered vehicle owners (12.3% vs. 3.8%). A similar result was found in relation to unlicensed driving infringements (6.7% vs. 1.6%).

Comparisons were made of driver licence sanctions that were in place *at the time of the observational survey*. Again, this was conducted on the basis of registration status at the time of the observational survey and utilising records relating to the registered owner (or last registered owner) of the vehicles. Unregistered vehicle owners were more likely to be unlicensed at the time of the observational survey (6.3%) compared to registered vehicle owners (0.8%), and this difference was statistically significant. It should be noted, however, that the vast majority (93.7%) of unregistered vehicle owners were validly licensed at the time of the observational survey.

Unregistered vehicle owners were more likely to have a sanction of any type on their driver licence (8.7% vs. 2.0%), and this difference was also statistically significant. They were also more likely to have a current a SPER suspension (4.7% vs. 0.4%), a Late Night Restriction (1.1% vs. 0.6%), or a Good Driving Behaviour option (2.4% vs. 0.9%) on their driver licence at the time of the observational survey, and all these differences were statistically significant.

At the time of the observational survey, none of the unregistered vehicle owners had a current high speed suspension, immediate suspension⁵, a work licence or a hardship sanction on their driver licence.

4. Discussion

The unregistered rate increased significantly from the 2005 (1.81%) to the 2010 (2.88%) surveys, however the 2010 unregistered rate is still below those found during the 2003 (5.19%) and the 2000 (4.05%) surveys. The prevalence of unregistered vehicles was found to be similar across the four TMR regions. This is consistent with findings from the most recent survey, conducted in 2005, but not the 2000 and 2003 studies. During the 10-year period in which the observational survey has been undertaken, the unregistered vehicle rate has fluctuated from a high of 5.19% in 2003 to a low of 1.81% in 2005.

A comparison of the current findings with the 2005 survey, shows unregistered rates for all observational periods have increased across all regions. The TMR region in which the highest unregistered rate was recorded also changed for each survey during the 10-year period, as have the days and times in which the highest numbers of unregistered vehicles were observed. One constant over the entire survey period is that the majority of unregistered vehicles observed have been unregistered for a period greater than two years.

Individuals whose vehicle was unregistered during the observational survey were significantly more likely to have had a sanction recorded against their driver licence in the preceding five-year period (30.7% vs. 10.6%). This pattern was found to be similar, and

⁵ Immediate licence suspensions prevent drivers charged with high-risk drink driving offences, particularly alcohol related offences, from continuing to drive until any case is decided in a Magistrate's Court.

statistically significant for licence disqualifications, demerit point and SPER suspensions, good driving behaviour, work licence and late night driving restrictions.

Unregistered vehicle owners were more likely to have a sanction of any type on their driver licence *at the time of the observational survey* (8.7% vs. 2.0%), and this difference was statistically significant. Unregistered vehicle owners were also more likely to be unlicensed at the time of the observational survey (6.3%) compared to registered vehicle owners (0.8%), with this difference also statistically significant. These findings compliment a recent study of the infringement history of drivers in Queensland who had lost their licence between 1st January 2003 and 31st December 2008, which found that 22.6% had also committed an unregistered vehicle offence in this period (Watson, Livingstone, Armstrong, Watson and Barraclough, 2011). In this study approximately 40% of identified unregistered driving offences were committed during a period of sanction or licence loss. Findings are also consistent with other research undertaken in Australia which has demonstrated that a positive association exists between unlicensed driving and the driving of unregistered vehicles (Watson, Armstrong, & Wilson, 2011).

A comparison of different infringement types revealed unregistered vehicle owners to be more likely than registered vehicle owners to have committed any type of infringement, with the exception of speeding infringements. This was the case for both the period April 2005 to May 2010 and at the time of the observational study. The comparison of speeding infringement histories found no statistically significant difference between unregistered vehicle owners and registered vehicle owners. These findings above are also consistent with previous research (Harrison, 1997; FORS, 1997; Griffin & DelaZerda, 2000) and tend to confirm a link between unlicensed driving and risk-taking behaviour and recreational road use. This is also supported by Queensland crash data which found unlicensed drivers to be more likely than licensed drivers to be considered at fault by the police for the crashes in which they are involved (Watson 2004; Watson, Armstrong, Watson, et al., 2011). The finding that unregistered vehicle usage increases on weekends is in line with studies that show unlicensed driving to be associated with recreational behaviours (Elliott, Ginsburg & Winston, 2008; Heck, Sousa, Hanna & Nathaniel, 2008).

5. Study Limitations

This study observed vehicles parked in locations that were considered destinations (e.g. shopping centres, hospitals, airports and park-and-ride facilities) rather than vehicles parked in residential areas. An underlying assumption for sampling these types of locations is that it provides a higher probability that the vehicles captured in the survey are being driven on a regular basis. However, the survey observations are of vehicles which are parked and it is possible that some vehicles have been abandoned at these locations and are not actually being utilised on the Queensland road network.

As mentioned previously, it was not possible during the observational phase to verify the individual who had driven and parked the vehicle at the time of observation. Therefore, the comparison of the sanction and infringement histories compared the status of the observed vehicle with the offence history of the currently registered, or in the case of unregistered vehicles, the last registered owner of the vehicle.

A further limitation of the current study is the proportionately large number of observed vehicle number plates (2.11% of vehicle number plates presented for matching) which could not be matched against the TRAILS database. There is concern that this may result in the stated unregistered rate (2.88%) being grossly underestimated. The proportion of vehicle number plates which could not be matched against the TRAILS database has not been reported in previous surveys (2000, 2003 & 2005), so it is also unknown whether this figure has changed over time.

During the 2010 survey, the details of motorcycles, scooters and mopeds parked in the observation locations were also recorded. No attempt was made during the current survey to

observe areas set aside specifically for the parking of these vehicles. The numbers of motorcycles, scooters and mopeds recorded during the current survey (0.19% of the total number of vehicles observed) was not representative of the number of this vehicle type registered in Queensland (4.83% of all registered vehicles). Accordingly, it was not possible to provide any meaningful analysis in relation to these vehicles.

While many of the differences found between the driving records of unregistered and registered vehicle owners were statistically significant, it is important to note that the effect sizes for most of the chi-square analyses were very small ($\Phi < .10$). The statistical significance of the chi-square tests may have been influenced by large sample size ($N = 48,060$). Therefore care must be taken in the interpretation of some findings. It would also be advisable to consider the actual differences in the proportions of unregistered and registered vehicle owners for each of the types of sanctions and infringements.

6. Conclusion and recommendations

The results from the comparison of the infringement and sanction histories of the owners of the observed vehicles show that generally unregistered vehicle owners are more likely to have committed driving offences and were more than three times more likely to have had a sanction applied to their driver licence compared to the owners of registered vehicles. Unregistered vehicle owners were also more likely to be unlicensed at the time of the observational survey, and to have previously committed unlicensed and unregistered driving offences. It is also of interest to note that during the 10-year period in which the observational survey has been undertaken, the majority of unregistered vehicles observed have been unregistered for a period greater than two years.

One technique which offers significant potential to improve the methodology of an unregistered vehicle survey would be the use of Automated Number Plate Recognition technology (ANPR). Automated methods not only allow for the possibility to reduce costs, but also allow for the sampling of vehicles in a moving stream of traffic. This offers a potentially superior estimation of the numbers of unregistered vehicles which are currently being utilised on the road network, as it confirms that unregistered vehicles that are observed at destinations are being utilised. Other advantages of using ANPR to sample vehicles is that observations can be undertaken after daylight hours when the risks for the data collection staff are considered high, and it removes the need to enter onto private property (e.g. shopping centre car parks) to conduct the vehicle observations.

Notwithstanding the limitations mentioned previously, the current survey method is considered by the authors to be one of the more robust and reliable methods for determining the number of unregistered vehicles currently being utilised on the road network. Surveying vehicles parked at destinations such as shopping centres and transport hubs offers a reliable way of capturing the proportion of the unregistered vehicle fleet that are being utilised. Furthermore, one benefit of this approach is the potential to identify vehicles and drivers who adjust their driving behaviours to avoid detection, such as avoiding roads and times where police enforcement activities occur. The method by which unregistered vehicles were identified in this study could be incorporated into future police activities to address unregistered vehicle usage, possibly in combination with approaches which utilise ANPR technologies. Findings based on registered owners of vehicles may also provide useful insights into the links between the driving of unregistered vehicles and a range of dangerous driving behaviours, including unlicensed driving. This knowledge can in turn inform other research and the development of programs aimed at improving safety for all road users.

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