# Mobile Phone use while Driving after a New Law: Observational study

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## Abstract

**Aims:** To identify the prevalence of mobile phone while driving after the introduction of the New Zealand legislation (in 2009), and to study the socio-demographic characteristics of mobile phone users.

**Method:** We devised and tested an observation method. This was used to examine the use of mobile phones by drivers in cars at or near traffic lights and away from traffic lights at three locations in Wellington (of contrasting area deprivation). In addition, we performed key informant interviews to provide a background context.

**Results**: A total of 9520 cars "away from traffic lights" and 8335 at "traffic lights" were observed. 1.34% of drivers were observed using mobile phones away from traffic lights, and 1.87% at or near traffic lights. These levels were lower than a pre-law study in Auckland (at 3.9%). Under 25's were significantly more likely to use their mobile phones compared to over 25's. There were some significant differences between prevalence of mobile phone use in the two suburban sites, and also with the Central Business District.

**Conclusion:** Mobile phone use by drivers appears to have declined after the new law, though other explanations for the differences in the pre- and post-law studies are possible. Nevertheless, mobile phone use amongst drivers remains common in New Zealand and to further reduce this hazard, the Government may need to consider such options as: additional mass media campaigns around the hazard, enhanced enforcement, and increased level of fines.

## Introduction

The negative impact of mobile phone use on driver performance has been widely acknowledged and investigated. Drivers using mobile phones have slower reaction times, impaired lane-keeping, decreased visual field awareness (1), and a reduced ability to identify hazards (2). Given public and professional concern around this hazard, the New Zealand Government acted (in November 2009) to prohibit the use of hand-held mobile phone devices while driving. In New Zealand, between 2003 and 2008 the use of mobile phones is estimated to have contributed to 25 fatal crashes and 482 injuries (3). In 2010, data from the Ministry of Transport showed 249 fatal or injury causing car crashes per 100,000 people. This figure continues to decrease since 2007 (4).

It is difficult to identify whether driver inattention has been the cause of a car crash. The Ministry of Transport reported that in 2010, diverted attention contributed to 1,396 crashes, of which 31 were fatal (5). Mobile phone use is just one form of 'driver inattention'.

Since the introduction of the legislation in New Zealand, no studies have investigated mobile phone use by drivers. Prior to the ban, an observational study was conducted in Auckland and showed that 3.9% of drivers were using mobile phones while driving past a fixed point (6). A 2011 survey reported that 60.4 % of respondents admitted to conversing on their mobile phone while driving on a weekly basis (7).

Multiple studies have identified that hands-free mobile phone devices have a similar impact on driver performance compared to hand-held mobile devices (8–11). Studies have suggested that the cognitive demands of conversation cause impairment in driving performance. A recent Waikato University simulator-based study (12), found that conversations are not the inherent cause of impairment. Those who were conversing via mobile phone failed to take any action to reduce their speed as they approached hazards, resulting in the highest crash rates. In comparison, those drivers talking with in-car passengers performed nearly as well as the no-conversation group.

Studies report that young and middle-aged drivers are more likely to use their mobile phones while driving than older drivers (13,14). Associations with gender are inconsistent, with some studies reporting higher use amongst males (13,14), while others reported no difference (6,13,15–17). New Zealand statistics on crashes show that those aged between 15-24 years have the highest reported injury and death (6,18,19). Male drivers are also killed or injured more than females (18,19). Crashes caused by diverted attention in New Zealand are shown to peak in rush hour traffic (6). Correlations between mobile phone use and time of day are inconsistent amongst studies (14,17–19).

Currently there is no research that looks at associations between socioeconomic divisions and mobile phone use whilst driving. There is evidence that occupation status has an inverse association with driver injury and fatality (18,19) and that Māori are over-represented in fatal crashes in New Zealand (19,20).

A 2004 New Zealand study showed that 84 % of participants rated mobile phone use whilst driving as 'moderately dangerous', 'very dangerous', or 'extremely dangerous' (14). This is consistent with American and Australian data (21,22). The potential risk of being fined by police was shown not to be a deterrent to the behaviour in these American and Australian studies (21,22).

Given this background, this study aimed to identify the prevalence of mobile phone use after the introduction of the 2009 legislation. We also aimed to explore associations between mobile phone use by drivers and various demographic variables (gender, age-group, and locality), but also variation by setting (i.e., away from traffic lights vs at traffic lights).

## Methods

### Quantitative Data

We observed the use of mobile phones by drivers in cars 'at traffic lights' and 'away from traffic lights' as they passed through a defined area at traffic intersections within three locations. The overall speed 'at traffic lights' was expected to be slower as it included both moving and stationary vehicles. The locations were Wellington central city, Karori, and Titahi Bay – all within the Greater Wellington Region.

### Procedure

For the purpose of this study, the definition of mobile phone use was a visible mobile phone in the driver's hand. This was subdivided into mobile phone held to the ear and mobile phone held elsewhere. This definition was adopted in order to exclude the use of 'hands free' mobile phone kits as per New Zealand law **(Figure 1).** (23) To ensure the visibility of drivers' hands, the observations were limited to cars; specifically sedans, coupe, hatchbacks, and station wagons. The study excluded vans, utility vehicles, SUVs, buses, trucks, and all two-wheeled vehicles. Where data collectors were uncertain about the use of a mobile phone it was not recorded.

A pilot run was performed at several locations before the final sites were chosen and training was conducted. This ensured that the selected locations would work logistically. The pilot allowed potential sources of error or bias to be identified and eliminated or minimised prior to data collection. Problems encountered in the pilot included: a local private school in a more deprived area probably influencing the demographic characteristics of the drivers, inadequate flow of traffic, difficulty visualising mobile phone use in larger vehicles, inappropriate position of the intersection, and defining an observation area on a map.

### Location and timing

The Greater Wellington Region was considered for convenience reasons (where the investigators lived). The suburbs of Karori and Titahi Bay were chosen to represent opposing NZDep areas, NZDep1 (least deprived) and NZDep 9 (most deprived) respectively (24). The Wellington Central Business District (CBD) was chosen to facilitate comparisons with the study conducted by Townsend in Auckland (6). Locations were selected to provide a good flow of traffic volumes in and out of the suburb, observer safety and good visibility of mobile

phone use within vehicles. Data were collected at "rush hours" between 0730-0930h and 1630-1830h, so as to observe commuter traffic heading out of and into the suburbs respectively and to maximise efficiency of data collection. The observations were conducted on two separate occasions in the morning and evening at each location. All observations were performed on five weekdays over a seven day period in September 2012 (early spring with no rain at any of the observation times). An assumption was made that cars entering or exiting the suburbs of Karori and Titahi Bay were generally likely to represent the population demographic of that particular area.

Two teams comprising of two observers per team were employed at each location. One observer recorded the total number of eligible cars passing, and the other observer recorded mobile phone use and driver characteristics. At each location one team observed all eligible cars passing through a set of traffic lights within a defined area **(figures 2, 4, 6, 8, 10, 12)**. A second team observed cars approximately 100m before or after the traffic lights **(figures 3, 5, 7, 9, 11, 13**).

A standard template was used for recording data on mobile phone use by drivers **(Appendix Table 1)**. Variables recorded were: gender, approximate age-group and if the phone was by the driver's ear or not. Age-groups were estimated using the following three categories, <25, 25-65, and 65+ (as these age-groups are those used in official road usage data in New Zealand).

Data collectors attended a training session where a definition of the vehicles inclusion and exclusion criteria was explained. Images of various vehicles were used to illustrate this principle. Collectors were instructed that they must observe a mobile phone in the driver's hand to be included as a positive finding. Where uncertainty existed collectors were instructed not to record the findings. Data collectors were also trained how to use the template and mechanical counters, and were instructed to behave in a manner so as not to draw unnecessary attention to themselves. Teams undertook a practice session to ensure that any questions could be answered prior to data collection. Kits were provided to all teams and comprised: a recording sheet, a map of the area to be observed with locations shaded, a mechanical click counter, and images of eligible types of vehicles.

In order to validate the observations, an inter-observer variation study was carried out at the Central Business District (CBD) location during both morning and evening times, at both the traffic lights and 100m positions. This involved another team of two people collecting exactly the same data alongside each other, but independently of the original team.

Ethical approval for this study was obtained through the University of Otago ethics approval process (Category B).

**Qualitative Data**

A qualitative approach was used to provide a background context. The interviews were semi-structured and the questions asked arose from the findings from the literature review.

Ten people were identified as having experience in the issue of mobile phone use and driving, from a variety of organisations. The interviewees included politicians, doctors, NZ Police Force, Ministry of Transport, activists and academics. Emails with a brief description of the project were sent inviting them to contribute to our study. Those that agreed were then sent the list of questions and a consent form (**Appendix Form 1 and 2**).

Four interviews were conducted, two in person and two by video conference. No specific respondents were identified.

## Results

A total of 9520 cars "away from traffic lights" and 8335 at "traffic lights" were observed. 1.34% of drivers were observed using mobile phones away from traffic lights, and 1.87% at or near traffic lights. Demographic data is shown in Table 1, including the differences between use of mobile phones away from traffic lights, compared to at the traffic lights.

**Table 1: Demographics of mobile phone users by drivers at traffic lights and while moving (away from traffic lights)**

| **Population of drivers (using mobile phones)*** | **Away from traffic lights (n=9520 cars)** | | | **At traffic lights[i] (n=8335 cars)** | | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **Risk ratio (RR) (95% CI)** | **N** | **%** | **RR (95% CI)** |
| **All drivers** | 128 | 1.34 (95%CI: 1.13-1.59) | | 156 | 1.87 (95%CI: 1.60-2.18) | |
| **<25 year olds**[ii] *n=1247 in MT; n=1092 at TL* | 39 | 3.13 | 2.85 (1.96-4.13), p=<0.0001) | 54 | 4.95 | 3.40 (2.45-4.69), p=<0.0001) |
| **25+ years** *n=8273 in MT; n=7243 at TL* | 89 | 1.08 | 1.0 (reference) | 102 | 1.41 | 1.0 (reference) |
| **Females**[iii] *N=4065 in MT; N=3559 at TL* | 55 | 1.35 | 1.01 (0.71-1.43), p=0.473 | 73 | 2.05 | 1.18 (0.86-1.61), p= 0.152 |
| **Males** *N=5455 in MT; N=4776 at TL* | 73 | 1.34 | 1.0 (reference) | 83 | 1.74 | 1.0 (reference) |
| Phone held elsewhere[iv] | 95 | 1.0 | 2.88 (1.94.27) p<0.0001 | 126 | | 4.2 (2.82-6.25), p<0.0001 |
| Phone "at ear" | 33 | 0.35 | 1.0 (reference) | 30 | 0.36 | 1.0 (reference) |

* MT – moving traffic; TL – traffic lights

i. Includes moving and stationary traffic

ii. Denominator data for analysis is based on the road user survey(25) which showed the proportion of <25 drivers to be 13.1 %, and 25+ to be 86.9 %. Percentages indicate the % of drivers under 25 who were using their phones

iii. Denominator data: proportion of female drivers= 42.7 %, males 57.3 % (25)
iv. Elsewhere: e.g., texting, dialling, phone at wheel. Excludes hands-free phones.

As there were only three cases of mobile phone use in drivers over 65-years-old, this group were combined into the 25-65-year-old group to make a single "25+ group" There was a statistical difference with under 25's being 2.85 times more likely to be using their phones at the "away from traffic lights" location and 3.40 times at the traffic lights, compared to over 25's. Under 25's were 1.16 (95 % CI 1.01-1.34, p= 0.031) times as likely to use their phone in the "non-ear position" at the traffic lights compared to over 25's (Table 2).

Table 2: **Comparison of how mobile phones are used by drivers**

| **Age-group and mobile phone use** | **Away from traffic lights** | | | **At traffic lights** | | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **RR (95%CI)** | **N** | **%** | **RR (95%CI)** |
| <25 years, use at ear | 8 | 24.2 | 0.73 (0.36-1.47), p=0.186 | 6 | 20 | 0.47 (0.21-1.09), p=0.031 |
| +25 years, use at ear | 25 | 75.8 | 1.0 (reference) | 24 | 80 | 1.0 (reference) |
| <25 years, use elsewhere | 31 | 32.6 | 0.87 (0.63-1.21), p=0.201 | 48 | 38.1 | 1.16 (1.01-1.34), p=0.031 |
| +25 years, use elsewhere | 64 | 67.4 | 1.0 (reference) | 78 | 61.9 | 1.0 (reference) |

There were numerically fewer females than males using mobile phones while driving, although this was not statistically significant (Appendix Table 1). How mobile phones were used (at ear or elsewhere) by gender was also not statistically significant. (Appendix Table 2)

Analysis done on drivers shows the 'under 25' group used their phones more than those in the 'over 25' group, for both away from traffic lights and at lights (Table 3).

**Table 3: Mobile phone use by drivers by age-group and gender**

| **Demographic group** | **Away from traffic lights** | | | **At traffic lights (moving/stopped)** | | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **RR (95% CI)** | **N** | **%** | **RR (95% CI)** |
| <25 years males | 16 | 21.9 | 1.84 (1.07-3.20), p=0.014) | 29 | 34.9 | 3.56 (2.29-5.55), p=<0.0001 |
| 25+ years males | 57 | 78.1 | 1.0 (reference) | 54 | 65.1 | 1.0 (reference) |
| **Total** | 73 | 100.0 | | 83 | 100.0 | |
| <25 years females | 23 | 41.8 | 4.83 (2.85-8.19), p=<0.0001 | 25 | 34.2 | 3.45 (2.15-5.55), p=<0.0001 |
| 25+ years females | 32 | 58.2 | 1.0 (reference) | 48 | 65.8 | 1.0 (reference) |
| **Total** | 55 | 100.0 | | 73 | 100.0 | |
| <25 years females | 23 | 59.0 | 1.91 (1.12-3.25), p=0.009 | 25 | 46.3 | 0.98 (0.64-1.51), p=0.465 |
| <25 years males | 16 | 41.0 | 1.0 (reference) | 29 | 53.7 | 1.0 (reference) |
| **Total** | 39 | 100.0 | | 54 | 100.0 | |

We then compared the suburbs (Table 4), which showed that Titahi Bay had a higher level of mobile phone users away from traffic lights compared to Karori (RR=1.71, 95%CI: 1.047-2.778, p=0.015). However at traffic lights, we observed the opposite pattern with higher levels of mobile phone use by drivers in Karori. When looking at the use of mobile phones in the CBD compared to the other suburbs, there was no statistically significant difference.

**Table 4: Mobile phone use by drivers at different locations, comparing at traffic lights and away from traffic lights**

| Location | Away from traffic lights | | | At traffic lights | | |
|---|---|---|---|---|---|---|
| | N | % | RR (95%CI) | N | % | RR (95%CI) |
| Titahi Bay (more deprived suburb) (n=3470 in MT; n=3744 at TL) | 66 | 1.90 | 1.71 (1.05-2.78), p= 0.015 | 46 | 1.22 | 0.59 (0.38-0.91), p= 0.008 |
| Karori (least deprived suburb) (n=1883 in MT; n=1678 at TL) | 21 | 1.12 | 1.0 (reference) | 35 | 2.09 | 1.0 (reference) |
| Central Business District (n=3893 in MT; n=3187 at TL) | 61 | 1.57 | 0.96 (0.70-1.33), p=0.413 | 55 | 1.73 | 1.12 (0.82-1.62), p=0.203 |
| Suburbs combined (Titahi Bay, Karori) | 87 | 3.02 | 1.0 (reference) | 81 | 3.31 | 1.0 (reference) |

Data was also divided into ‘morning’ and ‘evening’ sessions during rush hour. There were no statistically significant findings comparing these times (Appendix Table 3).

## Method Quality

The inter-observer agreement on identifying drivers using mobile phones had a high Cohen’s kappa score of 0.96 away from traffic lights, and 1.0 at traffic lights (Table 5). There was perfect agreement between observers regarding the gender of drivers using a mobile phone at both lights and away from traffic lights. There was a kappa score of 0.88 between observers regarding the mobile phone position away from traffic lights. Agreement was perfect at the traffic lights. There was a kappa score of 0.65 regarding the age of drivers using mobile phones away from traffic lights, and 0.91 at traffic lights. Where there were disagreements, the data that were used was based on the primary observer’s tally, and not the secondary observer’s tally.

**Table 5: Inter-observer agreement for key variables in the observational data**

| Key variable considered | Cohen's kappa (95%CI) | |
|---|---|---|
| | Away from traffic lights [n=3870 cars observed] | At traffic lights [n=3116 cars observed] |
| Reporting mobile phone use by drivers | 0.96 (0.91-1.0) | 1.0 |
| Age (<25 vs +25) of drivers using mobile phones | 0.65 (0.35-0.95) | 0.91 (0.75-1.0) |
| Gender of drivers using mobile phones | 1.0 | 1.0 |
| 'At ear' use of phones | 0.88 (0.66-1.0) | 1.0 |

## Results from qualitative data

Several themes were identified, importantly that the law change of November 2009 was necessary. Most interviewees agreed that tightening of the law to include hands-free telephone devices would be justified in terms of risk prevention. They also identified problems with it including: hands-free devices are more likely to be used by older more experienced drivers, social and economic costs may outweigh justification for the law to include hands-free devices.(27)

Interviewees identified the need to strengthen current legislation and enforcement. One criticised the use of fines, "fines are like sticking your hand into the fire and getting burnt months later" as fines are not required to be paid immediately. This results in little association between the behaviour and punishment. They viewed texting as the most dangerous form of mobile phone use while driving and believed it should be targeted first. An interviewee thought that underlying all of this behaviour is a social construct, "That we have to be in touch 24/7… change the construct you can change the behaviour."

The qualitative results are described in detail in the Appendix.

## Discussion

The aims of our study were:

1) To estimate the prevalence of mobile phone use while driving after the 2009 New Zealand law change

2) To identify associations between mobile phone use by drivers, demographic variables (gender and age-group) and variations by traffic speed.

3) Investigate any differences in mobile phone use between drivers in the CBD, a relatively less deprived area (low decile area) and a deprived (high decile) area.

*Prevalence of mobile phone use*

There have been no other studies observing mobile phone use amongst New Zealand drivers after the 2009 New Zealand law change. Our results suggest that mobile phone use by drivers appears to have decreased compared to the Auckland study by Townsend (6). The Townsend study prior to the law change demonstrated a prevalence of 3.9% while our study found a prevalence of 1.57% in the Wellington CBD. The difference in prevalence could be attributed to the 2009 New Zealand law change. However, variation in mobile phone use between cities (Auckland and Wellington) could have also contributed to this difference, as could methodological variables, such as differences in the sites observed, time of day, and in definitions of the types of vehicles observed. With the emergence of touch-screen mobile phones and applications tasks requiring more concentration and dexterity, it is also possible that this extra difficulty may deter drivers from using their mobile phones while driving.

Our results are concordant with an American study conducted after the introduction of similar law changes. The American study showed that seven years after the law was introduced, phone use in New York was 24% lower than expected numbers (26).

*Use of mobile phones at traffic lights and away from traffic lights*

Our study showed that drivers were more likely to use their mobile phone at or near traffic lights compared to away from traffic lights (1.87 % vs. 1.34 % respectively). No previous studies have studied this difference. We suspect that this association could be due to a perception of decreased risk from mobile phone use while stationary. The difficulty of identifying phone use at speed could also contribute to this apparent association, however the good inter-rater reliability results would count against this.

*Demographics*

This study found that under 25 years old were more likely to use a mobile phone compared to drivers over 25 years old. This result was consistent both at or near lights and away from traffic lights. Yet another New Zealand study showed that there was no difference between drivers aged 15-25 and 26-59 years old (14), and this has been replicated in international studies (13,15–17).

We found that there was no statistically significant difference between males and females in mobile phone usage while driving. In addition, there was no statistical difference found between the genders on how mobile phones were used (i.e. at ear or use elsewhere). This result is consistent with previous New Zealand and international research (6,13,15,17).

*Mobile phone use in Low/High decile areas and CBD*

There were no overall differences in mobile phone use while driving in the two suburbs. Nevertheless, significantly more drivers in Titahi Bay (the more deprived suburb) were using a mobile phone away from traffic lights compared to drivers in Karori (the least deprived suburb). Secondly, significantly more drivers in Karori were using a mobile phone at traffic lights compared to drivers in Titahi Bay. The first finding could have been due to different road types; the road in Titahi Bay was straight compared to the winding road in Karori. This may had made it easier to use a mobile phone while driving. The second result may have been due to the traffic often being backed up around the traffic lights in Karori. The slower speed of cars may have contributed to drivers perceiving it to be safer to use mobile phones. Furthermore, it is plausible that attitudes to safety differ by socioeconomic status, with drivers from Karori being more wary of using their mobile phone while driving at speed.

Drivers in the CBD at/near traffic lights were 2.1 times more likely to use their phones at the ear, compared to drivers at traffic lights in Karori and Titahi Bay. This could be due to the high proportion of businesses within the CBD increasing the prevalence of business-related phone calls

*Strengths, limitations and future recommendations*

The inter-observer agreement on identifying drivers using mobile phones had a kappa score of 0.96 away from traffic lights, and 1.0 at traffic lights (Table 5). This indicates that it was possible to collect reliable data even for cars that were viewed for only several seconds. It was more difficult for observers to consistently estimate driver age-group, as suggest with a low kappa score of 0.65 in the “away from traffic lights” location.

This study was the first to investigate socio-economic status and mobile phone use while driving. There are some limitations in using the NZDep map as an indicator of driver’s socio-economic status (24). While this was minimised by using main roads leading towards and out of the suburbs at commuter times, we cannot confirm that the traffic accurately reflects the population of the area. The locations chosen are comparable to other areas of New Zealand with similar deprivation status. It is possible that the physical differences between these sites could have contributed to our results, rather than the driver demographics.

It was important to assess moving versus stationary traffic as drivers using mobile phones while driving at speed pose a higher risk to themselves and other road users. Yet logistically it was difficult to assess purely stationary or purely moving vehicles, especially at the traffic light location. Hence the differences we report between these two locations may under-estimate true differences between continuously moving traffic and that which is *always stopped* at traffic lights.

There were several ways in which this study could have been improved if time and resources had permitted. The inclusion of large vehicles would provide a better overall estimate of mobile phone use. It has been reported that drivers in cars and four-wheel-drive vehicles were

three times more likely to use a mobile phone compared to other vehicles, such as taxis, buses and trucks (13). Based on the exclusion of vans, trucks and four-wheel drives, generalisation to the entire population of traffic may be limited, and this provides an opportunity for further studies.

*Implications*

Further changes need to be made to reduce mobile phone use in drivers in New Zealand. Various suggestions from NZ Transport Agency, Ministry of Transport and NZ Police include: (i) stronger enforcement of the current laws; (ii) increasing fines; or (iii) introducing an immediate penalty, such as the disabling or confiscating phones. Challenges to the enforcement of this law include poor visibility of mobile phones in cars and distinguishing this from other behaviours.

In New Zealand, television advertisements about the risks of distracted driving have been used. We suggest these be continued in order to maintain awareness of the risks. This can be targeted at both male and female drivers and those in the younger age-group in concordance with our findings.

The New Zealand Government could look at banning hands-free phone use in vehicles, which has been shown to hold similar risks as hand-held mobile phones. But with little public knowledge of this association, introduction of further bans may attract resistance from drivers.

## Conclusions

Mobile phone use amongst drivers is common on New Zealand roads. It is likely that the 2009 law has contributed to a reduction in the use of mobile phones while driving, although other factors may have contributed to the difference with the pre-law study. This study is the first to observe mobile phone use in drivers after the 2009 law, providing a benchmark for later studies. With continued education and improved law enforcement, New Zealand has the potential to further minimise prevalence of mobile phone use while driving.

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