# WHY DRIVERS CRASH CLOSE TO HOME

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## ABSTRACT

New Zealand drivers are relatively more likely to be involved in an injury crash on roads close to home compared to roads further away, even accounting for travel exposure. This research paper explores how the 'close to home effect' relates to fatal and serious injury crashes, and where they tend to happen on rural and urban roads. The work is important as a contribution to understanding road trauma and where it happens, so that countermeasures can be designed. However, this work is also an interesting example of combining 'safe system' quadrants, namely road user behaviour and infrastructure design. Crashing close to home is largely associated with relatively high crash risk on urban roads, which are close to home for most New Zealand drivers. The more that road safety practitioners can learn from analyses of crash patterns, the more likely it will be that investment is targeted to where it can save the most lives. The main recommendations from this paper are that (1) Road Controlling Authorities address risk on urban streets in terms of community and area-wide treatments; and (2) that investment in protected (kerb-separated) cycleways and slow or separated pedestrian crossings is likely to reduce fatal and serious road trauma involving everyday driving on familiar urban streets.

# INTRODUCTION

There is a 'close to home' effect in road crashes, because a higher proportion of crashes than travel happen on roads within 10km of home, for New Zealand drivers (Burdett, Starkey, & Charlton, 2016). Understanding why drivers crash close to home is of inherent interest to road safety practitioners because of the trauma and social cost associated with those crashes. The close to home effect is also of theoretical interest, in that we do not know whether the effect is solely related to exposure, or whether there are psychological mechanisms at play that make driving on familiar roads close to home 'different' from driving on less familiar places further away.

This paper builds on analyses previously published which showed that per kilometre travelled, more crashes than travel happen on roads close to home for New Zealand drivers (Burdett, Starkey, & Charlton, 2016). The main analysis, reproduced here as Figure 1 below, was based on analyses of 12 months of travel by drivers of cars, from New Zealand's Household Travel Survey (Ministry of Transport, 2016); and of reported injury crashes by drivers of cars in New Zealand, from the same 12-month period, extracted from the NZ Transport Agency's Crash Analysis System (CAS).

The crash data include all reported crashes involving a driver of a car or van, where the driver had a known and recorded home address. For crashes involving more than one driver, only the first driver (recorded as 'Driver 1') was included in this analysis. The curves in Figure 1 comprise the distances between the reported crash locations and each driver's home address. The travel data include every kilometre travelled and recorded in New Zealand's 2016 Household Travel Survey, by drivers of cars or vans. The distance between the driver's home and each kilometre travelled was calculated based on the distance from home of the trip origin and destination. For example, a trip that started 2.5km from home and ended 4.5km from home comprised one kilometre at 3km from home and one kilometre at 4km from home. The travel exposure data were combined to produce the travel curve in Figure 1.

The data in Figure 1 show that all injury crash severities are over-represented compared with travel on roads within the first 10km of home. The first aim of this paper is to explore how the close to home effect relates to fatal and serious injury crashes, given current focus in road safety policy on preventing the most serious trauma (Safer Journeys, 2018). Second, the location and mechanisms behind patterns in crashes will be explored, as a step towards understanding the relative contributions of exposure and behavioural effects associated with driving in familiar environments, to the close to home effect.

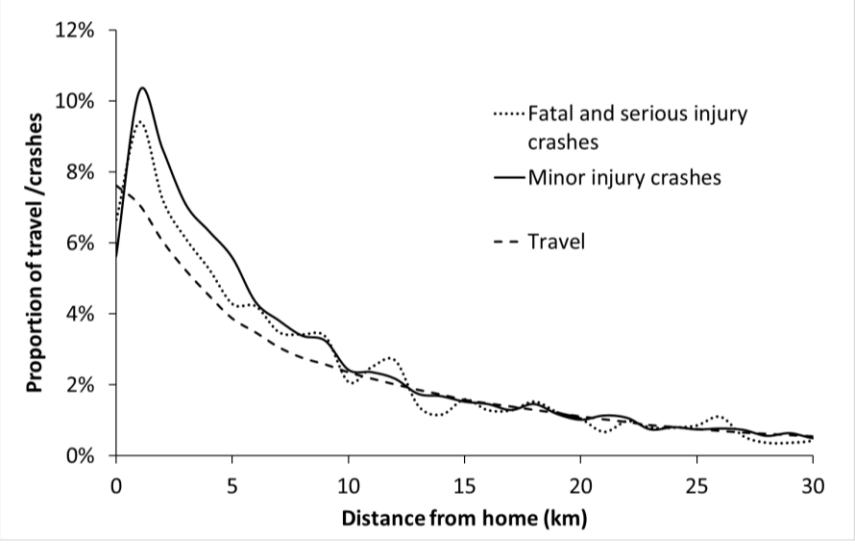


*Figure 1: Proportions of travel and crashes at increasing distance with crashes separated by severity of outcome (minor injury vs fatal or serious injury): from Burdett, Starkey, & Charlton, 2016*

# METHODS

To address the first aim, the frequencies of fatal and serious crashes, and minor crashes, at different distances from home are compared to overall travel distance from home. The crash distributions are then compared separately for crashes on urban and rural roads. Only crashes on roads with 50km/h and 100km/h posted speed limits are compared. That is, high speed (80km/h) urban arterial roads and 80km/h rural roads are excluded from this analysis. The distribution of minor crashes is included to explore whether they show a different pattern to fatal and serious crashes. Differences between distributions are tested with t-tests to determine whether the difference between mean distance from home is likely to be significant.

The second aim of this paper relates to the kinds of crashes that happen close to home, and whether their frequency at different distances from home can likely be explained by exposure to different kinds of environments. To address this aim, crashes on urban roads are split into tertiles (thirds, excluding the furthest 10% of crashes). The frequency of different kinds of errors, and crashes at different locations are then compared between tertiles. Crashes involving different modes or numbers of vehicles were not compared, because the data were based on crash distance from home for one driver (of a car or van) involved in the crash.

To analyse error, crashes with 'inappropriate speed' as a contributory factor are categorised as 'violations'. Crashes coded as 'failure to notice'; 'failure to give way'; 'attention diverted'; or 'did not see or look' were coded as a 'lapse'. Crashes with causal factors in both groups, or neither group, were excluded from analysis of crash patterns at different distances from home. Differences between the prevalence of each error type at different distances from home on urban roads only were not tested because there were <5 crashes in each group with 'violation' as a contributory factor.

To analyse crash location (intersection or midblock), crashes were separated according to whether they were reported at an intersection or not, using the intersection code from the crash reports. Although some crashes happen close to an intersection and may be related to intersection manoeuvres, the analysis was a comparison of patterns between 'distance from home' groups, and not crashes at intersections per-se, so the definition was considered sufficient for this exercise.

# RESULTS

### Fatal and Serious Crash Distance from Home on Urban and Rural Roads

The data in Figures 2 to 4 show that the 'close to home' effect in reported injury crashes by drivers of cars on New Zealand roads is related to crashes on urban roads. Compared with all travel, a higher proportion of crashes are reported on urban roads within 10km of home, compared with roads further away.

It appears from the data in Figures 2 and 3 that the Close to Home Effect can largely be explained by higher crash risk on urban (50km/h) roads in New Zealand. Based on all reported injury crashes and estimated total kilometres travelled, crash risk on 50km/h roads in New Zealand is 1.9 times higher than risk on 100km/h roads (F Tate 2018, personal communication, 9 October). Fatal and serious crash risk is also higher on urban roads.

The data in Figure 3 show the distance from home for all reported urban crashes, split by their severity. Minor injury crashes happen further from home (M = 13km) than fatal and serious injury crashes (M = 11km) but the difference is not significant ($t(444.3) = 1.15$, $p = 0.24$; $d = 0.09$). Also, the difference in distance from home for reported injury crashes by severity on rural roads (Figure 4) was not significant (Minor injury: M = 51.7; Fatal & Serious injury: M = 52.5; $t(409.4) = 0.22$, $p = 0.86$; $d = 0.01$).

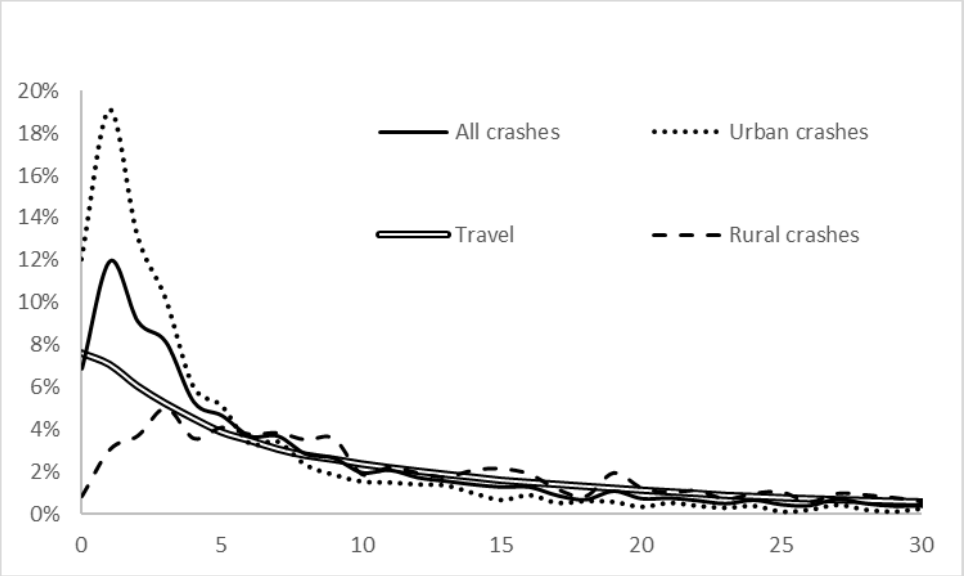


*Figure 2: Travel and crash distance from home, including crashes on urban (50km/h posted speed limit) and rural (100km/h posted speed limit) roads*

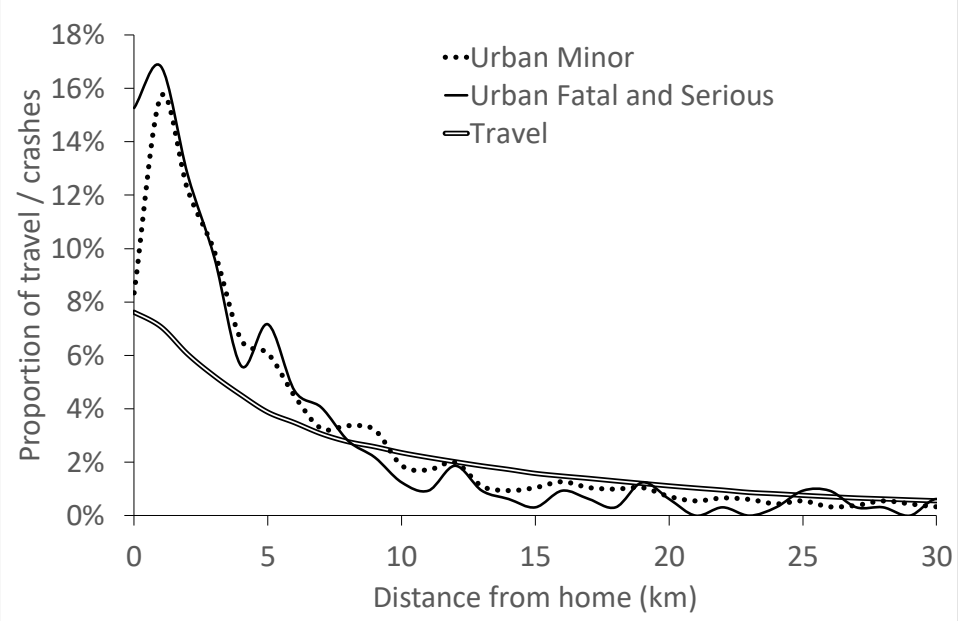


*Figure 3: Travel and crash distance from home, with crashes on urban roads (50km/h posted speed limit) split by crash severity*

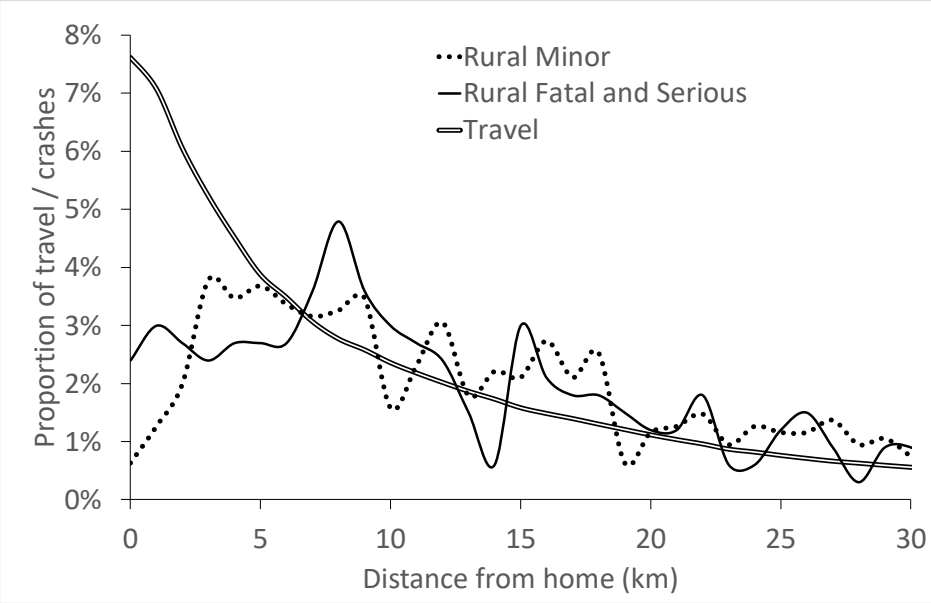


*Figure 4: Travel and crash distance from home, with crashes on rural roads (100km/h posted speed limit) split by crash severity*

*Table 1: Crash risk on urban and rural roads in New Zealand*

| **Posted speed limit** | **Reported crashes (per annum, based on 2013 – 2017 data)** | | | **Vehicle-kilometres per year** |
|---|---|---|---|---|
| | **Minor** | **Serious & Fatal** | **All injury** | |
| **50km/h** | 3997 | 903.2 | 4900.2 | 1.58E+10 |
| ***Crash rate per VKT*** | 2.53E-07 | 5.73E-08 | 3.11E-07 | |
| **100km/h** | 2334.2 | 941.2 | 3275.4 | 1.98E+10 |
| ***Crash rate per VKT*** | 1.18E-07 | 4.76E-08 | 1.66E-07 | |
| **Ratio of risk: 50km/h vs 100km/h** | 2.15 | 1.20 | 1.87 | |

## Patterns in Fatal and Serious Crashes on Urban and Rural Roads

To explore the close to home effect in more depth, crashes at different distances from home were compared, with different comparison groups for crashes on urban and rural roads. Three comparison groups (tertiles) are used in each case. The distance from home for each tertile is defined by 30th, 60th and 90th percentile distances from home for minor injury crashes on urban and rural roads, as listed in Table 2. The data in Table 2 show that 30% of reported fatal and serious injury crashes on urban roads happen within the first kilometre of the driver's home, and 90% of all fatal and serious injury crashes on urban roads happen within 19km of home. Reported minor injury crashes on urban roads happen slightly further from home. The tertiles for injury crashes on rural roads cover longer distances.

*Table 2: Distance from home groups (tertiles) for reported injury crashes on urban and rural roads*

| Fatal and Serious Injury Crashes: Road type | "Distance from home" groups (number of crashes in brackets) | | | Total number of crashes |
|---|---|---|---|---|
| | Close (30th percentile) | Middle (60th percentile) | Far (90th percentile) | |
| **Urban roads (50km/h posted speed limit)** | 2km (103) | 4km (90) | 19km (96) | 289 |
| **Rural roads (100km/h posted speed limit)** | 9km (102) | 26km (95) | 144km (89) | 286 |

## Urban Roads: Crash Location

The distribution of crashes at different locations (signals or roundabout / priority intersection / midblock) are shown in Figure 5. There are more crashes at priority intersections and midblocks close to home, and more crashes at signals and roundabouts further away, despite similar numbers of crashes overall at each 'distance from home' group. The difference was significant ($\chi^2$ (4, 289) = 0.07, $p < 0.001$). Post-hoc 2x2 tests revealed contingency between proportions of crashes at signals/roundabouts and priority intersections at different distances from home ($\chi^2$ (2, 175) = 0.07, $p < 0.001$); and between signals/roundabouts and midblocks ($\chi^2$ (2, 153) = 0.11, $p$ = 0.001), but the difference between crash proportions across priority intersections and midblocks was not contingent on distance from home ($\chi^2$ (2, 250) = 1.32, $p$ = 0.142).

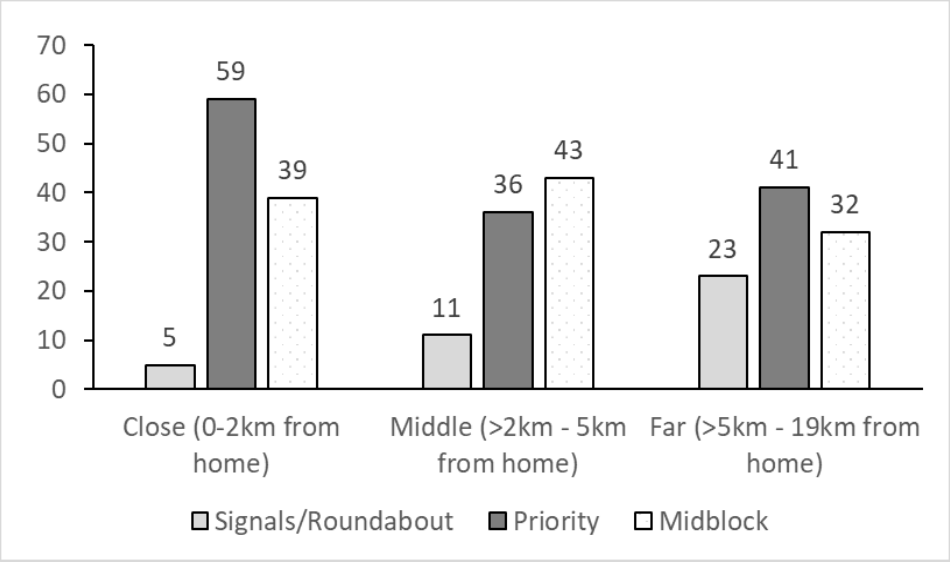


*Figure 5: Urban roads: Percentage of reported fatal and serious injury crashes by 'distance from home' group (close, middle or far) and location.*

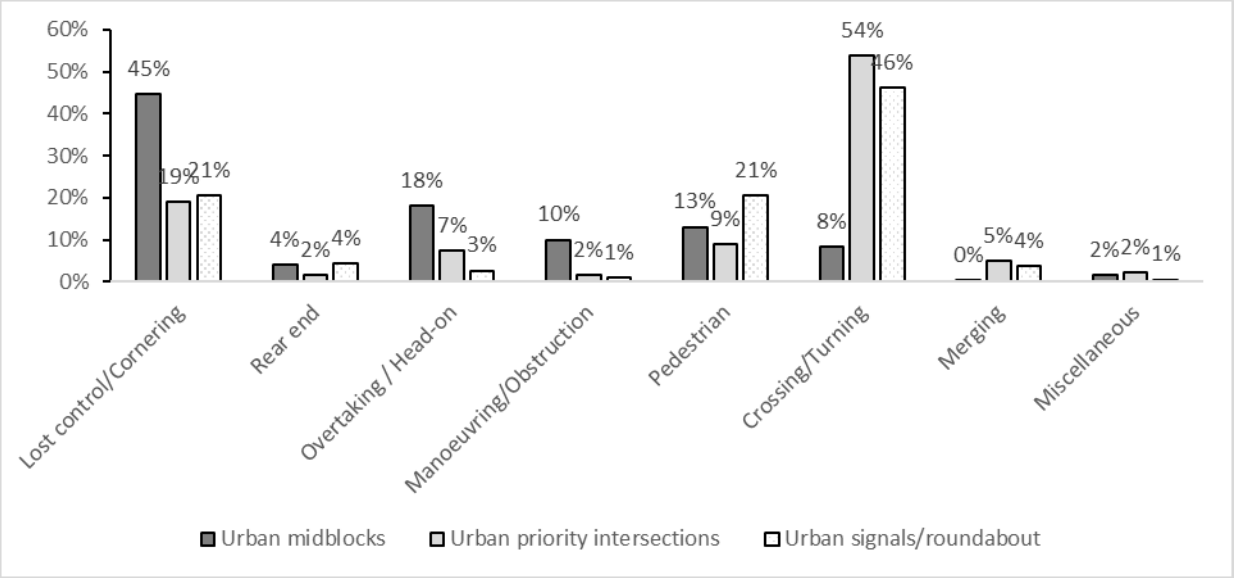


*Figure 6: Fatal and serious crashes on urban roads by manoeuvre / crash type and location*

## Urban Roads: Crashes involving Pedestrians and Cyclists

The distribution of crashes involving pedestrians and cyclists (and not involving pedestrians or cyclists) are shown in Figure 7. The proportions are considerable; over 40% of crashes on roads closest to where drivers live involve a pedestrian or cyclist. However, there is no significant 'close to home effect' for crashes involving pedestrians or cyclists on urban roads ($\chi^2$ (2, 269) = 0.38, $p$ = 0.18).

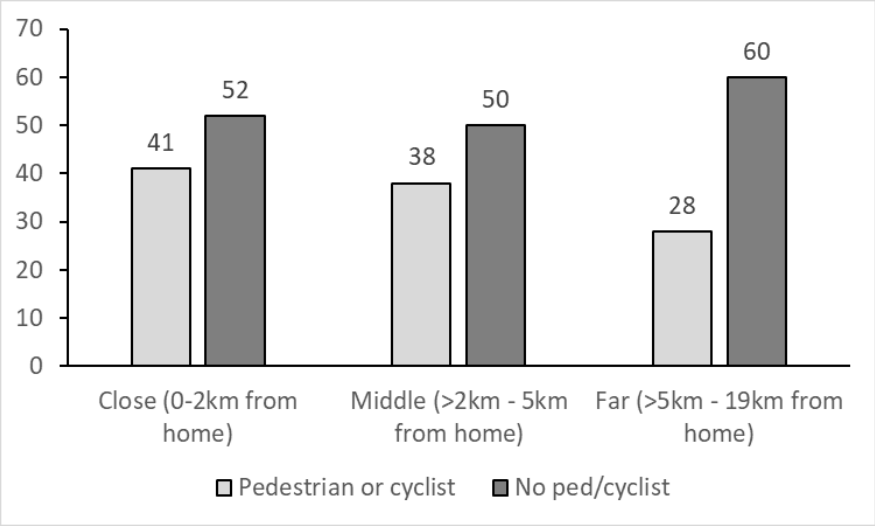


*Figure 7: Urban roads: Percentage of reported fatal and serious injury crashes by 'distance from home' group (close, middle or far) and road users involved*

## Rural Roads: Error and Crash Location

The distribution of crashes involving different kinds of error on rural (100km/h) roads at different distances from home are shown in Figure 8. There are relatively more crashes involving lapses of attention (such as 'failed to notice') on rural roads close to home, but the difference was not significant ($\chi^2$ (2, 68) = 0.39, $p$ = 0.18).

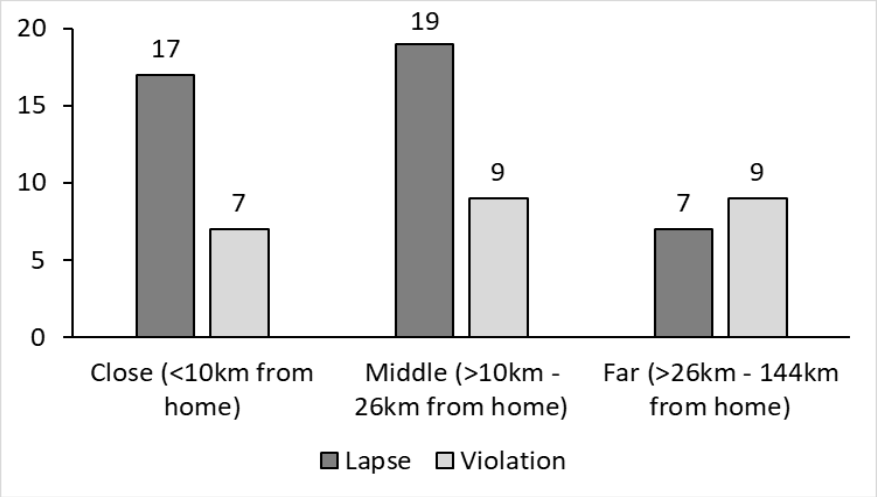


*Figure 8: Rural roads: Numbers of crashes assigned as lapse-only, or violation-only, by different 'distance from home' group (close, middle or far)*

**Rural Roads: Crash Location**

The distribution of crashes at different locations (intersection / midblock) on rural roads are shown in Figure 9. The difference between crash locations on rural roads was not significant ($\chi^2$ (2, 289) = 0.07, $p < 0.001$). Post-hoc 2x2 tests revealed contingency between proportions of crashes at signals/roundabouts and priority intersections at different distances from home ($\chi^2$ (2, 291) < 0.01, $p = 0.79$). Crash location on rural roads is not contingent on distance from home.

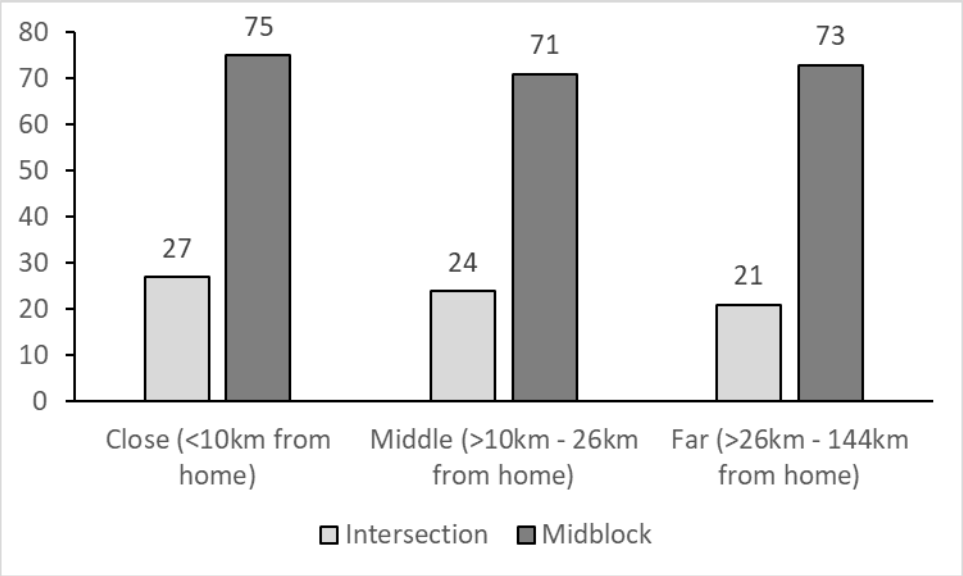


*Figure 9: Rural roads: Percentage of reported fatal and serious injury crashes by 'distance from home' group (close, middle or far) and location.*

## DISCUSSION

The aims of this paper were to explore the close to home effect in fatal and serious crashes, to determine what kinds of fatal and serious crashes happen on roads close to home, and to investigate whether the effect is related to exposure, or whether behavioural effects associated with driving on very familiar roads might be involved.

The first finding was a reconfirmation of the close to home effect established by Burdett, Starkey, & Charlton (2016) in that fatal and serious crashes are over-represented compared with travel, on

roads close to home. However, the data presented in this paper do not clarify whether the effect is wholly related to increased risk on urban roads. Most New Zealanders live on urban roads, so their exposure to urban road risk is higher close to home than further away. The most logical next step for this work would be to compare crashes and travel on 50km/h roads, and crashes and travel on 100km/h roads separately.

There is no significant difference in the distribution of fatal and serious crashes in terms of distance from home when compared with reported minor injury crashes. That is, the close to home effect is not only related to minor injury crashes. Around half of all fatal and serious crashes happen on urban roads, and 30% of those crashes are on roads within two kilometres of the drivers' home: that is, roughly one seventh of all fatal and serious road crashes in New Zealand involving a driver of a car take place within one kilometre of that driver's home, on a 50km/h street. However, without travel data that accounts for exposure on urban and rural roads, this effect may solely be due to a high proportion of driving on those streets close to home.

The main differences in crash patterns on urban roads close to home compared with further away relates to the places where crashes happen. Fatal and serious crashes on urban roads are more commonly located at midblocks and priority intersections close to home, with a higher proportion of crashes at traffic signals and roundabouts further from home; a finding which is observed for crashes generally regardless of road speed limit (Burdett, Starkey, & Charlton, 2017). There could be several reasons for this finding. First, it may be that as drivers travel further from home, they are more likely to be traveling on busy arterial roads with a higher exposure to roundabouts and traffic signals than they are very close to where they live. It is impossible to know whether this is the case without exposure data that includes exposure to different kinds of intersections, but it is plausible that the initial one to two kilometres of a drivers' trip is more likely to be on quiet suburban streets, whereas further from home they may be more likely to be traveling on busier roads on their way through a town, for example.

However, it may be that there are indeed behavioural effects associated with increased crash risk at quiet midblocks and priority intersections very close to where a driver lives. It has long been known that practice reduces the amount of attention drivers pay to their task, such that on familiar streets they are more likely to 'zone out' and drive without awareness (Charlton & Starkey, 2013; Kerr, 1991). In a study of drivers' likelihood to report mind wandering in different kinds of street environments, it was found that drivers are much more likely to focus on the driving task at roundabouts than they are along midblocks, or at priority intersections where they were not required to give way (Burdett, Charlton, & Starkey, 2019).

The finding that lapses of attention are relatively more likely to be reported on rural roads close to home also supports the idea that drivers might be operating in a different mode of awareness in their most familiar places. Fatal and serious crashes are by their nature very rare events, so any driver facing such a crash must react to a situation they are unlikely to have encountered before. If drivers are 'zoned out' close to home, they are more likely to exhibit inattention and change blindness – that is, not notice hazards because they have not learned to expect them (Martens & Brouwer, 2013); may be less likely to be scanning as widely in the first place (He et al., 2011); and may have longer reaction times than they would if they were focused on the driving task (Yanko & Spalek, 2013).

## IMPLICATIONS FOR TRANSPORT PLANNING AND ENGINEERING

The question suggested by the title of this paper (*Why do drivers crash close to home?*) can largely be explained by the fact that most of their driving happens near to where they live. However, there may well be more to this question than can be explained by exposure to different kinds of road environments and hazards. More investigation is warranted to understand how all road users think and behave in different places, both geographically, and in terms of their relative familiarity.

Regardless of what underpins the close to home effect, analysis in terms of crash risk at different

distances from home has highlighted two aspects of crash patterns that may not be obvious to transport professionals:

1) *A high proportion of road trauma is associated with everyday travel at midblocks and priority intersections on urban streets.*

The main implication for the high observed proportion of crashes very close to drivers' homes is that Road Controlling Authorities could address risk in terms of communities and area-wide treatments, to capture the collective risk associated with crashes at midblocks and relatively quiet priority intersections. It may be that low-cost but widespread treatments such as changes to pavement markings, and physical changes to foster lower speeds, could improve safety as much as a similar investment in isolated intersection treatments.

2) *A considerable component of urban road trauma is related to pedestrian and cyclist injury, involving local drivers very close to where they live.*

Drivers may not be aware of the risk of collision with a pedestrian or cyclist on roads closest to where they live, at midblocks as well as at busy roundabouts and signalised intersections. Investment in protected (kerb-separated) cycleways and slow or separated pedestrian crossings can improve safety and amenity. Raised pedestrian crossings and road narrowing associated with cycle infrastructure can also contribute to speed management that helps improve safety for all road users.

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