

**Review and Critique**

**of**

**Chapman, S., Alpers, P., Agho, K., & Jones, M. (2006). Australia's 1996 gun law reforms: faster falls in firearm deaths, firearm suicides, and a decade without mass shootings. *Injury Prevention*, 12: 365-372.**

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## **Review and Critique**

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### **Summary**

The paper investigates whether there were significant changes in the trends for firearm homicide, firearm suicide, total firearm deaths, mass fatal shooting incidents, and total homicide and suicide before and after the introduction of the Australian National Firearm Agreement (NFA) of 1996. It also asks whether there is any evidence of method substitution for homicide and suicide following the implementation of the NFA.

### **Major Findings**

There was no significant difference in the rate of decline in firearm homicide, pre- and post-1996. Firearm homicides did not drop more quickly after 1996 than before.

There was a significant acceleration in the rate of decline in firearm suicides, post-1996. It should be noted that suicides using other methods also started to decline, although the authors fail to present any discussion as to why this may have occurred.

These results confirm earlier research conducted by Baker and McPhedran [1], published in the British Journal of Criminology.

The paper also found that the trends in non-firearm homicide differed significantly pre- and post-1996, with the result just reaching significance. Baker and McPhedran [1] noted that observations about non-firearm homicide should be interpreted with care, due to the moderate fit between non-firearm homicide data and the statistical model used.

**Statistical note**

The statistical tests performed by Chapman et al. (presented in Table 3) aim to establish whether or not the declining rate of various types of firearm-related deaths observed prior to 1996 accelerated post-1996.

If the results are significant (i.e.,  $p < 0.05$ ) it means that firearm-related deaths fell more quickly after 1996 than before. If, however, the results are not significant ( $p > 0.05$ ), it means there was no difference before and after 1996.

In instances where the results are not significant, additional discussion is purely speculative because the statistical test is actually stating that there is no difference in the trend before and after 1996. Consequently, any such discussion is likely to be subject to interpreter bias.

Table 3 from Chapman et al. is reproduced below, with the key statistical findings highlighted.

**Table 3** Estimated effect of gun laws on trends in firearm-related death rates using negative binomial models

Mortality	Trend before 1997 RR (95% CI)	Trend in 1997 and later RR (95% CI)	Ratio of slopes RR (95% CI), p value
Firearm homicide	0.971 (0.958 to 0.984)	0.925 (0.881 to 0.973)	0.955 (0.897 to 1.016), $p=0.15$
Firearm homicide (omitting mass shootings)	0.961 (0.948 to 0.973)	0.925 (0.880 to 0.973)	0.965 (0.908 to 1.024), $p=0.2$
Total non-firearm homicide	1.011 (1.001 to 1.021)	0.976 (0.954 to 0.999)	0.965 (0.932 to 0.999), $p=0.05$
Total homicide (all methods including firearm)	0.999 (0.992 to 1.006)	0.967 (0.946 to 0.988)	0.968 (0.943 to 0.993), $p=0.01$
Firearm suicide	0.970 (0.964 to 0.977)	0.926 (0.892 to 0.961)	0.954 (0.922 to 0.987), $p=0.007$
Total non-firearm suicide	1.023 (1.018 to 1.029)	0.959 (0.951 to 0.968)	0.938 (0.920 to 0.956), $p<0.001$
Total suicide (all methods including firearm)	1.010 (1.005 to 1.015)	0.956 (0.948 to 0.964)	0.946 (0.930 to 0.963), $p<0.001$
Unintentional firearm deaths	0.924 (0.907 to 0.942)	1.085 (0.975 to 1.207)	1.171 (1.070 to 1.282), $p=0.001$
Total firearm deaths	0.967 (0.961 to 0.973)	0.936 (0.912 to 0.961)	0.968 (0.940 to 0.997), $p=0.03$

Note that unintentional firearm deaths rose after 1996. Work currently under review (McPhedran & Baker, *submitted*) addresses possible reasons for this observation.

## **Findings and shortcomings**

### **Contradiction between statistical analysis and conclusions - firearm homicide**

The statistical analysis showed that the rate of decline in firearm homicides pre- and post-1996 did not differ significantly. This agrees with the findings of Baker and McPhedran [1].

However, despite the results showing that the downward trend in firearm homicide did not accelerate significantly after 1996, the authors conclude that the downward trend did accelerate, even though they acknowledge on p.367 that:

“The ratio of trend estimates failed to reach significance...”

Thus it is unclear how the authors reconcile the stated knowledge that the results were not statistically significant, with their subsequent claims that the laws had an impact on firearm homicide.

It should be highlighted that two of the authors are given sole credit for conducting the statistical analyses (see note under ‘Author’s affiliations’, end of paper). It is possible that the authors who conducted the statistical tests may not have written the conclusions, which may explain why the conclusions contradict the statistical outcomes.

### **Conclusions based on figures not subject to analysis**

The authors do not discuss the results of their statistical analysis (Table 3).

Instead, the conclusions in the paper are based on claims regarding percentage declines in various types of firearm-related death, before and after 1996.

It is stated at various points that the percentages are provided in the statistical analyses in Table 3, and in the charts in Figure 1. However, the percentage figures cited are not contained within the statistical analyses or figures, and are not subject to any form of objective analysis.

The authors rely upon their percentage calculations to support the assertion that rates of firearm homicide, in particular, fell more quickly after 1996 than before. Such arguments contradict the results of the statistical analysis contained in Table 3, where it was found that there was no significant difference in the rate of decline in firearm homicides, pre- and post-1996.

### **Reliance on averaged values**

In addition to basing conclusions upon percentages that contradict the statistical findings of the paper, the authors present as supporting information ‘average’ values for the incidence of various types of firearm related deaths pre- and post-1996.

For example, it is stated that:

“In the 18 years (1979-96) there were 8850 firearm suicides (annual average 491.7). In the 7 years for which reliable data are available after the announcement of the new gun laws, there were 1729 firearm suicides, an annual average of 246.6.”

While averages can provide a useful tool for quantifying changes, they are generally unsuitable for assessing examples where long term, ongoing trends are apparent. If a consistent trend is present in the data, as is the case for firearm suicide and firearm homicide, then ‘grouping’ data and comparing averages of those groups will produce predictable but severely constrained results.

Whenever the occurrence of an event shows a decline over time (for whatever reason/s), it logically follows that the ‘later’ end of the trendline will be lower than the ‘earlier’ end of the trendline. Therefore, groups which combine ‘later’ years (1997-2003) will always produce lower averages than groups formed by combining ‘earlier’ years (1979-1996).

Citing averages does not provide any information about whether an intervention (i.e., legislative reform) had an impact on what was already occurring.

Again, it is curious as to why the comparisons of rates of decline for both time periods were undertaken if the discussion subsequently reverts to averaging data despite obvious declining trends. Presenting averaged values as support for the premise that the laws had an impact contradicts the authors’ acknowledgement on p.366 that:

“...the statistical question addressed is not just whether death rates were lower after the laws were changed, as the pre-existing trend would predict this even in the absence of changed laws...”

### **Lack of explanation for observed statistical results - homicide**

The results show that there was no significant acceleration in the downward trend for firearm homicide (with or without mass shootings included), but that the trends for non-firearm homicide differed significantly pre- and post-1996 (the pre-1996 trend was upward, the post-1996 trend was downward). No explanation for this finding is provided.

It is unclear, therefore, why the authors conclude that the laws had an impact on firearm homicide, when their statistical analysis shows this was not the case.

It is also troubling that the authors fail to discuss potential factors that may have affected non-firearm homicide, or acknowledge the relevance of this finding in the context of firearms legislation.

It is illogical to argue that gun laws would affect non-firearm homicide. Therefore, the decline in non-firearm homicides strongly indicates that other factors must be considered (see Baker and McPhedran [1] for discussion of potential risk factors for homicide in general). The authors fail to realise that as a result of the change in non-firearm homicide trends post-1996, their claims of an accelerated rate of decline in firearm homicide post-1996 are not only unsupported by the statistical analysis, but in addition reflect the likely influence of external factors in reducing the incidence of homicide in general, rather than offering support for any effect of the gun laws.

It is possible that the statistical model chosen may not adequately describe the variable rates of non-firearm homicide pre-1996. The post-1996 decline in non-firearm homicide rates was noted by Baker and McPhedran [1], who also suggest that due caution should be exercised when examining trends in both firearm and non-firearm homicide.

### **Lack of explanation for observed statistical results - suicide**

The results show a significant acceleration in the downward trend for firearm suicide, and an emerging downward trend in non-firearm suicides after a period of steady increase through the 1980's and 1990's. No explanation for the latter observation is provided.

Just as gun laws would not be expected to affect non-firearm homicide, it cannot be expected that restrictions upon firearm ownership would affect non-firearm suicide, except within the possible context of method substitution (addressed below). Therefore, it should be considered that other factors, such as the introduction of national suicide prevention programmes in the late 1990's, may have reduced suicides across the board (see Baker and McPhedran [1] for discussion of this possibility. See also Morrell, Page, & Taylor [2] for evidence supporting the efficacy of the National Youth Suicide Prevention Strategy implemented during 1995-1999).

However, the authors do not recognise this potential confound in the data. Nor do they acknowledge that the fall in other types of suicides entails the need for exercising caution when interpreting firearm suicide data.

### **Confusion concerning method substitution**

The conclusion is drawn that the 1996 removal of firearms was responsible for the decline in firearm suicides, even though non-firearm suicides also began to decline. Similarly, it is concluded that the gun laws were responsible for a decline in firearm homicide, despite there being no significant acceleration in the rate of decline, and unexplained concurrent declines in non-firearm homicides. It is, however, argued that there is no evidence of method substitution.

The authors state on p.366 that if method substitution occurred after the legislative reforms, there would be:

“...an increasing downward trend in firearm deaths after the introduction of gun control laws but a compensatory lesser downward or even upward trend in non-firearm related deaths over the same period.”

If method substitution did not occur, it would be expected that the trends in non-firearm homicide and suicide would remain unchanged (i.e., not differ significantly) pre- and post-1996.

Therefore, the conclusion that there was no method substitution does not follow from the result that the post-1996 trends in non-firearm homicides and suicides differed significantly from pre-1996 trends. In particular, the reversal of the upward trend in suicides using methods other than a firearm, and subsequent decline from the late 1990's onwards, indicates the impact of other factors that would be expected to generate declines across the board (improved suicide prevention strategies, for example), rather than providing evidence of an absence of method substitution.

To conclude that there was no method substitution between firearm and non-firearm homicides represents a continuation of the authors' errors in reasoning outlined for suicide. Furthermore, making this claim with regard to firearm homicide contradicts the authors' own key assertion that an important premise underlying method substitution is an "increasing downward trend in firearm deaths."

There was no increase in the downwards trend in firearm homicide post-1996. Therefore, the authors' application of method substitution arguments to firearm and non-firearm homicide is logically incoherent.

### **Mass shootings**

The results do not analyse the hypothesis that the 1996 legislative reforms have prevented mass shootings, although it is stated (p.366) that:

"These [data] were used to compare the incidence of such shootings before and after the introduction of the new gun laws."

Statistical comparison was not undertaken. Instead, the authors examine the trends in firearm homicide pre- and post-1996, with and without the influence of mass shootings. The analysis compared whether there was an acceleration in the downward trend in firearm homicide after 1996, compared with pre-1996 data that included mass shootings, versus pre-1996 data that excluded mass shootings.

The results showed that in both cases, there was no significant acceleration in the downward trend post-1996. This demonstrates that the influence of mass shootings was in fact not significant on the trends overall. If the mass shootings exerted a significant effect on the data, then it would be expected that their absence (which, it is argued in the conclusions, has made Australia "safer") would cause the existing downward trend to accelerate post-1996. This was not the case.

### **Analysing/predicting rare events**

The absence of analysis of mass shooting events is problematic for the conclusion that the absence of a rare event after 1996 means the laws ‘caused’ the absence of that event. Extreme caution must be applied to this issue. Achieving reliable statistical analysis of rare events is recognised as a difficult task [3] and requires data collated over an extremely long time period in order to provide meaningful information. Even when long term datasets are available, and a variety of statistical methods applied to the data, the results of such tests are subject to a high degree of error [4].

With the difficulties of analysing rare events duly noted, the lack of any attempt at analysis is particularly concerning given the key conclusion of the paper was that it provides evidence that the laws have prevented mass shootings.

There is no statistical evidence whatsoever offered to support this. There is a notable difference between stating that no mass shootings with mass fatalities have occurred since 1996, and concluding that no mass shootings have occurred because of the laws.

### **Control data – mass shootings**

Given the authors’ contention that the gun laws prevented mass shootings, it would be desirable to see some form of control data offered to support this bold conclusion. A prime example of such data comes from New Zealand.

Although various anti-gun lobbyists have referred to the New Zealand firearms licensing system as ‘dangerously lenient’, this is not an accurate description. The New Zealand system<sup>1</sup> is simply based on a different premise to that of Australian legislation. The difference is primarily that New Zealand arms control focuses on ensuring the licensing of fit and proper persons to possess firearms, and as a consequence of this process the

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<sup>1</sup> Described as world class by Mr Tsutomu Ishiguri, Director of the United Nations Centre for Peace and Disarmament in Asia and the Pacific, in February 2006 [5].

range of firearms approved persons may possess is determined on a different basis to that occurring in Australia. New Zealand has a relatively high density of firearms ownership, and semi-automatic rifles and semi-automatic and pump action shotguns are available to approved persons, subject to controls. New Zealand has not experienced a mass shooting with mass fatalities since 1997. This raises the possibility that a decade without mass shootings with mass fatalities in Australia may not be attributable to the legislative intervention of bans and buybacks of certain types of firearm.

Canada provides a complementary case study. Canadian firearms legislation is similar to Australian legislation, with the exception that semi-automatic firearms can still be owned by suitably licensed civilians. Canada experienced a mass shooting with mass fatalities in 1989, but did not experience a repeat of this event until 2006 (one fatality, 19 wounded). Thus, Canada experienced over 15 years without a mass public shooting, despite the availability of firearms that are prohibited in Australia.

The New Zealand and Canadian examples illustrate the vital importance of exercising caution with regard to the Australian situation concerning mass shootings with mass fatalities.

### **Confounding factors – mass shootings**

With the exception of Port Arthur, mass shootings occurred in years that had higher than usual rates of firearm homicide – for evidence of this, see the peaks in Chapman et al., Figure 1, Panel C (mass shootings excluded).

Note also the peaks in non-firearm homicide in the late 1980's. These peaks smoothed out after 1996. No explanation is provided for why the larger fluctuations observed in both firearm and non-firearm homicide pre-1996 appear to have stabilised after 1996. It is possible that the authors may have intended to address shared contributory factors to homicide and mass homicide, by the inclusion of references 28 and 29. However, although these papers appear in the reference list, they are not cited in the text.

### **Failure to consider the full range of legislative changes**

In addition to the points raised above, it is concerning that the conclusion that the gun laws prevented mass shootings is framed within the context of the buyback alone. The authors do not consider that other changes (for example, background checking procedures, a 28-day waiting period prior to the issuing of a licence) may have exerted an influence on the incidence of mass shootings.

Similarly, whether the perpetrators exhibited characteristics that would, today, preclude their legal ownership of firearms, is not discussed. These are critical and crucial questions, given the background of perpetrators of mass shootings in the years prior to the legislative reforms.

For example:

Julian Knight (Hoddle St, VIC) – assault charges, awaiting court appearance at the time of the shooting.

Martin Bryant (Port Arthur, TAS) – known to police, history of erratic behaviour, under the care of a Guardianship Board.

Malcolm Baker (Terrigal/Central Coast, NSW) – history of domestic violence, subject to an Apprehended Violence Order.

Frank Vitkovic (Queen St, VIC) – ongoing severe depression.

Peter May (Hillcrest, QLD) – history of domestic violence.

Paul Evers (Surry Hills, NSW) – history of violent behaviour, mental illness.

### **Incorrect data**

It should be noted that the information concerning mass shooting incidents provided by the authors is incorrect. The authors state that there were 13 mass shooting incidents between 1980 and 1996. However, 2 of the incidents that are included by the authors are serial murders that crossed state lines and occurred over a period of days or weeks (the

“Top End” killings, NT/WA, and the “Cangai Farmhouse Siege”, QLD/NSW. Note that the Cangai incident involved three perpetrators).

It is implied that there was, on average, 1 mass shooting per year pre-legislative reform. This is a half truth. Averaging rare events does not provide an adequate picture of their temporal clustering, just as averaging numbers does not provide meaningful information when a trend in the data is present.

Examination of the years in which the events occurred shows that four of the 11 mass shooting events occurred within a 13 month time period of one another, across 1987-1988. This raises the question of what other contributing factors may underlie this clustering of rare events within a very short time period. The authors have made no comment on this.

### **Redundant analyses**

The title of the paper refers to falls in firearm deaths overall. However, this finding is purely a by-product of the nature of the data. Approximately 80% of firearm related deaths are suicides. This fact is acknowledged on p.367:

“Firearm suicides represent the largest component cause of total firearm deaths in Australia (more than three in four of all firearm deaths).”

Therefore, given the significant acceleration in decline in firearm suicides, and the fact that these make up the majority of firearm related deaths, the significant acceleration in decline overall is explained by the preponderance of suicides in the total data set.

To overcome this statistical problem, it would be necessary to ‘weight’ the data so that the large discrepancies in numbers of different types of death are controlled for (meaning homicide is given equal ‘importance’ in the data as suicide). This control was not undertaken.

Similarly, analyses of total homicide and total suicide (that is, including firearm-related deaths along with all others) are meaningless in terms of answering the question of whether the gun laws had an effect. In each of these cases, firearm-related deaths account for only a small percentage of the total number of deaths, but this is not controlled for.

The authors, however, argue that the observed overall declines are evidence that method substitution did not occur following the legislative reforms. As discussed above, this argument is not adequately sustained due to the emergence of downward trends in non-firearm suicide and homicide. Rather than providing evidence that method substitution did not occur, the declines in non-firearm suicide, and suicide overall, and non-firearm homicide, and homicide overall, strongly indicate that factors other than the gun laws were influencing general trends for all ‘methods’.

### **Theft**

The authors claim that the removal of over 640 000 firearms means:

“...700 000 fewer guns were available to be stolen or otherwise leaked from lawful owners to criminals.” (p.370)

The available data concerning both theft and the number of legally owned firearms in Australia do not support the statement that the buyback reduced theft.

If the buyback had an impact on theft, then the abrupt removal from private owners of over 640 000 firearms would be expected to create a sudden ‘stepwise’ drop in theft. However, extant research concerning theft shows that there has been a long, steady decline over a period of years [6][7]. It is difficult, therefore, to contend that the buyback caused any decline in theft. A more likely explanation is that the requirement for safe storage of firearms, and the policing of that requirement, has exerted an ongoing influence on theft.

Also, evidence does not support the inference that the number of legally owned firearms relates proportionally to the number of firearms stolen. Nor do the authors offer substantiation for the related assertion that the number of legally owned firearms in Australia has undergone ongoing reductions since 1996 (p.370).

Indeed, the available figures contradict the authors' belief that the level of legal firearms ownership in Australia continues to decline; in various Australian States/Territories the number of legally owned firearms has, after an initial decrease post-1996, risen steadily. In some instances, the number of legally owned firearms has increased to levels estimated as equivalent to pre-1996 numbers [8].

However, despite increases in the number of legally held firearms, firearms theft continues to decline.

### **Failure to distinguish between the buyback and other legislative reforms**

The authors note briefly that the 1996 gun laws included a range of changes, including background checks and waiting periods. However, their conclusions do not consider the possibility of these factors contributing to the observed results.

The authors conclude that their results support the premise that the removal of a large number of firearms from private owners reduced firearm homicide and suicide. As discussed above, these conclusions do not follow from the analyses and results contained in the paper. Similarly, to claim that the buyback prevented mass shootings, without taking into account the full range of legislative changes enacted following 1996, is unsupported.

### **Neglect of vital references**

The paper refers extensively to items in the popular media, and includes limited, highly select examples of research from the United States. However, there is an overall lack of inclusion of peer-reviewed research regarding Australia.

For example, crucial findings from the National Homicide Monitoring Program (Australian Institute of Criminology) [9] such as the licensing and registration status of firearms used to commit homicide, are not included. The 2002-2003 NHMP Annual Report is given a cursory mention in the context of overall rates of firearm homicide in Australia for that 12 month period, in comparison with the US.

None of the Australian Institute of Criminology (AIC) papers regarding theft are included.

### **Conclusions**

The Chapman et al. paper is a useful adjunct to published studies already undertaken by the AIC, Reuter and Mouzos [10], and Baker and McPhedran [1]. The application of negative binomial statistics to compare before and after 1996, and detect changes in those trends, confirms the results already published by Baker and McPhedran [1].

However, it is a notable shortcoming that Chapman et al.'s discussion failed to address the critical issues outlined in this critique, or to take into account their implications. It is particularly disappointing that the outcomes of the statistical analyses were ignored in the speculative comments made in the conclusions. It is of serious concern that many of the conclusions drawn are contrary to the results of the objective tests undertaken, resting instead upon a demonstrably incorrect foundation.

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