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The economic cost of firearms accidents in New Zealand

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Aims: *To study trends in accidental deaths from firearms and estimate the incidence and economic cost of firearms accidents in New Zealand.* ***Methods and data:*** *Accidental firearms deaths between 1960 and 2003 were compared with total population and imports of cartridges. Costs were estimated from a societal perspective in 2004 NZ dollars. Multiple linear regression and Monte Carlo methods were used to conduct sensitivity analysis on the estimates of costs.* ***Results:*** *Annually there are on average 9 firearms accidents, 3 are treated in the community, 3 are treated in hospital and 3 die. Between the five years ending 1964 and the five years ending 2003 accidental firearms deaths have reduced by 72% from 11 (0.43 per 100,000 population) to 3 (0.08 per 100,000). Over the same period all firearms accidents fell from 33 to 9 a decline of 24 incidents. Annual total cost amounted to $1,304,696 ($144,645 per incident).* ***Conclusions and implications:*** *New Zealand's accidental firearms death rate is lower than the US and is similar to rates recorded in Australia and Sweden. If the decline in the number of firearms accidents had not occurred, there would have been annually 8 more deaths and 24 more accidents (8 more deaths and 16 more accidents requiring medical treatment) and societal costs would be 267% higher. Society would be justified in allocating an additional $144,645 of resources to reduce firearm accidents by one. Total costs reported in this paper should be regarded as conservative because a conservative value for human life was used.*

Key words: *Economics, public policy, firearms, accidents, cost, New Zealand*

1. Introduction and aims

No studies have been published that have investigated both the incidence and cost of firearms accidents in New Zealand. Without such information it is difficult to formulate strategies and select the most cost-effective interventions for the prevention of firearms accidents. Accordingly, the aims of this study were to review the current literature, to study trends in accidents from firearms in New Zealand, and to estimate the economic cost of firearms accidents.

This paper first reviews the international and New Zealand literature relating to firearms accidents causing fatal and non-fatal injuries. We then discuss the data and methods used to estimate the numbers of injuries, and the cost of such injuries in New Zealand. The results are presented, and limitations of the research and findings are discussed with respect to the literature. Detailed data tables are included in appendices.

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2. Literature review

The first comprehensive New Zealand study on firearms was that of Forsyth in 1977 which was updated in 1985 (Forsyth, 1977, [1986]). Forsyth estimated the numbers of rifles and shotguns, investigated firearm related accidents and suicides, and firearm legislation. Later studies have researched nonfatal injuries in the period 1979 - 1992 (J. Langley *et al.*, 1996a; J. D. Langley *et al.*, 1996b), firearm related deaths in the period 1978 – 1987 (Norton & Langley, 1993) and 1979 – 2002 (J Green, 2003), investigated the licence status of those involved in nonfatal firearm misuse (Gardner *et al.*, 1996), and researched firearm related suicide (Annette Beautrais, 2003; AL Beautrais *et al.*, 1996).

Internationally, laws relating to firearms differ between countries, often based on strongly held personal conviction on the historical use of firearms for hunting and protection of farm animals and persons. Literature suggests that there is a correlation between access to and ownership of guns, and the risk of accidents and death from firearms (Chapdelaine & Maurice, 1996; Rushforth *et al.*, 1974).

Official attempts to control firearms in New Zealand date from 1845 and the comprehensive 1997 Review (Thorp, 1997) documents the history of such legislation that culminated in the Arms Act 1983. This Act controlled firearms dealing, increased the security requirements for the storage of firearms and licensed all persons handling such weapons. Each person now has a Firearms Record Number and is issued with a Firearms Licence (valid for 10 years), and both of these, together with other details, are held in the Firearms Register. New Zealand Mountain Safety Council Firearms Safety Section is funded by and acts on behalf of the Police to coordinate and deliver firearm safety education courses. To obtain a firearms licence candidates must attend one of these courses, pass a test based on the Arms Code (New Zealand Police, 2001) and be assessed by the Police as to their suitability to hold a licence. Both the New Zealand Police and the New Zealand Mountain Safety Council have over several decades issued and updated educational material relating to the Arms Code, types of firearms, hunting and firearms safety.

A government-commissioned report (Thorp, 1997) recommended the registration of all guns but successive governments have rejected this, choosing to license the holder of a firearm rather than the firearm itself. The Police Minister as recently as December 2004 (Hawkins, 2004) stated that registration of firearms would not be included in a Bill intended to tighten border control of illicit arms trading. The registration of all firearms is seen as both cumbersome and costly and “Police advice was that most of the times guns are used illegally, they are illegal guns and they don’t know about them anyway.” (Hawkins, 2004). The inquiry commissioned by the Minister of Police (Thorp, 1997) provided several estimates of the number of firearms in existence in New Zealand (taking into account non-compliance, amnesties and re-licensing) as lying between 700,000 and 1 million firearms used for hunting, farming, pest control and target shooting.

Virtually all fatal firearms accidents in New Zealand occur while hunting deer. The typical hunting accident victim and shooter are male, have a median age of 29 years, likely to be hunting companions and will have some experience of hunting deer (J

Green, 2003). Most events occur in the roaring season for deer, during the day, in the bush and when a shooter moves into the firing area of another. The United States has the highest incidence of firearm-related deaths among western industrialised nations (Nelson *et al.*, 1987), recording a death rate from unintentional firearms incidents of 0.32 per 100,000 in 1998 (Frattaroli *et al.*, 2002) and 0.59 per 100,000 in 1993 (Krug *et al.*, 1998). Studies in other countries that have a tradition of recreational hunting show accidental death rates ranging between 0.22 per 100,000 in Canada to 0.01 in England/Wales.

3. Methods and data

All firearms deaths broken out by cause from 1992 – 2000 were obtained from the New Zealand Health Information Service (Lewis, 2004). Accidental firearms deaths were obtained from the New Zealand Mountain Safety Council (New Zealand Mountain Safety Council, 2004) that has studied coroner reports relating to firearms injuries and extracted those attributed to accidents. We calculated a series of accidental deaths from firearms per 100,000 total population from 1960 to 2003 and deaths per 100,000 imports of cartridge from 1988 - 2003. Imports of the two most common types of cartridges (22 calibre rimfire and shotgun 12 bore) and population numbers were derived from Statistics New Zealand (Statistics New Zealand, 2004b). Accident Compensation Corporation (ACC) (McCormack, 2004b) has volume data for community treatment and Ministry of Health (Ministry of Health, 2004b) has numbers treated in hospital for all firearms incidents but neither source is able to categorise the incident as an accident, self-inflicted, assault or legal intervention. Accordingly, the percentage of deaths resulting from accidents was applied to total community and hospital treatment cases to obtain the community and hospital volumes attributable to firearms accidents. Public hospital discharges for firearms accidents and average days stay in hospital were obtained from the Ministry of Health (Ministry of Health, 2004b).

The literature provides a number of different health cost classifications. A US authority (Luce *et al.*, 1996) classifies costs as either direct costs (direct health care costs and direct non-health care costs and the value of patient time for treatment), or productivity costs (changes in production or output). Another system described by British and Canadian authors (Drummond, 2005 Fig 2.1 p 19) delineates costs as, health sector (C1), other sectors C2), patient and family (C3) and productivity losses (C4). This system of grouping costs does not allow cross-tabulation of cost categories by perspective because some of the cost categories are perspectives. The method we have chosen to follow (Kielhorn & Graf von der Schulenburg, 2000) categorises costs as: direct medical, direct non-medical, indirect, and intangible. This classification system provides more information than any of the discussed options, and permits a cross-tabulation of cost category by perspective. Brief descriptions of the above costs and the methods of estimating and sources of specific unit costs follow.

Direct medical costs of illness/ accident are directly related to treatment or prevention with services delivered by the health sector. These costs are usually explicit (involving money payments). This study was able to isolate community based treatment and hospital treatment costs of firearms accidents. Unit costs for community treatment by health professionals was the mean of all medical treatment claimed for firearm accidents from the ACC (McCormack, 2004b). The Corporation's data do not distinguish between accidents and deliberate acts but it would be expected that the unit costs would be similar. Hospital treatment unit cost was assumed to be the mean DRG (diagnostic related group) cost over all DRG codes derived from the Ministry of Health (Ministry of Health, 2004a) weighted by the ratio of the average length of stay for firearms accident inpatients compared with the average length of stay for all patients in 1999/2000 and 2000/2001 (Ministry of Health, 2004b) ($2,473x7.2/8.1). The mean DRG cost weighted by average length of stay was used because diagnostic codes relate to the type of treatment and anatomical body part and many different DRG codes could describe the hospital treatment of a firearms accident. The costs related to the 2001/2002 year and because a specific hospital input price index does not exist these costs were not inflated to 2004 values for the base case analysis, but this was taken into account in the sensitivity analysis.

Direct non-medical costs are directly related to treatment or prevention of illness/ accidents but the services may not be delivered by the health sector. Some of these costs are implicit (not identified by money payments). Ambulance transport to hospital and to mortuary was the mean cost of an ambulance callout to an emergency incident (Ministry of Health, 2004c). Private motor vehicle costs were calculated by multiplying the cost per kilometre (Inland Revenue Department, 1996) by the average distance travelled by an ambulance for an emergency call (Ministry of Health, 2004c). Funeral and other additional costs to dependents were the average of the five years ending 4 October 2004 payout by the ACC (McCormack, 2004a, 2004b) for fatal claims. It could be argued that the cost of a funeral should be excluded because eventually everybody dies, but we have chosen to include this cost. Had these victims lived the cost for each funeral would have been deferred for 48 years and we have assumed that ACC payments take this into account. The cost of a coroner inquiry into a death was the average of coroner fees over the five years ending 3 September 2004 multiplied by 2 (to cover court costs), plus the approximate post-mortem and mortuary costs (Baird, 2004).

Indirect costs are concerned with productivity and are time-related costs of patients, and informal care givers. They involve paid and unpaid productive activity and leisure time foregone. Many of these costs are implicit, for example, unpaid work. The production loss unit cost for those treated in the community was the average weekly income from wages, salaries and self-employment for all people aged 15 and over (regardless of employment status) (Statistics New Zealand, 2004c). Production loss unit cost for those treated in hospital was the mean ACC firearms accident entitlement claims over the 5 years ending 4 October 2004 (McCormack, 2004b). Current year production loss unit cost for each death was the average annual income from wages, salaries and self-employment for all people aged 15 and over (regardless of employment status) (Statistics New Zealand, 2004c).

Intangible costs are the costs of pain, suffering and the value placed on loss of life. Although changes in quality and loss of life do not in themselves incur opportunity costs, citizens may be willing to pay to avoid reductions in quality of life and death. We did not evaluate the costs of pain and suffering of accident victims (or their families) but used both the human capital and willingness to pay approaches

(Kielhorn & Graf von der Schulenburg, 2000) to place a value on a human life. A willingness to pay value of $2,830,000 (Ministry of Transport, 2004) was used in the sensitivity analysis as a high bound. We estimated the human capital value (used in the base case) of a life lost in a firearm accident as $395,433, which is the present value of annual earnings (Statistics New Zealand, 2004c) foregone in the event of premature death discounted over 36 years at a discount rate of 5%. [The median age of the typical firearms fatal accident victim is 29 years (J Green, 2003) and a male aged 29 would be expected to live for another 48 years (Statistics New Zealand, 2004d). Thus, a 29 year old New Zealand male would have an expectation of 36 additional years of work before retirement at age 65. A discount rate varying between 3% and 6% is commonly used in health economics evaluations where future costs and effects are discounted to present values (Kielhorn & Graf von der Schulenburg, 2000).]

Sensitivity analysis (Drummond, 2005; Earl-Slater, 1999; Kielhorn & Graf von der Schulenburg, 2000) was conducted to investigate the robustness of the estimates, worst case and best case scenarios and changes in key estimates and assumptions. In particular, (as we did not have enough information to apply statistical methods) uncertainty in some of the estimates of unit costs and outcomes volumes was investigated by sensitivity analysis.

Univariate (or single parameter) sensitivity analysis was used to determine the impact of the major cost drivers. Multiple linear regression analysis was applied and normalised regression coefficients or beta-weights isolated and used to evaluate the impact of various determinants (independent variables) on total direct and indirect cost and total cost (dependent variables). The beta-weight represents the number of standard deviations change in the predicted value of the dependent variables associated with one standard deviation of change in the independent variable.

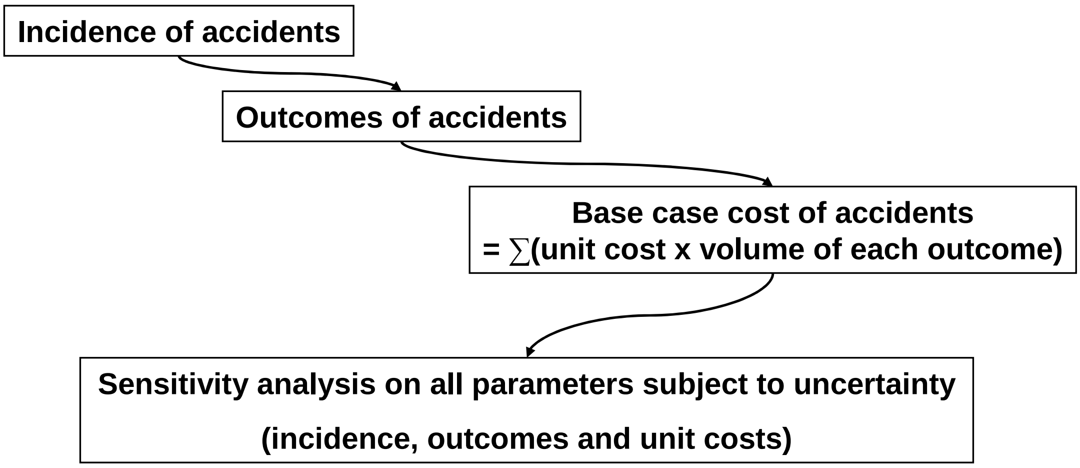
Multivariate (or multiple parameter) sensitivity analysis involves simultaneous changes to more than one parameter or assumption. Monte Carlo analysis was used by considering base case values and upper and lower bounds for each estimate (Palisade Corporation, 2004). This type of analysis generates random values for all uncertain cost components and calculates the impact on total cost. All volumes and unit costs subject to uncertainty[i] were varied 25% up and down from the base case to provide high and low limits. The upper and lower bounds for the intangible value of human life were $2,830,000 (willingness to pay estimate) and $23,898 (one year loss of earnings resulting from death) respectively. The Monte Carlo sampling used triangular distributions, that is, a distribution defined by a lower bound, a base case and a high bound. There was an equal chance of selecting all values between the high bound and base case and between the low bound and the base case.

The cost of the firearms accident prevention programme was obtained from the New Zealand Police (Joe Green, 2005). Firearms licensing costs $7,199,000 per year and the cost of advertising, education and voluntary training amounted to $992,000 (advertising $100,000, grants for education and training to New Zealand Mountain Safety Council $142,000, and volunteer time estimate of $750,000). We excluded the cost of firearms licensing from our analysis as this would have been undertaken for crime prevention regardless of any safety considerations.

A societal analytic perspective was adopted and all unit costs were valued in 2004 dollars exclusive of GST (goods and services tax, a transfer payment from one sector of society to another). All costs were measured incrementally compared with the counterfactual. For example, if a cost would have been incurred, irrespective of whether or not an accident occurred, it was not relevant to the analysis.

Chart 1 summarises the steps in estimating the costs of firearms accidents.

Chart 1: Process for estimating the costs of firearms accidents



4. Results

Over the five years ending 2000 there was an annual average of 65 firearms deaths, 5% of which were accidental, 79% suicides, 12% assault by other persons, 1%, legal intervention (by armed police), and 3% where the causes of injury could not be determined as either accidental or deliberate. Males accounted for 94% of all firearms deaths. Of the 9 accidental injuries caused by firearms, 3 resulted in death, 3 were treated in hospital and 3 were treated in the community (appendix 1).

Between the five years ending 1964 and the five years ending 2003 accidental firearms deaths have reduced by 72% from 11 (0.43 per 100,000 population) to 3 (0.08 per 100,000). There have been fluctuations about the downward trend, for example, in 2002 there were no accidental firearms deaths and in 2003 there were 6 deaths. Accidental deaths as a ratio to imports of cartridges have also declined over the period 1988 and 2003. This information is summarised in chart 2. Using the ratio of 9 accidents per 3 deaths (appendix 1), it is estimated that firearms accidents reduced by 24, from 33 (1.28 per 100,000 people) for the 5 years ending 1964 to 9 (0.23 per 100,000 people) for the five years ending 2003.

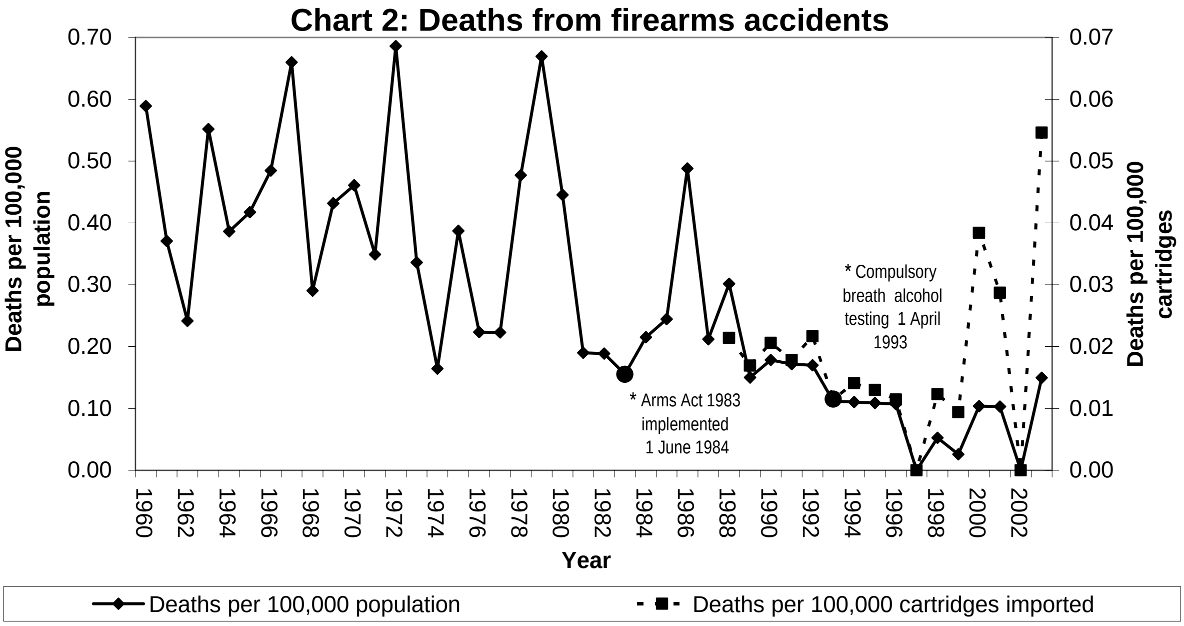


Table 1 and appendix 2 detail base case costs of injury caused by firearms accidents. Total annual cost of all firearms accidents amounted to $1,304,696 or $144,645 per accident. Most of these costs (91% of the total) resulted from intangibles while direct costs amounted to 5% and loss of production 4% of the total. If willingness to pay criteria are used to value human life, base case costs rise to $8,608,396 or $954,368 per accident ($8,608,396÷9.02). Using another measure, there were on average, 144 life years (3 deaths multiplied by life expectancy 48 years) lost annually from firearms accidents.

Table 1: Base case annual cost of firearms accidents

Cost item	Incidents 9.02	Per incident $	Total cost $
Direct medical			
Heath professional		98	884
Hospital		675	6,085
Total direct medical cost		773	6,969
Direct non-medical			
Ambulance		174	1,566
Private motor vehicle		10	93
Funeral and other additional costs to dependents		5,109	46,083
Coroner inquiry		1,042	9,396
Total direct non-medical cost		6,335	57,138
Total direct		7,107	64,107
Indirect			
Loss of productivity		6,019	54,289
Total direct and indirect cost		13,126	118,396
Intangible cost		131,519	1,186,300
Total cost		144,645	1,304,696

The results of the sensitivity analysis for costs (appendix 3) shows that with respect to total direct and indirect costs, the most important parameters were the numbers of hospitalisations and deaths, the cost of lost productivity while in hospital, and additional family expenses. The key cost drivers with respect to total societal costs were the value of human life and number of deaths. Multivariate sensitivity analysis found that the total for the direct and indirect cost was $100,265 at the 5th percentile and $137,158 at the 95th percentile. For the total of all costs (direct, indirect and intangible) the 5th percentile was $828,108 and the 95th percentile was $6,988,857. If the intangible cost of human life is increased from the base case unit cost (human capital estimate, $395,433) to a high value unit cost (willingness to pay estimate, $2.8 million) total costs rise by 560% (from $1,304,696 to $8,608,396).

5. Discussion

We found that 33% of all firearm accidental injuries requiring treatment by a medical professional or hospital resulted in death (for every recorded death there was one hospitalisation and one case treated in the community). Forsyth (C. Forsyth & Weatherston, 2006) using a different methodology estimated that 23% of accidents causing injury (not necessarily requiring medical intervention) resulted in death. Max and Rice found that in the US for every fatal firearm injury there were 2 hospitalisations and 5 injuries not serious enough to be treated in hospital (Max & Rice, 1993). In New Zealand a greater proportion of firearms accidents occur when hunting and are caused by higher powered shoulder aimed firearms rather than hand guns. The higher powered firearms and remote accident locations (distance from medical help despite recent improvements in communications and medical helicopter services) in New Zealand are more likely to result in death than would firearm injuries in many other countries. In both countries young males dominate the firearms injury and mortality statistics.

In New Zealand firearms deaths have been trending downwards since 1960 but the trend has been most marked since the early 1980's and the numbers since this time have remained low. Over the period investigated (1960 to 2003) there was a statistically significant (F-test $p<0.01$) downward linear trend in accidental firearms deaths per 100,000 population. Accidental firearms deaths have reduced from an average of 11 (0.43 per 100,000 population) over the five years ending 1964 to 3 (0.08 per 100,000) averaged over the five years ending 2003. Between 1988 and 2003 a similar downward trend was evident in accidental deaths caused by firearms as a ratio to imports of cartridges (this correlation does not indicate a causal link).

Norton and Langley looked at firearms deaths (1978 – 1987) and found that suicides were 75.5% of the total firearm deaths, homicides 10.6%, and unintentional deaths 11.6% (Norton & Langley, 1993). In our study comparative firearms deaths for the past 5 years (1996 -2000) were 78.8% for suicides, assaults by other persons (homicides) 11.7%, and unintentional (accidents) 5.2%. Suicides and homicides have both risen as percent of total deaths from firearms, but numbers of deaths from all categories of firearms incidents have declined between 1992 and 2000.

Forsyth reported that 39% of firearms accidents occurred in the home and surroundings and 35% in the field, but our study did not investigate the location of accidents or if there has been any change (Forsyth, [1986]). In Canada most deaths from gunshot injuries occurred in the home and the rates were higher in rural areas (Chapdelaine & Maurice, 1996). In Sweden 59% of accidental firearms injuries were associated with hunting (Ornehult & Eriksson, 1987).

During the period investigated a number of legislative changes relevant to both drink/ driving and firearms accidents were implemented. The Arms Act ("Arms Act, 1983," 1983) together with the 1984 Arms Regulations came into force 1 June 1984, evidential breath testing became possible in 1978 and compulsory breath testing was introduced 1 April 1993 (Ministry of Health, 1998; Moore, 2004). We investigated[ii] the impact of both the introduction of the Arms Act 1983 and the introduction of compulsory breath alcohol testing (for motorists) in 1983 but the effects on the downward trend were not statistically significant. Breath testing of motorists was investigated because anecdotal evidence suggested that before the introduction of such testing hunting parties, particularly duck shooters, consumed alcohol in quantities that may have contributed to accidents. In international studies, alcohol was not a key factor in Sweden (Ornehult & Eriksson, 1987) but in Cleveland (Rushforth et al., 1974) about half of the victims had been consuming alcohol.

It is likely that it has been the combined effects of a wide range of factors that has influenced firearm accident trends. These factors could include; the introduction of licensing, personal vetting and safety training of new applicants, restricted availability of firearms, demographic changes, attitudinal changes, prominent media reporting of accidents, economic conditions, availability of game and changes in hunting and shooting patterns, and compulsory breath testing. As the number of firearms accidents is low and small changes in incidence result in substantial percentage changes we can expect fluctuations about a low rate to continue. The annual cost of firearms safety training and promotion ($992,000) would be covered by preventing 6.9 firearms accidents (6.9 = $992,000 divided by the cost per accident, $144,645).

A causal link between the decline in firearms’ accidents and the introduction of the firearms legislation and safety initiatives could not be proven statistically but this does not mean that education and control of firearms should be abandoned. The safety impact of the licensing of owners of firearms and safety education is analogous to licensing of motor vehicle drivers in that both systems contribute to the elimination of many potentially dangerous practices.

6. Conclusion

This study provides new data on the number of accidents resulting from firearms and the cost of such accidents in New Zealand. Sensitivity analysis of factors effecting total costs (direct, indirect plus intangible) generated by firearms accidents in New Zealand, revealed that the unit costs for the value of human life and the number of deaths were the most important cost factors. The number of hospitalisations and loss of earnings were the main determinants of direct and indirect cost.

Total base case costs reported in this paper should be regarded as conservative because the base case used a conservative human capital value for human life (the upper bound estimates in the sensitivity analysis were based on a much higher willingness to pay value). In addition, we did not estimate the intangible costs of mental trauma accruing to family and friends of the victim.

The reduction in firearm accidents has probably resulted from a combination of factors but if the decline in the number of firearms accidents by 72% (between the 5 years ending 1964 and the 5 years ending 2003) had not occurred, there would have been annually 24 more accidents and 8 more deaths and societal costs would be 267% higher. Society would be justified in allocating an additional $144,645 of resources to reduce firearm accidents by one.

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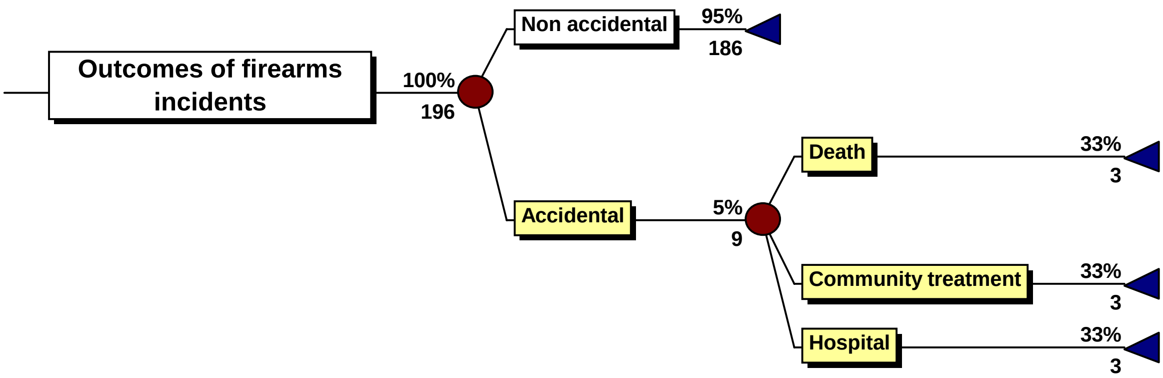
Appendix 1

Outcome of firearm incident

	Outcome of firearms incident causing injury or death			
Outcome	Accidents		All incidents	
	N		N	
Community treatment	2.7	(a)	58.2	(e)
Hospital treatment	3.3	(b)	72.5	(f)
Death	3.0	(c)	65.2	(g)
% of deaths from firearms attributed to accidents	4.6%	(d)		
Total	9.0		195.9	

Notes Appendix 1

(a) Calculated by multiplying (e) by (d)
(b) Calculated by multiplying (f) by (d)
(c) Mean of 5 years ending December 2003 (New Zealand Mountain Safety Council, 2004)
(d) Calculated by dividing (c) by (g)
(e) ACC (McCormack, 2004b) medical fee claims, mean of 5 years ending June 2004
(f) Mean of 2 years ending June 2001, ICD codes: W32, handgun discharge; W33, rifle, shotgun and larger firearm discharge; W34, discharges from other and nonspecified firearms (Ministry of Health, 2004b)
(g) All deaths from firearms five years ending June 2000 (Lewis, 2004)



Appendix 2

Base case annual cost of firearms accidents

	Outcome of injury								
	Non fatal				Death		All outcomes		
	Community treatment		Hospital treatment						
Volumes (from Appendix 1)	N = 2.68		N = 3.34		N = 3.00		N = 9.02		
	Unit cost	Total cost	Unit cost	Total cost	Unit cost	Total cost	Cost per incident (l)	% of total	Total cost
Cost item (a)					$				
Direct medical									
Heath professional	246.52 (b)	661			74.28 (h)	223	98		884
Hospital			1,821.92 (e)	6,085			675		6,085
Total direct medical cost	246.52	661	1,821.92	6,085	74.28	223	773	1%	6,969
Direct non-medical									
Ambulance			247.00 (f)	825	247.00 (f)	741	174		1,566
Private motor vehicle	34.72 (c)	93					10		93
Funeral and other additional costs to dependents					15,361.14 (i)	46,083	5,109		46,083
Coroner inquiry					3,132.00 (j)	9,396	1,042		9,396
Total direct non-medical cost	34.72	93	247.00	825	18,740.14	56,220	6,335	4%	57,138
Total direct	281.24	754	2,068.92	6,910	18,814.42	56,443	7,107	5%	64,107
Indirect									
Loss of productivity	458.00 (d)	1,227	15,886.72 (g)	53,062			6,019	4%	54,289
Total direct and indirect cost	739.24	1,981	17,955.64	59,972	18,814.42	56,443	13,126	9%	118,396
Intangible cost					$395,433 (k)	1,186,300	131,519	91%	1,186,300
Total cost	739.24	1,981	17,955.64	59,972	414,247.61	1,242,743	144,645	100%	1,304,696

Notes Appendix 2

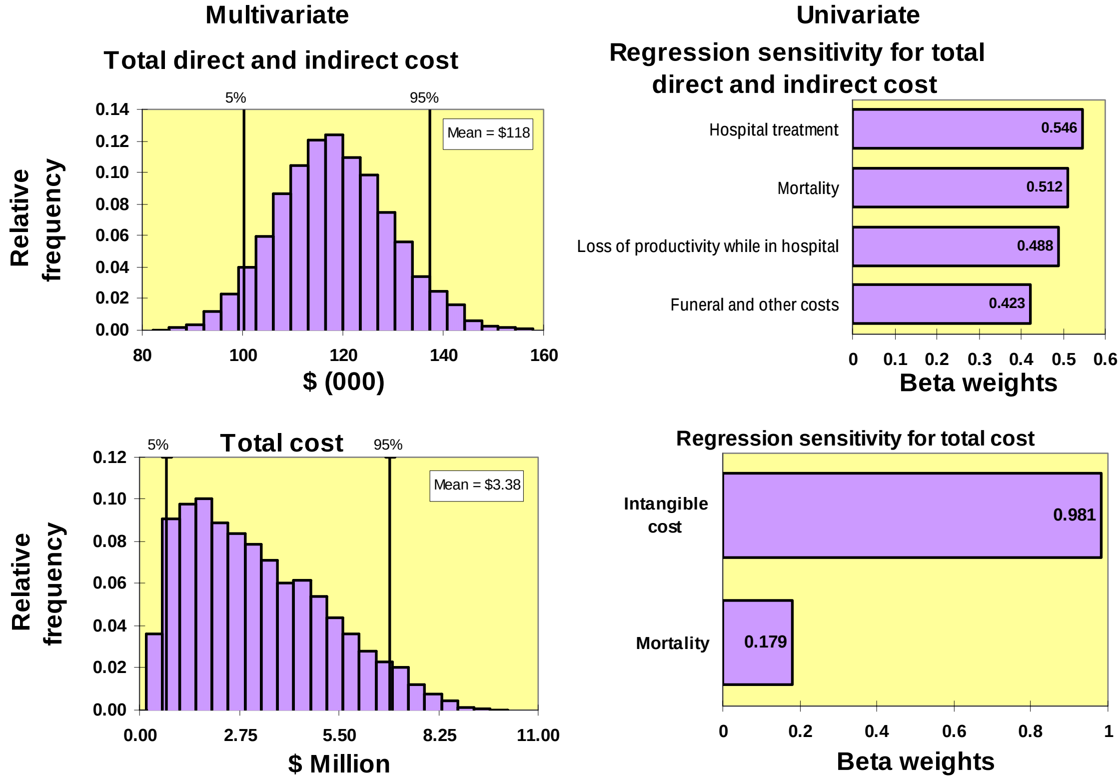
(a) Costs are valued in 2004 NZ dollars exclusive of GST (goods and services tax)
(b) Accident Compensation Corporation, mean medical fees claimed over the 5 years ending 2004. (McCormack, 2004b) The Consumers price index (Statistics New Zealand, 2004b) was used to convert earlier years' values into 2004 dollars
(c) $0.62 per km (Inland Revenue Department, 1996, p 27) multiplied by 56.km - the average distance travelled by an ambulance for an emergency call (St John, 2004)
(d) Average weekly income from wages, salaries and self-employment for all people aged 15 and over (regardless of employment status). (Statistics New Zealand, 2004c)
(e) Mean DRG price over all codes ($2,479) year ending June 2002 (Ministry of Health, 2004a) multiplied by the average days stay for firearms injury (7.2) divided by the average days stay over all admissions (8.1) for the two years ending June 2001 (Ministry of Health, 2004b)
(f) Mean cost of an ambulance for an emergency incident. (Ministry of Health, 2004c, p 33)
(g) Accident Compensation Corporation. Firearms entitlement claims - mean 5 years ending 4 October 2004. (McCormack, 2004b).
(h) Estimated as twice the standard consultation fee. (Statistics New Zealand, 2004a)
(i) Accident Compensation Corporation firearms fatal claims- mean 5 years ending 4 October 2004 (McCormack, 2004a, 2004b)
(j) Average of coroner fees over the five years ending 3 September 2004 ($739) multiplied by 2 (to cover court costs), plus the approximate post-mortem and mortuary costs ($1,654) (Baird, 2004)
(k) Discounted value of future earnings (n = 36 years, r = 5%). The median age of the typical firearms fatal accident victim is 29 years (J Green, 2003) and a male aged 29 would be expected to live for another 48 years (Statistics New Zealand, 2004d). Thus, a 29 year old New Zealand male would have an expectation of 36 additional years of work before retirement at age 65.
(l) Total cost divided by the total number of incidents
Rounding: because of rounding individual items may not add exactly to there totals shown

Exchange rates December 2004 mid rates to NZ$1

USA 0.7142, Aust 0.9315, UK 0.3702, Euro 0.5337

Appendix 3

Sensitivity analysis: costs



End Notes

[i] Volumes and unit costs subjected to sensitivity analysis
Volumes: deaths, hospitalisations, community treatment numbers
Unit costs: community treatment by health professionals, private motor vehicle, loss of productivity while treated in the community, hospital cost, ambulance, loss of productivity of those treated in hospital, general practitioner death certificate, funeral and additional cost to dependents, coroner inquiry, intangible value of human life

[ii] (a) Using dummy variables and multiple linear regression with SPSS, and (b) testing for structural breaks with Stamp Structural Time Series Analyser (version 6.3). Koopman S.J., Harvey, A.C., Doornik, J.A. and Shephard, N. (2000). Stamp: Structural Time Series Analyser, Modeller and Predictor, London: Timberlake Consultants Press.