

Manuscript title: The effect of legislation on firearm-related injuries and deaths in Canada: a systematic review

Author names and affiliations: Nick Bennett, MD (Candidate),¹ Manolhas Karkada, MD (Candidate),¹ Mete Erdogan, PhD, MHI,² Robert S. Green, MD, DABEM, FRCPC, FRCP (Edin)²⁻⁴; on behalf of the Heal-NS Research Program.

¹Dalhousie University Medical School, Halifax, NS, Canada, B3H 4R2. Emails: Nick.Bennett@dal.ca, M.Karkada@dal.ca

²Nova Scotia Health Trauma Program, Nova Scotia Health, Rm 1-026B Centennial Building, 1276 South Park Street, Halifax, NS, Canada, B3H 2Y9. Email: mete.erdogan@nshealth.ca

³Department of Emergency Medicine, Dalhousie University, Halifax, NS, Canada, B3H 4R2.

⁴Department of Critical Care, Dalhousie University, Halifax, NS, Canada, B3H 4R2. Email: greenrs@dal.ca

Corresponding author: Robert S. Green, Room 1-026B Centennial Building, 1276 South Park Street, Halifax, NS, B3H 2Y9. Phone: (902) 473-7157. Fax: (902) 473-5835. Email: greenrs@dal.ca

Running header: LEGISLATIVE EFFECTS ON FIREARM INJURIES

Word count: Abstract 261 words; Manuscript 2499 words

Keywords: Firearm; injury; legislation; trauma

Financial support: This research was funded by a research studentship from Dalhousie University Faculty of Medicine.

Conflict of interest: None.

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Abstract

Background: Our aim was to systematically review evidence from peer-reviewed literature on the effectiveness of Canadian legislation in reducing injuries and deaths caused by firearms.

Methods: Five electronic databases (MEDLINE, Embase, CINAHL, Web of Science, Scopus) were searched from inception until June 2021 for studies evaluating the effect of firearms legislation on rates of firearm-related injuries and deaths in Canada. Article screening and selection was performed, and data was synthesized using descriptive statistics. The outcome of interest was injury or death from firearms. Study quality was assessed using the Newcastle Ottawa Scale and criteria from the Guide to Community Preventive Services.

Results: We identified 18 studies assessing the effectiveness of Canadian firearm control laws in reducing rates of injury or death. Ten studies examined the effect on homicides, of which five reported a reduction during the post-legislation period; only one study reported evidence of substitution from firearms to other methods of homicide. Eleven studies evaluated the effect on suicide, with nine finding a reduction in suicide rates in the post-legislation period. Eight of these studies reported evidence of substitution from firearms to other suicide methods. Two studies investigated the effect on accidental deaths; neither study reported any benefit post-legislation.

Interpretation: Evidence supporting the effectiveness of Canadian firearms legislation in the reduction of homicide and accidental death rates is inconclusive. Existing studies are limited in design and present conflicting results. A decrease in firearm-related suicide rates was observed by most studies but evidence of method substitution was also identified.

Introduction

Firearm-related injuries are a major cause of morbidity and mortality.¹ In 2010, Canada ranked fifth in firearm death rate among high-income countries in the Organization for Economic Co-operation and Development.² The majority of Canadian firearm deaths result from suicide (75%) and homicide (20%).³ While firearm suicide rates have remained relatively unchanged since 2007,⁴ firearm-related homicide rates have increased in recent years and peaked in 2017.⁵ Various legislative approaches have been implemented internationally to regulate firearm access and use.⁶ In Canada, the federal government introduced the basis for firearm control in 1968 and subsequently passed 3 major pieces of legislation in 1977 (Bill C-51), 1991 (Bill C-17) and 1995 (Bill C-68). No major firearms control reform has occurred in Canada since 1995; however, some notable policy changes have occurred including abolishment of the long-gun registry in 2012 and the ban of 1500 assault-style weapons in the wake of the 2020 Portapique shootings in Nova Scotia.

The effectiveness of Canadian firearm legislation in reducing firearm-related injuries and deaths has resulted in extensive debate in both the media and literature. Previous reviews have reported a limited amount of contemporary research on this topic and suggest that knowledge gaps prevent definitive conclusions from being drawn.⁶⁻¹⁰ Gun violence causes irreparable harm to Canadian communities, and as caretakers of the public's health, physicians are uniquely positioned to witness the suffering experienced by victims and their families. Thus, clinicians play a critical role in advocating for effective preventative measures from firearm-related injury, including improved governmental regulations. Our objective was to synthesize evidence on the effectiveness of legislation in reducing firearm-related morbidity and mortality in Canada.

Methods

This systematic review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.¹¹ The study protocol was prospectively registered with PROSPERO (PROSPERO 2020: CRD42020192486).

Data Sources and Search Strategy

A systematic search of five electronic databases (MEDLINE, Embase, CINAHL, Web of Science, Scopus) was conducted in June 2020 and updated in June 2021. The search strategy was developed in collaboration with an experienced Health Sciences librarian and modified for each database (Supplementary Material 1). We used variations of keywords including “gun”, “firearm”, “legislation”, “law”, “injury”, “death” and “Canada”. Appropriate controlled vocabulary terms (MeSH headings, Emtree headings, CINAHL headings) were included where applicable. Proximity and truncation search techniques were applied. No limitations were placed on date or language of publication.

Eligibility Criteria

Criteria for inclusion were: (a) design – any design; (b) population – victims of firearm-related injury or death in Canada; (c) exposure – enactment of one or more pieces of Canadian firearm legislation; and (d) outcome – effect of firearm legislation on rates of firearm-related injury or

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1 death. We excluded studies that were not peer-reviewed, or if it was not possible to extract data
2 specifically on firearm-related injuries or deaths.

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4 The three major pieces of legislation that form the framework for the Canadian firearms control
5 schema are described in Table 1. Together, these bills sought to strengthen governmental
6 regulation over all firearm and ammunition control categories: usage, sale, ownership, transport,
7 storage, and penalties. Importantly, not all provisions of each bill were implemented
8 immediately; in some cases, rules came into effect years after legislation was passed, making it a
9 necessity for studies to account for these differences in their analysis.

10
11 **Article Screening and Data Extraction**

12 Article deduplication, screening and selection was performed using Covidence software (Veritas
13 Health Innovation, Melbourne, Australia). Two reviewers (NB, MK) independently screened
14 articles by title and abstract. The full text of potentially relevant articles were screened by the
15 same two reviewers. Any disagreements were resolved by consensus; if consensus was
16 unattainable, a third reviewer (ME) was consulted. Articles published in a language other than
17 English were translated using Google Translate. References of articles meeting inclusion criteria
18 were searched for additional relevant studies. Inter-rater agreement for article screening was
19 calculated using non-weighted Cohen kappa;¹² agreement interpretation was based on established
20 categories. Data were abstracted by a single reviewer (NB) using a standardized data extraction
21 form. We collected data on the effect of legislation on firearm-related injuries or deaths, as well
22 as any evidence of method substitution (i.e., increased rates of injury or death from non-firearm
23 methods during post-legislation period). Data from multiple reports of the same study were
24 collated in accordance with recommendations from Cochrane.¹³

25
26 **Quality Assessment**

27 Two reviewers (NB, MK) independently assessed risk of bias for each study using the
28 Newcastle-Ottawa Scale (NOS).¹⁴ In addition, study quality was summarized using 4 quality
29 metrics: 1) were appropriate data source(s) and outcome measure(s) used for the study question;
30 2) was the time frame studied adequate (i.e., sufficient surveillance before/after enactment of a
31 law; 3) were appropriate statistical tests used; and 4) was the study design suitable. Design
32 suitability was assessed using criteria from the *Guide to Community Preventive Services*.¹⁵

33
34 **Data Analysis**

35 Simple descriptive statistics were used to report the results. Studies were grouped by outcome
36 (homicide, suicide, accidental death). Heterogeneity among included studies precluded the
37 ability to perform meta-analysis.

38
39 **Results**

40
41 Overall, 2361 studies were identified in the literature search, from which 882 duplicates were
42 removed (Figure 1). Screening by two independent reviewers identified 90 articles for full-text
43 review, of which 21 were included ($\kappa = 0.56$, moderate agreement). An additional two articles
44 were identified from references of primary studies and literature reviews. Six articles that met
45 inclusion criteria were determined to be multiple reports of the same study as they were
46 performed by the same authors and evaluated the same legislation (Bill C-51), population, and

time period.¹⁶⁻²¹ Outcomes evaluated in these six reports included homicide¹⁷⁻²⁰ and suicide.^{16,18,19,21} For the purpose of this review, data from these reports were collated as a single study (referred to as reference 21) in accordance with recommendations from Cochrane.¹³ Thus, a total of 18 studies were included in the analysis.

Study Characteristics

Although all studies were focused in Canada,²¹⁻³⁸ two also included data from the United States (Table 2).^{23,24} Ten studies investigated the effect of Bill C-51,^{21-28,34,35} eight examined Bill C-17,^{29-35,38} and five examined Bill C-68;³⁴⁻³⁸ three studies evaluated more than one piece of legislation.^{34,35,38} The majority of studies examined the effect of legislation on suicide (11 studies)^{21,23,24,26,27,29-33,38} and/or homicide (10 studies);^{21,22,23,25,29,34-38} two studies focused on accidental deaths.^{23,28} All studies used a retrospective time-series design and most were conducted using population data from Statistics Canada (14 studies).^{21-23,25-29,31,34-38} Four studies were limited to Quebec,^{30,32,33,36} two used data from Ontario,^{24,26} and one included all provinces with the exception of Newfoundland and Labrador.²⁵ Most studies included all ages and genders (15 studies);^{21-23,25-30,32,34-38} two studies focused on male victims,^{24,33} and another was limited to youths aged 15-19 years.³¹

Effect on Homicide

Among 10 studies evaluating the effect of legislation on homicides, 50% (5/10) observed a beneficial effect on homicide rates during post-legislation periods.^{21,22,29,34,36} Regarding Bill C-51, six studies investigated its effect on homicide, of which 50% (3/6) observed a beneficial effect with minimal evidence of method substitution.^{21,22,34} Four studies assessed the effect of Bill C-17 on homicide,^{29,34,35,38} 25% (1/4) of which reported a beneficial effect;²⁹ this study also found the raw homicide rate by all other methods decreased post-legislation. Five studies looked at the effect of Bill C-68 on homicide,³⁴⁻³⁸ with 40% (2/5) of these reporting a beneficial effect post-legislation;^{34,36} neither study reported any evidence of method substitution. These studies found the reduction in firearm homicides was most noticeable in homicides committed with long-guns (shotguns, hunting rifles) and that the effectiveness of the law was attributable to reduced access and availability of firearms rather than to the severity of sentences provided in the legislation. Differences in study design precluded us from quantifying any change in mortality following legislation implementation.

Effect on Suicide

There were 11 studies that evaluated the effect of firearm legislation on suicides in Canada, of which 82% (9/11) reported a beneficial effect.^{21,24,26,27,29-31,33,38} Regarding Bill C-51, five studies investigated its effect on homicide and 80% (4/5) of these observed a benefit post-legislation.^{21,24,26,27} In 40% (2/5) of these studies, there was evidence of method substitution. Rich et al. observed an increase in the proportion of male suicides by leaping,²⁴ while Leenaars et al. found increasing trends in suicide by non-firearm methods (albeit a nonsignificant increase in their multivariate analysis).²¹ The effect of Bill C-17 on suicide was examined in six studies, of which 83% (5/6) reported a benefit post-legislation.^{29-31,33,38} These five studies all reported evidence of method substitution from firearms to other methods; three of these studies specifically found increased rates of suicide by hanging.^{31,33,38} In the remaining investigation, Caron and colleagues observed a decrease in firearm suicide rates, however the trend was not significant when compared to the trend prior to implementation of Bill C-17.³² Finally, one study

evaluated the effect of Bill C-68 on suicide and found no benefit.³⁸ This study by Langmann and colleagues observed an increase in firearm suicides compared to suicide by hanging among men.³⁸ Sensitivity analysis supported a substitution effect from suicide by firearm to hanging and not a switch to hanging from other suicide methods.³⁸

Effect on Accidental Death

Leenaars and colleagues reported significant decreases in the accidental death rate from firearms for males (9.89/million/year to 4.82/million/year; $p < 0.001$) and females (0.98/million/year to 0.52/million/year; $p < 0.01$) following passage of Bill C-51;²⁸ however, they noted the mortality rate for males began to decline 2 years prior to Bill-C-51. After adjusting for divorce rate and unemployment rate, Bill C-51 was not predictive of accidental mortality. A second study also found no effect on accidental deaths following implementation of Bill C-51.²³

Quality Assessment

Using the NOS for risk of bias, six studies received a score of five,^{23,24,26,30,31} four studies received a score of 6,^{22,29,32,37} five studies received a score of 7,^{21,25,27,28,36} and three studies received a score of 8 (Supplemental Table 1).^{34,35,38} A score of 3 (good quality) was assigned to nine studies,^{21,25,32-38} and a score of 1 (poor quality) was assigned to nine studies (Supplemental Table 2).^{22-24,26-31} While all studies had appropriate data sources and outcome measures, time frames, and design suitability, there was variation in the statistical analysis. Most studies published prior to 2008 performed analyses that had weak statistical power, failed to measure the immediate or gradual effects of the law, and/or failed to control for societal and economic variables.

Interpretation

Brief summary of main results

Although our review found some evidence of a decrease in homicide and accidental death rates following introduction of firearms legislation, a lack of high-quality literature makes it difficult to evaluate the effectiveness of current policies in preventing firearm-related homicides and accidental deaths. With regards to suicide, we found that while most studies reported a decrease in firearm-related suicide rates, there was also evidence of method substitution identified in the majority of studies, indicating that individuals may have turned to other methods such as hanging. Of the 18 studies that were identified in our literature search, none analyzed the effect of Canadian firearm legislation upon non-fatal firearm injuries.

Explanation of the findings

Our results are consistent with those of other reviews published in the last 15 years which sought to evaluate the effect of firearms legislation on injury and violent crime. Santaella-Tenorio and colleagues found that the reported effect of Canadian firearm legislation on homicide rates in the literature varied and that while firearm suicide rates were reduced, method substitution likely occurred and the overall Canadian suicide rates did not change.⁶ Cohen and Burke reported that Canadian firearms legislation likely reduced some portion of the violent crime rate, given that it restricts easy access to firearms, and that rather than having a significant effect on reducing suicides overall, the introduction of stricter Canadian firearm legislation forced people to find alternative means to die by suicide.⁷ Finally, Ferguson and Koziarski reported that the literature

yields mixed results, with certain studies reporting significant changes in homicide and suicide rates after legislation implementation, some noting that rates were not significantly affected, and others contending that legislation is not associated with a change in rates or produces inverse effects.⁸ All of these reviews also concluded that significant knowledge gaps, study design flaws, and a scarcity of contemporary research result in the need for further investigations.⁶⁻⁸

Future directions in the area of study

Our review was unable to identify any studies evaluating the effect of Canadian firearms legislation on non-fatal firearm injuries. This is likely due to data availability as Statistics Canada does not collect data on non-fatal firearm injuries. Non-fatal firearm-related injury is an important outcome that requires investigation, as it has been shown that in at least one province 55% of all firearm-related injuries are non-fatal.³⁹ Moving forward, we suggest that government should be deliberate when crafting firearms legislation by explicitly describing the goal of the policy and in determining how outcomes will be measured. Furthermore, in Canada, firearms differ in their availability and accessibility based upon their assignment into one of three categories by the federal government: unrestricted, restricted, and prohibited. However, illicit weapons or weapons obtained through illegal means escape the controls that legally obtained firearms must undergo, such as background checks and transportation regulations. The seriousness of the illicit firearms trade in Canada cannot be understated, as demonstrated by the fact that all firearms used in the 2020 Nova Scotia mass shooting were obtained illegally.⁴⁰ Currently, there is a lack of published research on illegal firearms in Canada; future research will benefit from exploring this gap in the literature.

Limitations

We urge caution in interpreting the results of this review due to methodological limitations and considerable variation among the included studies. Some studies did not use accurate dates of firearms legislation implementation for the post-legislation analysis period, and most studies did not account for potential confounding variables. Blais and colleagues identified numerous methodological flaws in some of the earlier studies included in this review, including several studies using interrupted time series analysis which failed to reach the minimum of 50 observations required to reach adequate statistical power.³⁴ Since national data was used in most of the studies, there is also uncertainty due to variation in how firearms laws were applied province-to-province; although the federal government designed the firearms control scheme, it is the provincial and territorial governments who were responsible for applying and administering the provisions of the criminal code. Finally, due to Canada's size, population distribution, and the federal origins of firearms legislation, the results of studies that use national data disproportionately reflect the situation in the country's most populous provinces. These limitations make it problematic to accurately assess the effect of Canadian firearms legislation.

Conclusion

Evidence supporting the effectiveness of Canadian firearms control legislation in the reduction of homicide and accidental death rates is inconclusive. Re-evaluation of existing laws may be beneficial for Canada to build an improved and effective evidence-based national framework for the prevention of gun-related violence. This review serves to highlight the responsibility of physicians to advocate for further research into and greater preventative measures for firearm violence, as clinicians are uniquely positioned within society to witness the physical and

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1 psychological harms done unto individuals, families, and communities by firearm-related injury
2 and death.

4 **Acknowledgements**

5 The authors are grateful to Robin Parker (Evidence Synthesis Librarian, Dalhousie University)
6 for assistance with development of the search strategy. We also thank Nelofar Kureshi for
7 support with statistical analysis.

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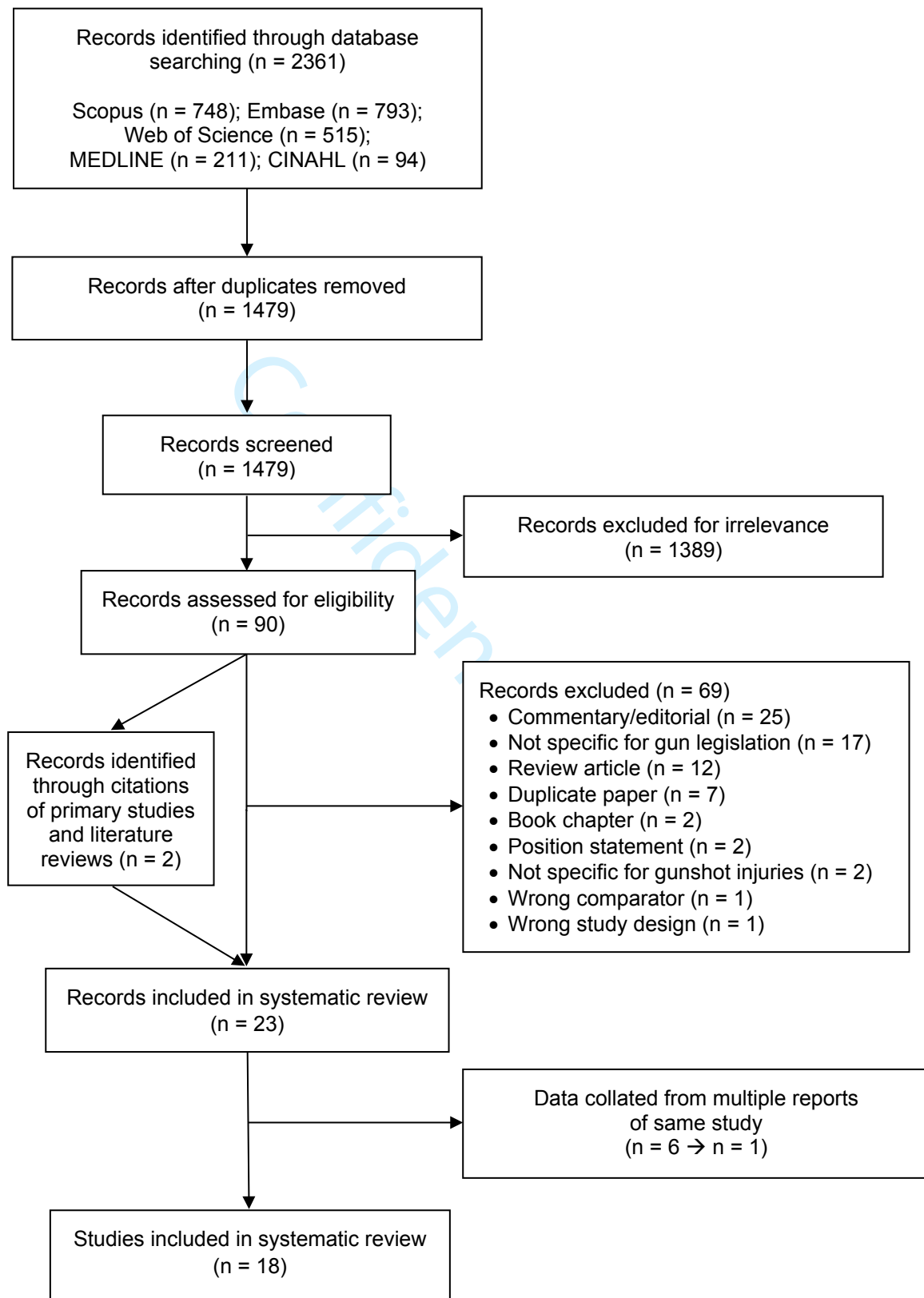
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Figures

Figure 1. Flow diagram of studies selected for inclusion in the review.



Tables

Table 1. Major pieces of firearms legislation in Canada

Bill	Description	Relevant dates
C-51	<ul style="list-style-type: none">• Mandatory FACs required criminal record checks of all firearm purchasers and record-keeping systems• New definitions for prohibited and restricted firearms• Mandatory minimum sentences (1-14yr consecutive sentence for use of firearm to commit indictable offence) and increased penalties for firearm homicides• Granted search and seizure powers	<p>Aug 5 1977: Bill received Royal Assent</p> <p>Jan 1 1978: All provisions came into effect except requirements for FACs</p> <p>Jan 1 1979: Requirements for FACs came into effect</p>
C-17	<ul style="list-style-type: none">• Changes to the FAC system:<ul style="list-style-type: none">- expanded application form and screening check- required psychological questionnaire, photo identification, 2 references, spousal endorsement, 28-day waiting period, safety training• New definitions for prohibited and restricted weapons• New prohibitions and restrictions on many military, and high-firepower guns and ammunition• New Criminal Code offences and increased penalties for firearm-related crimes• Clearly defined regulations for safe storage, handling and transportation of firearms	<p>Dec 5 1991: Bill received Royal Assent</p> <p>1992 – 1994: All provisions came into effect</p> <p>Jan 1 1994: Requirements for FAC applicant safety training and psychological questionnaire completion came into effect</p>
C-68	<ul style="list-style-type: none">• Creation of the Firearms Act, to take administrative and regulatory aspects of the licensing and registration system out of the Criminal Code• FAC system replaced with 2 new licensing systems (POLs and PALs) which required expanded screening of applicants• Registration of all firearms, including shotguns and rifles• Increased penalties for certain serious crimes using firearms• Authorization requirement for transportation of restricted or prohibited firearms	<p>Dec 5 1995: Bill received Royal Assent</p> <p>Jan 1996: Provisions requiring increased penalties for serious firearms crimes came into effect</p> <p>Dec 1 1998: The Firearms Act came into effect</p> <p>Mar 1998: Government passed the Firearms Act Regulations</p> <p>Jan 1 2001: Requirements for POLs/PALs came into effect</p> <p>Jan 1 2003: Requirements for registration of all firearms including non-restricted rifles and shotguns came into effect</p>

FACs, Firearm Acquisition Certificates; POLs, Possession-Only Licenses; PALs, Possession and Acquisition Licenses.

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Table 2. Characteristics of included studies

Study (Year)	Location	Population	Period	Law(s)	Outcomes	Statistical methods
Sproule (1988) ²²	Canada	All	1972-1982	Bill C-51	Homicide	Analysis of variance
Mundt (1990) ²³	Canada; USA	All	1971-1988	Bill C-51	Homicide, suicide, accidental death	Visual inspection
Rich (1990) ²⁴	Toronto, ON; San Diego, CA, USA	Males	1973-1983	Bill C-51	Suicide	T-tests, time series analysis
Mauser (1992) ²⁵	Canada (excluding NFLD & 3 Territories)	All	1968-1988	Bill C-51	Homicide	Pooled cross-section time series model
Leenaars* (1993, 1994, 1996, 1997b, 2001, 2003) ¹⁶⁻²¹	Canada	All	1969-1985	Bill C-51	Homicide, suicide	T-tests, simple linear regression, multiple regression, interrupted time series
Carrington (1994a) ²⁶	ON	All	1965-1989	Bill C-51	Suicide	T-tests, time series analysis
Carrington (1994b) ²⁷	Canada	All	1965-1989	Bill C-51	Suicide	Interrupted time series
Leenaars (1997) ²⁸	Canada	All	1969-1985	Bill C-51	Accidental death	T-tests, simple linear regression, multiple regression
Bridges (2004) ²⁹	Canada	All	1984-1998	Bill C-17	Homicide, suicide	T-tests, simple linear regression
Caron (2004) ³⁰	Abitibi-Temiscamingue, QC	All	1986-1996	Bill C-17	Suicide	Chi-square and likelihood ratio tests
Cheung (2005) ³¹	Canada	Age 15-19 yrs	1979-1999	Bill C-17	Suicide	Time series models
Caron (2008) ³²	QC	All	1987-2001	Bill C-17	Suicide	Linear regression, interrupted time series analysis, Pearson correlation coefficient analyses, multivariate analysis
Gagne (2010) ³³	QC	Males	1981-2006	Bill C-17	Suicide	Joinpoint analysis, Poisson regression analysis
Blais (2011) ³⁴	Canada	All	1974-2004	Bill C-51, Bill C-17, Bill C-68	Homicide	Multiple time series analysis

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Langmann (2012) ³⁵	Canada	All	1974-2008	Bill C-51, Bill C-17, Bill C-68	Homicide	Interrupted time series Poisson regression, ARIMA, Joinpoint analysis
Linteau (2012) ³⁶	QC	All	1974-2006	Bill C-68	Homicide	Extreme bounds analysis
McPhedran (2013) ³⁷	Canada	All	1974-2009	Bill C-68	Homicide, domestic homicide	ARIMA, Zivot–Andrews structural breakpoint test
Langmann (2020) ³⁸	Canada	All	1981-2016	Bill C-17, Bill C-68	Homicide, suicide	Difference in differences (DiD) analysis, negative binomial regression
ARIMA, autoregressive integrated moving average.						
*Data from multiple reports investigating the same legislation, population, and outcome were collated.						

Confidential

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Table 3. Effect of legislation on firearm homicides in Canada

Study (Year)	Bill	Reported beneficial effect?	Effect on firearm homicides	Evidence of method substitution
Sproule (1988)	C-51	Yes	<ul style="list-style-type: none"> • No change in total standardized national homicide rate • Mean standardized firearm homicide rate decreased from 1.38 to 1.10 per 100,000 	Non-firearm homicide increased post-Bill C-51. After accounting for relationship between suspect/victim, effect was diminished due to high victim:suspect ratio in firearm vs. non-firearm homicides
Mundt (1990)	C-51	No	<ul style="list-style-type: none"> • No effect on homicide rate 	None reported
Mauser (1992)	C-51	No	<ul style="list-style-type: none"> • No significant effect on homicide rate • Covariates: male youth % of population, unemployment rate, % of population foreign immigrant, gun law (before/after 1977), homicide clearance rate, % of population with Indian status, time (to account for linear trend in homicide rates) 	None reported
Leenaars (1994, 1996, 1997b, 2001)	C-51	Yes	<ul style="list-style-type: none"> • Mean firearm homicide rate (per 100,000 per year) decreased from 0.96 ± 0.15 to 0.82 ± 0.08 • Use of firearms for homicide was decreased for those >15 years 	Non-firearm methods for homicides increased in 15-24 year olds
			Multivariate model <ul style="list-style-type: none"> • Decline in overall homicide rate • Nonsignificant decline in firearms homicide rate • Nonsignificant reduction in % of homicides committed by firearms • Covariates: Bill C-51, % young males, birth rate, marriage rate, divorce rate, unemployment, median family income 	No increase in homicide rate by all other methods
Bridges (2004)	C-17	Yes	<ul style="list-style-type: none"> • Mean firearm homicide rate decreased from 0.69 per 100,000 (SE 0.03) to 0.57 per 100,000 (SE 0.04) • Rates of firearm homicide, total homicide rate, and homicide by all other methods showed significant decreases 	Raw rate of homicide by all other methods decreased
Blais (2011)	C-51	Yes	<ul style="list-style-type: none"> • Firearm homicide rate decreased by 5%-10%, depending on the province • Reduction most noticeable in homicides committed with a shotgun or a hunting rifle 	No evidence of method substitution
	C-17	No	<ul style="list-style-type: none"> • No decline in firearm homicide rate 	No evidence of method substitution
	C-68	Yes	<ul style="list-style-type: none"> • Firearm homicide rate decreased by 5%-10%, depending on the province • Reduction most noticeable in homicides committed with a shotgun or a hunting rifle 	No evidence of method substitution
			Covariates: Bill C-51, Bill C-17, Bill C-68, %	

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			population aged 15-24 yrs, population growth associated with immigration	
			• Effectiveness of laws was attributed to reduced access and availability of firearms rather than to the severity of sentences provided in the legislation	
Langmann (2012)	C-51	No	• No effect on firearm homicide rate • No effect on overall homicide rate or spousal homicide rate	No evidence of method substitution
	C-17	No	• No effect on firearm homicide rate • No effect on overall homicide rate or spousal homicide rate	No evidence of method substitution
	C-68	No	• No effect on firearm homicide rate • No effect on overall homicide rate or spousal homicide rate • Joinpoint analysis showed an increasing trend in homicide by firearm rate after enactment of the licensing portion of C-68	No evidence of method substitution
			Covariates: median age of population, population attributed to immigration, population per police officers, rate of prison incarceration, rate of unemployment, % of 15-24 yr old population in low income bracket, % of total population in low income bracket, Gini index of equality	
Linteau (2012)	C-68	Yes	• Gradual decline in firearms homicide rate was observed in homicides committed with long guns (rifle, shotgun)	No substitution effect was observed
McPhedran (2013)	C-68	No	• ARIMA modelling showed no effect on domestic firearm homicide • ZA test for males showed no significant breaks in firearm homicide time series • ZA test for females showed significant breaks in firearm homicide time series but these breakpoint occurred prior to Bill C-68	None reported
Langmann (2020)	C-17	No	• No effect on male or female homicide rates	None reported
	C-68	No	• No effect on male or female homicide rates	None reported
			Covariates: province/territory, year, % license holders, alcohol consumption, unemployment rates, % aboriginal population, % low income persons	
SE, standard error; ARIMA, autoregressive integrated moving average; ZA, Zivot-Andrews.				

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Table 4. Effect of legislation on firearm suicides in Canada

Study (Year)	Bill	Reported beneficial effect?	Effect of legislation	Evidence of method substitution?
Mundt (1990)	C-51	No	• No perceptible effect on suicides	None reported
Rich (1990)	C-51	Yes	• No change in total suicide rate • % of male suicides by firearm decreased from mean \pm SE of 23.2% \pm 1.3% to 16.2% \pm 1.1% (difference of 7% \pm 1.7%, $p < 0.001$)	% of male suicides by leaping increased
Carrington (1994a)	C-51	Yes	• Age-standardized total suicide rate decreased • Firearm suicide rate had a slight nonsignificant downward trend • T-test for change in slope from pre- to post-legislation was significant for firearm suicides, non-firearm suicides, and total suicides	No evidence of method substitution
Carrington (1994b)	C-51	Yes	• 9 of 10 provinces had increasing trends in total & firearm suicide rates pre-Bill C-51 • All provinces had stable or decreasing total & firearm suicide rates post-Bill C-51	No evidence of method substitution
Leenaars (1993, 1996, 1997b, 2003)	C-51	Yes	• Use of firearms for suicide was decreased for those 15-65 years Interrupted time-series analysis: • Total, male, & female overall suicide rate trends decreased • Total, male, & female firearm suicide rate trends decreased Multiple regression analysis: • Firearm suicide rate and % of suicides by firearm decreased Covariates: Bill C-51, % young males, birth rate, marriage rate, divorce rate, unemployment, median family income	Non-firearm methods increased in 15-24 yr olds Non-firearm methods increased in men only Nonsignificant increasing trend for use of other methods for suicide
Bridges (2004)	C-17	Yes	• Mean firearm suicide rate decreased from 4.09 per 100,000 (SE 0.09) to 3.17 per 100,000 (SE 0.16) • Rates of firearm suicide and % of suicides using firearms decreased	Raw rate of suicide by all other methods increased. Linear regression showed nonsignificant increase in suicide rate by other methods
Caron (2004)	C-17	Yes	• Firearm suicide rate decreased significantly from 12.7 to 10.0 per 100,000 • Overall suicide rate showed a slight nonsignificant increase from 24.5 to 26.8 per 100,000	Suicide rate by all other methods increased significantly from 11.8 to 16.8 per 100,000
Cheung (2005)	C-17	Yes	• No change in total suicide rate • Time series models showed significant decrease in rate of suicide by firearms	Time series models showed significant increase in rate of suicide by hanging
Caron	C-17	No	• Firearm suicide rates decreased by 17%	Correlation analysis suggested

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(2008)				(16.8% decrease in males, 42.6% decrease in females), but downward trend was not significant when analysis included the trend in firearm suicide rate in 5 years preceding Bill-C17 • Decline in suicide rates involving firearms did not result in a parallel decline in total suicide rates	replacement of firearm suicide by hanging suicide (more significant among males than females)
Gagne (2010)	C-17	Yes		• In males 15-34 yrs, firearm suicide rate decreased (APC -11.1) from 1996-2006 • In males 35-64 yrs, firearm suicide rate decreased (APC -5.6) from 1997-2006 • Pre/post firearm regulation Poisson regression analysis failed to detect specific point in time when significant changes in trends occurred	Between 1981-2006, male hangings increased, replacing firearms as main method of suicide. Rates of hanging increased until late 1990s and subsequently declined
Langmann (2020)	C-17	Yes		• Decrease in the trend of suicide by firearm compared to hanging in males 45-59 yrs and >60 yrs • Decrease in trend of female firearm suicide rates	Increasing trend in suicide by hanging for males 45-59 yrs and >60 yrs, and in females. Findings supported by sensitivity tests
	C-68	No		• After 2001, there was an increase in firearms suicide compared to hanging for males (aggregate) and specifically for males 15-29 yrs and 30-44 yrs Covariates: province/territory, year, % license holders, alcohol consumption, unemployment rates, % aboriginal population, % low income persons	Increasing trend in suicide by hanging for males >60 yrs. Findings supported by sensitivity tests. Sensitivity tests supported substitution effect from suicide by firearm to hanging, and not a switch to hanging from other methods of suicide
SE, standard error; ARIMA, autoregressive integrated moving average; ZA, Zivot-Andrews; APC, annual percent change.					

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1 Supplementary Material

Supplemental Table 1. Risk of bias assessment using the Newcastle-Ottawa Scale										
Author (year)	Selection				Comparability		Outcome			Total
	1	2	3	4	5	6	7	8	9	
Sproule (1988) ²²	★	★	★	-	-	-	★	★	★	6
Mundt (1990) ²³	★	★	★	-	-	-	-	★	★	5
Rich (1990) ²⁴	-	★	★	-	-	-	★	★	★	5
Mauser (1992) ²⁵	★	★	★	-	★	-	★	★	★	7
Leenaars (1993, 1994, 1996, 1997b, 2001, 2003) ¹⁶⁻²¹	★	★	★	-	★	-	★	★	★	6
Carrington (1994a) ²⁶	-	★	★	-	-	-	★	★	★	5
Carrington (1994b) ²⁷	★	★	★	-	★	-	★	★	★	7
Leenaars (1997a) ²⁸	★	★	★	-	★	-	★	★	★	7
Bridges (2004) ²⁹	★	★	★	-	-	-	★	★	★	6
Caron (2004) ³⁰	-	★	★	-	-	-	★	★	★	5
Cheung (2005) ³¹	-	★	★	-	-	-	★	★	★	5
Caron (2008) ³²	-	★	★	-	★	-	★	★	★	6
Gagne (2010) ³³	-	★	★	-	-	-	★	★	★	5
Blais (2011) ³⁴	★	★	★	-	★	★	★	★	★	8
Langmann (2012) ³⁵	★	★	★	-	★	★	★	★	★	8
Linteau (2012) ³⁶	-	★	★	-	★	★	★	★	★	7
McPhedran (2013) ³⁷	★	★	★	-	-	-	★	★	★	6
Langmann (2020) ³⁸	★	★	★	-	★	★	★	★	★	8

2 Articles were assessed using the NewCastle-Ottawa Scale for case-control or cohort studies.

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1 **Supplementary Material**

Supplemental Table 2. Quality assessment of included studies

Author (Year)	Appropriate data source/outcome measure	Appropriate time frame studied?	Appropriate statistical tests used?	Study design suitability ¹	Overall quality score ²
Sproule (1988)	<ul style="list-style-type: none">• Data sources appropriate<ul style="list-style-type: none">- Statistics Canada; Canadian Center for Justice Statistics• Outcome measure appropriate<ul style="list-style-type: none">- Canadian firearm homicide rates	Yes: 1972-1976 (pre-Bill C-51), 1977-1982 (post-Bill C-51)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Mundt (1990)	<ul style="list-style-type: none">• Data sources appropriate<ul style="list-style-type: none">- Statistics Canada; Canadian Center for Justice Statistics; US Justice Dept; National Center for Health Statistics• Outcome measure appropriate<ul style="list-style-type: none">- Canadian and US firearm homicide, suicide, accidental death rates	Yes: 1971-1988 (Bill C-51 provisions came into effect in 1978 and 1979)	No: Visual inspection was performed without statistical tests	Moderate	1
Rich (1990)	<ul style="list-style-type: none">• Data sources appropriate<ul style="list-style-type: none">- Office of the Chief Coroner for Ontario• Outcome measure appropriate<ul style="list-style-type: none">- Canadian firearm homicide, suicide, accidental death rates	Yes: 1973-1977 (pre-Bill C-51), 1979-1983 (post-Bill C-51)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Mauser (1992)	<ul style="list-style-type: none">• Data sources appropriate<ul style="list-style-type: none">- Statistics Canada; Canadian Center for Justice Statistics; Employment and Immigration Canada; Canadian Dept of Indian Affairs and Northern Affairs• Outcome measure appropriate<ul style="list-style-type: none">- Canadian firearm homicide rates	Yes: 1968-1977 (pre-Bill C-51), 1978-1988 (post-Bill C-51)	Yes: Pooled cross-section time series model	Moderate	3
Leenaars (1993,1994 1996,1997b 2001,2003)	<ul style="list-style-type: none">• Data sources appropriate<ul style="list-style-type: none">- Statistics Canada• Outcome measure appropriate<ul style="list-style-type: none">- Canadian firearm homicide and suicide rates	Yes: 1969-1976 (pre-Bill C-51), 1978-1985 (post-Bill C-51)	Yes: Interrupted time-series, multiple regression analysis	Moderate	3
Carrington (1994a)	<ul style="list-style-type: none">• Data sources appropriate<ul style="list-style-type: none">- Statistics Canada• Outcome measure appropriate<ul style="list-style-type: none">- Ontario firearm suicide rates	Yes: 1965-1977 (pre-Bill C-51), 1979-1989 (post-Bill C-51)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1

Carrington (1994b)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Statistics Canada Outcome measure appropriate <ul style="list-style-type: none"> - Canadian firearm suicide rates 	Yes: 1965-1977 (pre-Bill C-51), 1979-1989 (post-Bill C-51)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Leenaars (1997a)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Statistics Canada Outcome measure appropriate <ul style="list-style-type: none"> - Canadian firearm accidental death rates 	Yes: 1969-1976 (pre-Bill C-51), 1978-1985 (post-Bill C-51)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Bridges (2004)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Statistics Canada Outcome measure appropriate <ul style="list-style-type: none"> - Canadian firearm homicide and suicide rates 	Yes: 1984-1990 (pre Bill C-17), 1991-1998 (post-Bill C-17)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Caron (2004)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Quebec Coroner's Office Outcome measure appropriate <ul style="list-style-type: none"> - Abitibi-Témiscamingue (Northern Quebec) firearm suicide rates 	Yes: 1986-1991 (pre-Bill C-17), 1992-1996 (post-Bill C-17)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Cheung (2005)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Statistics Canada Outcome measure appropriate <ul style="list-style-type: none"> - Canadian firearm suicide rates in adolescents 15-19 years 	Yes: 1979-1990 (pre-Bill C-17), 1991-1999 (post-Bill C-17)	No: Violated test postulates, weak statistical power, failed to measure immediate or gradual effects of the law, lacked 3 rd party variables	Moderate	1
Caron (2008)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Quebec Coroner's Office; Quebec Statistics Institute Outcome measure appropriate <ul style="list-style-type: none"> - Quebec firearm suicide rates 	Yes: 1987-1991 (pre Bill C-17), 1992-2001 (post-Bill C-17)	Yes: Linear regression, interrupted time series, Pearson correlation coefficient analyses, multivariate analysis	Moderate	3
Gagne (2010)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Quebec Statistics Institute Outcome measure appropriate <ul style="list-style-type: none"> - Quebec male firearm suicide rates 	Yes: 1981-2006 (Bill C-17 implemented in 1992)	Yes: Joinpoint analysis, Poisson regression analysis	Moderate	3
Blais (2011)	<ul style="list-style-type: none"> Data sources appropriate <ul style="list-style-type: none"> - Statistics Canada Outcome measure appropriate <ul style="list-style-type: none"> - Canadian firearm homicide rates 	Yes: 1974-1977 (pre-Bill C-51), 1978-2004 (post-Bill C-51); 1974-1991 (pre-	Yes: Multiple time series analysis	Moderate	3

			Bill C-17), 1992-2004 (post-Bill C-17); 1974-1997 (pre-Bill C-68), 1998-2004 (post-Bill C-68)			
	Langmann (2012)	<ul style="list-style-type: none">• Data sources appropriate - Statistics Canada• Outcome measure appropriate - Canadian firearm homicide rates	Yes: 1974-2008 (Bill C-51 implemented in 1978, Bill C-17 implemented in 1992, Bill C-68 implemented in stages 1996-2003)	Yes: Multivariate regression, Interrupted time series, Poission regression, ARIMA, Joinpoint analysis	Moderate	3
	Linteau (2012)	<ul style="list-style-type: none">• Data sources appropriate - Statistics Canada; Canadian Minister of Indian Affairs Office; Statistics Institute of Quebec• Outcome measure appropriate - Quebec firearm homicide rates	Yes: 1974-1997 (pre-Bill C-68), 1998-2006 (post-Bill C-68)	Yes: Extreme bounds analysis	Moderate	3
	McPhedran (2013)	<ul style="list-style-type: none">• Data sources appropriate - Statistics Canada; Dept of Justice• Outcome measure appropriate - Canadian firearm homicide rates	Yes: 1974-1995 (pre-Bill C-68), 1996-2009 (post-Bill C-68)	Yes: ARIMA, Zivot–Andrews structural breakpoint test	Moderate	3
	Langmann (2020)	<ul style="list-style-type: none">• Data sources appropriate - Statistics Canada• Outcome measure appropriate - Canadian firearm homicide & suicide rates	Yes: 1981-2016 (Bill C-17 passed in 1991; Bill C-68 was implemented in stages 1996-2003)	Yes: Difference-in-difference analysis, negative binomial regression	Moderate	3

¹Longitudinal prospective studies with a concurrent comparison group and multiple pre/post-intervention measurements were classified as having “greatest” design suitability; longitudinal studies without a concurrent comparison group but with multiple pre/post-intervention measurements were classified as “moderate”, and longitudinal studies without a concurrent comparison group and with only single pre/post-intervention measurements or with only post-intervention measurements were classified as having “least” design suitability.

²If all 4 metrics were achieved, a score of 3 (good quality) was assigned. If 2 to 3 metrics, including appropriate statistical testing, were achieved, a score of 2 (fair quality) was assigned. If 1 metric or 2 to 3 metrics without appropriate statistical testing were achieved, a score of 1 (poor quality) was assigned.

Supplemental Material 1

Search strategies for CINAHL, Embase, PubMed, Web of Science, and Scopus.

CINAHL

"(MH Firearms+ OR TI Gun* OR TI Firearm* OR TI Weapon* OR TI Handgun* OR TI Rifle* OR TI Shoot* OR AB Gun* OR AB Firearm* OR AB Weapon* OR AB Handgun* OR AB Rifle* OR AB Shoot*)

AND

(MH ""Social Control+"" OR TI ""Social Control*"" OR TI Polic* OR TI Law* OR TI Licensure OR TI Legislation OR TI Bill* OR TI Regulation* OR TI Legal* OR TI ""Mandatory Report*"" OR TI ""Mandated Report*"" OR TI Jurisprudence OR TI Storage OR TI Traffic* OR TI Ownership OR TI Safety OR TI Carry* OR TI Permit* OR TI Ban* OR TI Control* OR TI ""Background Check*"" OR AB ""Social Control*"" OR AB Polic* OR AB Law* OR AB Licensure OR AB Legislation OR AB Bill* OR AB Regulation* OR AB Legal* OR AB ""Mandatory Report*"" OR AB ""Mandated Report*"" OR AB Jurisprudence OR AB Storage OR AB Traffic* OR AB Ownership OR AB Safety OR AB Carry* OR AB Permit* OR AB Ban* OR AB Control* OR AB ""Background Check*"")

AND

(MH Mortality+ OR MH Death+ OR MH ""Wounds and Injuries+"" OR MH Violence+ OR MH ""Assault and Battery+"" OR MH Suicide+ OR MH Homicide+ OR MH Institutionalization+ OR MH ""Emergency Service+"" OR MH Emergencies+ OR MH Trauma+ OR MH Incidence+ OR MH ""Trend Studies+"" OR TI Mortality OR TI Death* OR TI Wound* OR TI Injur* OR TI Violence OR TI Assault* OR TI Suicid* OR TI Homicide* OR TI Murder* OR TI Admission* OR TI Emergenc* OR TI Trauma* OR TI Impact* OR TI Assessment* OR TI Hospitalization OR TI Incidence OR TI Trend* OR AB Mortality OR AB Death* OR AB Wound* OR AB Injur* OR AB Violence OR AB Assault* OR AB Suicid* OR AB Homicide* OR AB Murder* OR AB Admission* OR AB Emergenc* OR AB Trauma* OR AB Impact* OR AB Assessment* OR AB Hospitalization OR AB Incidence OR AB Trend*)

AND

(MH Canada+ OR TI Canada OR TI Canadian* OR TI ""British Columbia"" OR TI Alberta OR TI Manitoba OR TI ""New Brunswick"" OR TI ""Newfoundland and Labrador"" OR TI ""Northwest Territories"" OR TI ""Nova Scotia"" OR TI Quebec OR TI Ontario OR TI Nunavut OR TI ""Prince Edward Island"" OR TI Saskatchewan OR TI Yukon OR TI Halifax OR TI Montreal OR TI Toronto OR TI Ottawa OR TI Winnipeg OR TI Calgary OR TI Edmonton OR TI Vancouver OR TI ""Bill C-150"" OR TI ""Bill C-51"" OR TI ""Bill C-17"" OR TI ""Bill C-68"" OR AB Canada OR AB Canadian* OR AB ""British Columbia"" OR AB Alberta OR AB

Manitoba OR AB ""New Brunswick"" OR AB ""Newfoundland and Labrador"" OR AB
""Northwest Territories"" OR AB ""Nova Scotia"" OR AB Quebec OR AB Ontario OR AB
Nunavut OR AB ""Prince Edward Island"" OR AB Saskatchewan OR AB Yukon OR AB
Halifax OR AB Montreal OR AB Toronto OR AB Ottawa OR AB Winnipeg OR AB Calgary
OR AB Edmonton OR AB Vancouver OR AB ""Bill C-150"" OR AB ""Bill C-51"" OR AB
""Bill C-17"" OR AB ""Bill C-68""")"

Embase

("firearm"/exp OR gun*:ti,ab OR firearm*:ti,ab OR weapon*:ti,ab OR handgun*:ti,ab OR
rifle*:ti,ab OR shoot*:ti,ab)

AND

('legal aspect'/exp OR 'social control'/exp OR 'policy'/exp OR law*:ti,ab OR licens*:ti,ab OR
legislation*:ti,ab OR regulation*:ti,ab OR polic*:ti,ab OR 'mandatory report*':ti,ab OR
'mandated report*':ti,ab OR bill*:ti,ab OR legal*:ti,ab OR storage*:ti,ab OR traffic*:ti,ab OR
ownership*:ti,ab OR safety*:ti,ab OR permit*:ti,ab OR ban*:ti,ab OR control*:ti,ab OR
'background check*':ti,ab OR jurisprudence:ti,ab OR carry*:ti,ab)

AND

('mortality'/exp OR 'death'/exp OR 'injury'/exp OR 'violence'/exp OR 'hospital admission'/exp
OR 'emergency treatment'/exp OR 'incidence'/exp OR 'trend study'/exp OR mortality:ti,ab OR
death*:ti,ab OR wound*:ti,ab OR injur*:ti,ab OR violence:ti,ab OR assault*:ti,ab OR
suicid*:ti,ab OR homicide*:ti,ab OR murder*:ti,ab OR admission*:ti,ab OR emergenc*:ti,ab OR
trauma*:ti,ab OR impact*:ti,ab OR assessment*:ti,ab OR hospitalization:ti,ab OR incidence:ti,ab
OR trend*:ti,ab)

AND

('Canada'/exp OR Canada:ti,ab OR Canadian*:ti,ab OR 'British Columbia':ti,ab OR Alberta:ti,ab
OR Manitoba:ti,ab OR 'New Brunswick':ti,ab OR 'Newfoundland and Labrador':ti,ab OR
'Northwest Territories':ti,ab OR 'Nova Scotia':ti,ab OR Quebec:ti,ab OR Ontario:ti,ab OR
Nunavut:ti,ab OR 'Prince Edward Island':ti,ab OR Saskatchewan:ti,ab OR Yukon:ti,ab OR
Halifax:ti,ab OR Montreal:ti,ab OR Toronto:ti,ab OR Ottawa:ti,ab OR Winnipeg:ti,ab OR
Calgary:ti,ab OR Edmonton:ti,ab OR Vancouver:ti,ab OR 'Bill C-150':ti,ab OR 'Bill C-51':ti,ab
OR 'Bill C-17':ti,ab OR 'Bill C-68':ti,ab)

PubMed

((Firearms[mh]) OR (Gun[tiab]) OR (Guns*[tiab]) OR (Firearm*[tiab]) OR (Weapon*[tiab])
OR (Handgun*[tiab]) OR (Rifle*[tiab]) OR (Shoot*[tiab]))

AND

((Social Control, Formal[mh]) OR (Policy[mh]) OR (legislation and jurisprudence[sh]) OR (Law[tiab]) OR (Laws[tiab]) OR (Licensure[tiab]) OR (Legislation[tiab]) OR (Polic*[tiab]) OR (Bill*[tiab]) OR (Regulation*[tiab]) OR (Legal*[tiab]) OR ("Mandatory Report*" [tiab]) OR ("Mandated Report*" [tiab]) OR (Storage[tiab]) OR (Traffic*[tiab]) OR (Ownership[tiab]) OR (Safety[tiab]) OR (Carry*[tiab]) OR (Permit*[tiab]) OR (Ban[tiab]) OR (Bans[tiab]) OR (Control*[tiab]) OR ("Background Check*" [tiab]))

AND

((Mortality[mh]) OR (Wounds and Injuries[mh]) OR (Suicide[mh]) OR (Homicide[mh]) OR (Violence[mh]) OR (Hospitalization[mh]) OR (Emergencies[mh]) OR (Incidence[mh]) OR (Trauma Severity Indices[mh]) OR (Emergency Service, Hospital[mh]) OR (injuries[sh]) OR (trends[sh]) OR (Mortality[tiab]) OR (Death*[tiab]) OR (Wound*[tiab]) OR (Injur*[tiab]) OR (Violence[tiab]) OR (Assault*[tiab]) OR (Suicid*[tiab]) OR (Homicide*[tiab]) OR (Murder*[tiab]) OR (Admission*[tiab]) OR (Emergenc*[tiab]) OR (Trauma*[tiab]) OR (Impact*[tiab]) OR (Assessment*[tiab]) OR (Hospitalization[tiab]) OR (Incidence[tiab]) OR (Trend*[tiab]))

AND

((Canada[mh]) OR (Canada[tiab]) OR (Canadian*[tiab]) OR ("British Columbia" [tiab]) OR (Alberta[tiab]) OR (Manitoba[tiab]) OR ("New Brunswick" [tiab]) OR ("Newfoundland and Labrador" [tiab]) OR ("Northwest Territories" [tiab]) OR ("Nova Scotia" [tiab]) OR (Quebec[tiab]) OR (Ontario[tiab]) OR (Nunavut[tiab]) OR ("Prince Edward Island" [tiab]) OR (Saskatchewan[tiab]) OR (Yukon[tiab]) OR (Halifax[tiab]) OR (Montreal[tiab]) OR (Toronto[tiab]) OR (Ottawa[tiab]) OR (Winnipeg[tiab]) OR (Calgary[tiab]) OR (Edmonton[tiab]) OR (Vancouver[tiab]) OR ("Bill C-150" [tiab]) OR ("Bill C-51" [tiab]) OR ("Bill C-17" [tiab]) OR ("Bill C-68" [tiab]))

Web of Science

"ts=(Firearm* OR Gun* OR Weapon* OR Handgun* OR Rifle* OR Shoot*)

AND

ts=("Social Control*" OR Polic* OR Law* OR Licensure OR Legislation OR Bill* OR Regulation* OR Legal* OR "Mandatory Report*" OR "Mandated Report*" OR Jurisprudence OR Storage OR Traffic* OR Ownership OR Safety OR Carry* OR Permit* OR Ban* OR Control* OR "Background Check*")

AND

ts=(Mortality OR Death* OR Wound* OR Injur* OR Violence OR Assault* OR Suicid* OR Homicide* OR Murder* OR Admission* OR Emergenc* OR Trauma* OR Impact* OR Assessment* OR Hospitalization OR Incidence* OR Trend*)

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AND

ts=(Canada OR Canadian* OR ""British Columbia"" OR Alberta OR Manitoba OR
Saskatchewan OR Ontario OR Quebec OR ""New Brunswick"" OR ""Nova Scotia"" OR
""Prince Edward Island"" OR Newfoundland OR Yukon OR ""Northwest Territories"" OR
Halifax OR Montreal OR Toronto OR Ottawa OR Winnipeg OR Calgary OR Edmonton OR
Vancouver OR ""Bill C-150"" OR ""Bill C-51"" OR ""Bill C-17"" OR ""Bill C-68"")"

Scopus

"TITLE-ABS-KEY(Firearm* OR Gun* OR Weapon* OR Handgun* OR Rifle* OR Shoot*)

AND

TITLE-ABS-KEY("""Social Control*"" OR Polic* OR Law* OR Licensure OR Legislation OR
Bill* OR Regulation* OR Legal* OR ""Mandatory Report*"" OR ""Mandated Report*"" OR
Jurisprudence OR Storage OR Traffic* OR Ownership OR Safety OR Carry* OR Permit* OR
Ban* OR Control* OR ""Background Check*"")

AND

TITLE-ABS-KEY(Mortality OR Death* OR Wound* OR Injur* OR Violence OR Assault* OR
Suicid* OR Homicide* OR Murder* OR Admission* OR Emergenc* OR Trauma* OR Impact*
OR Assessment* OR Hospitalization OR Incidence* OR Trend*)

AND

TITLE-ABS-KEY(Canada OR Canadian* OR ""British Columbia"" OR Alberta OR Manitoba
OR Saskatchewan OR Ontario OR Quebec OR ""New Brunswick"" OR ""Nova Scotia"" OR
""Prince Edward Island"" OR Newfoundland OR Yukon OR ""Northwest Territories"" OR
Halifax OR Montreal OR Toronto OR Ottawa OR Winnipeg OR Calgary OR Edmonton OR
Vancouver OR ""Bill C-150"" OR ""Bill C-51"" OR ""Bill C-17"" OR ""Bill C-68"")"



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1, line 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 3, 2 nd paragraph
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 3, 2 nd paragraph
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 3, last paragraph, Page 4, lines 35-36
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 3, lines 33-34
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplemental material
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 3, last paragraph, to Page 4, lines 1-24
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 4, lines 11-32
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 4, line 21
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 4, lines 21-23
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 4, lines 27-32
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 4, line 35
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 3, last paragraph, Page 4 1 st paragraph
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 4, lines 16-17, line



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
			35, lines 23-24
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 4, line
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 4, lines 35-36
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 4, lines 36-37
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	-
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 4, lines 27-32
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	-
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1, Page 4, lines 41-46
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	-
Study characteristics	17	Cite each included study and present its characteristics.	Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supplemental Table 1
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3, Table 4
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Supplemental Table 2
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Table 3, Table 4
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	-
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	-
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Page 6, lines 15-23
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Supplemental Table 2
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 6, lines 28-35
	23b	Discuss any limitations of the evidence included in the review.	Page 6, lines



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
			28-35
	23c	Discuss any limitations of the review processes used.	Page 6, lines 25-38
	23d	Discuss implications of the results for practice, policy, and future research.	Page 7, lines 8-22
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 3, lines 29-30
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 3, line 30
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	None
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Title page
Competing interests	26	Declare any competing interests of review authors.	Title page
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Supplemental Material 1

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>