

Risk Predictors Associated with Firearm Use: A Scope Review

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Abstract: The use of firearms is a complex issue which involves issues related to mental health and public policies. This scoping review aimed to analyze individual and social risk predictors for the use of firearms. Based on the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews - PRISMA-ScR, six databases were consulted and 605 studies, retrieved. After screening, 16 empirical studies were selected for this review. Individual predictors included psychiatric diagnosis, abusive use of alcohol, high anxiety, and use of psychiatric medication; whereas social ones, access to firearms, absence of laws restricting the possession of weapons, and war experiences. We find the need for further research on the subject, especially by Brazilian science, since 87.5% of the studies this review screened came from the United States.

Keywords: firearms, risk, mental health

Preditores de Riscos Associados ao Uso da Arma de Fogo: Uma Revisão de Escopo

Resumo: O uso da arma de fogo pela população é um tema complexo que envolve questões relacionadas à saúde mental e políticas públicas. O objetivo dessa revisão de escopo foi analisar os preditores de riscos, individuais e sociais, para o uso da arma de fogo. Com base nas diretrizes do *Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews - PRISMA-ScR*, seis bases de dados foram consultadas com a identificação de 605 artigos. Após processo de triagem, 16 estudos empíricos foram selecionados para a revisão. Os preditores individuais identificados foram: diagnóstico de transtornos mentais, uso abusivo de álcool, ansiedade elevada, uso de medicação psiquiátrica. Os classificados como sociais compreenderam: acesso a armas de fogo, ausência de leis restritivas à posse de armas, experiência de guerra. Verificou-se a necessidade de mais pesquisas sobre o tema principalmente pela ciência brasileira, visto que 87,5% dos estudos triados nesta revisão foram provenientes dos Estados Unidos.

Palavras-chave: armas de fogo, risco, saúde mental

Predictores de Riesgo Asociados con el Uso de Armas de Fuego: Una Revisión del Alcance

Resumen: El uso de armas de fuego por parte de la población es un tema complejo que involucra cuestiones relacionadas con la salud mental y las políticas públicas. El objetivo de esta revisión de alcance fue analizar los predictores de riesgo individual y social para el uso de armas de fuego. Con base en los lineamientos de *Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews* (PRISMA-ScR), se consultaron seis bases de datos, lo que generó la identificación de 605 artículos. Después de un proceso de selección, se seleccionaron 16 estudios empíricos para su revisión. Los predictores individuales identificados fueron: diagnóstico de trastornos mentales, abuso de alcohol, ansiedad elevada y uso de medicación psiquiátrica. Los predictores sociales: acceso a armas de fuego, ausencia de leyes que restrinjan la tenencia de armas y experiencia de guerra. Se observó una necesidad de más investigación sobre el tema, principalmente por parte de la ciencia brasileña, ya que el 87,5% de los estudios seleccionados en esta revisión provenían de los Estados Unidos.

Palabras clave: armas de fuego, riesgo, salud mental

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Carrying and possessing firearms by the general population and security professionals is a complex theme which involves issues related to mental health and public policies. Each country establishes more or less restrictive rules of use according to its history, culture, and social values. Gun violence is a global problem that demands public health actions and evidence-based policies. Thus, mental health

professionals, especially physicians and psychologists, play a fundamental role in evaluating the clinical aspects directly implicated in risk factors related to the access and use of firearms (Kangas & Calvert, 2014; Price, Kinnison, Dake, Thompson, & Price, 2007; Rozel & Mulvey, 2017.) Brazil is one of the few countries in the world which requires that a professional psychologist evaluate individuals' psychological aptitude to authorize them to possess and carry firearms.

Injuries from accidental shootings, suicide, homicide, and mass shootings occur for different reasons and consequently require different individual and populational interventions to reduce risks (Rozel & Mulvey, 2017). Thus, psychological evaluations should investigate the psychological phenomena directly associated with the tendency of candidates for firearm use for violence, self-extermination, recklessness, and malpractice.

From a psychological point of view, a number of cognitive and emotional characteristics are relevant for proper use of firearms, including emotional stability, impulse control, vitality, and cognitive control (Navarro Montes, 2002; Vilert i Barnet & Hernández i Padiá, 2004). People with an unsuitable profile for firearm possession/carrying show emotional instability and a lesser ability to react to stressful experiences. The desirable psychological aspects to minimize risk in managing and carrying weapons include cognitive and psychomotor abilities related to the psychological disposition to understand, analyze, and interpret stressful situations and react in a timely manner (Navarro Montes, 2002).

Risk factors or predictors, a term used in epidemiology, configure social or individual determinants that influence the occurrence and distribution of health problems in a population (Bonita, Beaglehole, & Kjellström, 2010). Determinants may be socioeconomic, environmental, behavioral, hereditary, or related to life habits (Porta, 2014). Finding and measuring risk factors for certain health outcomes in a population provides evidence to predict the occurrence or frequency of diseases and enables the establishment of individual prevention strategies and those within the scope of public policies (Bonita et al., 2010).

The studies this review analyzed deal with individual and social risk factors. Individual risk factors consist of individuals' characteristics, including age, gender, behavior, life habits, cognitive repertoire, family aspects, and mental health problems; whereas social factors refer to socioeconomic, environmental, occupational, public policy, and legislation contexts. Given the relevance and complexity of the discussion involving the relations among firearms, mental health, and public policies and the importance of the role of psychologists as mental health professionals, especially in Brazil, research must understand the individual and social factors that predict negative outcomes related to the access and use of firearms.

This scope review aimed to analyze the individual and social predictors of risks for the use of firearms. We considered the following outcomes to include the evaluated studies: accidental gunshot injuries, suicides, and homicides. The question that guided our study was *What*

are the risk predictors for the use of firearms in the adult population, i.e., individuals aged over 18 years?

Method

A scope review was performed since it enables mapping the existing knowledge about an emerging topic, thus characterized as essentially exploratory (Peters et al., 2020). Our review was conducted according to the PRISMA-P (*Preferred Reporting Items for Systematic Reviews and Meta-Analysis*) checklist at the planning stage, during which our objectives and methodology were defined in advance. To report our results, the PRISMA-ScR guidelines, a PRISMA extension recommended for scope reviews (Tricco et al., 2018), were used. The use of international protocols in literature reviews aims to increase the methodological rigor and transparency of studies (Peters et al., 2020).

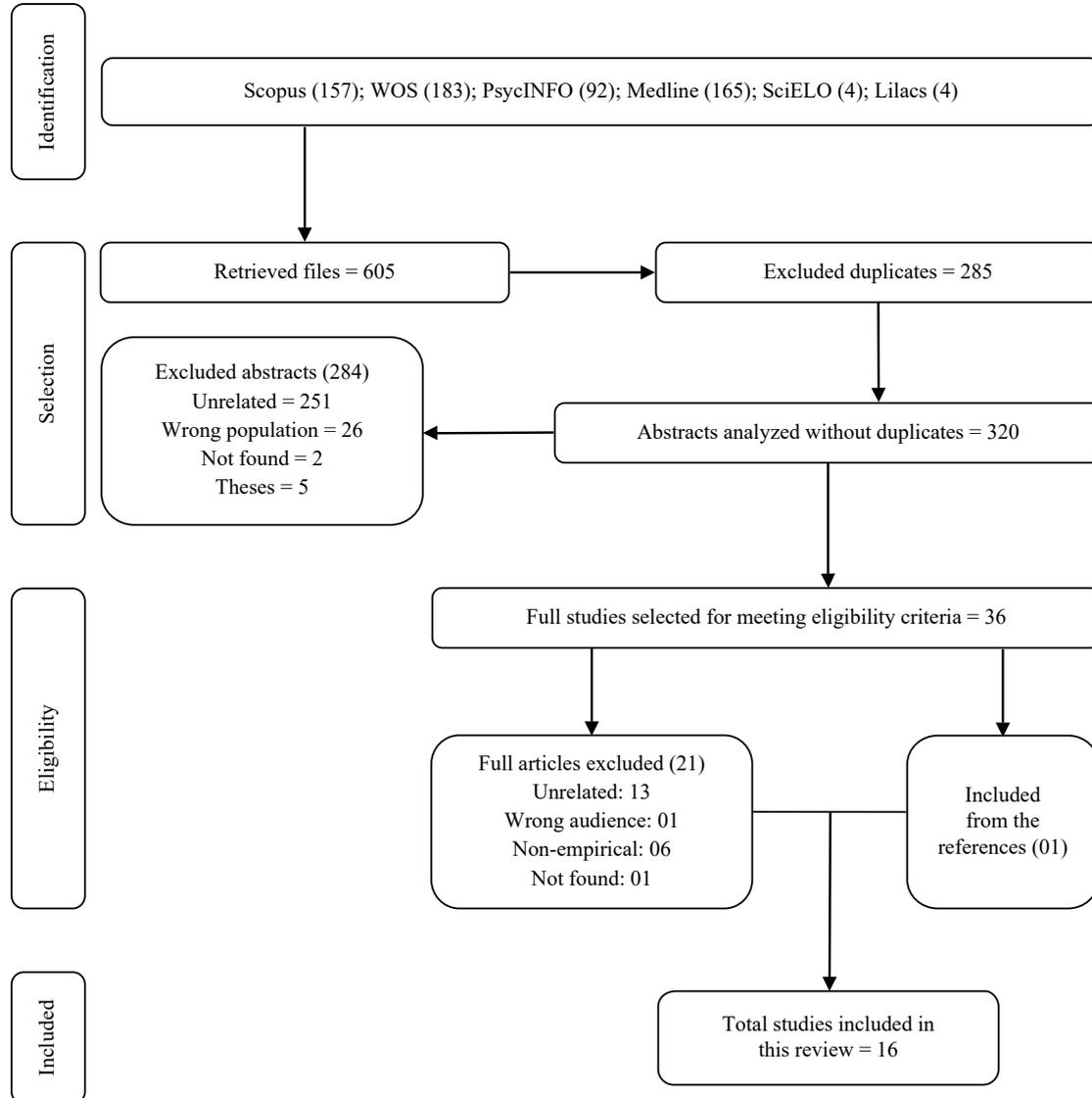
The SCOPUS, Web of Science-WOS, PsycINFO (APA), MEDLINE, LILACS, and SciELO databases were searched in July 2021 and selected due to their international scope, scientific relevance, and their inclusion of journals on psychology and health, among other aspects. Neither search filters per publication period nor language restriction were used. Our search strategy was elaborated with the help of a librarian following our guiding question and based on a prior search of the most used keywords in relevant studies, resulting in the following combination: risk AND (predictor OR predictors) AND (firearm OR firearms OR gun).

Eligibility criteria to choose the evaluated studies were defined in the planning phase of this review. Thus, only studies with the following characteristics were included: (1) addressing the association between risk predictors and the use of firearms in the population aged over 18 years; (2) empirical methodologies; and (3) journal article format. Studies were screened via the EndNote® and Rayyan online managers in two stages. Study titles and abstracts were read, ineligible ones were excluded, and the included studies of interest, fully read. To collect data from the chosen studies at the end of screening, a form was developed in Excel with previously stipulated items, containing only the information necessary to synthesize the chosen studies.

A total of 605 studies were retrieved from the six databases, of which 285 were repeated documents and excluded. Based on their titles and abstracts, 320 remained for analysis. After reading their abstracts, 284 were excluded as they either failed to relate to our theme, focused on adolescents, had formats other than journal studies or contained no abstract. Thus, 36 studies remained for full reading. Of these, 21 were excluded as they failed to meet our eligibility criteria and another was unretrievable. Scope reviews can find studies in the references of chosen research as an additional source of information if they correspond to the set eligibility criteria (Peters et al., 2020). Thus, one study was included during the complete reading of the chosen studies as it offered relevant information to our theme. After screening, 16 documents were selected for qualitative analysis. Our selection process is shown in Figure 1.

Figure 1

Flowchart of the study screening process based on the PRISMA model



Results

Key findings

Of the 16 chosen studies, 87.5% ($n = 14$) were conducted in the United States and 12.5% ($n = 02$) in Ireland. All studies were quantitative, although this review would also have admitted qualitative ones. Regarding their design, 11 showed a cross-sectional methodology; three, a longitudinal one; one, a panel one; and one included a cohort and retrospective cases/controls.

We also analyzed the chosen articles based on the risk predictor levels they investigated, which we categorized as social and individual ones. Social risk predictors relate to participants' occupation, socioeconomic issues, public policies, and access to firearms, whereas individual ones refer to their characteristics, family environment,

psychiatric diagnosis, age, gender, lifestyle, and violent intimate relationships.

We found a wide heterogeneity in the perspectives studies employ to evaluate the use of firearms, i.e., research studies risk predictors based on different problems with some relation between them. To facilitate result description, we classified our findings into the following conceptual categories (Peters et al., 2020): mental health, suicide, firearm possession, legislation, police force, and armed violence.

In total, five of the 16 studies focused on mental health, analyzing individuals' psychopathological aspects and its relation with firearms; five, on suicide, addressing how firearms related to its risk; two highlighted relation between firearm possession and deaths by them; two emphasized firearm legislation associated with fatal outcomes; one focused on police force; and one on armed violence. Table 1 summarizes the selected studies.

Table 1

Summary of reviewed studies

Source/ country	Study objective	Sample/design	Results	Risk levels	Central topic
Conwell et al. USA	To test hypotheses on the risk of suicide associated with access to and storage of firearms.	86 suicide victims aged 50 years and above. Cross-sectional study of psychological autopsy.	The presence of firearms in households was associated with increased suicide risk. The storage of unlocked and loaded guns increased suicide risk.	Social: possession of firearm.	Suicide
White (2002) USA	To identify situational predictors of police shootings involving suspected gun robberies.	Shooting data of the Philadelphia Police Department from 1970 to 1978 and 1987 to 1992. Cross-sectional study.	The situational determinants related to armed suspects, robbery, and public disturbances showed a strong association with the lethal use of force by police officers.	Social: situational and occupational.	Police use of force
Mahon et al. (2005) Ireland	To examine specific risk factors for suicide among regular duty military personnel.	Retrospective case control study of all individuals who died by suicide ($N=63$).	Firearms caused 53% of suicides. Psychiatric illnesses, self-mutilation, being in a military place with access to guns, and recent medical consultation configure risk factors.	Social: occupation and access to firearms. Individual: psychiatric diagnoses.	Suicide
Sarma and Kola (2010) Ireland	To compare the sociodemographic characteristics of people who committed suicide with firearms with those who committed suicide by other methods.	Database with a record of 9,674 suicides. Cross-sectional study.	Men living in rural areas, employed in agriculture and aged between 20 and 25 years tend to be responsible by a higher proportion of suicide by firearms than other methods.	Social: occupation and access to firearms. Individual: demographic - age, gender, and rural location.	Suicide
Johnson et al. (2012) USA	To examine the association between gun carrying and risk factors in women using psychotropic substances and out of treatment.	858 women using psychotropic substances (alcohol, heroin, cocaine, or amphetamines). Cross-sectional study.	Illegal activities to obtain income and victimization were the most significant predictors of gun carrying. Antisocial personality behaviors were associated with gun possession.	Social: unemployment. Individual: psychiatric diagnoses, lifestyle, and gender.	Mental health
Bangalore and Messerli (2013) USA	To assess the relation between the prevalence of gun possession and the number of firearm deaths in 27 countries.	Secondary data analysis. Cross-sectional study.	Among 27 developed countries, gun possession rate was a strong and independent predictor of firearm-related deaths.	Social: access to firearm.	Gun possession
Siegel et al. (2013) USA	To examine the relation between the rates of domestic possession of firearms and homicide rates by firearms.	Longitudinal study of 30 years. Secondary data analysis.	Gun possession was a significant predictor of homicide rates by firearms	Social: access to firearm.	Gun possession
Anestis et al. (2015) USA	To examine the association between laws requiring license to buy and possess firearms and suicide-related outcomes.	Cross-sectional analyses of secondary data from 2010. Total number of suicide deaths in the U.S.	Specific laws regulating the possession of firearms are associated with lower suicide rates.	Social: access to gun and absence of restriction laws	Legislation
Ladapo et al. (2016) USA	To assess associations between owning or acquiring firearms, mental illness, and substance use in North American families.	5,147 father-son dyads. Longitudinal study.	Families with parents with a history of depression and use of alcohol and drugs are modestly more likely to have guns than families without these risk factors.	Individual: depression, alcohol/drug use. Social: access to gun	Mental health

(continued...)

Table 1
Continuation

Source/ country	Study objective	Sample/design	Results	Risk levels	Central topic
Tripp et al. (2016) USA	To analyze the relations among combat experiences, suicidal ideation, and PTSD in veterans with alcohol abuse.	68 veterans with dangerous alcohol use. Cross-sectional study.	Killing or believing having killed the enemy and firing a gun at the enemy in combat predicted the suicidal ideation of male veterans.	Social: occupation and war experience. Individual: having killed someone, alcohol use, MD.	Suicide
Díez et al. (2017) USA	To study the association between state gun laws related to intimate partner violence and intimate partner homicide rates.	50 U.S. states. Panel study.	Laws prohibiting people who are subject to restraining orders to own guns and require them to be handed over were associated with 9.7 homicide rates by firearms and was 14% lower than in lawless states.	Social: absence of restriction laws	Legislation
Calhoun et al. (2017) USA	To examine the association between non-suicidal self-injuries and interpersonal violence in veterans with PTSD.	729 U.S. veterans. Cross-sectional study.	Non-suicidal self-harm in the form of cuts or burns has been linked to gun-related violence, including gun threats and actual violent acts involving guns.	Individual: non-suicidal self-injury. Social: occupation	Mental health
Houtsma and Anestis (2017) USA	To examine the impact of gun possession on the relation between ideation and the perceived probability of suicide attempt among suicide survivors.	123 adults with at least one previous suicide attempt. Cross-sectional study.	Among suicide survivors, gun possession increases the probability of predicting engagement in future suicidal behaviors.	Social: possession of firearms.	Suicide
Delaney et al. (2018) USA	To determine whether the use of psychiatric medication affects performance in decision-making with firearms in a video game simulation.	147 participants. Cross-sectional study of simulation with a video game.	Individuals with faster reactions performed better in the firearm simulation. Those who used psychiatric medication and/or had more severe anxiety performed worse.	Individual: use of psychiatric medication, severity of anxiety	Mental health
Wintemute et al. (2018) USA	To examine the association between previous convictions for alcohol-related crimes and the risk of further arrest for violent crimes or those with firearms.	5,923 people who bought firearms in California in 1977. Longitudinal study.	Prior convictions for drunk driving have been associated with a four-to five-fold increase in the risk of future arrest for violent or firearm-related crime among gun owners.	Individual: alcohol abuse, previous convictions for alcohol-related crimes	Mental health
Abaza et al. (2020) USA	To assess the demography of gunshot wounds in the last 20 years and create a risk map model.	2,188 participants injured by firearms. Cross-sectional study.	Areas with the highest per capita incidence of gunshot wounds were strongly correlated with rates of area deprivation.	Social: poverty, education, housing, and employment	Armed violence

Mental Health – of the five studies that addressed this topic, two found exclusively individual aspects as potential risks to the reckless or violent use of firearms. The remaining studies included individual and social aspects. Delaney et al., (2018), who used a video game simulation, examined the relation among firearm performance, use of psychiatric medication (serotonin reuptake inhibitors), and anxiety symptoms, finding that those who took medication and reported anxiety symptoms performed worse in their simulation (showing a tendency to hesitate and be targeted). A longitudinal survey of people who owned firearms,

were convicted of alcohol-related crimes, especially drunk driving (Wintemute, Wright, Castillo-Carniglia, Shev, & Cerdá, 2018) showed that alcohol use constitutes a strong predictor of violent or firearm-related crimes.

Moreover, two studies evaluated the relation between firearm possession, psychiatric diagnosis, and substance use, suggesting similar findings. Ladapo et al. (2016) found that U.S. families who owned firearms show a slightly higher chance of parents having a history of depression, alcohol use, or illicit drugs. Similarly, Johnson, Cottler, Ben Abdallah, and O’Leary (2012) evaluated women who used psychoactive

substances, finding that, among mental disorders, antisocial personality behaviors were strongly associated with gun possession (OR=13,7). On the other hand, risk factors such as depression, posttraumatic stress disorder, alcohol, and cocaine dependence slightly increased the probability of individuals owning firearms (OR 1.45 to 1.76). That study also found that social risk predictors, stood out among the most significantly associated with firearm possession and carrying. Individuals involved in illegal activities to obtain income were four times more likely to carry firearms and women who reported violent victimization throughout their lives were twice as likely to report carrying a firearm.

In a study with U.S. veterans with a positive diagnosis for PTSD, Calhoun et al. (2017) found that soldiers who cut, stroke, or burned themselves were more likely to commit interpersonal violence with a firearm via threats or concrete violent acts. The type of self-injury seems to be significant because veterans who showed only poking and scratching behavior had no higher risk of interpersonal violence than those who avoided engaging in self-injuring behavior.

Suicide by firearm – In total, five of the 16 studies in this review assessed suicide by firearm as a fatal outcome. Firearms configures a violent and highly lethal means of suicide. Overall, two studies that examined the relation of suicide with firearms (Conwell et al., 2002; Houtsma & Anestis, 2017) emphasized firearm possession as a factor that increases the probability of suicide. Houtsma and Anestis (2017) found that having firearm facilitates the transition from suicidal ideation to suicidal behavior. Thus, statistically, the association strength between suicidal ideation and a positive stance toward future attempts was higher among those who had firearms at their homes than among those who owned no firearms.

Conwell et al. (2002) analyzed suicidal intention among suicide survivors (but not death by suicide or their future outcomes) and found similar results via a psychological autopsy with 86 suicide victims aged 50 years or older. Those researchers compared two groups, one with suicidal individuals and another with non-suicidal ones, with similar sociodemographic characteristics and found that possessing firearms was significantly higher in suicide victims aged over 50 years old than the control group, even after isolating other variables (mental illnesses and demographic factors). We had another important finding regarding manner of storage form. Guns which were kept loaded in unlocked storage were an independent predictor increasing suicide risk.

Tripp, McDevitt-Murphy, and Henschel (2016) evaluated alcohol abuse in war veterans and found this to be a risk factor for suicidal ideation. Combat experiences, such as participating in attacks on entrenched or fortified positions, witnessing enemy soldiers seriously wounded or killed, and killing or believing to have killed someone were the most strongly experiences associated with the severity of post-traumatic stress disorder. A relevant aspect this study detected was the negative psychological impact of having harmed or killed another person on war soldiers.

These experiences configure predictors of suicidal thoughts that can precipitate suicidal behavior.

Mahon, Tobin, Cusack, Kelleher, and Malone (2005) researched the risk factors for firearm suicide, specifically associating it to military work, and found that firearms were the most frequently used instrument for suicide (53% of cases), evidencing the nature of the occupation as a source of risk. Regarding public and private security, access and opportunity to use lethal means at work predict suicide risk. The combination of carrying firearms with diagnoses of mental disorders, a history of self-mutilation, recent medical consultation, and working at a military workplace were significantly associated with the suicide of the military personnel.

Sarma and Kola (2010) analyzed the risks and particularities of suicide via firearms compared to those by other methods. They investigated 9,674 suicides in 1980 and 2005 in Ireland. The authors found that the sociodemographic profile of suicides is similar, regardless of the used method. However, the proportion of men in the group that used firearms was 4.54 times higher than the proportion in the group that used other means. Thus, men are more likely to own firearms and tend to use more violent and lethal methods than women.

The sociodemographic profile for suicide in both groups included men living in rural areas, who were employed in an agricultural environment and were aged between 20 and 25 years. Suicidal people who used firearms tended to be younger than those belonging to the other group. The main finding of this study was that access to firearms renders sociodemographic risk factors (age, gender, rural location, and occupation) more potent, i.e., the presence of the violent mechanism increases suicide rates in the population with that profile.

Firearm possession – The findings of the two studies that emphasized access to firearms identified the availability of firearms in a country/state as a strong predictor of risk for population mortality. Bangalore and Messerli's (2013) surveyed the prevalence of firearm possession and mental illness compared to the number of firearm deaths in 27 developed countries. Their findings indicated that the number of guns per capita per country independently predicted firearm-related deaths. The correlation between mental illness and the number of deaths from firearms was statistically insignificant. Thus, the sheer availability of firearms in a country may facilitate the occurrence of firearm-related deaths. Among the 27 developed countries the authors studied, Japan stood out as by its lowest prevalence of firearms and related deaths. On the other hand, the United States had the highest prevalence of firearms and related deaths. Siegel, Ross, and King (2013) results corroborate the findings of Bangalore and Messerli (2013). By examining the relation between firearm ownership rates in households and those of gun homicides in 50 states in the United States over a 30-year period, gun possession significantly predicted firearm homicide rates, i.e., states with the highest incidence of firearms had a disproportionately large number of firearm-related homicide deaths.

Legislation – Overall, two studies researched the influence of gun restriction laws on fatal outcomes involving the use of firearms in the U.S. A study evaluated the association of laws with suicide (Anestis et al., 2015) and another, with intimate partners' murder (Díez et al., 2017). By examining the total number of suicides in the U.S. in 2010, researchers found that 35 of the 50 states had some kind of legislative restriction for firearm possession in that year (requirements for permission, registration, or license to buy). Moreover, states that had laws restricting the possession of firearms showed a lower rate of death by suicide and a lower proportion of suicides by firearms than those without restriction laws (Anestis et al., 2015).

Díez et al. (2017) showed that states that had laws prohibiting the possession of firearms by people subject to a restriction order due to intimate partner violence and which required aggressors to hand over their guns showed intimate partner homicide by firearms rates 14% lower than states without those laws. On the other hand, laws prohibiting the possession of firearms failed to require that aggressors handed over the guns and were insignificantly associated with intimate partner homicide rates. The release by law of aggressors handing over their firearms was the main predictor for higher homicide rates.

Police force – White (2002) studied the situational predictors that influence police officers using lethal force toward suspects of armed robbery to assess police officers' shooting behavior. Results showed five variables that increased the probability of police officers firing their firearms in an operation. The strongest predictor involved incidents in which police were called to respond to an incident with armed men. Other situations configuring a higher chance of firing include incidents with armed suspects, robberies, public disturbances, and chases.

Armed violence – Abaza et al.'s (2020) geocoding study aimed to assess the association between area deprivation and the number of patients hospitalized for gunshot wounds in the USA. Their findings confirmed a consistent and positive correlation between the two factors. Thus, the socioeconomic condition of a given locality is strongly related to the incidence of firearm violence. They measured the Area Deprivation Index of geographic regions by four social dimensions: poverty, education, housing, and employment; providing data on the socioeconomic status of the localities. The authors showed that poverty, unemployment, and a lack of public policies for education and housing are important predictors of the social risk for armed violence.

Discussion

This study overviewed the types of studies that investigate predictors of risks for firearm use in adults. The evaluated studies address a plurality of perspectives related to gun outcomes, most of which investigated aspects related to mental health and suicide. The predominance of studies conducted in the United States of America

(87.5 %) was remarkable, considering that we avoided language restrictions during our search for articles. The U.S. concentrates the highest number of guns in the world and has the highest prevalence of firearm deaths among high-income developed countries (Bangalore & Messerli, 2013; Grinshteyn & Hemenway, 2019). This reality and the scientific development of that country justifies the interest and wide academic production on the subject.

We found no study on the risk predictors for the use of guns in Brazil. In a survey on global mortality from firearms including 195 countries, Brazil ranked first (followed by the U.S.) in the number of gun deaths in 2016 (Naghavi et al., 2018). In Brazil, Law No. 10,826 of 2003 establishes the conditions restricting firearm possession and carrying, including the requirement of psychological evaluation for proof of aptitude. However, since 2019 constant changes in gun legislation have been employed in an attempt to make access to arms more flexible. Thus, the number of authorizations to hunters, shooters, and collectors grew 473.6% between 2018 and 2022, and, by 2021, Brazil already had more guns in private stocks than those belonging to public agencies such as the police (Fórum Brasileiro de Segurança Pública, 2022). These data justify the imperative need for research on the subject that identifies, for example, the association between the availability of guns, deaths, injuries, and changes in gun laws.

Studies that emphasized clinical aspects such as mental health and suicide predominantly described individual risk predictors, such as the presence of psychiatric diagnosis, alcohol abuse, and the prevalence of males in their samples. However, these studies found that social aspects related to gun restriction policies and easy access are also implicated in firearm outcomes resulting from mental disorders. Having a firearm at home or at work, for example, posed an increased risk for suicidal ideation and behavior by potentiating individual risk predictors. Moreover, storing loaded firearms in unlocked places further increase individuals' chance for suicide and unintentional injuries (Conwell et al., 2002).

These findings corroborate the evidence in other studies that show a strong association between gun availability and suicide (Balestra, 2018; Haw et al., 2004; Kivisto, Kivisto, Gurnell, Phalen, & Ray, 2021; Miller, Barber, White, & Azrael, 2013). Public authorities must face the issue by employing preventive policies based on scientific evidence. Health professionals may also care for individuals' mental health, and disseminate information, and offer guidance on safe ways of storing firearms.

A study tested the effect of psychiatric medication on performance with firearms, showing a correlation between the use of medications — specifically serotonin reuptake inhibitors —, gun use, and anxiety severity (Delaney et al., 2018). Further empirical research with other classes of psychiatric medication could be conducted to fill this gap in the literature. Research requires evidence on the effects of medication use on firearm use to provide a scientific basis for healthcare providers' decision to grant individuals firearm possession/carrying and establish guidelines to establish

which firearms configure working tools. Moreover, studies investigating the association between types of mental disorders, such as depression, panic disorder, and post-traumatic stress related to gun outcomes remain scarce in the literature.

However, studies found that men are more vulnerable to firearm outcomes than women as other studies have also evinced (Naghavi et al., 2018; Patel, Badolato, Parikh, Iqbal, & Goyal, 2021). Men die more often from murder, suicide, and unintentional injuries from firearms and most often perpetrate armed violence in Brazil (Fórum Brasileiro de Segurança Pública, 2022). Men are more likely to acquire guns, have greater familiarity and attraction to them, usually configure most high-risk work personnel, and find themselves more prone to violent suicides than women (Conwell et al., 2002; Sarma & Kola, 2010).

By analyzing individual and occupational risk predictors, we find a profile which seems to be at increased risk for the use of firearms: males who reside in agricultural regions (especially regarding suicide), work in risky professions, have killed in service, owned firearms, showed psychiatric diagnosis, and use medication. This evidence provides important clues for healthcare providers and public policy policymakers to develop prevention strategies.

Access to firearms, facilitated by the absence of laws or legislations which fail to restrict gun ownership by the population proved to be a significant predictor of social risk for suicidal ideation and behavior, intimate partner homicide, gunshot wound, armed violence, and population mortality. In other words, more restrictive laws and the subsequent reduction in the number of guns among the population could avoid several outcomes with firearms. The scientific production on the association between results with firearms and restriction laws is long (Hahn et al., 2005; Lee et al., 2017; Zeoli et al., 2019). It would be appropriate to review the literature to specifically map this theme and to more deeply evaluate the controversies in existing empirical results.

The only study that addressed armed violence pointed to the issue as a public health problem which demands meaningful actions against poverty and scarce access to health, employment, housing, and education (Abaza et al., 2020). Research discusses the urban misuse of firearms as a social problem unrelated to individual mental illness issues, which were provoked by isolated individuals in massacres. Mass shootings cause popular commotion and explain the fervent discussion in American media and academia involving gun policies, violence, and mental illness. Bangalore and Messerli (2013) found, however, no significant correlation between mental illness and crime rates. Some researchers point out that attributing gun violence to mental illness avoids the discussion of easy access to weaponry and the need to tighten gun legislation (Ahonen, Loeber, & Brent, 2019; Swanson, McGinty, Fazel, & Mays, 2015).

Another gap relates to the lack of studies investigating the use of police force and the determinants that influence

police officers firing of the firearm during operations. The only study addressing this theme showed situational predictors for firing firearms. Knowing or identifying that the opponent is armed at the time of the operation predisposes police to fire (White, 2002).

Study limitations – As the studies in this review predominantly portray the reality of a single country, we are unable to safely generalize our results to populations of other cultures. Our search strategy may have neglected some studies, excluding geographic areas other than those we found. Thus, we failed to assess studies from countries other than the USA and Ireland, this underrepresenting them review. Another limitation refers to the absence of an instrument to evaluate the methodological quality of each study. Although not a requirement for scope reviews (Khalil et al., 2021), the evaluation of methodological quality offers greater confidence in the study evidence.

Since this is a scope review, we aimed to overview the literature on the issue. Each sub-theme we identified, however, deserves a specific study as other research on the same subject which our search strategy ignored may offer different results and conclusions. The specific themes this review identified can serve as a basis for other literature reviews to further develop each of them and expand knowledge on the predictors related to each subtheme and outcome.

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