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Open Data on Gun Violence: a production in the field of (Physical) Education

Dados Abertos sobre Violência Armada: uma produção no âmbito da Educação (Física)

Datos Abiertos sobre Violencia Armada: una producción en el ámbito de la Educación (Física)

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Resumo
Introdução: Há uma lacuna entre estudos de dados abertos em violência armada na educação e a capacidade deles cumprirem papéis efetivos no cotidiano de unidades escolares. As evidências nesses trabalhos não alimentam mudanças práticas nas escolas porquê, apesar de direcionados à Educação, são produtos genéricos, cujos resultados versam sobre realidades meso e macrogeográficas, levando quem os consulta a realizar inferências ecológicas – inclusive na imprensa. Tal cenário dificulta, tanto o trabalho de gestores da Educação, quanto o de gestores de escolas singulares: os primeiros porque ações direcionadas para uma área demasiado abrangente seriam dispendiosas e fora da alçada da Educação; os segundos seriam desencorajados a agir em função das evidências demonstrarem o bairro que a escola está inserida como "de risco". No entanto, como seria se pudessem ser produzidos dados abertos sobre a violência armada nas escolas que refletissem a realidade interna? Objetivo: Apresentar, a partir de casos de balas perdidas ocorridos dentro de escolas do Rio de Janeiro, uma maneira de produzir dados com potencial de generalização e capazes de aumentarem as possibilidades de prevenção. Método: Estudo de caso sobre vítimas de balas perdidas dentro de escolas no Rio de Janeiro, cumprindo os protocolos de ética com seres humanos. A amostra é composta pelos casos ocorridos nos últimos 9 anos. Foram entrevistadas ou consultadas vítimas, familiares, testemunhas e informantes. Resultados: Permitiu-se mapear processos de vitimação dentro de escolas e os espaços de Educação Física são críticos. Conclusão: Esta pesquisa produz um conhecimento menos genérico que os atuais estudos oferecem, com possibilidades de prevenção mais específicas, precisas e seguras, permitindo generalizar e atender demandas por segurança, tanto em escolas singulares quanto em nível agregado (meso e macrogeográfico); pais, estudantes, professores e sindicatos também teriam mais ferramentas para reivindicar melhorias.
Palavras-chave: Violência armada; Instalações de risco; Gestão da segurança; Prevenção de acidentes; Escolas.

Abstract
Introduction: There is a gap between open data studies on armed violence in education and their ability to play an effective role in the daily life of schools. Evidence from these studies does not translate into practical changes within schools because, although they are directed at education, they are generic products whose results address meso- and macro-geographical realities, leading users—including the press—to make ecological inferences. This scenario hinders both the work of education system administrators and that of individual school managers: the former because actions targeting overly broad areas tend to be costly and fall outside the scope of the education sector; the latter because they are discouraged from acting when the evidence portrays the school's surrounding neighborhood as "at risk." However, what if open data on armed violence in schools could be produced in ways that reflect their internal realities? Objective: To present, based on cases of stray bullets occurring inside schools in Rio de Janeiro, a way of producing data with generalization potential and capable of increasing prevention possibilities. Method: A case study of stray-bullet victims inside schools in Rio de Janeiro, conducted in accordance with human research ethics protocols. The sample comprises cases that occurred over the past nine years. Victims, family members,

witnesses, and key informants were interviewed or consulted. Results: The study made it possible to map victimization processes within schools, identifying Physical Education spaces as critical areas. Conclusion: This research produces knowledge that is less generic than that offered by current studies, with more specific, precise, and reliable prevention possibilities. It allows for generalization and addresses safety demands both at the level of individual schools and at aggregated (meso- and macro-geographical) levels. Parents, students, teachers, and unions would also gain more tools to advocate for improvements.
Keywords: Gun violence; Risky facilities; Safety management; Accident prevention; Schools.

Resumén
Introducción: Existe una brecha entre los estudios de datos abiertos sobre violencia armada en educación y su capacidad para influir de manera eficaz en la vida cotidiana de las escuelas. La evidencia de estos estudios no impulsa cambios prácticos en las escuelas porque, a pesar de estar dirigidos a la educación, son productos genéricos cuyos resultados abordan realidades meso- y macrogeográficas, lo que lleva a quienes los consultan a realizar inferencias ecológicas, incluso en la prensa. Este escenario dificulta el trabajo tanto de los gestores educativos como de los gestores de escuelas individuales: los primeros, porque las acciones dirigidas a un área excesivamente amplia resultarían costosas y quedarían fuera del ámbito de la educación; los segundos, porque se verían desalentados a actuar al mostrar la evidencia que el barrio donde se ubica la escuela está "en riesgo". Sin embargo, ¿qué ocurriría si se pudieran producir datos abiertos sobre la violencia armada en las escuelas que reflejaran su realidad interna? Objetivo: Presentar, a partir de casos de balas perdidas ocurridas dentro de escuelas de Río de Janeiro, una forma de producir datos con potencial de generalización y capaces de aumentar las posibilidades de prevención. Método: Estudio de caso sobre víctimas de balas perdidas en escuelas de Río de Janeiro, realizado de conformidad con los protocolos éticos de investigación con seres humanos. La muestra se compone de casos ocurridos en los últimos nueve años. Se entrevistó o consultó a víctimas, familiares, testigos e informantes clave. Resultados: El estudio permitió mapear los procesos de victimización dentro de las escuelas, identificando los espacios de Educación Física como áreas críticas. Conclusión: Esta investigación genera un conocimiento menos genérico que el ofrecido por los estudios actuales, con posibilidades de prevención más específicas, precisas y fiables, lo que permite la generalización y atiende las demandas de seguridad tanto en escuelas individuales como a nivel agregado (meso- y macrogeográfico). Asimismo, padres, estudiantes, docentes y sindicatos contarían con más herramientas para exigir mejoras.
Palabras clave: Violencia armada; Instalaciones de riesgo; Administración de la seguridad; Prevención de accidentes; Escuelas.

Introduction

The expansion of criminal factions (*facções*) and militias has become an increasingly prevalent phenomenon in the everyday life of Brazilian favelas and urban peripheries. In Rio de Janeiro in particular, this model has prevailed for over four decades and is characterized by territorial disputes manifested in armed conflicts, through which different groups aim to expand their influence in criminal markets (Misse, 2019). Armed domination (*domínio armado*) constitutes one of the central mechanisms of coercion and economic exploitation imposed on the inhabitants of these territories (Miranda & Muniz, 2018). In an effort to combat these crimes, the model of police operations involving armed incursions has been regarded as the primary public action undertaken by the State in these areas, thereby intensifying the relationship between shootings and their harmful effects (Hirata *et al*., 2021). Essential public services, such as education and healthcare, have experienced forms of so-called "collateral damage" as a result of this reality. As a result, the contingencies of this war-like scenario (Morais *et al*., 2024) have generated emerging demands in the daily work of professionals (Santos & Silva, 2020; Santos, 2015) and are increasingly being addressed in the scientific literature in these fields (Ribeiro *et al*., 2024; Morais *et al*., 2024; Xavier, 2021).

The need to map and measure armed violence (AV) has become part of civil society initiatives aimed at addressing the risks of victimization in urban spaces. Platforms such as mobile applications, websites, and social media profiles—including "*Onde Tem Tiroteio*" (OTT, 2025), "*Fogo Cruzado*" (Oliveira, 2025), "*Tem barricada aí*?" (O São Gonçalo, 2018), the Historical Map

of Armed Groups (GENI/UFF & *Fogo Cruzado*, 2025), and the Map of Areas Dominated by Factions (Dados de Riscos, 2025) illustrate these efforts.

In both academic and media discourse on education, there appears to be a near-conventionalized adoption of the unit of analysis "shots/shootings" when drawing on open data to measure AV. However, in this study, we argue that there are certain gaps in using this unit of analysis to assess the impacts of AV within facilities serving specific purposes, such as educational institutions.

Santos and Silva (2020, pp. 2–3) mapped a set of "emerging demands" for education, highlighting how the escalation of AV in schools in Rio de Janeiro prompted the need for more precise quantification. Their findings indicated that the percentage of schools with shootings in their surroundings rose from 19.7% in 2015 to 46% in 2018, reaching 50% in 2024 (*Fogo Cruzado*, 2025). The authors further argue that these issues have fueled the quantitative debate centered on the binomial 'open schools *versus* closed schools'. In this sense, all harmful effects encompass the discussion around "shootings".

Nevertheless, Santos and Silva (2020) also list as "emerging demands" a number of municipal laws in Rio de Janeiro introduced in response to the impacts of violence on education, such as the 2016 law requiring the inclusion of students' blood types on school uniforms and the 2018 law authorizing the municipal executive branch to assume funeral expenses for students who fall victim to violence within or on the way to municipal schools. The authors also highlight five people shot on school courts between 2017 and May 2019. Recent studies indicate that public facilities such as schools and healthcare institutions are used as "shields" by both police officers and drug traffickers during shootings (Xavier, 2021; Ribeiro *et al*., 2024), while there are also reports that physical exposure in open spaces increases the likelihood of victimization in these settings (Santos & Silva, 2020; Xavier, 2021; Ribeiro *et al*., 2024). As can be observed, the cases presented in this paragraph concern incidents of stray bullets; in order to adequately address these issues, it is necessary to quantify similar cases rather than relying solely on shootings as the unit of analysis. In this regard, shots or shootings operate as a constant variable, but do not constitute the most precise metric.

Thus, when correlated with the aforementioned cases, the lack of specificity in the open data used has led to a certain degree of confusion in the information conveyed to society, particularly in media reporting. Let us consider a practice widely reproduced in the dissemination of information on stray-bullet victims, taking as an example two recent cases that occurred in schools in the city of Rio de Janeiro.

In June 2025, a 13-year-old student was struck by a stray bullet inside her school in the northern zone of Rio de Janeiro[1]; less than two months later, in August 2025, a similar incident occurred involving a 7-year-old boy, who was also hit by a stray bullet inside his school[2] in the southwestern region of the city. When reporting these cases, media outlets relied on open data concerning child victims of stray bullets across the municipalities of the Rio de Janeiro Metropolitan Area (RJMA) for that year, thereby missing the opportunity to establish correlations between recent victimizations that had recurred within different schools over such a short period of time. Moreover, these incidents took place within the same type of setting. These two key aspects would have reshaped the reporting, shifting attention not only toward public security but also toward education-related data.

Such ways of quantifying and mobilizing open data tend to generate generic accounts of AV and Education, ultimately reinforcing debates that remain largely confined to the domain of Public Security. Victimization cases thus cease to function as instances capable of revealing more detailed

[1]Gama (2025, June 24). Student is shot during PE class inside school in Del Castilho. https://extra.globo.com/rio/noticia/2025/06/aluna-e-baleada-durante-aula-de-educacao-fisica-dentro-de-escola-em-del-castilho.ghtml

[2]*Jornal da Record* (2025, August 15). A 7-year-old boy is shot at school during Physical Education class in Rio de Janeiro. https://www.youtube.com/watch?v=8rIY274rhyg&list=PLAFW6pG7OkZDSj2NdMK8hHpGeBOZM1PZ-&index=16

insights into the specific interactions of AV within schools, thereby limiting the potential of open data to play an effective role in the everyday life of school units and to foster more productive debates in the field of preventing new cases of stray bullets in schools.

Accordingly, the objective of this article is to present, based on cases of stray bullets occurring within schools in Rio de Janeiro, an approach to producing specific data on armed violence and education, with the potential for generalization and for enhancing possibilities for prevention in school settings.

"Up to the Door": how open data on armed violence are classified

The principal studies quantifying armed violence and education in Rio de Janeiro were reviewed for this research. In table 1, we present those considered most relevant to the topic. We highlight their main units of analysis, periodicity, period of production, number of publications, and the number of school years covered. It should be emphasized that studies like *Fogo Cruzado* (2025) make use of additional metrics, such as stray bullets, yet they do not offer specific analyses for schools.

Table 1 - Open data studies on armed violence in Education

Source	Unit of analysis	Periodicity	Since	Quantity	School years
Fogo Cruzado (2025)	**Shot/Shootings**	Annual	2017	8	8
FBSP (2025)	**Shot/Shootings**	Biennial	2023	2	2
CESeC (2022)	**Shot/Shootings**	-	2022	1	1
UNICEF (2025)	**Shot/Shootings**	-	2025	1	8
FGV (2017)	**Shot/Shootings**	-	2017	1	1

Prepared by the authors.

As table 1 shows, the main unit of analysis addressed by the most relevant studies on AV and education is "shots/shootings." These studies count the proximity of gunfire in the surroundings of schools, but the metrics used to measure proximity vary. Regarding periodicity, it can also be observed that consistency is found only in the publications of *Fogo Cruzado* (2025)—which has produced eight annual reports since 2017—and, more recently, in the Brazilian Public Security Yearbook (FBSP, 2025), which has produced two biennial reports since 2023. The Yearbook draws on data from *Prova Brasil*, in which school principals across the country report their perceptions of the frequency of shootings near their schools (FBSP, 2025). The UNICEF study (2025) was carried out in partnership with data from the *Fogo Cruzado* Institute, covering 8 school years. Other studies such as CESeC (2022) and FGV (2017) also used the *Fogo Cruzado* database. Therefore, the data produced by *Fogo Cruzado* emerge as the most stable and the most frequently used as a reference across studies, while shootings constitute the most relevant unit of analysis.

Data on the measurement of shootings in the surroundings of schools reveal more about the broader context than about the internal insecurity produced by AV. Thus, as shown in table 1, there are studies adopting state-level (FBSP, 2025), municipal-level (CESeC, 2022), regional and neighborhood-level (*Fogo Cruzado*, 2025; UNICEF, 2025; FGV, 2017), and even school-level perspectives (UNICEF, 2025; FGV, 2017), in which shootings in the vicinity of schools are counted. It can be observed that counting shootings does not explain the "behavior" of violence within schools, but rather informs the context in which they are embedded. Therefore, the measurement of shootings goes "up to the door" of the schools.

Methodological procedures: open data to enter schools

The methodological design was conducted as a case study research (Gerring, 2017) on victims of stray bullets within schools in the Metropolitan Region of Rio de Janeiro, with a sample

comprising cases that occurred over the past nine years (2017–2025). Accordingly, the construction of a database began in 2017, focusing on cases of stray bullets in educational settings.

Following the literature, cases of armed violence in educational settings are considered "hard-to-study crimes" (Freilich *et al*., 2022, p. 96). Therefore, online searches were carried out across major search engines, newspapers, magazines, and news websites to identify relevant incidents, using keywords related to schools (Freilich *et al*., 2022; Holland et al., 2019; Huff-Corzine *et al*., 2014). The spatial and temporal boundaries related to the school community comprise events occurring within educational units across the geographic extent of the RJMA. Victimizations were classified as "single" in cases with only one individual shot, and "multiple" in situations where more than one person was struck in the same incident (Holland *et al*., 2019). In these events, each person was counted individually, for example: "case 3 and case 4 in the same incident".

In order to increase data reliability, a form of "audit" (Mau, 2019) was conducted, involving verification through interviews or brief consultations with informants linked to cases of stray bullets in schools, including the victims themselves, their relatives, witnesses, or others able to provide relevant information (Freilich *et al*., 2022; Huff-Corzine *et al*., 2014), thereby establishing two comparative sources.

News reports provide key information such as the name of the school, basic victim characteristics (e.g., sex and age), and the specific school space where the victim was shot (Freilich *et al*., 2022). The verification process is carried out subsequently, either at the site of victimization or by contacting individuals through social media, making it possible to confirm the victim's identity, age, the school space where the incident occurred, and its architectural features. This makes it possible to address potential inaccuracies or errors in information provided by news sources.

The importance of characterizing victimization within each school space at units smaller than the address level lies in the physical differences that shape architectural designs/programs, which nonetheless follow similar spatial patterns (Kowaltowski, 2011). Because victimizations are rare events, they occur across different schools; however, their physical similarities — linked to specific functions — facilitate the overlap and aggregation of cases within these spaces over time, enabling the identification of patterns across schools. The particular architectural features of actual school spaces in which victimizations take place — such as classrooms, sports courts, and schoolyards — are considered within-case evidence (Gerring, 2017), adding to the aggregation of cases and supporting the analysis of environmental mechanisms that may either enable or constrain stray bullet incidents inside schools. Thus, generalization is produced through the sum of cases (Gerring, 2019).

The study was authorized by the Research Ethics Committee of the Clementino Fraga Filho University Hospital at the *Universidade Federal do Rio de Janeiro*. All ethical protocols involving human subjects were observed. Among the limitations is the potential underreporting of cases, which requires the data to be considered as a lower bound (Hirata *et al*., 2021). Verification was also limited by the fear of some individuals.

Accordingly, this approach provides an objectifying perspective capable of "entering" schools by using the "stray bullet" as the unit of analysis. The method demonstrates that analyzing the internal school spaces where victimizations have occurred can reveal new spatial configurations that have not yet been problematized and that should be addressed, as they can inform school administrators in taking measures to prevent future cases.

Analysis

According to what we argued in the introduction, the "emerging demands" of As discussed in the introduction, the "emerging demands" posed by armed violence to education (Santos & Silva, 2020) are not confined to the fear of shootings, but become evident when they materialize in bodies. We demonstrate that, in addition to the authors discussed, more recent studies also identify other

factors more closely related to stray bullets (Ribeiro *et al*., 2024; Morais *et al*., 2024; Xavier, 2021) Researchers studying armed violence in the United States classify cases in which individuals are struck as "serious gun violence" (Braga *et al*., 2010), a category within which stray bullet incidents can be included. Therefore, the stray bullet constitutes a unit of analysis capable of at least minimally measuring the most severe risks associated with shootings.

Moreover, the way data are organized in studies addressing AV and education at the neighborhood, regional, city, and state levels leads to the production of ecological inferences (Castellanos, 1998), including in the case of the press example discussed in the introduction. In that way of reporting, the issue seems to be framed exclusively as a matter of public security. In a previous study (Santos & Silva, 2020, p. 2), five victims in school sports courts between 2017 and May 2019 were identified, without this having generated discussions or practical actions, either in academia or in other spheres of civil society. Failing to address the issue reinforces the perception that intersectionalities such as race, class, and childhood (Collins, 2024) shape the risks faced by hidden victims in education.

The inferences derived from current studies contribute to a situation in which, despite being directed toward education, the units of analysis "shot/shooting" do not lead to practical changes in schools, as it is not possible to understand their behavior within them. That's why we said they go "up to the door". Approaching the reality of AV in this manner makes it more difficult for school managers, both within education systems and at the level of individual institutions: for the former, because interventions targeting excessively broad areas would be costly and fall outside the remit of education; for the latter, because they may be dissuaded from taking action when the evidence frames the school's surrounding neighborhood as a "risk area." Additionally, it hinders the school community's access to context-specific data about themselves in relation to AV.

As the aim of this manuscript is to present a way of producing data with the potential for generalization and capable of expanding possibilities for prevention, only selected proportions from the empirical study will be presented, as the study is still in progress at the time of writing.

In this proposal (table 2), the distinctiveness of the data we obtained — and which more clearly illustrate the potential of this method — will be exemplified through those already published on victims shot in schools between the shcool years of 2017 and May 2019 (Santos & Silva, 2020, p. 2). Instead of focusing solely on school sports courts, the data were expanded to include victims struck in all school spaces. We found that victims were struck in schoolyards, sports courts, classrooms, and other open spaces. An additional correction was made after verification: one more victim struck by a stray bullet on a sports court was identified. This person belonged to a case previously counted, but the site visit made it possible to recognize them as a victim. Along with confirming their case and gathering testimonies from other witnesses, photographs of the injury were also obtained.

Table 2 – Victims of stray bullets in schools in the RMRJ between 2017 and May 2019

School Space	Sports court	Classroom	Schoolyard	Total
Number of victims	6	3	2	11
Percentage	54.5%	27.3%	18.2%	100.0%

Prepared by the authors.

Through the time frame presented in table 2, it is possible to observe how this new way of producing open data on armed violence and education makes it possible to identify the spaces with greater physical vulnerability and, thus, to better understand the characterization of AV within schools. By combining victimizations in sports courts and schoolyards, a total of 72.7% of victims

within schools are found to be in open spaces. The spatial configurations of these facilities were analyzed, and all were found to include openings that facilitated the occurrence of victimizations.

These results demonstrate that some schools, through their common spaces of victimization, are consistently aligned with the concept of "risky facilities" (Eck, 2007), in which, within a set of places with a homogeneous purpose that provide a specific type of service, a small number of units concentrate a high incidence of crime or undesirable situations, potentially driven by poor space management, insufficient control measures, among other factors (Eck *et al*., 2007; Ioannidis *et al*., 2025).

Conclusions

This article seeks to argue that, although productive and valuable, the open data on AV and education most commonly used today lack sufficient specificity to inform the behavior of armed violence within school premises and, therefore, generate gaps whose evidence does not support practical changes in schools. In this way, although directed at education, they constitute generic outputs, as they primarily reproduce data and debates related to public security (*Fogo Cruzado*, 2025; CESeC, 2022), only tangentially engaging with the field of education. There is no doubt regarding the importance of this discussion and the temporary benefits achieved, as evidenced by the successful data associated with ADPF 635 ("Favelas ADPF"), when police operations in the vicinity of educational and health facilities were regulated by the Supreme Federal Court (UNICEF, 2025). Due to its temporary nature, the suspension of the benefits of this important public measure for schools revealed that it was yet another antiracist "experiment," reflecting a historical pattern of progress marked by "spurts" followed by conservative setbacks (Prado Jr., 2011).

We demonstrate that stray bullets, as a unit of analysis, can generate less generic knowledge than that offered by current studies, with more specific possibilities for prevention that may be more precise and effective.

The limitations of this study are linked to the manuscript's objective of initially presenting selected findings from a doctoral thesis on a method for producing data with generalizable potential and capable of enhancing prevention in AV and education. A broader temporal range is advisable to consolidate data stability. Since the analysis relies on a short time frame for illustrative purposes, the intention is not to offer definitive empirical results, but to exemplify the application of the method. Results based on an appropriate temporal scope will be presented in future publications.

Based on the data presented, it is possible to improve the management of educational facilities, addressing safety demands both at the level of individual schools and at aggregated levels (meso- and macro-geographical), such as public education systems. Furthermore, the data produced in this study provide parents, students, teachers, and unions with more specific evidence that can be used as a tool to advocate for change.

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