

REVIEW

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Commercial practices of the arms industry and implications for global public health: a scoping review

Stephanie Meciar^{1*} , Deborah Gleeson² , Stacey Pizzino¹ , Navid Teimouri¹ and Katherine Cullerton¹

Abstract

Background The arms industry and the global trade in weapons pose significant direct and indirect risks to population health and equity. While health-harming industries such as tobacco, alcohol, and ultra-processed foods have been extensively examined with a commercial determinants of health lens, the commercial strategies of the arms industry remain critically underexplored in public health research. To address this gap, we conducted a scoping review of peer-reviewed literature published between 2004 and 2024. Searches were undertaken across four academic databases (Web of Science, Scopus, ABI/INFORM, and Business Source Complete) and Google Scholar. Data were extracted and analysed using deductive and inductive coding, guided by a previously published typology of commercial practices: financial, political, scientific, marketing, supply chain and waste, labour and employment, and reputational management practices.

Results Forty-one studies met the inclusion criteria. Marketing and political practices were the most frequently reported, while supply chain and waste, financial, labour and employment, reputational management, and scientific practices were less common. Our review found that the arms industry not only engages in commercial practices identified within established commercial determinants of health frameworks but also employs additional strategies, such as bribery and corruption, worker surveillance, contesting worker illness claims, and a number of supply chain practices that extend beyond existing typologies. The majority of studies focused on firearms-related practices, particularly within the United States, while few addressed other arms industry sub-sectors such as major conventional weapons and nuclear weapons, and little attention was given to low- and middle-income countries.

Conclusion Despite the scale and influence of the arms industry, its commercial sector practices remain largely overlooked in public health research. Greater scrutiny and recognition of the arms industry as a commercial determinant of health is essential to mitigate the health harms and inequities associated with the global production, proliferation, and use of weapons.

Keywords Arms industry, Weapons, Commercial determinants of health, Commercial sector practices, Global health, Governance, Proliferation

*Correspondence:

Stephanie Meciar
s.meciar@uq.edu.au

¹School of Public Health, The University of Queensland, Brisbane, Queensland, Australia

²School of Psychology and Public Health, La Trobe University, Melbourne, Victoria, Australia



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Background

In 1981 the World Health Assembly adopted a resolution (WHA 34.38) to recognise “*the role of physicians and other health workers in the preservation and promotion of peace as the most significant factor for the attainment of health for all*” [1]. However, more than four decades later, the integration of disarmament concerns into public health discourse and practice remains limited. Although this agenda was revived with the launch of the World Health Organization (WHO) Global Health and Peace Initiative in 2019, a critical gap remains in addressing the upstream commercial and political forces that sustain militarised systems and drive the proliferation of weapons [1–4]. While the public health sector has long responded to the consequences of war and armed conflict, far less attention has been directed to the structural determinants, particularly the commercial practices of the arms industry that underpin and perpetuate these harms.

The concept of the commercial determinants of health (CDoH), defined in a 2023 Lancet Series as “*the systems, practices, and pathways through which commercial actors influence health and equity*” [5], offers a valuable lens for understanding how corporate power shapes health outcomes. It is increasingly recognised as a tool to examine the broader influence of commercial actors on health, both positively and negatively [5].

In March 2025, the WHO released a report on the CDoH emphasising the need for broader and more inclusive approaches to CDoH research [6]. The report urges scholars and policymakers to move beyond a narrow focus on specific health-harming industries, and to instead examine the wider influence of commercial and quasi-commercial actors on health outcomes and equity [6, 7]. While the existing CDoH literature predominantly focuses on industries such as tobacco, ultra-processed foods (UPFs), sugar-sweetened beverages and alcohol as key drivers of noncommunicable diseases (NCDs) [5], there is also a growing, albeit less extensive, body of evidence on the harmful health impacts of industries such as gambling, fossil fuels, pesticides, and pharmaceuticals [8]. However, industries whose products are explicitly designed to cause injury, death and destruction, such as the arms industry, have been largely absent from the CDoH literature [5, 9] with the exception of a recently published series in the British Medical Journal which begins to explore the application of CDoH concepts and frameworks to this sector [10–14].

The global arms industry comprises a complex network of public and private actors involved in the development, production, and transfer of weapons, military technologies and related services [15]. In 2024, global military expenditure rose to US\$2.7 trillion, representing a 9.4% increase from the previous year (2023), continuing

a decade-long trend of steady growth [16, 17]. This increase reflects a surge in global conflict events between 2020 and 2024, with an estimated 200,000 conflict events recorded in November 2024 [18]. Much of this rise was driven by the Russia-Ukraine war and the Israel-Palestine conflict, alongside violence in regions experiencing ongoing intrastate conflict, such as Myanmar, Sudan, Mexico, Yemen and the Sahel [18].

However, the health implications of weapons extend into everyday life and are not confined to contexts of war. Rising military expenditure shapes global security dynamics while diverting resources away from health, education, and social services [4]. Research indicates that the accumulation of weapons does not deter conflict but instead heightens and shapes the risks of armed violence further fuelling the arms trade and creating a perpetual cycle of violence and militarisation [19–22]. Moreover, the legacies of conflict such as toxic remnants of war, unexploded and abandoned ordnances, and environmental contamination from both conventional weapons and weapons of mass destruction (including nuclear, chemical, radiological, biological agents), have intergenerational consequences, and pose ongoing risks to human and planetary health long after conflict has ended [23, 24].

The small body of CDoH literature on weapons has focused primarily on the commercial practices of the firearm or small and light weapons (SALW) industry, a narrow subset of the broader arms industry (see Supplementary Material 1 for weapon categories), and there has been limited attention to the wider arms industry and its practices [10–14, 25–27]. To date, no study has systematically mapped the extent, range, and nature of the peer-reviewed literature examining the arms industry as a commercial determinant of health. This gap reflects both the limited availability of organised, transparent, and systematically collected data, and the relatively recent emergence of CDoH literature [4, 5]. Therefore, understanding how the arms industry operates through commercial practices that have implications for human health is essential to advancing public health scholarship, clarifying concepts, exploring the breadth of existing literature, and informing future research and policy agendas.

This scoping review seeks to bridge this research gap by systematically examining the peer-reviewed literature on commercial practices of the arms industry using a conceptual framework on the CDoH. This analysis was guided by two main research questions:

1. What is the extent and nature of existing evidence on the commercial practices of the arms industry that impact on health, including political, financial, scientific, marketing, supply chain and waste, labour

Table 1 Definitions of commercial practices and activities adapted and expanded on from the Gilmore et al. (2023) CDoH framework

Commercial Practice adapted from Gilmore et al. (2023) [5]	Commercial activity	Definition^a
Financial Supports financial position of the organisation and results in decreased state revenues [5] (often enabled by political practices).	Tax avoidance/minimisation (use of tax havens)	Reducing corporate tax obligations by shifting profits or operations to jurisdictions with favourable tax laws and financial regulations.
	Mergers/acquisitions and buy-outs to reduce competition.	Acquiring or merging with other firms/companies to eliminate competitors, consolidate market share, and increase corporate power.
	Pricing strategies (price fixing, price hiking)	Manipulating product or service prices, including coordinated price fixing or setting inflated prices to maximise profit.
	Promoting credit and debt	Encouraging individuals or governments to take on debt in order to finance the purchase of goods and services.
	Accounting and security fraud	Manipulating or falsifying financial records or disclosures to mislead shareholders, investors, or regulatory authorities.
	Government subsidies	Receiving direct financial support or incentives from governments to reduce operational costs or stimulate production.
	Externalising costs	Shifting the environmental, social, or health-related costs of production onto third parties, such as communities, governments, or ecosystems.
	Smuggling to evade duties	Illegally transporting goods across borders (into or out of a country) to avoid taxes, tariffs, or regulatory restrictions.
	Encouraging consumer debt	Promoting the use of credit or financial schemes that result in increased debt burdens for individuals, households, or governments to sustain consumption or procurement.
	Lobbying	Efforts by businesses or representatives to influence policymaking i.e., through direct communications with government officials, engaging in public hearings, or through advocacy campaigns promoting industry-favourable policies.
Political Practices to secure preferential treatment or prevent, shape, circumvent, or undermine public policies (or a combination of the above) in ways that further corporate interests [5].	Financial contributions/ payments to secure policy influence	Monetary contributions made by individuals or corporations, such as political donations or other forms of financial support to gain access favour or influence over political decision-making processes.
	Building constituencies of support (including third parties through which they operate).	Forming alliances with supportive individuals, communities, or organisations, including think tanks, advocacy groups, or front groups, to promote industry positions and enhance legitimacy through third-party endorsement.
	Producing and using (often misleading) information to make the industry's case that the policy will be ineffective and economically disastrous.	Disseminating selective or misleading information to discredit public health policies i.e. frame them as ineffective or economically harmful, and generate doubt among policy makers and the public.
	Threatening and taking legal action	Using the threat of legal proceedings or initiating lawsuits to challenge, delay, or block policy proposals that may negatively impact commercial interests.
	Intimidating opponents	Verbal, legal or behavioural activities to silence or pressure critics, researchers, advocates, or policy makers through fear, reputational damage, or other coercive means.
Scientific Practices involving the production and use of science to alter products or otherwise secure favourable outcomes (or both) for the industry [5].	Bribery and corruption**	Use of illegal strategies or financial incentives to secure defence contracts.
	Controlling and/or influencing steps of the scientific process (from evidence production to dissemination and use).	Intervening at various stages of the research process, such as funding, study design, data analysis, publication, and/or dissemination, in order to bias findings in favour of industry interests.
	Ghost writing	Producing scientific articles or policy documents on behalf of industry, which are then attributed to independent experts to hide conflicts of interests/industry involvement.
	Fabricating/misrepresenting information	Deliberately falsifying, manipulating, or selectively reporting scientific data or findings to mislead stakeholders or obscure potential harms.
	Discrediting scientists and/ research organisations	Undermining the legitimacy, credibility, or public trust in independent researchers or institutions that produce evidence unfavourable to the industry.

Table 1 (continued)

Commercial Practice adapted from Gilmore et al. (2023) [5]	Commercial activity	Definition^a
Marketing Practices that increase the demand for and consumption of products (i.e., unhealthy commodities) or services [5].	Changing physical and information environments	Changing physical, digital, or social environments to increase exposure to products or services i.e., through advertising placement, retail designs, or promotional content.
	Exaggerates structural inequalities by targeting specific geographical areas and population subgroups categorised by ethnicity or vulnerability.	Marketing efforts targeted in specific geographical areas or towards groups defined by ethnicity, socioeconomic status, or other vulnerabilities, which ultimately reinforce structural inequalities.
Supply chain and waste Practices involved in the creation, distribution, retail, and waste management of products or services (can negatively affect human and planetary health) [5]. (often enabled by political practices).	Shaping new cultures and norms to drive consumption.	Promoting values, lifestyles, and behaviours that normalise or encourage the use of certain products or services i.e., linking them to identity, success, or social acceptance.
	Despoiling the environment (i.e. pollution, deforestation, resource depletion, habitat destruction)	Engaging in practices that degrade ecosystems and natural resources, including air and water pollution, land clearing, overextraction, loss of biodiversity.
	Ground water contamination	Polluting underground water sources i.e. used for drinking or agriculture through industrial waste, chemicals, or runoff from manufacturing process.
	Toxic waste release	Releasing hazardous or toxic substances into the environment, creating risks to both human and environmental health.
	Externalising costs of restoration	Avoiding responsibility of environmental damage by shifting cleanup or remediation costs on to governments, communities or future generations.
Labour and employment practices Practices to manage people employed directly within, or under contract to, the organisation within its supply chain [5]. (often enabled by political practices).	Weak supply chain oversight**	Failing to implement systems that monitor inventory, product movement, personnel, or sales practices across the supply chain.
	Delegating distribution to third parties to reduce downstream accountability**	Transferring responsibility for product sales and distribution to third-party actors in order to limit oversight, liability, or accountability for how products are marketed, sold, or used.
	Exploiting regulatory gaps or loopholes**	Taking advantage of inconsistencies or weaknesses in national or international law to facilitate sales or avoid compliance.
	Destabilising, outsourcing, and offshoring the costs of production (enabled by weak labour market regulations)	Shifting labour to low cost jurisdictions to reduce wages, avoid labour protections, and externalise employment costs.
	Modern slavery	Exploiting individuals through coercion, threats, or deception in a way that denies them freedom and control over their labour.
	Informal or zero hour contracts that offer no stability of income	Employing workers under insecure conditions with no guaranteed income, hours, or employment protections.
	Forced labour	Individuals working under threat or penalty.
	Child labour	Employing children in work that is exploitive or harmful their health and safety, and that interferes with their education.
	Reduced private-sector union coverage	Limiting or undermining worker's ability to organise, collectively bargain, or engage in union representation.
	Surveillance and/control of workers**	The use of monitoring, intimidation, censorship, disciplinary actions, or the withholding of information to control workers' behaviour, suppress dissent, and discourage the reporting of harm or misconduct. These practices can lead to feelings of worker alienation, disconnect, exclusion/powerlessness, and may be carried out directly by employers or indirectly through external influence, such as donors or corporate partners.
	Contesting/rejecting illness claims**	Undermining, denying, or deflecting responsibility for workers' health claims about illness due to occupational exposures. (often overlaps with scientific practices)

Table 1 (continued)

Commercial Practice adapted from Gilmore et al. (2023) [5]	Commercial activity	Definition ^a
Reputational management Efforts to shape legitimacy and credibility, reduce risk, and enhance corporate brand image [5].	Corporate social responsibility	Practices or initiatives that portray the company as socially or environmentally responsible i.e. through greenwashing, philanthropic activities, partnerships, or ethical brand campaigns. Often used as a public relations tools to manage reputation and maintain social legitimacy.
	Environmental, social, governance	Frameworks and reporting standards used by companies to demonstrate performance in environmental sustainability, social impact, and corporate governance.
	Institutionalisation of public private partnerships	Placing commercial actors within public programs or decision making processes in ways that increase their influence and reduce public accountability.

**These practices and/activities are not mutually exclusive and are inextricably linked; **This practice was not part of the original coding framework and was identified inductively during data analysis;^adefinitions were generated by the authors of this review expanding on and considering existing definitions provided by the CDoH framework by Gilmore et al. (2023)*

and employment and reputational management practices?

2. What are the key gaps in the evidence base, and what areas warrant further research?

Methods

This review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews and reported using the Preferred Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) checklist. A protocol has been pre-registered in Open Science Framework [28].

Commercial determinants of health framework

Our review was guided by the CDoH framework developed by Gilmore et al. [5], which outlines an emerging typology of seven key commercial practices: political, scientific, marketing, supply chain and waste, labour and employment, financial, and reputational management practices. Prior to commencing the review, the Lancet Series on the CDoH was examined in detail and specific examples of commercial activities associated with each practice were extracted into a table to guide the screening and coding process. These categories and associated activities underpinned the coding and analysis of included studies (see Table 1) [5, 29, 30].

Search strategy

A three-staged search strategy was used to identify relevant literature. We conducted a preliminary search of PubMed, Scopus, Web of Science, to identify relevant articles and key search terms. Based on this, seven search strings (each corresponding to one of the commercial practice domains) were developed in collaboration with a research librarian at The University of Queensland. We used predefined terms related to ‘weapons’, ‘industry’, ‘health’ and ‘commercial practices’ (i.e., (weapons) **AND** (industry) **AND** (health) **AND** (commercial practices)) (see Supplementary Material 1 for the full search strategy).

A comprehensive search of peer-reviewed literature was carried out across four electronic databases: Web of Science (Clarivate), Scopus (Elsevier), ABI INFORM (ProQuest), and Business Source Complete (EBSCO), with October 2024 the last date of search. Google Scholar was used to supplement the search and reference and citation searching of included studies was also conducted to identify relevant articles not captured in the database search.

Inclusion and exclusion criteria

Studies were eligible for inclusion if they were: (1) published in English between January 2004 and October 2024; (2) peer-reviewed; (3) focused on the global arms industry including the production, manufacturing, sale, export, or import of weapons or military technology; and (4) described at least one of the seven commercial practices or activities defined in the framework developed by Gilmore et al. [5] (see Table 1).

Our initial search did not place any restrictions on publication date and document type to ensure broad coverage of the literature. However, our inclusion criteria were refined during title and abstract screening to narrow the scope to peer-reviewed literature, and hence increase feasibility due to the heterogeneity and amount of the literature captured in the initial search. Many of the older articles retrieved focused on the First and Second World Wars, as well as the Cold War period. Therefore, to better capture literature relevant to modern warfare and the rise of neoliberal globalisation, we restricted the review to studies published from January 2004 and October 2024 (last date of search). We also found a large number of studies on topics outside the scope of this review, including on nail gun injuries; spray guns (pesticides and paint); the use of non-lethal weapons or those used by security personnel (tasers, rubber bullets); private military contractors; health surveillance systems for military equipment; injuries among military personnel; and illicit SALW trafficking. Additionally, papers that focused on government practices (rather than commercial practices)

or on radiation exposure, occupational hazards, and the health impacts of weapons (e.g. gun violence and fire-arm injuries) without reference to commercial practices by commercial actors were also excluded. Grey literature (i.e., reports from civil society, inter-governmental organizations, and investigative journalists) were excluded due to its vast and heterogeneous nature. Books, book chapters, review articles and meta-analyses,

letters, briefs, abstracts, conference proceedings were also excluded.

Study selection

Figure 1 details the study search and retrieval process using Covidence software [31]. The title and abstracts for each publication retrieved by the database search were uploaded to Covidence [31] and were independently screened against the inclusion criteria by one reviewer

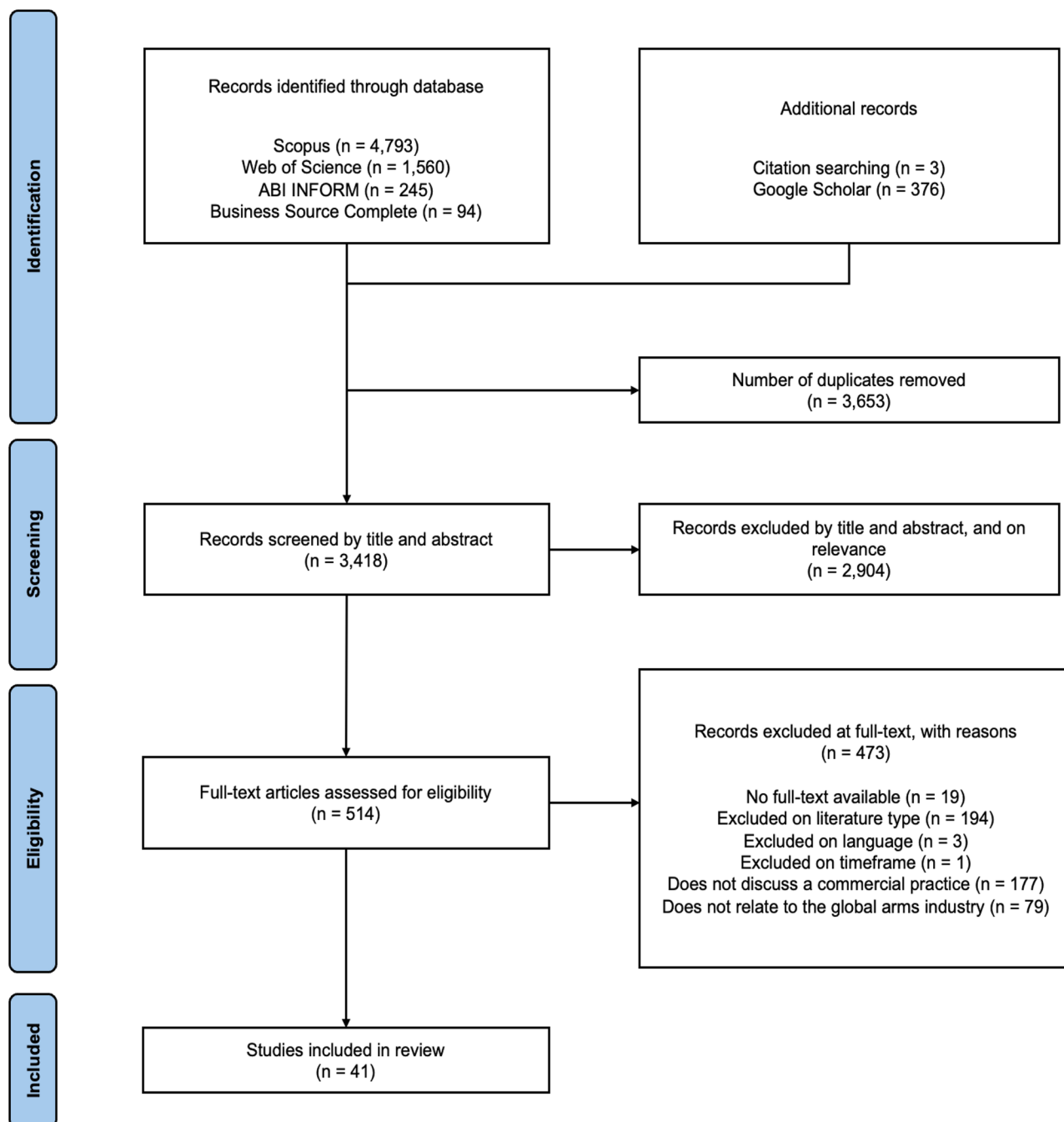


Fig. 1 PRISMA-ScR flow diagram

(SM), with 20% independently double-screened by a second reviewer (DG, SP, or NT). Full-text articles were then assessed for eligibility by one reviewer (SM), with 20% double screened by a second reviewer (DG, KC, SP, or NT). Any discrepancies that arose between the reviewers at any stage of the selection process were resolved through discussion to reach consensus.

Data extraction

Data extraction was conducted by the lead reviewer (SM) in Microsoft Excel, and the data table was reviewed by DG, KC, or SP for accuracy and consistency. For each study, data was extracted on author(s); publication year; title; journal; date of data collection; country/region; study setting; document type; aim/focus; study design; methods; funding; actor type; actor details; weapon type; weapon details; government practices; and any additional notes or comments.

Commercial practices were deductively coded using the predefined categories outlined by Gilmore et al. [5]. Practices that did not fit within these categories or activities were inductively coded to identify new and emerging themes. All articles were independently coded by the lead reviewer (SM), with 20% double-coded by a second reviewer (DG, KC, SP, or NT) to ensure reliability and rigour in the extraction process. Discrepancies that arose between reviewers during data extraction were resolved through discussion to reach consensus.

Results

Search results

Figure 1 details the PRSMA flow diagram for the scoping review. A total of 3,418 studies were screened at the title and abstract stage, of which 2,904 were identified as irrelevant and excluded. The remaining 514 studies underwent full-text review, of which 41 studies met inclusion criteria and were included for analysis.

Study characteristics

Table 2 provides a summary of the key characteristics of included studies. Full details of included studies are available in Supplementary Material 1.

Of the 41 included studies, 20 (49%) were conceptual/theoretical in nature [32, 33, 35, 36, 38, 39, 42, 44, 46, 47, 51, 52, 57, 60, 61, 64, 65, 67–69], four (10%) were commentary or perspective articles [53, 54, 62, 70], and 17 (41%) were empirical studies [27, 34, 37, 40, 41, 43, 45, 48–50, 55, 56, 59, 63, 66, 71]. Most of the research was predominantly situated within social and political sciences literature, and many papers were narrative in nature.

The majority of studies ($n=28$, 68%) focused on the United States of America (US) [27, 32–34, 36, 37, 39, 41–48, 50, 51, 53–55, 59, 62–66, 69, 71]. In addition, three

studies focused on more than one country or region. For example, one explored nuclear discourse in the US, Marshall Islands, and Japan [35], another analysed firearm violence and gun ownership in the US and Switzerland [68], and the third focused on munition dumping in US and European coastal waters [38]. Additional country- or regional-specific studies included China [61] ($n=1$), the United Kingdom [67] ($n=1$), and Sub-Saharan Africa [56] ($n=1$). Six studies (15%) did not specify a country or region (Table 2) [40, 49, 52, 57, 60, 70]. We also reported on studies that examined government practices alongside commercial sector practices; 19 (46%) of the included studies met this criterion [32, 34, 35, 37–40, 46, 48, 52, 53, 55, 58, 61, 64, 65, 67, 70, 71]. Furthermore, disclosure of funding was limited. Thirty-two (78%) of the included studies did not report their funding sources [32, 33, 35–39, 41–47, 49, 51–57, 59–61, 64–68, 70, 71], eight (19%) acknowledged receiving funding [27, 34, 40, 50, 58, 62, 63, 69], and one paper (2%) explicitly stated that no funding was received (Table 2) [48].

Studies were also categorized by arms industry sub-sector (Fig. 3). Of the included studies, six (15%) focused explicitly on major conventional weapons [39, 48, 49, 60, 61, 64], 21 (51%) on small arms and light weapons (SALW) [27, 32, 33, 36, 41–47, 50, 54, 57, 59, 62, 63, 66, 68, 69, 71], nine (22%) on nuclear weapons [34, 35, 37, 40, 51, 53, 55, 65, 70], one (2%) on chemical weapons [67], and two (5%) examined the arms industry more broadly or without specifying an industry sub-sector [52, 58]. Additionally, two studies (5%) addressed more than one sub-sector. One study focused on both major conventional weapons and chemical weapons [38], and another focused on SALW alongside general discussion of the arms industry (Table 2; Fig. 3) [56].

Mapping of commercial practices

Of the 41 included studies, the most frequently documented practices were marketing ($n=22$), political ($n=19$), and supply chain and waste practices ($n=16$) (Fig. 2; Table 3). By contrast, financial ($n=8$), labour and employment ($n=8$), reputational management ($n=8$), and scientific practices ($n=6$) were less frequently reported. The following sections describe the strategies identified within each domain in greater detail.

Marketing practices

Twenty-two studies (54%) reported on marketing practices (Table 3). Of these, eleven described strategies aimed at shaping physical and information environments, particularly through digital marketing [32, 33, 44, 46–50, 54, 60, 63]. Arms manufacturers, particular in the SALW industry, used platforms such as Twitter, YouTube, and other social media channels to promote brand identity, disseminate promotional content, and normalise

Table 2 Characteristics of included studies (N=41)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Adams RJ (2004) [32]	To explore how firearm manu- facturers and retailers may be held responsible for gun violence through the con- cept of negligent distribution.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Retailers; Trade/Labour Union Association; Industry Association	Accu-Tek; Be- retta; American Arms; Smith & Wesson; Glock; Colt's Arms; Taurus International; Browning Arms; Navegar; Ashland Shoot- ing Supplies; Jennings Firearms; The Sports Author- ity; Suburban Sporting Goods; Gun World; National Rifle Associa- tion; National Shooting Sports Founda- tion; Taurus International; Saf-T-Hammer Corp.	Small Arms and Light Weapons (SALW)	Yes	Financial; Political; Marketing; Supply chain and waste
Adams RJ (2006) [33]	To critically analyse the im- plications of the Protection of Lawful Commerce in Arms Act on accountability within the fire- arms industry.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Industry Association; Trade/Labour Union Association; Manufacturer/Supplier; Retailers; Brokers/Dealers	Navegar; Smith & Wesson; American Shooting Sports; Nation- al Rifle Associa- tion; National Association of Manufacturers	Small Arms and Light Weapons (SALW)	Not Specified	Financial; Political; Marketing; Supply chain and waste

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Ash- wood L & Wing S (2016) [34]	To critically examine the limitations of radiation exposure monitoring and compensation systems for workers at the Savannah River Site, a U.S. nuclear weapons facility.	United States of America	Empirical Study (qualitative interviews)	Stated	Nuclear Weapons Industry	Manufacturer/Supplier	DuPont	Nuclear Weapons	Yes	Scientific; Marketing; Labour and employment; Supply chain and waste; Reputational management
Barker HM (2015) [35]	To examine how government and nuclear industry discourses obscure past harms to Indigenous communities from nuclear weapons, enabling the promotion of nuclear energy as a climate solution.	United States of America; Marshall Islands; Japan	Conceptual/Theoretical	Not Stated	Nuclear Weapons Industry	Not Specified	Not Specified	Nuclear Weapons	Yes	Supply chain and waste
Benson P (2014) [36]	To analyse how industries that produce harmful products employ public relations strategies to shape public discourse and influence regulatory frameworks.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier Retailers	Walmart	Small Arms and Light Weapons (SALW)	Not Specified	Political; Marketing; Reputational management

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Cable S, Shriver TE & Mix TL (2008) [37]	Using the risk society thesis to address gaps in the environmental illness literature, focusing on why authorities dis- pute illness claims even when the exposure–illness link is scientifically confirmed.	United States of America	Empirical Study (qualitative interviews)	Not Stated	Nuclear Weapons Industry	Manufacturer/Supplier	Union Carbide; General Electric; Westinghouse; Martin Marietta; Lockheed; Monsanto	Nuclear Weapons	Yes	Political; Scientific; Labour and employment; Supply chain and waste
Carton G & Jag- usiewicz A (2009) [38]	Historic Disposal of Munitions in US and European Coastal Waters, How Historic Information Can be Used in Char- acterizing and Managing Risk	United States of America; Norway; Sweden; Denmark; Belgium; Scotland; Ireland;	Conceptual/Theoretical	Not Stated	Major Conventional Weapons Industry; Chemical Weapons Industry	Not Specified	Not Specified	Major Conven- tional Weapons; Munitions and Explosives; Chemical Weapons	Yes	Supply chain and waste
Caver- ley JD (2017) [39]	Exploring an alter- native approach to moderating global arms trans- fers, particularly focusing on the proliferation of major conven- tional weapons.	United States of America	Conceptual/Theoretical	Not Stated	Major Conventional Weapons Industry	Manufacturer/Supplier	Lockheed Martin; Boeing; Leonardo	Major Conven- tional Weapons	Yes	Supply chain and waste

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Egeland K & Pelopi- das B (2022) [40]	To investigate the financial links between foreign policy think tanks, nuclear defence contractors and governments that espouse nuclear deter- rence strategies.	Not specified	Empirical Study (document analysis and interviews)	Stated	Nuclear Weapons Industry	Manufacturer/Supplier; Other	Airbus; BAE Systems; Bechtel; Boe- ing; Gen- eral Dynamics; Huntington Ingalls Indus- tries; Leonardo; Lockheed Mar- tin; Los Alamos National Laboratories; RAND Corpora- tion; Brookings; MBDA Missile Systems; Northrop Grumman; Raytheon; Roscosmos; Rolls Royce; Safran; San- dia National Laboratories; Textron; Thales	Nuclear Weapons	Yes	Financial; Political; Scientific; Marketing; Labour and employment; Reputational management
Esparza DP et al. (2022) [41]	A dataset that en- ables the analysis of temporal and spatial patterns of gun shows and their role in gun trafficking in the US and beyond.	United States of America	Empirical Study (quantitative; descriptive study)	Not Stated	Small Arms & Light Weapons Industry	Retailers; Broker/Dealer	Not Specified	Small Arms and Light Weapons (SALW)	No	Political; Marketing; Supply chain and waste
Freud- enberg N (2005) [42]	To explore how corporate prac- tices significantly impact public health in the United States.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturers/ Suppliers; Industry Association	National Rifle Association	Small Arms and Light Weapons (SALW)	No	Political; Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Freudenberg N, Bradley SP & Serrano M (2009) [43]	To examine the interactions between advocacy campaigns and industry opponents; explore the roles of governments, researchers, and media; and identify characteristics of campaigns that are effective in changing health-damaging practices.	United States of America	Empirical Study (multi-case history study)	Not Stated	Small Arms & Light Weapons Industry	Industry Association	National Rifle Association	Small Arms and Light Weapons (SALW)	Not specified	Political
Gluck AR, Nabavi-Noori A & Wang S (2020) [44]	To survey the field of litigation that has emerged in response to gun violence.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Industry Association; Manufacturer/Supplier; Retailers; Brokers/Dealers	Navegar; Smith & Wesson; Stoeger Industries; International Armament Corp.; R.G. Industries; Colt Industries; Walther's Inc.; K-Mart Corp.; Bushmaster Firearms International; Sturm, Ruger Company; Accu-Tek; AcuSport Inc; Badger Guns; A Pawn Shop; J&G Sales & World Pawn Exchange; ROMARM; Slide Fire Solutions; Remington	Small Arms and Light Weapons (SALW)	Not Specified	Political; Marketing; Supply chain and waste

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Gundlach GT, Bradford KD & Wilkie WL (2010) [45]	Examines the diversion of handguns from legal to illegal markets in the United States.	United States of America	Empirical Study (document analysis)	Not Stated	Small Arms & Light Weapons Industry	Industry Association; Manufacturer/Supplier; Retailers; Brokers/Dealers	Smith & Wesson Corporation; National Shooting Sports Foundation; AcuSport Inc; Accu-Tek	Small Arms and Light Weapons (SALW)	No	Marketing; Supply chain and waste
Hollas D (2022) [46]	Examines historical and current marketing strategies of the gun industry.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Retailers; Industry Association	Remington; National Rifle Association; Winchester; Colt; Smith & Wesson; National Rifle Association; Kel-tec	Small Arms and Light Weapons (SALW)	Yes	Financial; Political; Scientific; Marketing; Labour and employment; Supply chain and waste; Reputational management
Hunter-Pazzara B (2020) [47]	Examines how patterns of gun violence result from the mass production, distribution, and racialized marketing of guns for self-defence.	United States of America	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier	Winchester; Colt; Smith & Wesson; National Rifle Association; Kel-tec	Small Arms and Light Weapons (SALW)	Not Specified	Marketing
Hussain Z et al. (2023) [27]	To examine the ways in which the firearm industry and industry-associated organisations frame firearms, firearm-related harms and possible solutions to gun violence.	United States of America	Empirical Study (qualitative framing analysis)	Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Industry Association; Other	American Outdoor Brand Corp.; Sturm, Ruger and Co.; National Rifle Association; National Shooting Sports Foundation; Second Amendment Foundation	Small Arms and Light Weapons (SALW)	Not Specified	Political; Scientific; Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Jester N (2023) [48]	To examine the Twitter feeds of three large US arms manufactur- ers: Lockheed Martin, Raytheon and Northrop Grumman.	United States of America	Empirical Study (media content analysis)	No Funding Received	Major Conventional Weapons Industry	Manufacturer/Supplier	Lockheed Martin; Raytheon; Northrop Grumman	Major Conven- tional Weapons; Dual-Use Technologies	Yes	Marketing; Reputational management
Jester N et al. (2024) [49]	To examine Boeing's Twitter activity following the March 2019 Ethiopian Airlines flight 302 crash.	Not Specified	Empirical Study (media content analysis)	Not Stated	Major Conventional Weapons Industry	Manufacturer/Supplier	Boeing	Major Conven- tional Weapons	No	Marketing; Reputational management

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Jordan L, Kalin J & Dab- rowski C (2020) [50]	To quantify the characteristics of gun advertising on social media and to compare the reach of posts by manufactur- ers with those of influencers.	United States of America	Empirical Study (media content analysis)	Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Industry Association	Sturm, Ruger & Company; Smith & Wes- son; Rem- ington Arms; Sig Sauer Inc; Maverick Arms Inc; Henry Rac Holding Corp; Heritage Manufactur- ing; Kimber Mfg Inc; WM C Anderson Inc; Glock Inc; Palmetto State Armory; Springfield Inc; SCCY Industries LLC; Kel Tec CNC In- dustries; Radi- cal Firearms LLC; Strassel's Machine Inc; Aero Precision LLC; Beretta USA Corp; FN America LLC; Taurus Inter- national; Colt's Manufactur- ing; Brown- ing Arms; Diamondback Firearms; CZ; Armstrong; MKE; Zenith Firearms; National Rifle Association	Small Arms and Light Weapons (SALW)	No	Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Kyne D & Bolin B (2016) [51]	Discusses emerging environmental justice issues related to nuclear power and radioactive contamination.	United States of America	Conceptual/Theoretical	Not Stated	Nuclear Weapons Industry	Not Specified	Not Specified	Nuclear Weapons	Not Specified	Supply chain and waste
Mahmudi-Azer S (2006) [52]	Examines the health impacts of the global arms trade.	Not Specified	Conceptual/Theoretical	Not Stated	General/non-specified	Manufacturer/Supplier	Not Specified	Major Conventional Weapons; Nuclear Weapons; Chemical Weapons; Munitions and Explosives	Yes	Political; Supply chain and waste
Martin T (2011) [53]	This paper describes the concerns of stakeholders in the production of nuclear weapons, the secrecy of Hanford operations, and the potential impacts to public health and the environment from the unintended releases of weapons-grade materials and by-products associated with their production at the Hanford Site.	United States of America	Commentary/Perspective	Not Stated	Nuclear Weapons Industry	Manufacturer/Supplier	Not Specified	Nuclear Weapons	Yes	Supply chain and waste
Mertens B & Sorenson SB (2012) [54]	Examines the relationship between the elderly and firearms, and its potential implications for personal and public health.	United States of America	Commentary/Perspective	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier	Constitution Arms (Maplewood, NJ)	Small Arms and Light Weapons (SALW)	Not Specified	Financial; Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Mix TL, Cable S & Shriver TE (2009) [55]	Examines obstacles faced by nuclear weapon workers organising to challenge the Oak Ridge nuclear Reservation and the Department of Energy over health grievances.	United States of America	Empirical Study (observational, document analysis, qualitative interviews)	Not Stated	Nuclear Weapons Industry	Not Specified	Not Specified	Not Specified	Yes	Labour and employment; Supply chain and waste
O'Hare BAM & Southall DP (2007) [56]	To compare child and maternal health outcomes and government spending patterns in Sub-Saharan African countries with and without recent conflict, and to summarise small arms and light weapons (SALW) expen- diture, suppliers, and licensed production in the region.	Sub-Saha- ran Africa	Empirical Study (observational, descriptive study)	Not Stated	General/non-specified; Small Arms & Light Weapons	Manufacturer/Supplier	Not Specified	Major Conven- tional Weapons; Small Arms and Light Weapons (SALW)	Not Specified	Financial; Labour and employment
Pinto AD, Sharma M & Muggah R (2011) [57]	Proposes an agent-vector- host-environment model as a framework for ad- dressing the issue of small arms and light weapons.	Not Specified	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier	Not Specified	Small Arms and Light Weapons (SALW) Munitions and Explosives	Not Specified	Political; Labour and employment; Supply chain and waste

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Saka- moto EE (2010) [58]	This paper reports the history of the recently launched Common Industry Standards (CIS), an international anti-corruption code of conduct for the European defence and arms industry.	United Kingdom	Empirical Study (docu- ment analysis, qualitative interviews)	Stated	General/non-specified	Manufacturer/Supplier; Industry Association	Lockheed Martin; Boeing; Thompson-CSF (now Thales); EADS; BAE Systems; Raytheon	Not Specified	Yes	Financial; Political; Labour and employment
Saylor EA, Vittes KA & Soren- son SB (2004) [59]	Examines the current advertising prac- tices of firearms manufacturers.	United States of America	Empirical Study (media content analysis)	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier	Reming- ton Arms Company, Inc; Sturm, Ruger, & Company, Inc.; Marlin Firearms Co. H&R 1871/New England Fire- arms; Smith & Wesson; Argus Publications (Henry Repeat- ing Arms Co.); Beretta USA; Kel-Tec CNC Industries, Inc; Thompson/ Center Arms; Springfield Armory Kimber Mfg. Inc; Bushmas- ter Firearms, Inc.	Small Arms and Light Weapons (SALW)	No	Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Skulski P (2023) [60]	To establish the importance of adverts in the arms and military equipment market, as well as to identify the media and advertising styles used in them.	Not Specified	Conceptual/Theoretical	Not Stated	Major Conventional Weapons Industry	Manufacturer/Supplier	Boeing; Lockheed-Martin; Grumman Northrop; Baykar Makina; Leonardo; BAE Systems; Airbus	Major Conventional Weapons	Not Specified	Marketing; Reputational management
Taylor I & Wu ZY (2013) [61]	This article seeks to discuss the rationale behind China's arms sales to Africa and the effect that they have had on political violence in recipient countries. It also provides an analysis of the supply-and-demand circumstances of Chinese arms transfers to Africa, Beijing's attempts to control such transfers, and evidence that Chinese policies on proliferation are (slowly) evolving.	China	Conceptual/Theoretical	Not Stated	Major Conventional Weapons Industry	Manufacturer/Supplier	Not Specified	Major Conventional Weapons	Yes	Political; Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices Identified	Commercial Practices Identified
Vernick JS, Rut- kow L & Salmon DA (2007) [62]	To compare the scope of liability for firearms, vac- cines, and motor vehicles in order to examine the range of regula- tory approaches used to govern manufacturer and seller liability across these prod- uct categories.	United States of America	Commentary/Perspective	Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Brokers/Dealers	Smith Wesson Corp	Small Arms and Light Weapons (SALW)	Not Specified	Political; Marketing
Weiger C et al. (2020) [63]	The aim of this study is to explore the terms of service for brand websites with public health sig- nificance to assess possible legal and ethical challenges for conducting research on con- sumer product websites.	United States of America	Empirical Study (media content analysis)	Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier	Remington, Smith and Wesson, and Sturm Ruger	Small Arms and Light Weapons (SALW)	No	Marketing
Wilson I (2005) [64]	Discusses the globalisation of the conventional arms market and the commerciali- sation of the US. military-industrial complex, and the unintended consequences of outsourcing national security;	United States of America	Conceptual/Theoretical	Not Stated	Major Conventional Weapons Industry	Manufacturer/Supplier; Industry Association	Raytheon; Boeing; Northrop Grumman; Lockheed Martin; BAE Systems; EADS; General Dynamics; Thales; G.I. Honeywell; TRW; Aerospace Industries Association	Major Conven- tional Weapons	Yes	Financial

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Wing S (2010) [65]	Discusses how class and race have influenced occupational and environmental health within the U.S. nuclear weapons industry.	United States of America	Conceptual/Theoretical	Not Stated	Nuclear Weapons Industry	Manufacturer/Supplier	DuPont; Westinghouse; Union Carbide	Nuclear Weapons	Yes	Financial; Political; Scientific; Reputational management
Zoller HM & Casteel D (2022) [66]	To examine how March For Our Lives activists challenged individualised narratives that hinder structural gun reform, exposed corporate influences linked to gun violence, and fostered collective mobilization amid heightened political polarisation.	United States of America	Empirical Study (media content analysis)	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Industry Association	National Rifle Association; Glock; SIG Sauer; Freedom Group; Beretta; Smith & Wesson; Kevlar	Small Arms and Light Weapons (SALW)	No	Political
Thorsheim P (2024) [67]	Examines British chemical weapons factories during the first and second World War.	United Kingdom	Conceptual/Theoretical	Not Stated	Chemical Weapons Industry	Manufacturer/Supplier	Imperial Chemical Industries (now AstraZeneca)	Chemical Weapons	Yes	Labour and employment
Stroebe W, Leander NP & Kruglandski AW (2024) [68]	To compare gun ownership and gun violence between the United States and Switzerland.	United States of America Switzerland	Conceptual/Theoretical	Not Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier; Industry Association	National Rifle Association; New York State Rifle & Pistol Association, Inc.; Swiss Sport Shooting Association	Small Arms & Light Weapons (SALW)	Not Specified	Marketing

Table 2 (continued)

Citation	Aim/Focus	Country/ Regional Focus	Study Type	Study Funding Sources	Industry Subsector	Industry Actor	Actor Details ^a	Weapon Type(s)	Govern- ment Practices identified	Commercial Practices Identified
Stroebe W & Leander NP (2024) [69]	Examines the underlying reasons for the perceived need for self-defense guns and the fac- tors contributing to the growing prevalence of this belief among Americans.	United States of America	Conceptual/Theoretical	Stated	Small Arms & Light Weapons Industry	Manufacturer/Supplier	Remington Arms	Small Arms and Light Weapons (SALW)	Not Specified	Marketing
Nuss- baum RH (2007) [70]	Focuses on suppressed or manipulated epidemiologi- cal research that highlights the detrimental health effects of accidental and occupational exposures to ion- izing radiation.	Not Specified	Commentary/Perspective	Not Stated	Nuclear Weapons Industry	Not Specified	Not Specified	Not Specified	Yes	Scientific; Reputational management
Reich G & Barth J (2017) [71]	To examine whether increases in citizen de- mand for guns contribute to the advancement of firearms deregula- tion, by analysing state firearms leg- islation enacted between 2009 and 2013.	United States of America	Empirical Study (observa- tional, descriptive study)	Not Stated	Small Arms & Light Weapons Industry	Industry Association	National Rifle Association	Small Arms and Light Weapons (SALW)	Yes	Political

^a Company names reflect those specified in the text; some companies have since merged. Note: A full table of study characteristics is available in Supplementary Material 1

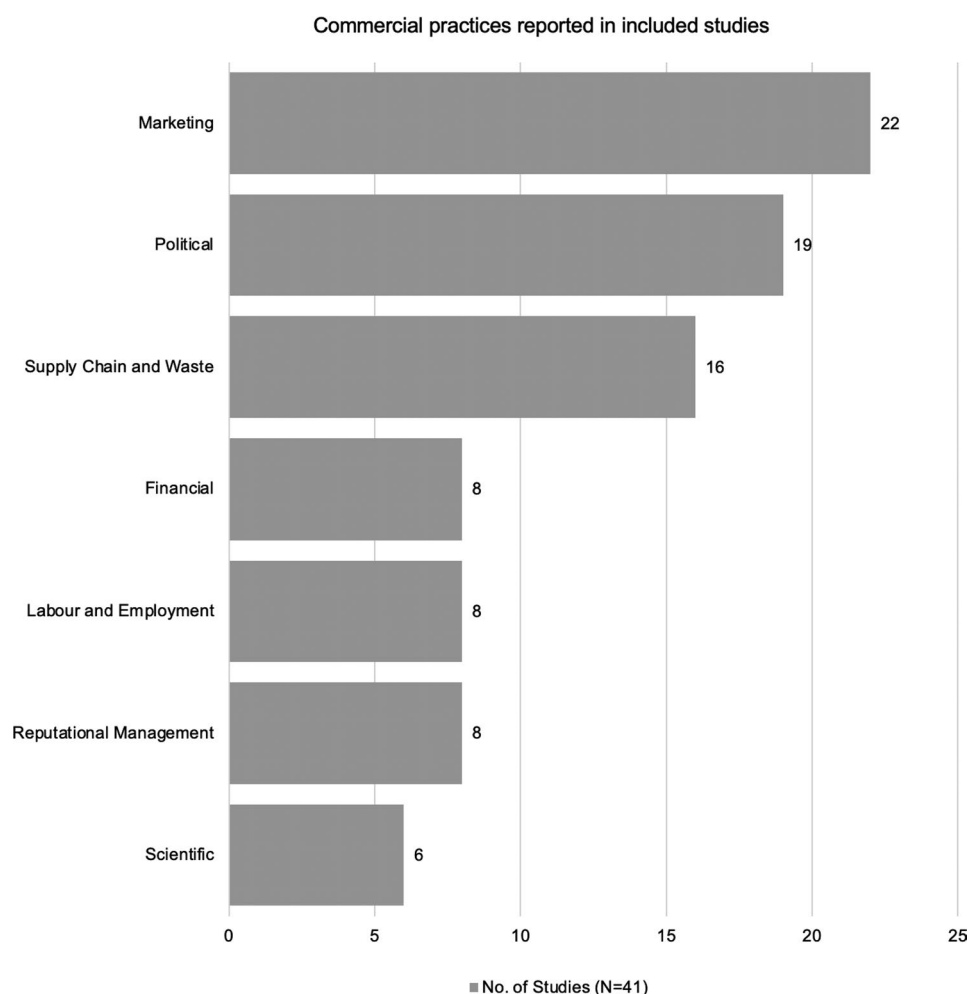


Fig. 2 Total number of studies reporting commercial sector practices. Counts represent practices reported; totals do not equal the number of included studies ($N=41$), as a single study may describe more than one practice or sub-sector

weapons use (Fig. 3) [48, 49, 66]. Promotional content often appeared in the absence of adequate safety warnings or recognition of the risks posed by these weapons and their broader societal consequences [32, 33].

Sixteen studies identified marketing practices that reinforced structural inequalities by targeting specific population subgroups [27, 32, 33, 41, 42, 44–46, 48, 50, 54, 59, 61, 62, 68, 69]. Examples include the promotion of firearms to women under the guise of self-defence, to young boys as part of constructing masculinity and rites of passage (in order to build future markets), and to older adults [32, 33, 46]. Studies also described the deliberate marketing of weapons to criminal networks including one example in which a manufacturer highlighted a firearm’s “excellent resistance to fingerprints” [32, 33]. Gun shows were frequently noted as key sales venues used to circumvent regulatory oversight [41].

Twelve studies reported on the use of marketing practices aimed at shaping cultural norms to increase demand for and consumption of arms-related products or services

[27, 32, 36, 40, 46–48, 50, 54, 59, 60, 69]. These practices commonly sought to legitimise the arms industry by framing it as aligned with lawful activity and distancing it from responsibility for harm, instead portraying violence as random or unavoidable [36, 47, 60]. A recurring theme was the promotion of firearms as essential for personal safety and household protection [32, 36].

Other marketing strategies included differentiating gun performance and features to encourage repeat purchasing, with some studies describing manufacturers as working “at all levels of society to shape gun demand” [47]. Furthermore, industry responses to mass shooting often involved rhetorical framing and selective marketing rather than substantive changes in sales practices [46]. Several studies also linked cultural norm-shaping to corporate social responsibility initiatives, where public relations and strategic communication were used to cultivate a positive brand image and normalise weapons in everyday life [48, 49].

Table 3 Number of studies reporting commercial practices (highest to lowest)

	No. of Studies* (N = 41)	Percentage (%)
Marketing Practices	22	53.7
Exaggerates structural inequalities by targeting specific geographical areas and population subgroups categorised by ethnicity or vulnerability.	16	39
Shaping new cultures and norms to drive consumption	12	29.3
Changing physical and information environments	11	26.8
Non-specified	0	0
Political Practices	19	46.3
Lobbying	14	34.1
Building constituencies of support (including third parties through which they operate)	8	19.5
Financial contributions/payments to secure policy influence	5	12.2
Producing and using (often misleading) information to make the industry's case that the policy will be ineffective and economically disastrous.	2	4.9
Threatening and taking legal action	2	4.9
Intimidating opponents	2	4.9
<i>Bribery and corruption**</i>	2	4.9
Non-specified	0	0
Supply Chain and Waste Practices	16	39
Despoiling the environment (i.e. pollution, deforestation, resource depletion, habitat destruction)	8	19.5
<i>Exploiting regulatory gaps or loopholes**</i>	6	14.6
Ground water contamination	4	9.8
Toxic waste release	4	9.8
<i>Weak supply chain oversight**</i>	4	9.8
<i>Delegating distribution to third parties to reduce downstream accountability**</i>	2	4.9
Externalising costs of restoration	0	0
Non-specified	0	0
Financial Practices	8	19.5
Non-specified	4	9.8
Externalising costs	2	4.9
Mergers/acquisitions and buyouts to reduce competition	1	2.4
Government subsidies	1	2.4
Tax avoidance/minimisation (use of tax havens)	0	0
Promoting credit and debt	0	0
Accounting and security fraud	0	0
Pricing strategies (price fixing, price hiking)	0	0
Smuggling to evade duties	0	0
Encouraging consumer debt	0	0
Labour and Employment Practices	8	19.5
<i>Surveillance and control**</i>	6	14.6
<i>Contesting/rejecting illness claims**</i>	4	9.8
Destabilising, outsourcing, and offshoring the costs of production (enabled by weak labour market regulations)	2	4.9
Child labour	1	2.4
Non-specified	0	0
Modern slavery	0	0
Informal or zero hour contracts that offer no stability of income	0	0
Forced labour	0	0
Reduced private-sector union coverage	0	0
Reputational Management Practices	8	19.5
Corporate social responsibility (CSR)	7	17.1
Institutionalisation of public-private partnerships	1	2.4
Non-specified	1	2.4
Environmental, social and governance (ESG)	0	0

Table 3 (continued)

	No. of Studies* (N = 41)	Per-centage (%)
Scientific Practices	6	14.6
Controlling and/or influencing steps of the scientific process (from evidence production to dissemination and use).	6	14.6
Fabricating/misrepresenting information	2	4.9
Discrediting scientists and/research organisations	2	4.9
Ghost writing	0	0
Non-specified	0	0

*Counts indicate the number of papers reporting each practice. Total will not sum to the overall number of papers in each practice domain because a single paper may describe more than one practice. **This practice was not part of the original coding framework and was identified inductively during data analysis

Political practices

Nineteen studies (46%) focused on political practices (Table 3). The most frequently observed strategy was lobbying, which was reported in fourteen studies and primarily within the SALW industry [27, 32, 33, 36, 41–44, 47, 52, 57, 62, 66, 71]. Five studies described financial contributions aimed at securing favourable policy outcomes [33, 40, 42, 66, 71]. This included articles describing the lobbying power of the firearm industry and industry groups such as the National Rifle Association, as well as funding of think tanks by nuclear defence contractors to influence weapons policy discourse [32, 33, 40, 62]. Constituency building to increase public and political support was also highlighted in eight studies [33, 36, 40, 44, 47, 58, 66, 71].

Political practices less frequently reported included producing and using information to secure policy preference ($n=2$) [27, 40], threatening or taking legal action ($n=2$) [42, 44], and intimidating opponents ($n=2$) [37, 43]. Bribery and corruption were identified in two studies, one focused on the major conventional weapons industry [61] and the other focused on the arms industry more broadly [58]. Examples included the sale of a military air traffic control system to Tanzania in the late 1990s despite the absence of an air force in that country [58], and the exchange of ivory for thousands of Chinese AK-47s by the Zimbabwean government in 2000 [61].

Supply chain and waste practices

Sixteen studies (39%) reported on supply chain and waste practices (Table 3) with several focusing on environmental harms, particularly within the nuclear weapons industry (Fig. 3) [34, 35, 37, 38, 51–53, 65]. These included health impacts of nuclear production and testing, such as ground water contamination and the release of toxic waste, as well as a one study examining widespread munition dumping following the Second World War [34, 35, 37, 38, 51–53, 65]. A recurring theme across studies was the exploitation of regulatory gaps and loopholes [32, 39, 41, 45, 52, 57]. In the SALW industry, this included negligent distribution practices such as weak oversight of

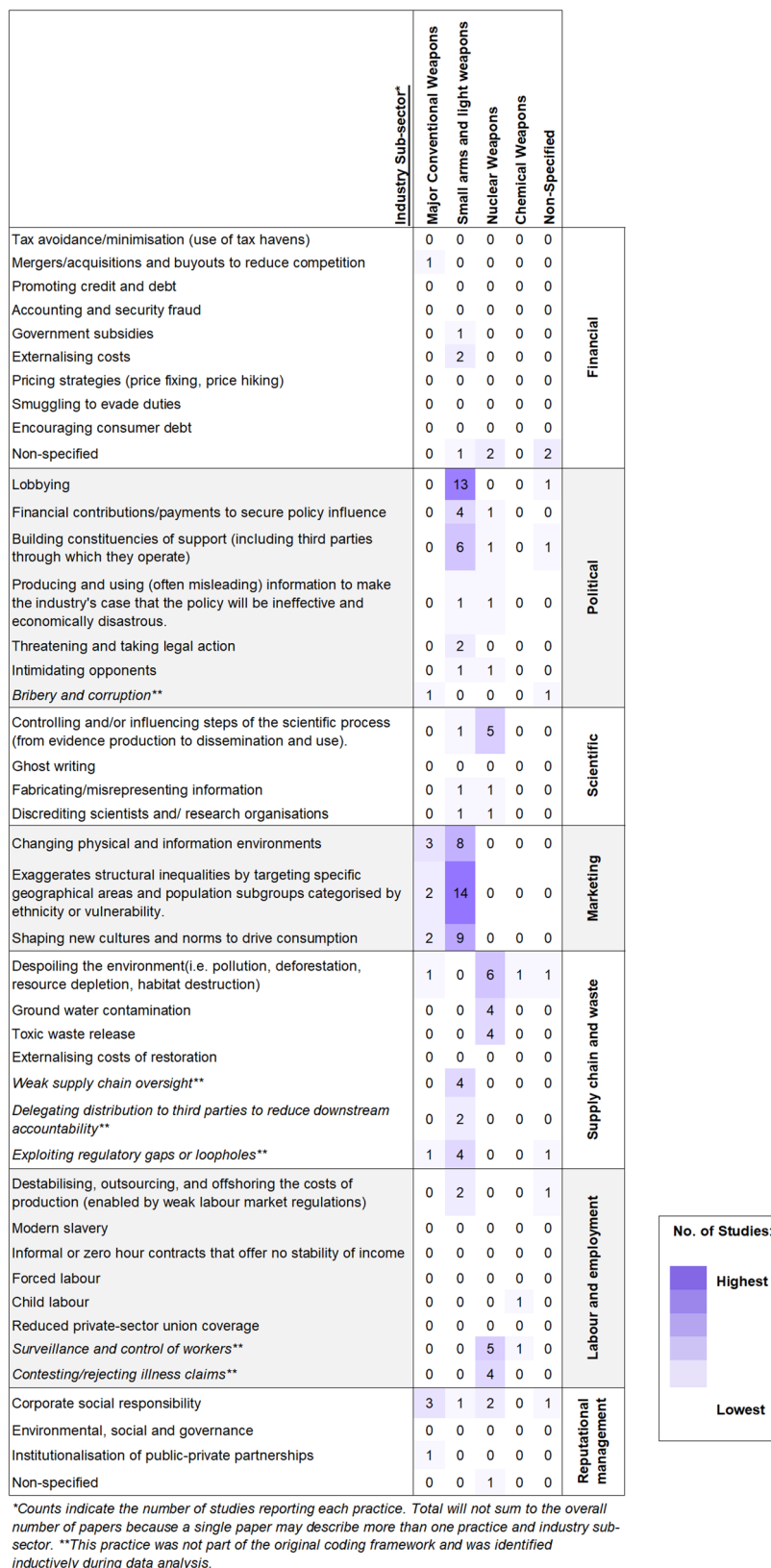
firearms sales through informal or unregulated channels [32, 33]. Under-the counter transactions, non-stock dealers, and gun shows were frequently noted as venues used to bypass background checks and other firearm control measures [45]. In the context of major conventional weapons, two studies highlighted how export restrictions were circumvented through the shipment of arms components to third-party countries with weaker regulatory environments [39, 52].

Financial practices

Eight studies (19%) focused on financial practices. Of these, one study discussed mergers, acquisitions, and buyouts as strategies to reduce market competition (Table 3) [64]. Use of government subsidies were also identified, including an example in which a firearm manufacturer registered a pistol as a medical device to make it eligible for Medicare reimbursement for elderly consumers [54]. Although the US Food and Drug Administration initially approved the registration, it was later revoked. Furthermore, two studies focusing on the SALW industry highlighted the externalisation of costs borne by society in relation to gun violence, such as policing, emergency care, and productivity losses associated with firearm manufacture and distribution [32]. Four additional studies mentioned financial practices more generally but did not detail specific strategies.

Labour and employment practices

Eight studies (19.5%) examined labour and employment practices, with a particular focus on the nuclear weapons industry (Table 3; Fig. 3) [34, 37, 40, 55–57, 65, 67]. Key themes included surveillance and control of workers ($n=6$) [34, 37, 40, 55, 65, 67] and the dismissal or contestation of illness claims ($n=4$) [34, 37, 55, 65]. Nuclear weapon workers reported experiencing alienation, strict surveillance, and hazardous working conditions. Poor labour protections and efforts to suppress compensation claims for work-related illnesses were commonly discussed in these studies. One study also described the use

**Fig. 3** Heat map of commercial practices reported across industry sub-sector

of child labour in British chemical weapon factories during the First and Second World War [67].

Reputational management practices

Reputational management practices were identified in eight studies (19.6%) (Table 3) [34, 36, 40, 48, 49, 58, 60, 70]. The most frequently reported strategy was the use of corporate social responsibility (CSR) initiatives to shape public perception and strengthen corporate brand image. Jester et al. (2023) [48] described how arms companies engaged in greenwashing, pinkwashing, and genderwashing, presenting themselves as environmentally progressive or socially responsible in order to project an image of “building rather than destroying, helping rather than hurting” while simultaneously diverting attention from the harms associated with their products [48].

Other reputational practices included corporate sponsorship of think tanks to enhance legitimacy and credibility through association with respected academic institutions [40]. One study also discussed the institutionalisation of public-private partnerships [49]. No studies in this review explicitly examined the adoption or implementation of environmental, social and governance (ESG) strategies in the arms industry.

Scientific practices

Six studies (14%) focused on scientific practices (Table 3). These studies described efforts by arms industry actors, primarily within the nuclear weapons sector, to influence various stages of the scientific process, from evidence production to dissemination (Fig. 3) [27, 34, 37, 40, 65, 70]. In several cases, scientific manipulation was closely related to labour and employment practices, particularly in studies on nuclear weapons development during the US Manhattan Project, which focused on constructing the first atomic bomb. Two studies, one examining the SALW industry [27] and one on the nuclear weapons sector [34], highlighted the fabrication or misrepresentation of information, as well as attempts to discredit scientists and research institutions that challenged industry interests [27, 34].

Discussion

This review systematically mapped the extent, range, and nature of peer-reviewed literature examining the arms industry as a commercial determinant of health. We identified only 41 papers published over a 20-year period, with most evidence concentrated on marketing, political, and supply chain and waste practices (Fig. 2; Table 3). The predominance of marketing and political practices, particularly within the small arms and light weapons (SALW) sector, is a notable finding of this review, and may be driven by several interrelated factors. These practices are generally more visible and externally observable

than other commercial strategies, making them more accessible for empirical study. Marketing strategies such as advertisements, promotional events, and sponsorships typically occur in public spaces or on digital platforms, allowing for documentation through content, discourse, and media analysis as noted in several studies in Table 2 [46, 50, 59]. The consumer-facing nature of the SALW industry, particularly in contexts like the United States, further contributes to the visibility of marketing practices identified in this review. Civilian firearms are actively promoted to the public through direct advertising and promotional campaigns, whereas other sectors such as conventional weapons and nuclear weapons are not marketed through public-facing channels and are instead procured through government and military processes [60]. Similarly, political practices including lobbying, campaign donations, and industry-government ties are documented in electoral commission databases, lobbying registers, and parliamentary records, particularly in countries with mandated transparency requirements [72, 73].

The concentration of research in these domains mirrors patterns seen in other health harming industries including tobacco, alcohol, food and beverage, and fossil fuels [5, 74, 75]. Recognising these parallels in commercial activity across sectors is essential as corporate political influence and strategic shaping of public opinions often create significant barriers to adopting public health policies, while industry-related environmental degradation continues to disproportionately impact vulnerable communities globally [5, 29]. In comparison, there was a notable absence of attention to practices in the financial, scientific, and reputational management domains (Fig. 2; Table 3), suggesting that these areas have either not yet been examined in the literature or that the information required to assess them is not readily or publicly available. Investigating financial flows, scientific influence, research sponsorship, and reputational strategies, among other activities outlined in Table 1, may require adapted or novel methodological approaches [11]. The complexity and limited transparency surrounding some of these practices pose significant challenges for researchers, particularly in the arms sector, where confidentiality requirements, security classifications and limited disclosure further constrain access to relevant data and may make these activities easier to obscure [7, 11, 12, 14].

Our findings are distinct from a previous conceptual analyses of CDoH and the arms industry [12] as we systematically applied the Gilmore et al. [5] CDoH framework. This approach enabled us to map both the strategies employed by the arms industry and the gaps that remain for future research. While our review reinforces the practices outlined in Bellis and colleagues' paper [12], it advances this work by demonstrating the

importance of distinguishing between arms industry sub-sectors. This distinction is critical, given the complexity of actors involved, the diversity of products, and the overlap between civilian and military applications, which together generate variation in corporate strategies.

Building on this, our review also identified practices not previously described, which reflects the novelty of systematically applying the CDoH framework to the arms industry. In particular, we identified six additional strategies covered in the included literature that were not represented in the original coding framework (Table 3). One of these, 'Bribery and corruption,' was categorized by us as a political practice. Two additional labour and employment strategies were identified: 'surveillance and/or control' of workers, and 'contesting or rejecting of illness claims.' Furthermore, three additional strategies were identified in the category supply chain and waste practices: 'weak supply chain oversight,' 'delegating distribution to third parties to reduce downstream accountability,' and 'exploiting regulatory gaps and loopholes.' The identification of these additional strategies suggests that the arms industry engages in a broader range of strategies than those outlined in Gilmour and colleagues' model of commercial sector practices [5], with distinct mechanisms of power that often operate in close alignment with governments.

Several of the included studies highlighted the blurred boundaries between the arms industry and governments. In many cases it was difficult to disentangle whether practices such as lobbying, political financing, and corruption were driven primarily by corporate actors, state actors, or their close interdependence. This reflects the structural entanglement of the arms industry with state security agendas, military procurement, and foreign policy, where commercial practices are often embedded within government functions. As a result, attributing responsibility for particular practices was not always straight forward, underscoring the need for public health research to examine the arms industry not in isolation but in relation to the state structures that enable and legitimise its activities. These findings align with a 2025 report by the UN Office of the High Commissioner for Human Rights [76] (OHCHR), which emphasises that both states and the private sector must do more to tackle the devastating human rights impacts of arms transfers [21, 76, 77]. The report highlights significant challenges, including corruption and conflicts of interest with the arms sector, and calls for additional measures to prevent human rights abuses by arms companies, particularly those that are state-owned, state-controlled, or heavily supported by government agencies, as highlighted in earlier OHCHR reports on responsible business conduct in the arms sector [21, 76, 77].

Our review also demonstrates that research on arms industry practices remains heavily concentrated on the United States and the SALW industry, reinforcing the observation of Bellis et al. [14]. This focus reflects the significant impact of gun violence in the US, where firearms represent a major public health issue. Notably, US firearm manufactures and dealers cannot be held liable when crimes have been committed using their products due to the Protection of Lawful Commerce in Arms Act, which shields the industry from litigation [32, 33]. Further, SALW are distinct from other weapon types analysed in this review because of their portability and availability through mainstream commercial retailers as noted above [36]. Data on firearms and related commercial practices are also comparatively more accessible than information on other arms sectors, which are often tied to issues of national security and classified government contracts [15]. Unlike SALW, which go across both military and civilian markets, major conventional weapons, nuclear weapons and emerging technologies are predominantly produced and controlled by states [15].

Furthermore, we identified a notable lack of empirical data, with most studies situated within political science, law, and the social sciences, and very few in public health. The scarcity may reflect the broader challenges of accessing data in this field, due to the opacity of the industry and limited transparency, which itself constitutes a fundamental weakness in the evidence base [78]. The limited peer-reviewed literature may also reflect broader perceptions of the arms industry. Unlike the tobacco, alcohol and ultra processed food and beverage industries, which are widely recognised as harmful to health, the arms industry may not be viewed as a 'bad actor' or corporate villain [79]. Instead, it is often framed as a legitimate and necessary sector that provides security, employment, and technological innovation [79]. This perception is reinforced by its close relationship with governments and its integration into national security agendas, which shield it from the public scrutiny faced by other industries. As a result, the health consequences of weapons production and proliferation are often overlooked creating significant challenges for public health. Efforts to regulate or contest arms industry practices are easily portrayed as threats to national security or economic interest.

Although there is substantial literature on the health impacts of weapons, few studies address the upstream commercial or systemic factors that drive these harms. It is important to acknowledge that the consequences of war and armed conflict extends beyond direct health impacts such as injuries and fatalities; it fundamentally reshapes social, cultural, and economic environments, leading to downstream and indirect impacts on health such as displacement, weakened healthcare systems, economic instability, and generational trauma, all of which

contribute to downstream and long-term health implications [80–82]. Importantly, despite the global impact of arms production and use, our review found almost no studies examining industry practices outside of a US setting, leaving significant gaps in understanding how the arms industry operates in different national contexts, particularly in low- and middle-income countries. Public health has a critical role to play in highlighting and contesting arms industry practices, just as it has done with other health harming industries such as tobacco, alcohol, food and beverages and fossil fuels [5].

Strengths and limitations

To our knowledge this is the first study to systematically map peer-reviewed literature on arms industry practices through a CDoH lens. We conducted a comprehensive search across four databases which covered the full spectrum of arms industry actors and weapons categories. This study adds to the growing body of CDoH literature on SALW, and extends analysis to manufacturers and defence contractors involved in other arms sectors, including major conventional weapons, nuclear weapons, and chemical weapons. However, we did not identify specific commercial practices by corporate actors in relation to biological weapons and lethal autonomous weapon systems.

Our review has several strengths, including the systematic mapping of commercial practices across industry subsectors and the novel application of the CDoH framework to an underexplored industry. However, there are also important limitations. We excluded non-English publications and grey literature, which may have omitted relevant sources. In particular, important insights into arms industry practices are often found in reports produced by civil society organizations, governmental and intergovernmental bodies, investigative journalists, and other non-academic actors. These sources frequently document practices such as lobbying, corruption, financial flows, supply chain practices, and reputational strategies, that are not well captured in the peer-reviewed literature. As such, our findings may under-represent the full scope and global diversity of commercial strategies employed by the arms industry, particularly in low- and middle-income country settings and emerging policy contexts. Future research that systematically incorporates grey literature would be important to complement the findings of this review, reduce the risk of overlooking broader global perspectives, and more effectively capture emerging and underreported strategies.

Moreover, research on the CDoH is still relatively new, having developed primarily over the past decade, and commercial practices are not consistently defined across the literature. This made it challenging to categorize commercial practice that varied by weapon type, by

companies operating across multiple sectors, and by the overlap between civilian and military production. Going forward, further analysis is needed to examine the portfolios of different companies and how they operate across different sectors (civilian and military). The close involvement of governments in arms production, manufacture, and use further complicates both categorization and accountability. Lastly, the findings reflect practices documented in the included studies at the time they were conducted. While regulatory and political contexts may have changed since, these accounts remain valuable for understanding how arms industry practices have evolved over time. Although scoping reviews do not typically assess the quality of included studies, future research may benefit from this to strengthen interpretation of the available evidence.

Conclusion

This review highlights the arms industry as an emerging and understudied area within the peer-reviewed commercial determinants of health literature. Evidence about the commercial practices of the industry remains heavily concentrated on small arms and light weapons, with limited research on other subsectors and almost none from low- and middle-income countries. The arms industry employs a wide range of commercial strategies that shape markets, policy, and cultural norms with significant implications for health and equity. Future research should critically examine each subsector of the arms industry, while recognising its place within the wider industry. Given the complexity and multisectoral nature of the arms industry, a more strategic and nuanced approach, supported by cross-sector collaboration, may be required. It is also essential to examine how the commercial and political determinants of health intersect in shaping the practices and influence of this industry. Research should investigate the distinct practices employed across different subsectors and assess whether harms are primarily driven by industry practices, government actions, or the interactions between the two. Finally, future work could consider how practices are evolving in response to new technologies, including emerging and autonomous weapons systems. This field is rapidly changing, yet our review identified no studies on these developments. Greater scrutiny of arms industry practices and recognition of the arms industry as a commercial determinant of health are essential to strengthen global governance, transparency, and accountability at local, national, and international levels.

Supplementary information

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Supplementary Material 1

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Author contributions

SM, KC, DG, and SP contributed to the conceptualisation and methodology of the review. Screening and data extraction were carried out by SM, KC, DG, SP and NT. SM led the data analysis and tabulation and prepared the original draft of the manuscript. SM, KC, DG and SP contributed to reviewing and editing iterations of the manuscript. KC, DG, and SP provided supervision throughout the project. All authors have read and approved the final version of the manuscript.

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Data availability

All data analysed or generated during this study are available within the article and its supplementary materials.

Declarations**Ethics approval and consent to participate**

Not applicable.

Consent for publication

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Competing interests

The authors declare no competing interests.

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