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Urgent injury and violence-related public health threats: the role of social determinants in cross-cutting injury and violence across the lifespan

Edited by
Ursula Ann Kelly, Dabney Evans, Joseph Carpenter
and Sangmi Kim

Coordinated by
Jill Woodard

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Topic editors
Ursula Ann Kelly — Emory University, United States
Dabney Evans — Emory University, United States
Joseph Carpenter — Emory University, United States
Sangmi Kim — Emory University, United States

Topic coordinator
Jill Woodard — Emory University, United States

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Guoqing Hu,
Central South University, China

*CORRESPONDENCE
Ursula Kelly
✉ ukelly@emory.edu

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Editorial: Urgent injury and violence-related public health threats: the role of social determinants in cross-cutting injury and violence across the lifespan

Ursula Kelly[1]*, Joseph Carpenter[2], Sangmi Kim[1], Jill Woodard[2] and Dabney P. Evans[3]

[1]Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA, United States, [2]School of Medicine, Emory University, Atlanta, GA, United States, [3]Rollins School of Public Health, Emory University, Atlanta, GA, United States

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Editorial on the Research Topic
Urgent injury and violence-related public health threats: the role of social determinants in cross-cutting injury and violence across the lifespan

Introduction

Our goals for this Research Topic are to disseminate science that advances our understanding of the ways in which social determinants of health (SDOH) impact injury and violence and to identify best practices for addressing these urgent public health priorities. We grouped articles into three settings: clinical, community, and policies; urgent public health priorities include the opioid epidemic, gun violence, adverse childhood experiences (ACE), interpersonal violence, and suicide. The articles are relevant to readers in different settings, disciplines, and focus areas, given the cross-cutting nature of injury and violence across the lifespan.

Clinical

SDOH influence health outcomes as well as the provision of health care. Clinical settings and individual clinical encounters are avenues to address SDOH-related health disparities via enhanced screening, trauma-informed care, and targeted education. The clinical setting-based articles in this Research Topic examined the role of SDOH in a broad range of violence- and injury-related subjects across hospital and outpatient settings.

ACEs and exposure to violence are associated with the subsequent development of chronic health conditions. Two author groups explored these relationships within specific populations: Afzal et al. found that cumulative ACEs are a strong predictor of chronic health conditions, independent of other SDOH among U.S. adults. Sales et al. reported that most people living with HIV they surveyed reported a history of ACEs or intimate partner violence (IPV). Both groups called for enhanced screening for ACEs or IPV, particularly among populations not traditionally targeted for screening, for example, asking male people living with HIV about IPV as an avenue for early intervention. Importantly, Sales et al. noted that the prevalence of ACEs and IPV was so high that the best practice may be to employ a universal trauma-informed approach to care, an approach that is likely beneficial to other/all patient groups.

Trauma-informed care models seek to level power dynamics between patients and providers, emphasizing collaboration and transparency and avoidance of re-traumatization. Through a series of vignettes, Febres-Cordero et al. described the stigmatization of substance use and assumptions of “drug seeking behavior” by nurses. Here, stigma is seen as an abuse of authority, violating patients’ rights of autonomy, dignity, and self-advocacy. Harm reduction is framed not simply as a treatment alternative but instead as an issue of health equity, social justice, and human rights. A call is issued to practice trauma-informed care in patients with pain or a history of substance use, echoing the call of Sales et al. for a universal approach.

Patients hospitalized following injuries encounter many health disparities based on SDOH. Giordano et al. used Medicaid claims data to demonstrate racial and ethnic disparities in opioid prescribing after orthopedic injury, highlighting biased and inequitable assessment and treatment of pain in Black and Hispanic individuals, and a need for scalable interventions to address these disparities. In an excellent example of community-engaged research, Zeidan et al. interviewed Spanish-speaking immigrants admitted for work-related injuries. After identifying a startling level of comfort working in hazardous environments, often with little support from employers, the authors introduced immigrant status by itself as a risk factor for injury, an often-under recognized SDOH. They went on to offer an opportunity for targeted intervention—specifically to offer targeted “Know Your Rights” training during hospitalization to decrease the chance of re-injury.

Community

Community is conceptualized as the physical and social environments inhabited by individuals that shape both their risk of injury and violence and the resources to protect against or mitigate their risk. In this Research Topic, four risk/protective factors at the community level were highlighted: hospital/community-based organization (CBO) partnerships, evidence-based in-home services, i.e., SafeCare, and community outreach; and more broadly, neighborhoods’ quality of resources and conditions to prevent IPV and gun violence. The SDOH identified by the authors span the SDOH categories of Neighborhood and Built Environment and Social and Community Context. Accordingly, the authors of these community-based articles described cross-sector problems and approaches, a departure from the prevalent community intervention model in which individual institutions and organizations use their specific resources and strengths to serve their populations of interest.

The authors identified a critical need for strengthened cross-institutional partnerships, education (for the public and professionals), and outreach to community members to amplify the effectiveness of violence prevention efforts through more integrative approaches. In that regard, Evans et al. called for more coordinated care between hospitals and CBOs for IPV survivors receiving care in an Emergency Department. Specifically, they suggested cross-training among personnel in hospitals and CBOs, warm handoff, co-location of services (domestic violence service organization staff housed in the emergency room), and improved communication between involved organizations and institutions. In addition, Osborne et al. discussed the role of an evidence-based in-home behavioral parenting program originally targeting child maltreatment (SafeCare) in pediatric firearm injury prevention. They suggested developing formal guidance or curricula for firearm secure storage counseling tailored to SafeCare providers and training SafeCare providers to improve their self-efficacy in discussing firearm safety at home. Moreover, healthcare providers are apt to provide parents with guidance on firearm safe storage to prevent unintentional and self-inflicted intentional injury in children. Fraser Doh et al. underlined the effectiveness of community outreach to educate and counsel parents and distribute safe storage devices, which was well-accepted by parents, demonstrated by a high percentage of using the provided safe storage device at follow-up.

Importantly, the availability and accessibility to such community resources are heavily influenced by the broader environments where individuals live, work, play, and learn. As Reddy discussed, pediatric firearm injury is concentrated in disadvantaged neighborhoods highly populated with racial/ethnic minorities (e.g., Black and Hispanic populations). A wide range of neighborhood conditions impact violence, such as green space, walkability, house vacancy, presence of early childhood education centers, proximity to schools, toxic exposures, food insecurity, employment, and poverty, among others, whose distribution is deeply rooted in structural racism (e.g., redlining, segregation), and hence, requiring policy change.

Policies

Policies—broadly understood as codified laws, principled plans of action, and written procedures—are important structural drivers of SDOH that can lead to health disparities. The submissions in this Research Topic identify necessary improvements in state and federal laws (e.g., 988 suicide hotline) and include calls to action for policy development to effectively prevent violence-related morbidity and mortality, which disproportionately affect disempowered populations, that is, unequal access to opportunities for health and safety. Notable themes across the policy-related articles are: (1) improved problematization and clearer definitions of types and causes of violence; (2) improved injury and violence surveillance systems and prevention; and (3) proposed systems improvements. Ziminski, in a social problem analysis of two firearm-related laws, identified the lack of social problematization of firearm violence, including its causes, context, and contributing factors. Similarly, Lewis et al., in their commentary on femicide, cited the need for a clear and codified definition of femicide in U.S. law and called for improved surveillance systems and use of evidence-based practices by law enforcement and criminal justice systems.

Surveillance systems are an important means to assess population health, allow for the identification of disproportionately affected populations, and inform interventions tailored to the population's needs. Both Ziminski and Lewis et al. called for improved and expanded violence-related surveillance systems and disaggregated data to enable the allocation of prevention efforts and resources toward the most affected communities and population groups. These calls are supported by Mulugeta et al., who found increases in pediatric firearm injury after the passage of a Georgia state law legalizing permit-less concealed carry of a firearm; the most affected population was Black and publicly insured boys who were injured through assault and unintentional shootings. The role of intersecting identity-based vulnerabilities was a thread through most policy articles.

Several authors explicitly addressed the role of social policy and systems on injury and violence. Baker and Sorenson examined the effects of the enactment of the national 988 suicide hotline in Georgia and noted that state context is an important consideration in the analysis of federal policy implementation. They observed a behavioral health workforce shortage and a lack of accessible and available healthcare in Georgia—a state that rejected Medicaid expansion. These authors' policy recommendations included sustainable behavioral and mental health federal funding (e.g., through SAMHSA subsidies and tax revenue) and strengthening health systems. Similarly, Jahangir et al. examined a Temporary Assistance for Needy Families (TANF) diversion program aimed at IPV prevention. They observed the protective effects of the diversion program and concluded that the policy was functioning. However, they also described how the program disincentivized people in need from seeking public assistance, creating barriers to other TANF benefits. The works of these authors highlight the limitations and sometimes unanticipated negative consequences of policies designed to support people in need of social support (e.g., those in crisis and survivors of IPV). The processes of policy development and implementation need to include careful consideration of how policies cause downstream health disparities.

Conclusion

SDOH and the urgent public health crises addressed in this Research Topic—ACEs, the opioid epidemic, gun violence, interpersonal violence, and suicide—are inextricably linked. Despite the complexities of SDOH and injury and violence, there are some clear and important takeaways from these articles.

Social resources are inequitably shared, leaving those without these resources disproportionately affected by violence compounded by multiple barriers to having their social and health care needs met. Public policies shape and determine the inequitable distribution of social resources; these public policies at local, state, and federal levels are themselves shaped and determined by political influence and reflect both persisting and transient social values that do not necessarily align with public health needs. To address these needs effectively, a shared perspective and meaningful collaboration across health care institutions, CBOs, and public health entities must replace the current approach to injury and violence prevention that is compartmentalized by their type. At the same time, it is critical to center the experiences and needs of individuals affected by injury and violence to inform and guide clinical interactions (trauma-informed care) and develop evidence-based community interventions and public policy. Public policy, arguably the most upstream driver of SDOH, requires meaningful input from the field of public health to maximize the *public's health* and eliminate health disparities. Thus, we strongly urge legislation to provide on-going robust funding for U.S. federal agencies charged with protecting the public's health and improving individual and public health related to addiction, mental illness, and violence, e.g., the National Center for Injury Prevention and Control in the CDC, the Substance Abuse and Mental Health Services Agency, and the National Institutes of Health. Additionally legislative priorities are needed to reduce access to lethal means and improve access to lifesaving means to prevent suicide, homicide, opioid overdose, and family violence. Likewise, the need for research to develop evidence on injury-related Research Topics is urgent. Existing NIH-supported research on injury is limited and additional funds are needed to advance scientific knowledge to inform public policies. Two important research areas are cross-sector (health care, social services, public health, and community groups) studies to address SDOH as they relate to the opioid epidemic, gun violence, ACEs, interpersonal violence, and suicide; and implementation science to apply existing evidence to these urgent public health threats, particularly targeting both risk and protective factors.

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Conflict of interest

The authors declare that the editorial was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Joseph Carpenter,
Emory University, United States

REVIEWED BY
Aurelio Luna,
University of Murcia, Spain

*CORRESPONDENCE
Sarah Febres-Cordero
✉ sfebre2@emory.edu

†These authors have contributed equally to this work and share first authorship

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Labeled as "drug-seeking": nurses use harm reduction philosophy to reflect on mending mutual distrust between healthcare workers and people who use drugs

Sarah Febres-Cordero*†, Rebecca O. Shasanmi-Ellis† and Athena D. F. Sherman†

Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA, United States

Introduction: Over 50 years of approaching drug use from the "War on Drugs" has led to ignoring the systemic structural and social determinants of health, enforced drug use stigma, and damaging stereotypes of people who use drugs or are labeled as "drug-seeking," and sorely failed to support those needing assistance.

On philosophy of harm reduction and power: People who use drugs are often disenfranchised and pathologized by being labeled as "a drug addict," which then serves as a rationalization for mistreatment by healthcare providers. This is in opposition to a harm-reduction approach. Harm reduction philosophy is an epistemic valuation necessary for drug use stigma and our moral obligation to reduce harm from interlocking systems of power that perpetuate harm.

On drug-seeking, mistrust, and human rights: We have encountered many clients who use drugs that report harmful interactions with healthcare providers. Harm reduction is an issue of health equity, social justice, and fundamental human rights. This paper presents three vignettes, the author's experiences of being labeled as—and advocating for family members labeled as "drug-seeking."

Discussion: To better serve as healthcare providers, workers must be equipped to work with people who use drugs and reinforce the social justice commitment against medical stigma, neglect, racism, and inadequate pain coverage and withdrawal treatment. Nurses and our epistemic lens can meet the challenge of complex intersectional issues affecting our use of power to develop more just and equitable health systems and advance our rebuilding of a trusting relationship with the people we serve.

KEYWORDS
nursing, harm reduction, philosophy, drug-seeking, stigma, discrimination, healthcare barrier, healthcare providers

1. Introduction

For better or worse, drug use is part of our world (1). For decades in the United States (US), we have identified people who use drugs as an enemy to be destroyed (i.e., the "War on Drugs") or an entity to be ignored (e.g., "Just Say No") (2–5). This rhetoric has created a widespread multi-level (individual, interpersonal, and structural) stigma aimed at people who use or are addicted to drugs in the US, particularly among Black people, Indigenous people, and other people of color (BIPOC) and Latinae communities (6–10). Stigma contributes to the avoidance of help and treatment-seeking, risks of social exclusion, loss of social support or employment, and potential incarceration complicate health promotion and premature death among those who use drugs (11).

Although many say the "War on Drugs" is ending, this stance has led to decades of structural racism, mass incarceration, generational poverty, and loss of life—as people conceal drug use and addiction related to stigma and fear of punitive policies (10–12). In the US, the ability to address recreational and excessive drug use has been pushed back onto the individual, leading to increased shame and self-deprecating behaviors (13, 14). Such approaches, which ignore the systemic structural and interpersonal determinants of health, enforce drug use stigma and damaging stereotypes of people who use drugs and sorely fail to support those needing assistance (15, 16). In response to complex issues in healthcare such as this, innovative, culturally aware approaches are necessary to repair the delivery of nursing care and, ultimately, improve health outcomes for disenfranchised communities (e.g., people who use or are addicted to drugs). To do so, Canty et al. (17) have called for the inclusion of diverse voices into the nursing philosophy discourse. Thus, our diverse team of nurses (i.e., a Hispanic nurse, a Black nurse, and a queer pansexual gender fluid nurse) has gathered to provide our insight on harm reduction and power in the care of people who use drugs and those perceived as drug-seeking by sharing our experiences of being labeled as drug-seeking with healthcare providers.

2. On philosophy of harm reduction and power

Healthcare workers are trained to treat and cure people. People who use or are addicted to drugs seek recovery when ready. In the meantime, they also get sick and injured like everyone else. However, they are not given the same respect, dignity, and compassion that people who do not use drugs receive (18). They are often disenfranchised and pathologized by being labeled as "a drug addict," which then serves as a rationalization for mistreatment by healthcare providers and staff (19). This opposes a harm-reduction approach, which is "a set of practical strategies and ideas aimed at reducing the negative consequences associated with drug use and is a movement for social justice built on a belief in, and respect for, the rights of people who use drugs" (1). Philosophers have discussed harm reduction as an epistemic valuation necessary for our discourse and moral obligation to reduce harm from interlocking systems of power that perpetuate harm (20). The paradigm shift to harm reduction in nursing borrows from Foucault's emphasis on the nurses' role and agency in using their power to promote and protect human dignity and human rights (21, 22).

3. On drug-seeking, mistrust, and human rights

Once someone becomes physically or emotionally dependent on drugs, they may require medicines to be free from withdrawal symptoms (23). This dependence, or need for medications, can be all-consuming, leading to injecting drugs in public spaces and practicing risky drug use behaviors (e.g., using unhygienic supplies) (24, 25). For some, this need brings them to emergency departments (ED) and healthcare providers, seeking relief from the pain and illness associated with withdrawal. Thus, nurses are often the first point of contact between people who use drugs and the healthcare system.

Over the years, the relationship between healthcare workers and people who use drugs has become increasingly strained. Healthcare workers may look out for drug-seeking behaviors, and when they encounter people who use and are addicted to drugs, they may assume drug-seeking is the reason they are seeking care (18). Additionally, once they recognize stereotypically stigmatized symbols of drug use (injection marks, abscesses), they often fail to see the humanity of the client, respond with discrimination or victimization, and may reinforce drug use stigma by labeling the client as a "drug user" or "drug seeking" (26). The term drug-seeking alone carries stigma and judgment, as seeking "drugs" implies a want rather than a need.

As harm reduction nurses, nurse scientists, and nurse educators, we have encountered many clients who use drugs that report harmful interactions with healthcare providers. The stories are different, but the one thing they all had in common was being grossly mistreated by nurses, doctors, and other healthcare providers. Moreover, those in recovery from harmful drug use often report needing to hide their past drug use due to the extreme stigma experienced by healthcare workers. Stories of neglect and discrimination toward people who use drugs are shared in qualitative research (18, 26, 27) and perspectives by healthcare providers (28) who see that both external (18) and internalized (28) stigma act as barriers to healthcare for people who use drugs (26, 29, 30).

These stories of mistrust may act as motivation to train healthcare providers to shift to a philosophy of harm reduction and become harm reduction practitioners, treating all with dignity, respect, and compassion (20, 31–33). Nurses are the most trusted profession, and doctors come in as a close second, except among people who use drugs (34). This mistrust has come from years of abuse and neglect (18, 29, 30, 33). The irony of this mistreatment of people who use drugs is that as many as 11–20% of the healthcare workforce is thought to have a substance use disorder (35, 36).

3.1. Vignettes

Some may say it is extreme to say that healthcare providers, especially nurses, abuse people who use drugs. Unfortunately, our team has experienced stigma related to drug use and suspected drug-seeking behavior in the form of mistreatment and neglect from nurses, midwives, and doctors. Below we detail three vignettes as evidence of the harmful nature of perpetuated drug use stigma in healthcare.

3.1.1. Vignette, SFC: trauma and pain in the ED

In the winter of 2021, I was in an accident. I sustained a displaced tibial plateau fracture while out with my family. I somehow got into a vehicle and was dropped off at the ED (COVID precautions kept anyone from joining me). I had no one to advocate for me in the ED. It was just me. My partner retrieved a wheelchair from inside and left me with the triage nurses. I was in tremendous pain, although from outward appearances, I looked fine. There was no swelling at the site, and the fracture was not visible. I was brought to triage, and I was crying and upset. I had experienced a trauma; I was in shock. In triage, the nurses asked me to consent to an X-ray. I asked if I would have to get onto a table for an X-ray. They answered in the affirmative. It was then that I said, I am a nurse. I know that to get onto that table, to have that procedure (the X-ray), I will need pain medication first. This is the standard teaching in the profession. I told them I could not get on the table without medication.

The nurses disagreed. They insisted that I try. I cried and begged for medication before the X-ray. I was denied. A nurse came to take me to the X-ray machine. I could not do it. The pain was unbearable. I have never screamed the way I did that day. I felt like a wounded animal, acting instinctually to protect my leg. I screamed, and I cried. I later wondered who could hear my screams throughout the hospital; they were terrible. The nurse laughed at me while struggling to get on the table and told me I was an amazing actress. She looked at me with disgust.

I could not do it. I was taken back to the empty waiting room and told it might be a while before they could take me to a bed and bring a mobile X-ray machine. I do not know how long I sat there, I was exhausted, saddened, and all I wanted was someone to help me. By being my advocate for pain relief, with no visible signs of injury, it seemed that I had been labeled a drug seeker.

Eventually, I was taken to a bed and received an X-ray and diagnosis. I had a new nurse. He apologized for the delay in the X-ray and pain medication. I called one of my colleagues, and they stayed with me, on the phone, for the rest of my time in the ED. They advocated for proper pain management and compassionate care. At one point, the nurse who abused me walked by my door; I saw her look into my room. Our eyes met for a moment, and then she walked away. I never received a formal apology from her or the hospital.

3.1.2. Vignette, ADFS: postpartum injury and denial of pain treatment

I had recently returned home after an unplanned c-section and prolonged hospital stay with my firstborn child. Seven days postpartum, I fell down a flight of stairs holding my newborn. I clutched my child to my chest to shield them from the fall and took the brunt with my back as I slid down the 8–10 stairs before stopping at the bottom floor. In a rush of terror and adrenaline, I screamed for my partner, who ran to our aid.

I could not stand, and my partner helped me sit on the floor while they looked over our newborn for injury. We immediately called the pediatrician for guidance and were assured that since the newborn's crying subsided within moments of being calmly held, they could be monitored at home and brought in for their regular check-up at the end of the following week.

The adrenaline began to subside once that emergency was resolved, and the pain set in. I had increased vaginal bleeding, extreme 10/10 pain at the surgical site with any attempted movement, and 7/10 throbbing pain while at rest. The pain made my head spin and nausea unbearable. We called the obstetrician, and they told me to come in immediately for an ultrasound to confirm if the surgical site had been compromised.

I cried in pain as I sat in the operatory, waiting for my ultrasound to be read. Finally, the clinician arrived, confirmed the site had not ruptured, and insisted that I could not be in the amount of pain I was reporting. I asked what I could safely take for pain management while breastfeeding. The provider laughed and said they would not be prescribing any medications and to handle my symptoms using Tylenol. They insisted that my pain was falsified. Finally, I broke down and asked to speak to another provider.

Shortly after, the lead clinician of the practice came in to assess me. After only minutes, they confirmed that my pain was real and valid and called a 2-week medication regimen to manage the pain and nausea and set a 1-week follow-up to adjust the regimen as needed.

3.1.3. Vignette, RSE: chronic pain among older adults, bullying, and denial of respectful care

My mother, at age 72, was diagnosed with Shingles. This resulted in a 3-day hospital stay and her being put on home oxygen for 1.5 years because the location of her Shingles exacerbated her existing lung condition. Working with her pulmonologist, we worked hard for her to regain better lung function, but during this time, she was also diagnosed with Postherpetic Neuralgia—a chronic pain condition caused by Shingles. The pain specialists told us she had the worst and most prolonged case they had seen. Flare-ups at her Shingles site sent her into pain so bad she could not breathe.

One of the reasons she and my late father, immigrants to the US, bought their home was because they were aging, and the house was across the street from a community hospital. One night a flare-up sent her to the ED. Being received at the hospital at 2:00 AM, she was made to wait 4 hours in a room alone with elevated blood pressure, heart rate, and decreased oxygenation, with no pain relief. The only attention given to her was a nurse coming in to assess her pain score, who repeatedly and forcefully said, "Your pain score is a 2 [out of 10], right." Confused and in pain, my mom kept crying out—telling the nurse, "I need a doctor. The pain is so bad," but she was bullied into saying yes to a 2/10 pain score.

Even though this was a hospital she had been a patient of for 15 years, their chart review, or even her medication reconciliation sheet she carried everywhere, would show them she was not on any narcotics for her chronic pain. This was ignored because she was labeled as "drug-seeking." She was bullied, and documentation stated that no medical intervention was needed. Nothing would be done for her care until I arrived at 6:00 AM and advocated for respectful care.

4. Discussion

As seen in our past experiences, the stigma of drug-seeking has permeated beyond those who seek drugs. Any stigmatized symbol of drug use (both present and past) and knowledge of pain medications may be interpreted as drug-seeking. People who are knowledgeable about drugs and their use for pain, or a preference for a drug or pain treatment, may be dismissed as drug-seeking (37). Additionally, subjective cues such as race and ethnicity have been found to affect prescribing opioids and potent painkillers, as people of color are more often labeled as drug-seeking (38). This and other factors, including racism, have led to the undertreatment of pain among minorities (39–45). This was evidenced in the above encounters. Mistreatment related to drug use stigma discounts patient autonomy, human dignity, and the right to advocate for themselves—thus, often relying on a third party to confirm the person's need for pain relief (20, 22). Removing autonomy and individual advocacy in patient care is neglectful and constitutes an abuse of authority in healthcare—perpetuating the paternalistic structures in the healthcare system (46, 47).

4.1. Toward a harm reduction nursing philosophy

To better serve as healthcare providers, we need to equip workers to work with people who use drugs, especially in the ED, where they often have their complex health needs addressed (48). Risjord (21, p. 36) presents from an epistemic standpoint, nurses, having a "political commitment to justice [while valuing their] role, [can] question the dominant account of society" regarding the stigma of drug use. Harm reduction philosophy allows nurses to integrate their commitment with empirical knowledge (21). Harm reduction benefits nurses' work by offering evidence-based public health strategies that align with nurses' ethical principles of autonomy (the right to self-determination), justice (treating all with dignity, respect, and humanity), and non-maleficence (avoiding or minimizing harm), and makes it possible for people who use drugs to seek non-judgmental care (rather than avoiding healthcare providers), considering the reality of peoples' lives and experiences (20). This makes a way forward to manage pain, healthcare, and well-being for people who use drugs, are in recovery, or are suspected of using drugs.

4.2. Approaches to rebuilding trust with disenfranchised communities

Mistreatment by medical teams has deleterious effects, including denial of care, reduced help-seeking, and disengaging treatment against medical advice when faced with stigma, neglect, racism, and inadequate pain and withdrawal treatment. The well-being of our patients necessitates us to support people who require healthcare, pain relief, and support from withdrawal to ensure they can receive the treatment they need. Varied approaches to rebuilding trust between disenfranchised communities and healthcare systems exist, including forming trusting relationships with public health and social service agencies to improve population health, having a clear vision for providing services that address social determinants of health, investing in communities by providing jobs and resources for the community and taking the time to understand the communities you wish to serve (49, 50). Additionally, people who use drugs must have a seat at the table when tailoring services for them. The "nothing about us without us movement" among people who use drugs insists that they be included in decision-making that impacts their care and is essential in regaining trust (51). Lastly, healthcare providers should engage in shared decision-making where people who use drugs can advocate for themselves to receive the care they require and want, supported by healthcare providers (52, 53).

4.3. Global human rights policy and reform

Systemic change is needed to increase access to care and expand resources while creating policies favorable to harm reduction (54). Globally, there has been an expressed need to expand harm reduction services to manage drug-related harm and inform healthcare interventions and policies (55). Policies and laws still act as barriers to providing harm reduction services for those at risk of drug-related harm. A 2023 systematic review of global harm reduction services for people who use drugs (syringe exchange, opioid agonist treatment, supervised consumption facilities, naloxone distribution, and drug-checking services) found that among the countries with evidence of drug injecting, many were lacking one or more harm reduction services for this population (55). Globally, structural barriers to implementing and accessing such services included barriers to funding, fear of arrest for drug use or possession of injecting equipment, stigma and discrimination, and lack of trust in government (55).

Additionally, as highlighted by African country contexts, recommendations for providing healthcare and harm reduction services for people who use drugs must consider the need for community-based approaches to accessing care (56). These include drop-in centers, mobile outreach, clinics, peer-led outreach, and community-led services while including people who use drugs in the development of policy and programs (56). Kenya's context and its advances in making a systemic change toward a harm reduction approach to people who use drugs have led it to be the largest and most widespread service delivery program in Africa, addressing the comprehensive health and wellness needs of people who use drugs as part of that country's national strategic plan. Kenya's programs have seen between 70 and 98% retention rates (56).

Though there have been global attempts at strategizing to improve the healthcare workforce specifically, concrete interventions are still lacking in countries like Australia (57). In Portugal, changing national policies to focus on drug use as an issue of health rather than a criminal issue by decriminalizing personal drug use and implementing harm reduction strategies has led to a greater understanding of why people use drugs. The work in Portugal has shown that 90% of people who use drugs do not have a substance use disorder (58), and people use drugs in functional, non-dependent, religious, healthy, socially integrated, and non-problematic ways (59). This global humanitarian view of drug use behaviors could aid healthcare providers in the US who quickly pathologize and stigmatize drug use to take a more human-centered, holistic view of people who use drugs. Additionally, the work being done in Portugal has led to the acknowledgment that individuals who use drugs should have the autonomy to consent to any mandates, clinical evaluations, diagnosis, and treatment as part of their human rights (59).

4.4. Harm reduction for health equity

As highlighted in this paper, we cannot separate the "messy empirical realm of real-world harms" (20). Decades of advocacy have gotten us to move from the punitive lens of the war on drugs, abstinence approaches, and "just say no," which have failed us, toward harm reduction philosophy with the opioid epidemic. We have a shared humanity, whether we use drugs or not. Those who get sick and sustain injuries require healthcare and deserve healthcare, regardless of drug use.

Harm reduction is an issue of health equity, social justice, and fundamental human rights. Nurses and our epistemic lens can meet the challenge of complex intersectional issues affecting our use of power to develop more just and equitable health systems and advance our relationship with the people we serve. We urge all nurses and healthcare providers to consider a harm reduction approach to working with people who use drugs. Harm reduction is a human rights approach to caring for people who use drugs. Nurses have an ethical duty to treat people with dignity, respect, and compassion, regardless of their drug use. By meeting people where they are, providing non-judgmental care, and providing non-coercive provision of services, we can work toward rebuilding a trusting relationship with people who use drugs.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

SF-C: Conceptualization, Writing – original draft, Writing – review & editing. RS-E: Conceptualization, Writing – original draft, Writing – review & editing. ADFS: Conceptualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Dabney Evans,
Emory University, United States

REVIEWED BY
Fuad Ismayilov,
Azerbaijan Medical University, Azerbaijan
Carolyn Gentle-Genitty,
Indiana University Bloomington, United States
Saahoon Hong,
Indiana University, United States

*CORRESPONDENCE
Tasfia Jahangir
✉ tasfia.jahangir@emory.edu

†These authors have contributed equally to this work and share first authorship

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Can adverse childhood experiences predict chronic health conditions? Development of trauma-informed, explainable machine learning models

Hanin B. Afzal[1†], Tasfia Jahangir[2*†], Yiyang Mei[3], Annabelle Madden[4], Abeed Sarker[5] and Sangmi Kim[6]

[1]Department of Mechanical and Industrial Engineering, University of Toronto, Toronto, ON, Canada, [2]Department of Behavioral, Social and Health Education Sciences, Rollins School of Public Health, Emory University, Atlanta, GA, United States, [3]School of Law, Emory University, Atlanta, GA, United States, [4]Teachers College, Columbia University, New York, NY, United States, [5]Department of Biomedical Informatics, School of Medicine, Emory University, Atlanta, GA, United States, [6]Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA, United States

Introduction: Decades of research have established the association between adverse childhood experiences (ACEs) and adult onset of chronic diseases, influenced by health behaviors and social determinants of health (SDoH). Machine Learning (ML) is a powerful tool for computing these complex associations and accurately predicting chronic health conditions.

Methods: Using the 2021 Behavioral Risk Factor Surveillance Survey, we developed several ML models—random forest, logistic regression, support vector machine, Naïve Bayes, and K-Nearest Neighbor—over data from a sample of 52,268 respondents. We predicted 13 chronic health conditions based on ACE history, health behaviors, SDoH, and demographics. We further assessed each variable's importance in outcome prediction for model interpretability. We evaluated model performance via the Area Under the Curve (AUC) score.

Results: With the inclusion of data on ACEs, our models outperformed or demonstrated similar accuracies to existing models in the literature that used SDoH to predict health outcomes. The most accurate models predicted diabetes, pulmonary diseases, and heart attacks. The random forest model was the most effective for diabetes (AUC = 0.784) and heart attacks (AUC = 0.732), and the logistic regression model most accurately predicted pulmonary diseases (AUC = 0.753). The strongest predictors across models were age, ever monitored blood sugar or blood pressure, count of the monitoring behaviors for blood sugar or blood pressure, BMI, time of last cholesterol check, employment status, income, count of vaccines received, health insurance status, and total ACEs. A cumulative measure of ACEs was a stronger predictor than individual ACEs.

Discussion: Our models can provide an interpretable, trauma-informed framework to identify and intervene with at-risk individuals early to prevent chronic health conditions and address their inequalities in the U.S.

KEYWORDS

behavioral risk factor surveillance survey, machine learning, adverse childhood experiences, chronic diseases, health behaviors, health outcomes

1 Introduction

Adverse childhood experiences (ACEs) represent a critical public health issue. Defined as potentially traumatic events that occur in childhood (0–17 years old), ACEs include but are not limited to children experiencing emotional, physical, and sexual abuse, parental neglect, household instability such as parents' divorce or separation, and suicide attempts (1). According to the Centers for Disease Control and Prevention (CDC), approximately 61% of adults surveyed across 25 states reported having experienced at least one ACE before adulthood; one in six claimed that they had experienced four or more ACEs (1). Despite the widespread prevalence of ACEs, some groups are at a higher risk of ACE exposure than others. For example, Black, Hispanic, or low-income individuals show the highest prevalence of ACEs (2). Additionally, social, economic, and environmental inequities are greater in the environments of those who have endured four or more ACEs (3).

Current literature has documented that experiences of maltreatment and psychosocial stress during childhood play a significant role in shaping a wide range of chronic health conditions, which constitute physical and mental health problems that last for a prolonged period (i.e., 1 year or longer) (4). The seminal ACE Study with 17,000 adults found a clear and strong correlation between the number of negative experiences during childhood and a wide spectrum of poor health and behavioral outcomes in adult life (5). The study demonstrates a dose–response relationship between the number of ACEs and chronic diseases (e.g., ischemic heart disease, cancer, and chronic lung disease) (5). Since then, mounting evidence indicates the positive associations between ACEs and chronic health conditions, including arthritis, pulmonary disease, cancers, cardiovascular disease, stroke, pre-diabetes, diabetes, high cholesterol, and renal disease (6–28). In addition, individuals with ACEs are found to be at greater risk of experiencing poor mental health (e.g., depression, anxiety, and hallucination) (29–36).

Multiple pathways connect ACEs to chronic health conditions, including social determinants of health (SDoH) and health behaviors. Individuals with a higher number of ACEs tend to live in areas of greater poverty, fewer economic and health resources, worse food access, less green space, and more community instability (3, 37, 38). ACE survivors are also more likely to engage in harmful behaviors, such as smoking, heavy alcohol consumption, substance use, high-risk sexual behavior, interpersonal violence, excess screen time, and inadequate sleep (5, 27, 30, 39–42).

Such clustering of social and disease conditions in a specific population is well-explained by syndemic theory. A syndemic is defined as the "aggregation of two or more diseases or other health conditions in a population in which there is some level of deleterious biological or behavior interface that exacerbates the negative health effects of any or all of the diseases involved" (43). In syndemics, social conditions contribute to disease formation, accumulation, spread, and progression by increasing susceptibility and reducing immune function, particularly among marginalized populations; hence, syndemics are most likely to emerge under conditions of health inequality (43). A syndemic can be exemplified by the interactions of ACEs, negative social conditions (i.e., SDoH), and risky health behaviors worsening the risk of various chronic health conditions (2, 3, 44). However, an accurate assessment of these complex associations can be methodologically challenging, as the involved risk factors may be highly correlated, interactive, or synergistic. In such cases, it is essential to employ models that are more flexible than linear regression, and robust at handling and computing features linked in nonlinear fashions. This need can be met by using more advanced modeling techniques such as machine learning (ML).

Most applications of Artificial Intelligence (AI) in healthcare read in categorical, numerical, or image-based data as an input; utilize algorithmic and statistical models to process the data; identify patterns; and produce a probability or classification (45–49). ML refers to the range of algorithms conducting these predictions (50). As briefly stated above, ML offers considerable benefits compared to traditional statistical modeling, as it is capable of handling complex multi-dimensional data, adapting new data as it becomes available, capturing non-linear relationships and interactions among variables more effectively, and generally accounting for noise and outliers in the data in a robust manner (50, 51). Moreover, ML can promote the P4 medicine paradigm—predictive, preventive, personalized, and participatory—an approach that proactively engages both providers and patients in early monitoring and intervention (52–54). For these reasons, there has been an exponential increase in using ML to predict the prognosis and outcome of chronic diseases.

Despite their advantages, however, health-related AI models are often impermeable black boxes: their inner workings are opaque, unintuitive, and uninterpretable to end-users. A lack of interpretability can compromise the end users' trust and confidence in model predictions, especially when the model and its outcomes influence people's decisions on their health and healthcare. In response to this growing need for transparency, explicability, and interpretability in AI models, the explainable AI (XAI) has emerged as a field. Today, XAI principles are applied for multiple purposes (e.g., reducing model bias toward certain racial or gender groups), and involve providing contextual information about the importance of variables in model decision-making (55).

Several existing studies have employed ML to predict an extensive range of chronic health conditions, such as autoimmune, cardiovascular, cerebrovascular, hepatic, metabolic, neurodegenerative, pulmonary, renal, and rheumatic diseases, as well as cancers (56–61). Most of these studies used K-nearest neighbors (KNN), support vector machines (SVM), Naïve Bayes (NB), deep neural networks, random forest (RF), and logistic regression (LR) (58, 60, 62–64). Existing classical ML models in the literature have predicted health outcomes based on SDoH with accuracies between 61 and 74% (65). It is common to combine different types and sources of data for these analyses, such as electronic medical records linked to omics data (63); clinical information linked to sociodemographic, behavioral, or anthropometric factors (58); and primary care data linked to insurance claims, cancer registries, or administrative sources (64). In terms of predictors, sociodemographic (e.g., age, sex, gender) and lifestyle factors (e.g., physical activity, lack of sleep, and use of alcohol, tobacco, and other drugs) are predominantly used for modeling chronic health conditions (58). However, only a small number of studies include ACE exposure in ML models to predict rheumatic and musculoskeletal disease (66), neurocognitive outcomes (67), and emergency department visits (68). Although a study by Ammar

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Abbreviations: ACE, Adverse childhood experience; AI, Artificial intelligence; AUC, Area under the curve; BMI, Body mass index; BRFSS, Behavioral Risk Factor Surveillance Survey; CDC, Centers for Disease Control and Prevention; KNN, K-nearest neighbor; LR, Logistic regression; ML, Machine learning; NB, Naïve Bayes; RF, Random forest; SDoH, Social determinants of health; SVM, Support vector machine; XAI, Explainable Artificial Intelligence.

and Shaban-Nejad (69) proposes a proof-of-concept semantic XAI model for using ACEs and SDoH data to improve mental health surveillance, the model's accuracy and usability are yet to be evaluated. Beyond these studies, few examine the use of ACEs in tandem with SDoH and health behaviors to predict a suite of chronic health conditions. Further, none of the previous studies use large national survey data to better represent the U.S. adult population.

The current study attempts to fill these gaps by developing interpretable ML models aimed at (i) predicting 13 chronic health conditions based on demographic characteristics, ACEs, SDoH, and health behaviors among U.S. adults and (ii) explaining the relative importance of variables in predicting each of the chronic health conditions. We use data from the CDC's Behavioral Risk Factor Surveillance System (BRFSS), the world's largest continuing national health survey (70). We employ classical ML models identified in the literature as robust tools for predicting chronic health conditions: LR, Gaussian NB, SVM, RF, and KNN (58, 60, 62–64) Although neural networks are also promising for this prediction task (58), they lack interpretability and demand greater computational power and time (71, 72). Computational resources are crucial during model deployment, given the higher prevalence of ACEs in disadvantaged communities that can benefit most from the models we developed (3, 37, 38, 73–76). Accordingly, we focus on classical ML models that can be scalable and adaptable, even in low-resource settings, while empowering end-users with explainable results to aid clinical decision-making.

2 Materials and methods

2.1 Data source

We utilized a subset of the latest publicly available data from the 2021 BRFSS (70). The BRFSS is a federally sponsored telephone-based survey conducted annually among U.S. adults. In 2021, the survey was conducted with 546,569 adults in all 50 states, the District of Columbia, and three territories in the U.S. The national survey collects data on SDoH, risky health behaviors, and the use of preventive services, among many other health-related factors, to facilitate health promotion efforts (70). Survey questions related to ACE exposure belong to an optional module of the BRFSS, which was implemented in 16 states in 2021 (Alabama, Arkansas, Iowa, Kansas, Maine, Mississippi, Nevada, New Hampshire, New Jersey, New York, Ohio, Oregon, South Carolina, Virginia, and Wisconsin). As ACE exposure was the study's key predictor, our final dataset was limited to the data collected by these 16 states.

2.2 Inclusion criteria

Our inclusion criteria were individuals who (a) resided in any of the 16 U.S. states that administered the optional ACE module of the BRFSS, (b) answered all questions about ACEs, and (c) answered at least one of the questions regarding the pre-determined 13 chronic health conditions ($n = 86{,}168$). We excluded respondents with inconclusive responses (i.e., "Do not know/Not sure," "Not Defined," "Not asked," "Yes, but female told only during pregnancy," "Refused," or missing answers) for any predictor and outcome variables ($n = 32{,}900$). As a result, our total sample size for analysis was 52,268 respondents.

2.3 Measures

The study's outcome variables included 13 chronic health conditions (Supplementary Table S1). The predictor variables included self-reported ACE exposure, SDoH, health behaviors, and demographic and anthropometric characteristics (Supplementary Table S2). Please refer to Supplementary material for the answering options of each variable.

2.3.1 Chronic health conditions

The outcome variables included self-reported diagnoses of 13 conditions with a well-established link to ACEs: (1) arthritis (including rheumatoid arthritis or other diseases with related symptoms, such as gout, lupus, or fibromyalgia), (2) asthma, (3) cancer (any type except skin cancer), (4) coronary heart disease (or angina), (5) depressive disorder (including depression, major depression, dysthymia, or minor depression), (6) pre-diabetes, (7) diabetes, (8) heart attack, (9) high blood pressure, (10) high cholesterol, (11) kidney disease, (12) pulmonary disease (chronic obstructive pulmonary disease, emphysema, or chronic bronchitis), and (13) stroke. These outcomes were categorized by the BRFSS as "Chronic Health Conditions" (77). Our final dataset included "Yes" and "No" responses.

2.3.2 ACE exposure

ACE exposure was assessed with 11 questions on ACEs and two questions on positive childhood experiences (PCEs): (1) living with someone who was depressed, mentally ill, or suicidal (Yes/No); (2–3) two questions about living with someone who was a problem drinker or alcoholic or used illicit street drugs/abused prescription medications (Yes/No); (4) living someone who served time or was sentenced to serve time in prison or other correctional facility (Yes/No); (5) having parents who were separated or divorced (Yes/No/Parents Never Married); (6–8) three questions about living with parents who were physically and verbally abusive toward each other or the respondent (1 = "Never," 2 = "Once," 3 = "More than once"); (9–11) three questions on being sexually abused by an adult (1 = "Never," 2 = "Once," 3 = "More than once"); (12) the presence of an adult who made the respondent feel safe and protected; (13) the presence of an adult who ensured that the respondent's basic needs were met. Both PCEs were evaluated on a 5-point Likert scale (1 = "Never," 2 = "A little of the time," 3 = "Some of the time," 4 = "Most of the time," 5 = "All of the time"), which were reverse-coded. Additionally, we computed two composite indices for ACE exposure: a binary variable measuring whether a respondent has experienced at least one ACE (Yes/No) and a numeric variable calculating the total number of ACEs experienced (range: 0–13).

2.3.3 SDoH

The eight variables on SDoH included area of residence (urban vs. rural counties), education, employment status, income, renting/home ownership status, source of health insurance, availability of a personal healthcare provider, and inability to see a medical provider due to cost. These variables were categorical and had answering options unique to each question.

2.3.4 Health behavior

The 13 variables included both health-promoting and deteriorating behaviors, such as exercise, smoking cigarettes, chewing tobacco, using e-cigarettes or vaping, heavy drinking, time since last cholesterol check, ever tested for HIV, monitoring blood sugar or blood pressure (two composite variables), cancer screening (two composite variables), and vaccination status (two composite variables). Like the SDoH, these variables were categorical and had differing rating scales.

We created six composite variables to handle missing data to preserve the information without dropping respondents: count of monitoring behaviors for blood sugar or blood pressure, ever monitored blood sugar or blood pressure, count of cancer screenings, ever screened for any cancer, count of vaccines received, and ever received any vaccines. The predictors for monitoring blood sugar or blood pressure were generated from two individual variables in the dataset (i.e., tested for blood sugar or diabetes in the past 3 years and regularly checked for blood pressure at home). These two variables were recoded, to where we assigned 1 ("Yes") if the respondent checked their blood sugar or blood pressure and 0 ("No") otherwise. The variable for the count of monitoring blood sugar or blood pressure was the sum of these binary items (range: 0–2).

Similarly, the cancer screening predictors were generated from six variables in the dataset (i.e., CT/CAT scan for lung cancer, mammogram for breast cancer, any cervical cancer screening, PSA test for prostate cancer, colonoscopy or sigmoidoscopy for colorectal cancer, and any other screening for colorectal cancer). These six variables were also re-engineered into binary variables (1 = "Yes," 0 = "No"). The variable for the count of cancer screenings was the sum of their answers (range: 0–6). The variable measuring whether the respondent ever screened for any cancer was coded as 1 ("Yes") if they underwent any of the six cancer screenings and 0 ("No") if they underwent none.

Lastly, the vaccination status predictors were generated from five variables in the dataset (i.e., flu, pneumonia, tetanus, shingles, and zoster), which were re-engineered into binary variables (1 = "Yes," 0 = "No"). The variable for the count of vaccines received was the sum of their answers (range: 0–5). The variable measuring whether the respondent ever received any vaccines was coded as 1 ("Yes") if they received any of the five vaccines and 0 ("No") if they received none.

2.3.5 Demographic and anthropometric variables

Demographic variables included age (grouped in 13 five-year categories [1 = "18–24" to 13 = "80 ≤"]), race (White, Black, American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, Multiracial, Hispanic, Other), and sex (Male/Female). Body Mass Index (BMI) was the sole anthropometric variable available in the data and was assessed in four standard categories (1 = "Underweight," 2 = "Normal Weight," 3 = "Overweight," and 4 = "Obese").

2.4 Preprocessing

We recoded all variables (reverse coding as needed) on a 0-N scale, such that all "Never" and "No" variables were coded as zero. As noted previously, we excluded any respondents with "Do not know/Not sure," "Refused," "Not asked," "Not defined," and missing values for the outcome and predictor variables. In addition, we excluded variables for sexual orientation, transgender status, nutrition (i.e., consumption of fruits and vegetables and salt intake), and marijuana consumption in the last 30 days due to large volumes of missing data ($n > 26{,}000$ or roughly 50% of our data).

Moreover, given the data imbalance in our outcome variables (i.e., the proportion of respondents without chronic health conditions substantially exceeding their counterparts with such conditions), we performed random under-sampling of the majority class for each outcome by retaining the data for respondents with the chronic health conditions, and randomly dropping the data from the larger group without the conditions. This approach ensured equally sized classes for the outcome data, which could reduce the risk of model bias and computational burden (see Supplementary Figure S1). Relative to other sampling methods, random under-sampling is considered an effective approach to reducing data imbalance in sufficiently large datasets while minimizing the risk of generalization error on test data (78–80).

3 Data analysis

3.1 Univariate and bivariate

We conducted descriptive analyses (i.e., counts, percentages, mean, and standard deviation [SD]) for the predictor variables. Adopting Chi-square tests, we compared respondents with vs. without missing information to investigate any significant differences in their racial and income distributions and health outcomes and ultimately prevent potential biases that might be introduced into the final dataset by deleting the missing cases.

3.2 ML modeling

After random under-sampling, we split the data into training and test datasets. 80% of the data was allocated for training, while the remaining 20% was reserved for testing. We built a suite of supervised ML methods, such as LR, Gaussian NB, SVM, RF, and KNN, specific to each of our target chronic health conditions.

We evaluated model performance with accuracy (i.e., the rate of correct predictions) and Area under the Curve or AUC score (i.e., the probability of a model ranking a random positive observation higher than a random negative observation).

We performed hyperparameter tuning for each model on the training set to determine the most accurate predictors for each chronic health condition. Briefly, we tested a variety of optimization algorithms, penalty terms, and regularization strengths for LR; variance smoothing values for Gaussian NB; loss functions, penalty terms, and regularization strengths for SVM; the number of trees, number of features, maximum tree depth, and bootstrapping method for RF; the number of neighbors, weights, and distance metrics for KNN (see Supplementary Table S3 for more details). We utilized 3-fold cross-validation and evaluated performance using validation AUC score.

3.3 Model interpretation

We calculated the importance of each predictor variable in predicting the occurrence of each chronic health condition using different metrics for each ML model type (81). We then examined the variable importance of the best-performing model for each chronic health condition. We performed min-max normalization on each set of variable importances, converting them to 0–1 scales. This approach allowed us to compare relative variable importance across the models. We computed variable importance for each ML model type: for LR, we referred to the coefficients of

TABLE 1 **Sample characteristics.**

Demographic characteristics	
Age, *n* (%)	
18–24	1,826 (3.43)
25–29	1,947 (3.66)
30–34	2,648 (4.97)
35–39	3,258 (6.12)
40–44	3,579 (6.72)
45–49	3,673 (6.9)
50–54	4,416 (8.29)
55–59	5,019 (9.42)
60–64	6,086 (11.43)
65–69	6,429 (12.07)
70–74	6,104 (11.46)
75–79	3,944 (7.4)
>80	4,339 (8.15)
Race/ethnicity, *n* (%)	
White	44,155 (82.89)
Black	4,467 (8.39)
American Indian/Alaska Native	544 (1.02)
Asian	631 (1.18)
native Hawaiian/Pacific Islander	55 (0.10)
Other	346 (0.65)
Multiracial	823 (1.55)
Hispanic	2,247 (4.22)
Sex, *n* (%)	
Male	25,226 (47.36)
Female	28,042 (52.64)
Marital status, *n* (%)	
Married	30,000 (56.32)
Divorced	6,928 (13.01)
Widowed	6,107 (11.46)
Separated	963 (1.81)
Never married	7,533 (14.14)
Unmarried couple	1,737 (3.26)
Anthropometric characteristics	
Body mass index, *n* (%)	
Underweight	640 (1.2)
Normal	13,933 (26.16)
Overweight	19,089 (35.84)
Obese	19,606 (36.81)
Social determinants of health (SDoH)	
Urban or rural county, *n* (%)	
Urban counties	43,734 (82.10)
Rural counties	9,534 (17.90)
Education level, *n* (%)	
Never attended school	21 (0.04)
Grades 1–8	572 (1.07)
Grades 9–11	1,681 (3.16)
Grades 12—GED	13,046 (24.49)
College 1–3 years	15,173 (28.48)
College >4 years	22,775 (42.76)
Employment status, *n* (%)	
Employed for wages	23,396 (43.92)
Self-employed	4,475 (8.4)

(Continued)

TABLE 1 (Continued)

Demographic characteristics	
Out of work for >1 year	1,042 (1.96)
Out of work for <1 year	868 (1.63)
Homemaker	1,715 (3.22)
Student	741 (1.39)
Retired	18,071 (33.92)
Unable to work	2,960 (5.56)
Income, *n* (%)	
< $10,000	1,127 (2.12)
$10,000–$15,000	1,585 (2.98)
$15,000–$20,000	2,077 (3.90)
$25,000–$30,000	3,107 (5.83)
$30,000–$35,000	6,626 (12.44)
$35,000–$50,000	7,742 (14.53)
$50,000–$75,000	9,594 (18.01)
$75,000–$100,000	7,820 (14.68)
$100,000–$150,000	7,759 (14.57)
$150,000–$200,000	3,120 (5.86)
>$200,000	2,711 (5.09)
Rent or own home, *n* (%)	
Own	41,687 (78.26)
Rent	10,009 (18.79)
Other arrangement	1,572 (2.95)
Marital status, *n* (%)	
Married	30,000 (56.32)
Divorced	6,928 (13.01)
Widowed	6,107 (11.46)
Separated	963 (1.81)
Never married	7,533 (14.14)
Unmarried couple	1,737 (3.26)
Source of health insurance, *n* (%)	
Employer or union plan	21,555 (40.47)
Private plan	4,342 (8.15)
Medicare	18,206 (34.18)
Medigap	59 (0.11)
Medicaid	2,500 (4.69)
Children's Health Insurance Program (CHIP)	12 (0.02)
Military-related healthcare	1,845 (3.46)
Indian Health Service	60 (0.11)
State-sponsored health plan	1,136 (2.13)
Other government program	1,442 (2.71)
No coverage	2,111 (3.96)
Has personal care provider, *n* (%)	
Yes, only one	34,089 (64.0)
More than one	14,397 (27.03)
No	4,782 (8.98)
Unable to see doctor due to medical cost, *n* (%)	
Yes	3,180 (5.97)
No	50,088 (94.03)
Health behavior	
Regular exercise, *n* (%)	
Yes	40,412 (75.87)
No	12,856 (24.13)
Smoked at least 100 cigarettes in life, *n* (%)	

(Continued)

TABLE 1 (Continued)

Demographic characteristics	
Yes	22,740 (42.69)
No	30,528 (57.31)
Currently use chewing tobacco, snuff or snuss, *n* (%)	
Every day	1,066 (2.0)
Some days	707 (1.33)
Not at all	51,495 (96.67)
Use-cigarettes or electronic vaping products, *n* (%)	
Every day	1,056 (1.98)
Some days	1,125 (2.11)
Not at all	43,338 (81.36)
Never used	7,749 (14.55)
Heavy drinker, *n* (%)	
No	49,893 (93.66)
Yes	3,375 (6.34)
Time since last cholesterol check, *n* (%)	
Never	3,739 (7.02)
<1 Year	39,096 (73.39)
1–2 Years	5,776 (10.84)
2–3 Years	1,803 (3.38)
3–4 Years	651 (1.22)
4–5 Years	580 (1.09)
>5 Years	1,623 (3.05)
Ever tested for HIV, *n* (%)	
Yes	17,195 (32.28)
No	36,073 (67.72)
Count of monitoring behaviors for blood sugar and blood pressure, *n* (%)	
0	33,238 (62.4)
1	18,837 (35.36)
2	1,193 (2.24)
Count of cancer screenings, *n* (%)	
0	49,771 (93.44)
1	2,354 (4.42)
2	1,095 (2.06)
3	48 (0.09)
Count of vaccines received, *n* (%)	
0	16,975 (31.87)
1	18,573 (34.87)
2	15,991 (30.02)
3	1,050 (1.97)
4	679 (1.27)
ACE exposure	
Four or more ACEs, *n* (%)	9,808 (18.41)
Total ACEs, mean (sd)	1.83 (2.27)

the predictor variables in the regression formulation (80); for Gaussian NB, we employed permutation importance that measures the decline in model performance when individual random variables are shuffled (82); for SVM, we calculated the weight vector that represents the hyperplane separating the classes in linear space (83); for RF, we examined GINI importance or mean decrease in impurity, indicating how often a specific feature is selected for splitting within the RF and, thereby, its discriminative value toward the classification (84). We performed all procedures using Python 3.8.3 run on Jupyter Notebook. We used several open-source Python packages: *numpy, pandas, matplotlib, sci-kit learn, seaborn,* and *scipy.*

4 Results

4.1 Sample characteristics

As illustrated in Table 1, 39% of the respondents were aged 65 or older. About 83% of them self-identified as White and 8.4% as

TABLE 2 **Classification model performance for all target chronic health conditions.**

Chronic disease	ML model	Validation accuracy [95% CI]	Test accuracy [95% CI]	Test AUC score [95% CI]
Arthritis *n* = 39,184	LR	0.696 [0.691, 0.7]	0.697 [0.693, 0.702]	0.697 [0.695, 0.7]
	NB	0.682 [0.678, 0.687]	0.688 [0.683, 0.693]	0.688 [0.685, 0.691]
	SVM	0.691 [0.686, 0.696]	0.697 [0.692, 0.701]	0.697 [0.694, 0.699]
	KNN	0.667 [0.662, 0.671]	0.677 [0.673, 0.682]	0.677 [0.675, 0.68]
	RF (Best Predictor)	**0.697 [0.693, 0.702]**	**0.701 [0.697, 0.706]**	**0.701 [0.699, 0.704]**
Asthma *n* = 14,268	LR	0.615 [0.607, 0.623]	0.615 [0.607, 0.623]	0.615 [0.61, 0.619]
	NB	0.572 [0.564, 0.58]	0.578 [0.57, 0.587]	0.578 [0.574, 0.583]
	SVM	0.615 [0.607, 0.623]	0.616 [0.608, 0.624]	0.616 [0.612, 0.621]
	KNN	0.569 [0.56, 0.577]	0.571 [0.563, 0.58]	0.571 [0.567, 0.576]
	RF (Best Predictor)	**0.61 [0.602, 0.618]**	**0.627 [0.619, 0.635]**	**0.627 [0.622, 0.631]**
Cancer *n* = 11,726	LR	0.675 [0.667, 0.684]	0.668 [0.66, 0.677]	0.668 [0.664, 0.673]
	NB	0.652 [0.644, 0.661]	0.661 [0.653, 0.67]	0.661 [0.656, 0.666]
	SVM	0.673 [0.665, 0.682]	0.671 [0.663, 0.68]	0.671 [0.667, 0.676]
	KNN	0.647 [0.639, 0.656]	0.659 [0.65, 0.668]	0.659 [0.654, 0.664]
	RF (Best Predictor)	**0.675 [0.666, 0.683]**	**0.687 [0.678, 0.695]**	**0.687 [0.682, 0.691]**
Coronary heart disease *n* = 6,554	LR	0.732 [0.721, 0.743]	0.715 [0.705, 0.726]	0.716 [0.709, 0.722]
	NB	0.704 [0.693, 0.715]	0.694 [0.683, 0.705]	0.694 [0.688, 0.701]
	SVM (Best Predictor)	**0.732 [0.721, 0.742]**	**0.725 [0.715, 0.736]**	**0.725 [0.719, 0.732]**
	KNN	0.7 [0.689, 0.711]	0.678 [0.667, 0.689]	0.678 [0.672, 0.685]
	RF	0.734 [0.724, 0.745]	0.719 [0.708, 0.729]	0.719 [0.712, 0.725]
Depressive disorder *n* = 21,288	**LR (Best Predictor)**	**0.708 [0.702, 0.714]**	**0.705 [0.699, 0.711]**	**0.705 [0.702, 0.709]**
	NB	0.648 [0.642, 0.655]	0.642 [0.636, 0.649]	0.642 [0.639, 0.646]
	SVM	0.705 [0.699, 0.711]	0.7 [0.694, 0.706]	0.7 [0.697, 0.704]
	KNN	0.665 [0.659, 0.671]	0.665 [0.659, 0.672]	0.665 [0.662, 0.669]
	RF	0.709 [0.703, 0.715]	0.702 [0.696, 0.709]	0.702 [0.699, 0.706]
Diabetes *n* = 15,504	LR	0.784 [0.778, 0.791]	0.772 [0.765, 0.778]	0.772 [0.768, 0.775]
	NB	0.764 [0.758, 0.771]	0.751 [0.744, 0.758]	0.751 [0.747, 0.755]
	SVM	0.783 [0.777, 0.79]	0.774 [0.768, 0.781]	0.774 [0.771, 0.778]
	KNN	0.737 [0.73, 0.744]	0.729 [0.722, 0.736]	0.729 [0.725, 0.733]
	RF (Best Predictor)	**0.79 [0.784, 0.797]**	**0.784 [0.778, 0.791]**	**0.784 [0.781, 0.788]**
Heart attack *n* = 6,236	LR	0.724 [0.713, 0.735]	0.725 [0.714, 0.736]	0.725 [0.719, 0.731]
	NB	0.695 [0.684, 0.707]	0.698 [0.687, 0.709]	0.698 [0.691, 0.704]
	SVM	0.722 [0.711, 0.733]	0.725 [0.714, 0.736]	0.725 [0.719, 0.731]
	KNN	0.689 [0.678, 0.701]	0.691 [0.679, 0.702]	0.691 [0.684, 0.697]
	RF (Best Predictor)	**0.728 [0.717, 0.739]**	**0.732 [0.721, 0.743]**	**0.732 [0.726, 0.739]**
High blood pressure *n* = 45,976	LR	0.707 [0.703, 0.711]	0.712 [0.708, 0.717]	0.712 [0.71, 0.715]
	NB	0.669 [0.665, 0.673]	0.669 [0.665, 0.673]	0.669 [0.667, 0.672]
	SVM	0.707 [0.703, 0.711]	0.711 [0.707, 0.715]	0.711 [0.709, 0.714]
	KNN	0.676 [0.672, 0.68]	0.679 [0.674, 0.683]	0.679 [0.676, 0.681]
	RF (Best Predictor)	**0.713 [0.709, 0.717]**	**0.716 [0.711, 0.72]**	**0.716 [0.713, 0.718]**
High cholesterol *n* = 49,526	LR	0.656 [0.652, 0.66]	0.657 [0.653, 0.662]	0.657 [0.655, 0.66]
	NB	0.612 [0.607, 0.616]	0.613 [0.608, 0.617]	0.613 [0.61, 0.615]
	SVM	0.66 [0.656, 0.664]	0.661 [0.657, 0.665]	0.661 [0.658, 0.663]
	KNN	0.609 [0.605, 0.613]	0.612 [0.608, 0.617]	0.612 [0.61, 0.615]
	RF (Best Predictor)	**0.67 [0.666, 0.675]**	**0.671 [0.667, 0.675]**	**0.671 [0.668, 0.673]**

(Continued)

TABLE 2 (Continued)

Chronic disease	ML model	Validation accuracy [95% CI]	Test accuracy [95% CI]	Test AUC score [95% CI]
Kidney disease *n* = 4,432	LR	0.692 [0.678, 0.706]	0.677 [0.663, 0.69]	0.677 [0.669, 0.685]
	NB	0.679 [0.665, 0.692]	0.653 [0.639, 0.667]	0.653 [0.645, 0.661]
	SVM	0.691 [0.678, 0.705]	0.669 [0.655, 0.683]	0.669 [0.661, 0.677]
	KNN	0.674 [0.66, 0.688]	0.633 [0.619, 0.647]	0.633 [0.625, 0.641]
	RF (Best Predictor)	**0.698 [0.684, 0.711]**	**0.681 [0.667, 0.695]**	**0.681 [0.673, 0.689]**
Pre-diabetes *n* = 51,060	LR	0.711 [0.707, 0.715]	0.717 [0.714, 0.721]	0.714 [0.712, 0.717]
	NB	0.694 [0.69, 0.698]	0.701 [0.697, 0.705]	0.696 [0.694, 0.699]
	SVM	0.708 [0.704, 0.712]	0.715 [0.711, 0.719]	0.711 [0.709, 0.713]
	KNN	0.671 [0.667, 0.675]	0.679 [0.675, 0.684]	0.674 [0.671, 0.676]
	RF (Best Predictor)	**0.724 [0.72, 0.728]**	**0.728 [0.724, 0.732]**	**0.726 [0.724, 0.728]**
Pulmonary disease *n* = 8,890	**LR (Best Predictor)**	**0.745 [0.736, 0.754]**	**0.753 [0.744, 0.762]**	**0.753 [0.748, 0.758]**
	NB	0.711 [0.701, 0.72]	0.715 [0.706, 0.725]	0.715 [0.71, 0.721]
	SVM	0.745 [0.736, 0.754]	0.749 [0.74, 0.758]	0.749 [0.744, 0.754]
	KNN	0.706 [0.697, 0.716]	0.711 [0.701, 0.72]	0.711 [0.706, 0.716]
	RF	0.756 [0.747, 0.765]	0.744 [0.734, 0.753]	0.744 [0.738, 0.749]
Stroke *n* = 4,488	LR	0.714 [0.701, 0.728]	0.714 [0.701, 0.727]	0.714 [0.706, 0.721]
	NB	0.706 [0.693, 0.72]	0.688 [0.675, 0.702]	0.688 [0.68, 0.696]
	SVM	0.712 [0.698, 0.725]	0.71 [0.697, 0.724]	0.71 [0.703, 0.718]
	KNN	0.698 [0.685, 0.712]	0.682 [0.668, 0.695]	0.682 [0.674, 0.689]
	RF (Best Predictor)	**0.718 [0.705, 0.731]**	**0.715 [0.702, 0.728]**	**0.715 [0.707, 0.722]**

Bold values indicate best-performing models for each chronic disease.

Black. Slightly over 50% were female and married, respectively. Over 40% of the respondents completed 4 years of college education or more and were employed, respectively, while 78% owned a home.

In terms of BMI, 35.8% of the respondents were overweight, and 36.8% were obese. For healthcare access, 64% reported having a personal provider, while 40.5% reported having an employer or union-sponsored insurance. Nevertheless, 94% reported that they could not see a doctor in the past 12 months due to cost. Regarding health behaviors, a majority of the respondents reported exercising in the past month (75.9%) and never using chewing tobacco (96.7%) and electronic cigarettes/vaping products (81.4%). Also, 57.3% had smoked less than 100 cigarettes in their lifetime, and around 6% were involved in heavy drinking.

73.4% of the respondents checked their cholesterol last time less than a year ago. On the other hand, a majority reported never having been tested for HIV (67.7%), not monitoring blood sugar or blood pressure (62.4%), and not screening for cancer (93.4%). Nearly one in three respondents received at least one vaccine. Lastly, the mean number of ACEs was 1.83 (SD = 2.27), and 18.4% of the respondents encountered four or more ACEs.

4.2 Analysis of missing data

There was no significant difference in the racial distribution of the missing and non-missing cases (data not shown). However, we found a significant difference in the income distribution between the two groups, wherein respondents with missing data were more likely to be in a higher-income group earning $75,000 or more. Regarding chronic health conditions, we found significant differences only in high blood pressure and arthritis, whereby those with missing data were more likely to experience these conditions. However, we do not expect the removal of missing data on high blood pressure and arthritis to impact model performance, as we performed under-sampling to ensure balanced distributions of classes for each outcome variable.

4.3 Model performance

With the inclusion of data on ACEs, our ML models achieved higher or similar accuracy and AUC scores compared to existing models in the literature that predicted health outcomes based on SDoH (65) (Table 2). Nine of the 13 models obtained test accuracies above 70% and test AUC scores above 0.7. The top-performing models were those predicting diabetes (78.4% accuracy, 0.784 AUC), pulmonary disease (75.3% accuracy, 0.753 AUC), and heart attack (73.2% accuracy, 0.732 AUC).

Training a single iteration of each model took an average of 38 s. Validation and model selection involved training a single iteration of each algorithm for every combination of the hyperparameters that were tested. This process determined the optimal performance for each model.

Three of the top five models employed RF (diabetes, heart attack, and prediabetes), whereas LR (pulmonary disease) and SVM

TABLE 3 Most predictive variables for each best-performing classification model.

Disease	Best performing model	Top 5 predictor variables
Arthritis	Random forest	1. Age
		2. Employment status
		3. Income
		4. Source of health insurance
		5. Count of vaccines received
Asthma	Random forest	1. Age
		2. Income
		3. Total ACEs
		4. BMI category
		5. Employment status
Cancer	Random forest	1. Age
		2. Employment status
		3. Source of health insurance
		4. Income
		5. Count of vaccines received
Coronary heart disease	Support vector machine	1. Sex
		2. ACE—lived with mentally ill/suicidal person
		3. Has personal health care provider available
		4. Smoking cigarettes
		5. Age
Depressive disorder	Logistic regression	1. ACE—lived with mentally ill/suicidal person
		2. Inability to see medical provider due to cost
		3. Sex
		4. Exercise
		5. Ever received any vaccines
Diabetes	Random forest	1. Age
		2. Ever monitored blood sugar or blood pressure
		3. Count of blood monitoring behaviors for blood sugar or blood pressure
		4. BMI
		5. Time since last cholesterol check
Heart attack	Random forest	1. Age
		2. Employment status
		3. Income
		4. Source of health insurance
		5. Sex
High blood pressure	Random forest	1. Age
		2. BMI
		3. Employment status
		4. Time since last cholesterol check
		5. Income
High cholesterol	Random forest	1. Time since last cholesterol check
		2. Age
		3. Income
		4. Employment status
		5. Source of health insurance

(Continued)

TABLE 3 (Continued)

Disease	Best performing model	Top 5 predictor variables
Kidney disease	Random forest	1. Employment status
		2. Age
		3. Source of health insurance
		4. Income
		5. Count of vaccines received
Pre-diabetes	Random forest	1. Ever monitored blood sugar or blood pressure
		2. Count of blood monitoring behaviors for blood sugar or blood pressure
		3. Age
		4. Income
		5. Time since last cholesterol check
Pulmonary disease	Logistic regression	1. Smoking cigarettes
		2. Exercise
		3. Inability to see medical provider due to cost
		4. Have you tested for HIV?
		5. ACE—lived with mentally ill/suicidal person
Stroke	Random forest	1. Age
		2. Employment status
		3. Income
		4. Source of health insurance
		5. Time since last cholesterol check

FIGURE 1
Swarm plot of normalized variable importance across all 13 chronic health condition models.

(coronary heart disease) were used in the other two. Overall, RF performed best for 10 of the 13 chronic health conditions: diabetes, heart attack, prediabetes, high blood pressure, stroke, arthritis, cancer, kidney disease, high cholesterol, and asthma. The linear model (i.e., LR) performed best only for two chronic health conditions.

4.4 Model interpretation

Age and SDoH, such as income, employment, and health insurance, were among the top five strongest variables to predict each chronic health condition (Table 3). ACEs, either cumulatively or individually, were also identified as an important variable for asthma, coronary heart disease, depressive disorder, and pulmonary disease. When individually examined, living with a mentally ill/suicidal person during childhood was the only ACE predictive of these health conditions (except asthma). Specifically, living with a mentally ill/suicidal person seemed to play the most critical role in the depressive disorder and coronary heart disease models and was listed as their first and second most important predictor, respectively. Supplementary Figure S2 outlines the variable importance of all models.

Normalized variable importance revealed the 10 most predictive variables across a total of 65 models (5 ML models × 13 chronic health conditions): age, ever monitored blood sugar or blood pressure, count of monitoring behaviors for blood sugar or blood pressure, BMI, time since last cholesterol check, employment status, income, count of vaccines received, primary insurance status, and the total number of ACEs (Figure 1).

5 Discussion

Our study developed explainable ML models using large national survey data to predict 13 chronic health conditions prevalent among U.S. adults. We found that non-linear models, particularly RF, outperformed the linear model in predicting chronic health conditions. In addition, our ML models cast light on the most predictive features of each condition. Among these, ACEs and SDoH such as income, employment, and health insurance, were robust predictors of multiple chronic health conditions. Additionally, cumulative ACEs were a stronger predictor than individual ACEs across chronic health conditions. Our models achieved comparable or superior performance to classical ML-based health outcome prediction models that previously used SDoH as predictors (65). Our findings not only align with previous studies linking ACEs to chronic health conditions (6–28, 30, 31), but also expand upon them by employing ML to factor in complex interactions between ACEs and other socioeconomic and behavioral factors to predict chronic health conditions. Our primary focus on ACEs and relevant socioeconomic and behavioral factors can distinguish the current study from others. While previous studies have documented excellent performance of classical ML models (e.g., RF, gradient boost, SVM, LR, KNN, decision trees, and NB) to predict chronic health conditions, they commonly focused on biomedical predictors such as clinical, biomarker, and genetics data (58, 60, 63, 64).

Our study, which emphasizes the role of ACEs and their cumulative impact, highlights the significance of predictive values of total ACEs in shaping chronic diseases. ACEs were among the top five predictors for four chronic health conditions: asthma, coronary heart disease, depressive disorder, and pulmonary disease. Living with a mentally ill/suicidal person during childhood was particularly predictive of coronary heart disease, depressive disorder, and pulmonary disease. These results are supported by Gallagher and colleagues, who found that living with a severely mentally ill person is associated with poorer subjective health, activity limitations, and higher utilization of physician visits than living with non-mentally ill household members (85). Beyond this single ACE, the total number of ACEs was a stronger predictor than individual ACEs across all the best-performing models of the 13 chronic health conditions. Notably, the total number of ACEs was among the top five predictors for the asthma model, which aligns with findings from the existing literature on the dose–response relationship between ACEs and asthma (12). The composite measure may more accurately represent how ACEs operate: not arbitrarily, but rather in clusters, especially among historically marginalized populations (2, 86–88). This finding underscores the significance of cumulative ACEs on an individual's likelihood of developing chronic health conditions. Although we demonstrated a strong association between ACEs and chronic health conditions by comparing various base learners, including LR, Gaussian NB, SVM, RF, and KNN, future work is guaranteed to improve prediction accuracy. For example, we may employ stacked ensemble algorithms (e.g., XGBoost), which has been reported to improve classification with imbalanced data (89–91); this may enhance performance while requiring smaller degrees of undersampling, thereby allowing the use of a larger volume of data. Additionally, we may perform more extensive iterations of training and validation using a wider range of hyperparameters.

On a relative scale, the models for diabetes, pulmonary disease, and heart attacks performed particularly well, whereas models predicting kidney disease, high cholesterol, and asthma exhibited lower performance. Such discrepancies may be attributable to the varying importance of different variables in predicting distinct chronic health conditions. Similarly, Battineni and colleagues report that their ML models used different sets of variables to predict various chronic diseases in different populations, demonstrating no "gold standard" for ML methods to predict chronic diseases, including how to select and prioritize predictors (56). Despite improved interpretability, this unclarity could still compromise ML models' transparency and trustworthiness. To partially address the issue, future research could compare different sets of predictors across domains, ML models, and strategies for interpretability to analyze the commonalities and variations in model output.

In addition to the ACEs discussed above, the following were the most predictive variables across all models of chronic health conditions: age, ever monitored blood sugar or blood pressure, count of monitoring behaviors for blood sugar or blood pressure, BMI, time since last cholesterol check, employment status, income, vaccine count, and primary health insurance status. Previous literature has revealed that chronic health conditions are indeed associated with age (92); self-management (93, 94); BMI (95); employment, income, and wealth (96–98); immunization (99–103); health insurance (104, 105).

Our study findings undergird the pivotal role of preventing ACEs and socioeconomic inequalities in chronic disease prevention at the population level. Our ML models could enable data-driven screening for various chronic health conditions to identify high-risk individuals, explain the most influential underlying factors, and develop personalized prevention strategies.

Despite the strengths and contributions of our study, some limitations must be acknowledged. First, we analyzed self-reported data, which could have introduced biases (e.g., recall bias, social desirability bias, or misinterpretation of the questions), potentially affecting the accuracy and reliability of the developed models. However, such reporting biases are inherent in survey data and not unique to the BRFSS. In addition, the prevalence estimates in the BRFSS data are known to be consistent with comparable national surveys (i.e., National Health Interview Survey, National Health and Nutrition Examination Survey) (106, 107). More objective measures, such as biomarkers, should be analyzed to predict chronic health conditions more accurately in the future.

Second, our final dataset comprised mostly White and middle-income respondents. Consequently, the developed models may not predict chronic health conditions among disadvantaged populations at higher risk of ACEs (e.g., Black, Hispanic, or low-income individuals) as accurately as among more privileged populations (e.g., White or affluent individuals). Future studies are needed to develop ML models optimized for subpopulations, compare their performance to models with a pooled population, and consider potential differences in important variables or magnitudes in prediction. Stratification by subpopulation could partially mitigate the system-wide bias in collecting and processing data among different populations.

Third, our random sampling method to create an artificially balanced dataset for model training may misrepresent model performance. Random under-sampling increases the possibility that the model underperforms with "real-world" data, as the inflated proportion of positive cases in the training data may introduce greater false positives in real-world data. However, relative to other sampling methods, random under-sampling minimizes the risk of generalization error on test data (78–80).

Fourth, we encountered some hurdles with data availability. For instance, there were no core questions in the BRFSS regarding transportation, food security, and green space, which are crucial SDoH. Relatedly, other variables that represent determinants of health were not factored into our models due to insufficient data: sexual orientation, transgender status, nutrition, and marijuana consumption. Furthermore, we were unable to predict specific types of cancer, joint conditions, and pulmonary disease due to unavailable data.

Lastly, our ML models were trained and tested on unweighted data due to a lack of computing resources to model the weighted data. Hence, our unweighted ML models are limited in generalizability, and their performance is likely inflated to some degree compared to weighted models (108). With these limitations in data collection and modeling, our findings should be interpreted with caution. Our models should be viewed as supplementary tools for screening and decision-making, rather than a standalone, definitive prediction system for chronic health conditions.

6 Conclusion

To our knowledge, this is the first study to employ interpretable ML methods to model the syndemic interactions of ACEs, SDoH, health behaviors, and chronic health conditions using extensive data from a large national health survey in the U.S. Our findings highlighted the significance of preventing ACEs and mitigating their cumulative impact on chronic health conditions later in life. This study serves as an initial step toward developing a data-driven screening tool to identify U.S. adults at high risk of chronic health conditions, aiding in prevention and early intervention efforts. Our models also offer an interpretable and trauma-informed framework, aimed at reducing the persistent inequalities associated with early trauma and chronic health conditions among U.S. adults. Acknowledging the insights from Battineni et al., we underscore the importance of continuous validation and testing of our models to ensure their reliability and practical utility in multiple settings with different patient characteristics. ML models are bound to the data they train; therefore, the model parameters we have developed can be used as a baseline, upon which future research can develop contextualized models that will be re-fitted to other datasets of new patient populations to predict their chronic health conditions more accurately.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: https://www.cdc.gov/brfss/annual_data/annual_2021.html.

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements.

Author contributions

HA: Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Writing – original draft. TJ: Conceptualization, Data curation, Methodology, Project administration, Software, Writing – original draft. YM: Visualization, Writing – original draft. AM: Visualization, Writing – original draft. AS: Validation, Writing – review & editing. SK: Supervision, Validation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1309490/full#supplementary-material

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EDITED BY
Sangmi Kim,
Emory University, United States

REVIEWED BY
Melissa Osborne,
Kennesaw State University, United States
Paul Kwon,
US Army PEO STRI, United States

*CORRESPONDENCE
Anireddy R. Reddy
✉ Reddya2@chop.edu

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Child opportunity index is associated with pediatric firearm injury in Philadelphia, Pennsylvania

Anireddy R. Reddy[1,2,3]*

[1]Department of Anesthesiology and Critical Care Medicine, Children's Hospital of Philadelphia, The University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, United States, [2]PolicyLab, Children's Hospital of Philadelphia, Philadelphia, PA, United States, [3]Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, PA, United States

Introduction: Firearm injury is the leading cause of death in children. This study uses geospatial mapping to illustrate the burden of pediatric firearm injury in Philadelphia and assesses the relationship between Child Opportunity Index (COI) and injury, hypothesizing that lower COI zip codes would have higher injury and mortality rates.

Methods: Pediatric firearm injury data for children aged 0–19years in Philadelphia, from 2015 to February 2023, was visualized by race/ethnicity, fatal versus non-fatal status, and COI for zip code. COI was then dichotomized as “High” or “Low” based on nationally normed scores and used to compare incidence and odds of mortality. Injury incidence rates by COI were calculated using weighted Poisson regression, to adjust for the total number of children in each COI category. Odds of mortality by COI, adjusted for age, sex and race/ethnicity, were calculated using multivariable logistic regression.

Results: Of 2,339 total pediatric firearm injuries, 366 (16%) were fatal. Males (89%), adolescents (95%) and Black children (88%) were predominately affected. Geospatial mapping showed highest burden in North and West Philadelphia, which corresponded with areas of low COI. The incidence rate ratio (IRR) of injury in low COI zip codes was 2.5 times greater than high COI (IRR 2.5 [1.93–3.22]; $p<0.01$). After adjusting for age, sex, and race/ethnicity, odds of mortality in low COI zip codes was nearly twice that of high COI zip codes (aOR 1.95 [0.77–4.92]), though did not demonstrate statistical significance ($p=0.16$).

Conclusion: Child opportunity index is associated with pediatric firearm injury in Philadelphia, Pennsylvania.

KEYWORDS

geospatial analysis, child opportunity index, pediatric, firearm injury, social determinants of health

Introduction

Firearm injury is the leading cause of death in children (1). There are over 7,000 children affected annually (2), a number that has increased dramatically in the last few years (1, 3). The burden of firearm injury is intimately related to social determinants of health and physical environment, resulting in inequalities in firearm-related deaths by homicide, suicide, or accidental injury (4, 5). Geospatial analysis is one strategy to further understand the unequal distribution of firearm injury and has primarily been used to characterize adult firearm injury, with emerging pediatric data (6–9). Prior studies have shown associations between firearm injury and lack of green space (10), vacant lots (11, 12), different policing practices (13), and social vulnerability (14–16). However, these studies have focused primarily on adult populations, which have a different distribution of injury intent and mechanism compared to children (17), and do not account for particular neighborhood factors (such as proximity to childcare and schools) which may promote child health. The aim of this study was to use geospatial mapping to illustrate the burden of pediatric firearm injury in Philadelphia, Pennsylvania and to determine the relationship between a pediatric-specific measure of social determinants of health—the Child Opportunity Index (COI)—and pediatric firearm injury. The hypothesis was that zip codes with low COI would have higher incidence of pediatric firearm related injury and mortality.

Methods

Pediatric firearm injury data was publicly available from the Office of the Controller for the City of Philadelphia (18). Data for children aged 0–19 years was obtained from 2015 (earliest data available) through February 2023. Pediatric firearm injury and death were visualized by race/ethnicity, fatal vs. non-fatal status, and COI for zip code. Zip code data was missing for seven children. COI is an area-based index of social determinants of health for children (19) and was also available publicly. COI creates a score based on 29 indicators across education, health/environment, and socioeconomic domains (19). Each indicator is converted to a z-score (0–100), averaged, and then categorized into Very Low, Low, Moderate, High and Very High Opportunity based on nationally normed scores. Because of low numbers of injuries in the higher COI categories, COI was subsequently dichotomized into "High" or "Low" based on nationally normed z-score (0–49 for "Low" and 50–100 for "High") for regression analysis. Firearm injury (fatal and non-fatal) incidence rates by COI were calculated using weighted Poisson regression, in order to account for the total number of children in each COI category. The association between COI and fatal pediatric injuries was assessed using multivariable logistic regression, adjusting for age, gender, and race/ethnicity. Geospatial analysis was completed using ArcMap (ArcGIS Desktop: Release 10. Redlands, CA: Environmental Systems Research Institute). Standard descriptive statistics, Poisson regression, and logistic regression were completed in Stata (StataCorp. Stata 17. College Station, TX).

Results

During study period, there were 2,339 pediatric firearm injuries, 366 (16%) of which were fatal (Table 1). Males were affected more (89%) compared to females (11%) and almost all (95%) were adolescents (13–19 years of age). Non-Hispanic Black children were predominately affected (88%) followed by Hispanic (9%), White (3%) and Asian (<1%) children. Nearly all the injuries and deaths occurred in the Low and Very Low COI quintiles (98% of all injuries, 96% of deaths). Geospatial mapping showed highest burden of both injuries and deaths in North and West Philadelphia, predominately affecting Black and Hispanic children (Figure 1), which also corresponded with areas of low COI (Figure 2). The incidence rate ratio (IRR) of injury in low COI zip codes was 2.5 times greater than high COI zip codes (IRR 2.5 [1.93–3.22]; $p < 0.01$; Table 2). After adjusting for age, sex, and race/ethnicity, odds of mortality in low COI zip codes was nearly twice that of high COI zip codes (aOR 1.95 [0.77–4.92]), though did not demonstrate statistical significance ($p = 0.16$; Table 2).

TABLE 1 Characteristics of children with firearm injury in Philadelphia 2015–2023.

	Fatal	Nonfatal	Total
	N = 366 (16%)	N = 1,973 (84%)	N = 2,339 (100%)
Age			
0–5 years	10 (3%)	34 (2%)	44 (2%)
6–12 years	9 (2%)	59 (3%)	68 (3%)
13–19 years	347 (95%)	1,880 (95%)	2,227 (95%)
Sex			
Male	342 (93%)	1,735 (88%)	2,077 (89%)
Female	24 (7%)	238 (12%)	262 (11%)
Race/Ethnicity			
White (Non-Hispanic)	13 (4%)	49 (2%)	62 (3%)
Black (Non-Hispanic)	313 (86%)	1,737 (88%)	2,050 (88%)
Hispanic (Black or White)	38 (10%)	181 (9%)	219 (9%)
Asian	2 (<1%)	6 (<1%)	8 (<1%)
Child Opportunity Index (Nationally Normed)			
Very High	0 (0%)	4 (<1%)	4 (<1%)
High	5 (1%)	50 (3%)	55 (2%)
Moderate	1 (<1%)	14 (1%)	15 (1%)
Low	33 (9%)	139 (7%)	172 (7%)
Very Low	325 (89%)	1,761 (89%)	2,086 (84%)
Missing	2 (<1%)	5 (<1%)	7 (<1%)

Discussion

This retrospective geospatial analysis illustrates the unequally distributed burden of pediatric firearm injury and death in Philadelphia and demonstrates an association between low COI and pediatric firearm injury. These data showed non-Hispanic Black males and adolescents as being most affected, a trend which has been observed nationally (2). The association between lower COI and pediatric firearm injury also mirrors findings from a large national retrospective study using the Pediatric Health Information System (PHIS) database (6) as well as a city-level study assessing injury in Milwaukee (7). There is notable overlap of social determinants of

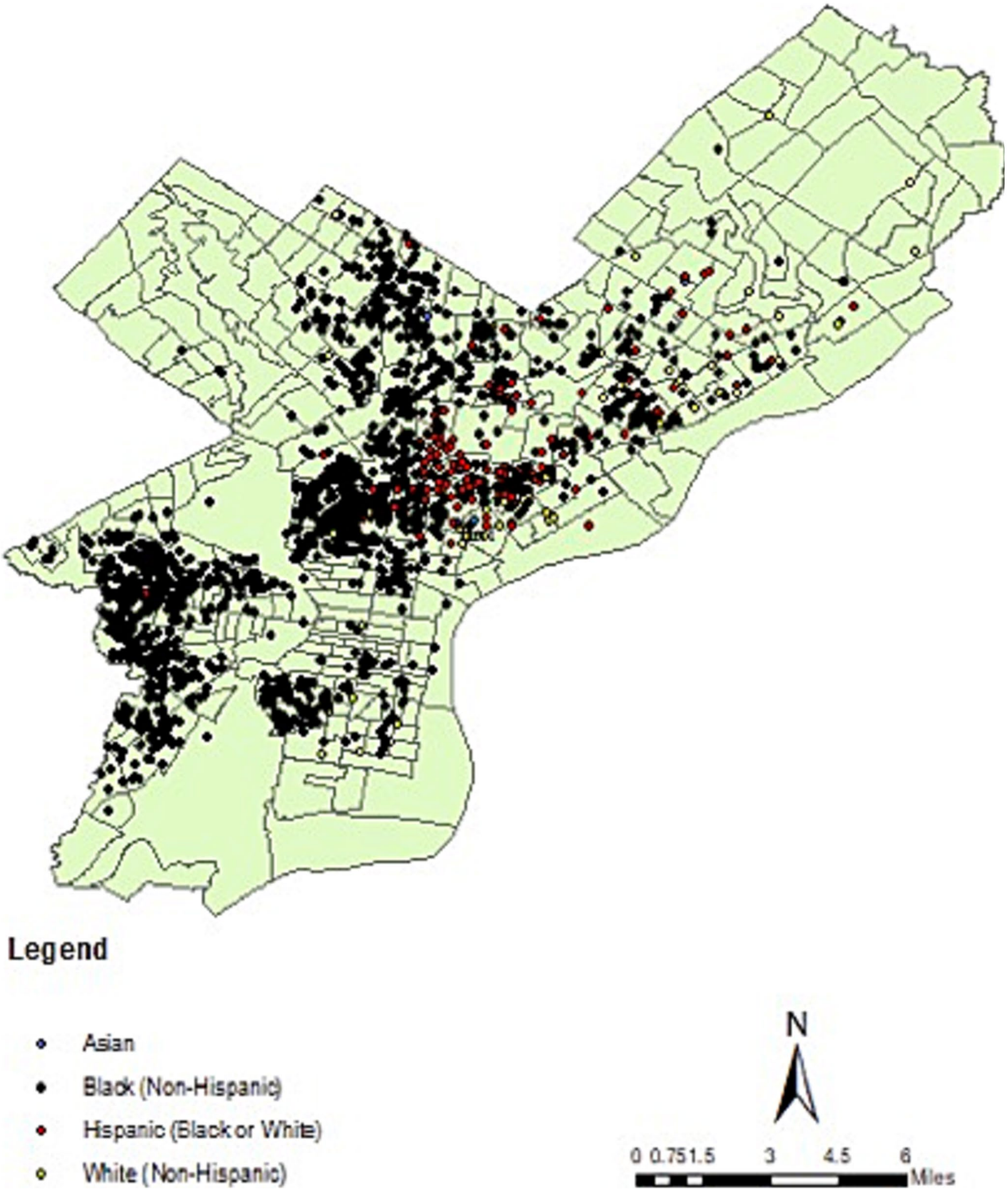

FIGURE 1
Pediatric firearm injury (fatal and non-fatal) in Philadelphia by race/ethnicity, from 2015 to 2023.

health, structural racism, and incidence of pediatric firearm injury. North and West Philadelphia demonstrated highest burden of firearm injury, with predominately Black and Hispanic children affected in these areas. While these areas overlap with Low or Very Low COI zip codes, race is not a full proxy for COI in this sample. After adjusting for race/ethnicity, there was nearly two-fold increased odds of firearm-related death in Low compared to High COI zip codes (Table 2), though this finding was not statistically significant. There is a wealth of literature which points to redlining, known as the historic racist lending practices of the Home Owners Loan Corporation, as the foundation for neighborhood level segregation and disparities seen today (20). At least one study found a statistically significant association between historically redlining and COI (21). With the caveat that this sample is limited, we see that COI, while co-linear with race, may contribute separately to both prevalence of firearm injury and increased odds of mortality by firearm injury.

Understanding the link between COI and pediatric firearm injury applies a child-focused lens to potentially modifiable economic, education, and health systems which may be protective against firearm injury. Further research is needed to understand what these factors may be in low COI neighborhoods and if they are

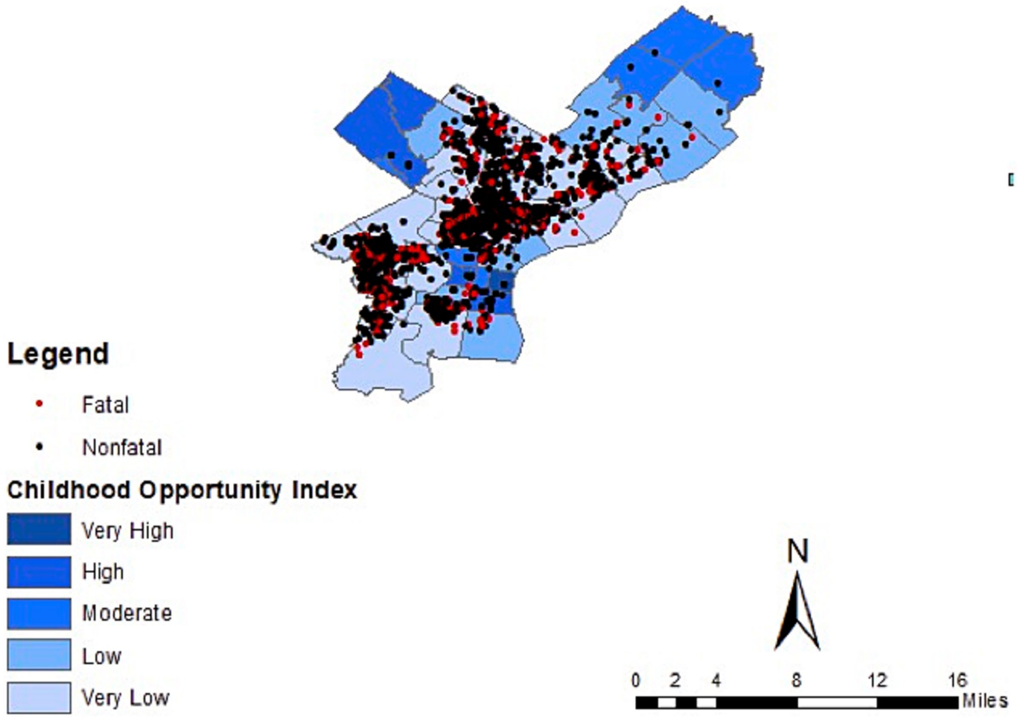

FIGURE 2
Pediatric firearm injury and death by child opportunity index in Philadelphia, from 2015 to 2023.

TABLE 2 Incident rate ratio and adjusted odds ratio of mortality by child opportunity index.

	Incidence rate ratio*		Adjusted odds ratio of mortality**	
Child opportunity index (dichotomized based on nationally normed z-score)	IRR [95% CI]	Value of *p*	aOR [95%CI]	Value of *p*
High	Ref	–	Ref	–
Low	2.5 [1.93–3.22]	<0.01	1.95 [0.77–4.92]	0.16

N = 2,332 (excludes seven patients for which COI not available). *Weighted Poisson regression to account for differences in population size in each COI category. **Adjusted for age, race/ethnicity, and sex.

amenable to intervention. While some of these factors, such as green space, walkability, and house vacancy have been associated with firearm injury and targeted for intervention (11, 12), there are other factors such as presence of early childhood education (ECE) centers, proximity to schools, toxic exposures (i.e., extreme heat exposure, industrial pollutants), food insecurity, employment rates and others which could be explored further. There are opportunities for targeted prevention efforts in areas with higher burden of injury, such as safe storage counseling (22, 23) and hospital-based violence intervention programs (24). There are additionally implications for emergency response systems and trauma care as geospatial access to care has been shown to be associated with firearm mortality in Philadelphia (25).

There are several limitations to this study. Firstly, because only zip code level data was available for the pediatric firearm injuries, it was not possible to do more granular analysis at the census-tract level. There exists heterogeneity within zip codes, and even block-to-block differences in COI, which is not accounted for in this study. Additionally, the most recent COI data is from 2020 and therefore may not be representative of the early end of the study period and cannot account for recent changes in both neighborhood exposures and trends in firearm injury during and after the COVID pandemic (3, 26, 27). This particular injury data set also does not have intent of injury (suicide, homicide, or accidental) which would be helpful to understand and develop potential interventions.

Conclusion

Retrospective geospatial analysis of pediatric firearm injury in Philadelphia demonstrates an association between low COI and pediatric firearm injury, with children in low COI zip codes experiencing 2.5 times greater incidence of injury compared to high

COI zip codes. While odds of mortality in low COI zip codes was nearly double that of high COI zip codes, it did not demonstrate statistical significance. This evidence suggests strong interplay between structural racism, social determinants of health, and burden of pediatric firearm injury and high-risk areas should be targeted for intervention.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

AR: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Dabney Evans,
Emory University, United States

REVIEWED BY
MD Rakibul Hasan,
Anglia Ruskin University, United Kingdom
Irene Minja,
Muhimbili University of Health and Allied Sciences, Tanzania

*CORRESPONDENCE
Jessica M. Sales
✉ jmcderm@emory.edu

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Experiences of childhood, intimate partner, non-partner, and hate crime-related violence among a sample of people living with HIV in the epicenter of the U.S. HIV epidemic

Jessica M. Sales[1]*, Katherine M. Anderson[1], Melvin D. Livingston[1], Sophia Garbarino[1], Selaem Hadera[1], Eve S. Rose[1], Madelyn S. Carlson[1] and Ameeta S. Kalokhe[2,3]

[1]Department of Behavioral, Social, and Health Education Sciences, Emory University Rollins School of Public Health, Atlanta, GA, United States, [2]Department of Medicine, Emory University School of Medicine, Atlanta, GA, United States, [3]Hubert Department of Global Health, Emory University Rollins School of Public Health, Atlanta, GA, United States

Introduction: Experiences of violence among people living with HIV (PLWH) are thought to be highly prevalent but remain inadequately captured. As a first step toward acceptable, trauma informed practices that improve engagement and retention in care for PLWH, we must acquire more comprehensive understanding of violence experiences. We examined experiences of various forms of lifetime violence: adverse childhood experiences (ACES), intimate partner violence (IPV), non-partner violence (NPV), and hate crimes among diverse sample of PLWH in Atlanta, Georgia.

Methods: Cross sectional data collected from in- and out-of-care PLWH (*N* = 285) receiving care/support from Ryan White Clinics (RWCs), AIDS Service Organizations (ASOs), or large safety-net hospital, February 2021–December 2022. As part of larger study, participants completed interviewer-administered survey and reported on experiences of violence, both lifetime and past year. Participant characteristics and select HIV-related variables were collected to further describe the sample. Univariate and bivariate analyses assessed participant characteristics across types of violence.

Results: High prevalence of past violence experiences across all types (ACES: 100%, IPV: 88.7%, NPV: 97.5%, lifetime hate crimes 93.2%). People assigned male at birth who identified as men experienced more violence than women, with exception of non-partner forced sex. Participants identifying as gay men were more likely to have experienced violence.

Conclusion: Among our sample of PLWH at the epicenter of the United States HIV epidemic, histories of interpersonal and community violence are common. Findings emphasize need for RWCs, ASOs, and hospital systems to be universally trained in trauma-informed approaches and have integrated onsite mental health and social support services.

KEYWORDS

interpersonal violence, ACES, intimate partner violence, hate crimes, people living with HIV

1 Introduction

Violence is increasingly recognized as a major public health problem. The spectrum of types of violence individuals encounter is vast, including adverse childhood experiences (ACEs), intimate partner violence (IPV), community-based violence (i.e., non-partner physical and sexual assault, hate crimes, gang violence), terrorism and war/combat. Though no individual is immune to violence, violence is disproportionately experienced by certain populations. For instance, while experienced by 1 in 7 United States (US) children (1). ACEs are disproportionately reported by individuals residing in Black, low-income, and urban communities (2–5). Maguire-Jack et al. (3) found that among a national child sample, Black children were significantly more likely to have ACE exposures than white children, with 64% of Black children having at least one ACE exposure compared to 41% of white children (3). Another national study found that compared to all other income groups, people with annual incomes lower than $15,000 had significantly higher ACE exposure (4). Additionally, hate crimes are more common among sexual and gender minority (SGM) populations (6, 7); an estimated 20% of SGM Americans have experienced a hate crime (8). Flores et al. (6) found that lesbian, gay, bisexual, and transgender (LGBT) individuals are nearly 9 times more likely to experience a violent hate crime than non-LGBT people. Sexual violence and intimate partner violence are higher among women than men;- compared to one in 13 men, nearly one in five women report contact sexual violence in the US (9). Forty-seven percent (47%) of women versus 44% of men in the US report lifetime contact sexual violence, physical violence, and/or stalking by an intimate partner (9). Overall, exposure to violence varies significantly by race, ethnicity, sexual orientation, gender identification, geographic location, and more (8).

There are over 1.2 million people living with HIV (PLWH) in the US, with over 36,000 new diagnoses in 2021 alone (10). HIV is disproportionally prevalent among historically under-resourced groups, including men who have sex with men (MSM), Latinx individuals, and Black women (10). In 2021, MSM and Latinx individuals accounted for 67 and 29% of all HIV diagnoses, respectively, while Black women accounted for 57% of HIV diagnoses among females (10). HIV increasingly impacts trans individuals, with diagnoses rising 74% among trans men and 21% among trans women between 2017 and 2021 (10). These HIV disparities are largely driven by homophobia, racism, stigma, and poverty (10). Perhaps unsurprisingly given who is most burdened by HIV in the US and the intersecting identities that many people with HIV hold (e.g., being female, being Black; being gay, being Latinx), PLWH also report experiencing violence at rates greater than those without HIV. For example, intimate partner violence is experienced by 68–95% of cisgender women with HIV (11), 68–77% of cisgender men with HIV, and 93% of transgender PLWH (11–13). A small qualitative study suggests that MSM with HIV may experience intimate partner violence at even higher rates than women with HIV (12). Specific to experiences of childhood violence, Henny et al. found that 53 and 39% of PLWH experienced childhood physical and sexual abuse, respectively (14), and another study found that reports of childhood physical and sexual abuse were significantly higher among women with HIV compared to those without HIV (15). Non-partner violence is also disproportionately experienced by those with HIV, as illustrated by a study among female sex workers which found that those with HIV were nearly four times more likely to experience physical and sexual violence than those without HIV (16).

As an upstream determinant of health, violence has direct effects on HIV care engagement and HIV viral suppression. It also has indirect effects through mental health and substance abuse pathways (17). Therefore, violence screening and intervention could be a critical first step in reducing mental health disorders, substance use disorders (SUDs), and downstream HIV-associated morbidity and mortality. Violence is often considered a traumatic experience. As defined by the American Psychiatric Association, a traumatic experience involves a threat to one's physical or emotional well-being, and elicits intense feelings of helplessness, terror or lack of control (18). Such experiences can alter a person's perception of themselves (e.g., self-efficacy), their environment (e.g., reaction to clinic environment and medical procedures), and the people around them (e.g., trust in providers) (18). The downstream negative effects of violent traumas, particularly IPV, are apparent on mental health (i.e., depression, post-traumatic stress disorder (PTSD), SUDs) (19–21), and HIV-related outcomes (i.e., CD4, viral load, opportunistic infections, AIDS mortality) (22–25).

Unfortunately, our understanding of the impact of violence on HIV outcomes and care engagement is largely limited to IPV experiences of heterosexual women or childhood experiences of violence (11, 26–31). Relatively little is known about the experiences of PLWH across multiple types of violence, the impact of other types of violence on HIV care continuum outcomes, and if and how experiences of violence differ by sex and gender. Acquiring a more comprehensive understanding of experiences of violence among both males and females with HIV, holding multiple intersecting identities, is a necessary first step to help tailor and prioritize violence screening and intervention practices for PLWH to address violence as a critical but often unaddressed social determinant of health. Thus, to begin filling this gap we examined experiences of various forms of lifetime interpersonal and community violence in a diverse sample of PLWH in the Southern US.

2 Materials and methods

2.1 Study overview

As part of a larger quantitative study of violence experiences among PLWH and their impact on HIV care outcomes, between February 2021–December 2022 we conducted a cross-sectional survey among PLWH ($N = 285$) in Atlanta, Georgia to assess the comprehensive experiences of various forms of lifetime interpersonal and community violence.

2.2 Study setting

The epicenter of the US HIV epidemic is in the southeastern region (10). The state of Georgia has the highest rate of new infections and over half of those infections occur in the Atlanta metropolitan area (32). This region experiences high poverty, unemployment, racism, transphobia/homophobia, and poor access to healthcare (33) and is home to eight of ten states with the highest rates of new HIV diagnoses and AIDS (10). The Southeast alone (Alabama, Florida, Georgia, Kentucky, Mississippi, North Caroline, South Carolina Tennessee – Department of Health and Human Services (DHHS) Region IV) contains six of the most highly impacted states (10), with Florida, Georgia, North Carolina, and Tennessee containing 13 of the 48 counties identified as high priority for the Ending the HIV Epidemic initiative (34). The study was conducted in nineteen HIV service or research settings in four Ending the HIV Epidemic (35) priority counties that make up the Atlanta metropolitan area (Fulton, Dekalb, Cobb, and Gwinnett): two Ryan White-funded clinics (RWCs) that combined serve more than 8,000 PLWH and affiliated hospital system; eight independent RWCs; eight AIDS service organizations (ASOs); and one community-based clinical research site. These study settings were selected to enable recruitment of individuals who were retained and not retained in HIV care, recognizing the breadth and magnitude of violence experiences would likely differ between these groups.

2.3 Data collection

Participants completed a one-time interviewer-administered survey, provided a blood sample for HIV viral load, and completed a Release of Information form and Health Insurance Portability and Accountability Act (HIPAA) authorization form for review of medical records. Study tools and protocols were reviewed by and edited to include feedback from two Ryan White CABs and ASO board members to increase acceptability of the study.

All participants provided written informed consent prior to their participation. Surveys were administered by study staff trained in data collection and trauma-informed research methods (36–38) in a private one-on-one setting and lasted approximately 60 min. Surveys were programed in REDCap and included questions about interpersonal and community violence experiences, mental health and substance use, resilience, quality of life, HIV history, and demographics. English and Spanish versions of the survey were available, and research staff were fluent in both languages. Significant efforts were made by study staff to ensure that privacy was maintained during the interviews. Participants were informed during the consent process that if privacy were disrupted during the interview, the research staff would pause the interview and switch subjects to avoid disclosure of the study's focus. Staff ensured the participants' understanding of the consent process and informed them that they could pause or exit the survey at any time if they wished. Recognizing the sensitivity of the information requested and in line with trauma-informed research methods, study staff spent significant time establishing rapport with participants prior to survey administration. Upon completion, all participants (regardless of violence disclosure) received a resource guide on community-located trauma support services that was concealed in a list of other social and community services to ensure they had access to potentially helpful resources. Further, all participants received $75 USD in cash for participation.

2.4 Research ethics

The development of the study protocol and team training were informed by the World Health Organization ethical and safety recommendations for domestic violence research (39). The study team underwent research ethics training, as well as training trauma-informed research methods, which emphasized the importance of establishing rapport, ensuring privacy/confidentiality of study data, noting signs of adverse emotional reactions, and methods for offering and facilitating referral to mental health or other trauma support services. Strict procedures were followed to minimize loss of confidentiality. All survey data were coded with a study ID number but otherwise de-identified and consent forms with participant identifying data as well as the master list linking study ID numbers to participant names were both kept in a locked filing cabinet in a secured office, separate from the de-identified study data. All study procedures were approved by the Emory Institutional Review Board (IRB00117548). Additionally, the team consulted two Ryan White CABs to determine equitable participant compensation. Finally, recognizing the potential emotional toll of these research activities on study team members, all data collectors were provided with resources on trauma and mental health support services available to them through the university. Staff were also asked to participate in weekly team debriefing sessions, encouraged to take time off from the study as needed.

2.5 Eligibility and recruitment

To be eligible for the study, participants needed to be living with HIV, age ≥ 18 years, have capacity to consent, and speak either English or Spanish fluently. Purposive sampling was employed to reach PLWH across gender, race/ethnicity, and HIV care retention status (retained vs. out of care (OOC)). Participants at outpatient clinics were recruited passively through flyers and word-of-mouth and actively through direct in-person contact via a recruitment table. Participants were recruited from the ASOs through flyers and word-of-mouth. Recruitment efforts in both of these settings were bolstered through Ryan White community advisory board (CAB) and ASO board support and dissemination efforts, including troubleshooting recruitment efforts. Participants in the hospital setting were identified through examination of inpatient social worker lists of admitted PLWH. Once a potentially eligible participant was noted, the primary medical team was contacted to assess whether the patient was medically stable and had capacity to participate in a one-hour interview, and to confirm the patient was not on COVID-19 isolation precautions. These efforts were supplemented by identification of potential participants through registries of PLWH who had previously expressed interest in research participation. These individuals were contacted by email and/or phone to assess interest and eligibility for enrollment.

2.6 Measures

2.6.1 Participant characteristics

Participants were asked to report sex assigned at birth, current gender identification, sexual orientation, race, ethnicity, highest level of educational attainment, employment status, annual household income, marital status and past-year relationship status. Additionally, participants responded to questions about the year they received an HIV diagnosis, how long ago they began receiving HIV care, whether they currently have a clinic where they receive HIV care, and if so, how long they have received care at that location. Finally, viral load was collected to assess level of viral suppression and chart data was extracted to assess retention in care to further characterize the sample.

2.6.2 Violence exposure

Exposure to ACEs was captured using the Childhood Trauma Questionnaire- Short Form (CTQ-SF) (40), a 28-item measure with response options on a five-point scale from "Never True" to "Very Often True." The CTQ-SF captures two domains of ACEs- neglect and abuse- with neglect comprised of two subtypes (emotional and physical) and abuse comprised of three subtypes (emotional, physical, and sexual). Each ACE subtype is measured using five questions (25 questions total across all subtypes), and three additional questions capture minimization and/or denial of ACEs. Dichotomous variables were created for any ACE, each ACE domain (neglect and abuse), and each ACE subtype (emotional and physical neglect and emotional, physical, and sexual abuse). For each variable, a participant was coded as "1" for lifetime ACE if they responded "yes" to any question within the overall scale, domain sub-scale, or subtype sub-scale, respectively. Items capturing minimization/denial of ACEs were not used for this analysis.

Experience of IPV was measured using the Revised Conflict Tactics Scale (CTS2) (41), a 39-item scale that captures psychological (8 items) and physical attacks (12 items), sexual coercion (7 items), physical injury (6 items), and use of negotiation (6 items) in intimate partnerships. For each prompt, participants were asked to indicate frequency of occurrence, with response options including "This has never happened," past-year occurrence of "once," "twice," "3–5 times," "6–0 times," "11–20 times," or "more than twenty times," or, "not in the past year, but it did happen before." Dichotomous variables were created for each IPV subtype (psychological, physical, sexual, injury), with each variable coded as "1" if a respondent indicated ever-experience of at least one subscale item. In a separate variable, if participants indicated any IPV experience during the past year, they were coded as "1" for past-year IPV. Items capturing negotiation were not used in the current analysis.

Non-partner violence (NPV) was captured using items from the Trauma History Questionnaire (THQ) (42), a 24-item measure of traumatic lifetime events. For each event, participants are asked to indicate if they have experienced it (yes/no), the approximate number of times they have experienced it, the approximate ages as which they experienced it, and if applicable, the participant's relationship to the perpetrator. *Crime* was measured using four items, including having someone "take something directed from you by using force or threat of force," "attempt to rob you or actually rob you," or "attempt to or access in breaking into your home when you were (not there/there)." If a participant indicated "yes" to any of these four items, they were coded as having experienced crime-related NPV. S*exual violence* was measured using three items; if a participant indicated prior experience of any of these items, they were classified as having experience of sexual violence. The items included being made to "have intercourse or oral or anal sex against your will," having someone who "touched private parts of your body, or made you touch theirs, under force or threat," and "situations in which another person tried to force you to have unwanted sexual contact" other than that which was captured by the previous two items. Each of these items was also considered as independent dichotomous variables of "forced sex," "unwanted physical touch," and "other sexual violence." Three types of physical attacks were captured, each measured dichotomously with one item: ever being attacked by someone (including family or friends) with a gun, knife, or other weapon; ever being attacked by someone (including family or friends) without a weapon; ever being beaten, spanked, or pushed by a family member hard enough to cause injury. These three questions were also aggregated into a single dichotomous variable indicating ever experience of physical violence by a family or non-family member.

Finally, experience of hate crimes was measured using an adapted version of the Anti-Gay Violence and Victimization scale, modified to include other primary reasons for discrimination/hate crime (32, 43). Twelve prompts included experiences that "might have been motivated by prejudice by others" such as "had verbal insults directed at you," "been chased or followed," and "been harassed by police (without assault)." Participants indicated if they have experienced each "never," "at least once in my lifetime," or "in the past year." Respondents indicating lifetime or past-year experience of any hate crime were classified as having experienced a hate crime in their lifetime; respondent indicating only past-year experience of a hate crime were classified as having experienced a past-year hate crime.

2.7 Statistical analysis

Univariate and bivariate analysis were conducted in SAS 9.4. Means and standard deviations are reported for normally distributed continuous variables, and median and interquartile range (IQR) are reported for non-normally distributed continuous variables. Bivariate analyses were run using chi-square tests, and Fisher's exact test when cell sizes were below 5. Significance was set at a level of $p < 0.05$. For bivariate analyses involving current gender identification, individuals identifying as transgender women or transgender females were grouped with individuals identifying as cisgender female/women; no participants identified as transgender male/men. Due to sub-sample size limitations, individuals identifying as gender queer or gender non-conforming ($n = 3$) or other ($n = 1$) were not included in gender identity analysis. Missingness was limited in the interview data (<5%) with the exception of length of receipt of HIV care (8.8% missing). Past 24-month medical record data was available for 72.6% of participants, while past 12-month medical record data was available for 90.5% of participants. Percents represent prevalence out of those with available data.

3 Results

3.1 Participant characteristics

Participants ($N = 285$) were primarily assigned male at birth (69.12%) and currently identified as men (63.86%); 42% of the sample identified as gay, lesbian, queer, same gender loving, or homosexual, including approximately 60% of individuals currently identifying as men (Table 1). Participants were 90.5% Black or African American and 7.7% White, while 7.1% reported Hispanic or Latinx ethnicity. Based on sex and race/ethnicity, our sample is generally representative of the Georgia HIV epidemic. According to the Georgia Department of Public Health, among people diagnosed with HIV in Georgia in 2019, 79% were male, 71% were Black, 10% were Hispanic, and 67%

TABLE 1 Characteristics of PLHW, Atlanta, GA, 2021–2022 (*N* = 285).

Age, median (IQR)	50 (22)	
Sex Assigned at Birth	Male	197 (69.12)
Gender, *n* (%)	Woman	90 (31.58)
	Man	182 (63.86)
	Transgender female/woman	9 (3.16)
	Transgender male/man	0
	Genderqueer or Gender Non-Conforming	3 (1.05)
	Other	1 (0.35)
Race, *n* (%)	American Indian or Alaskan Native	1 (0.35)
	Asian	0
	Black or African American	258 (90.53)
	Native Hawaiian or Pacific Islander	0
	White	22 (7.72)
	Multiracial	3 (1.05)
	Other	1 (0.35)
Ethnicity, *n* (%)	Hispanic/Latinx	20 (7.09)
Sexual Orientation, *n* (%)	Bisexual	32 (11.23)
	Gay, Lesbian, Queer, Same Gender Loving, or Homosexual	120 (42.11)
	Straight/Heterosexual	127 (44.56)
	Other	6 (2.11)
Educational Attainment, *n* (%)	High School Diploma, GED, or Less	136 (47.72)
	Some College, Technical school, or Vocational School	105 (36.84)
	4 Years of College or More	44 (15.44)
Employment Status, *n* (%)	Employed	95 (33.33)
Annual Household Income among Employed Participants (*n* = 95), *n* (%)	Less than $10,000	10 (10.64)
	$10,000–$19,999	15 (15.96)
	$20,000–$39,999	41 (43.62)
	$40,000–$59,999	17 (18.03)
	$60,000 or more	11 (11.70)
Marital status, *n* (%)	Single, never married	206 (72.54)
	Married or domestic partnership	30 (10.56)
	Widowed	11 (3.87)
	Divorced	37 (13.03)
Relationship status, *n* (%)	Partnered in Past 12 Months	133 (46.67)
Years since HIV Diagnosis, mean (SD)	16.38 (10.18)	
Years of HIV Care Engagement, mean (SD)	14.23 (9.10)	
Current HIV Care Clinic, *n* (%)	Yes	274 (96.48)
Years of Engagement with Current Clinic, median (IQR)^	2 (1)	
Retention in HIV Care, past 24 months	119 (44.24)	
Engagement in HIV Care, past 6 months	223 (82.59)	
Ever Virally Suppressed, past 24 months	237 (86.81)	
Durable Viral Suppression, past 24 months	145 (69.38)	
Ever Virally Suppressed, past 12 months	253 (89.61)	
Durable Viral Suppression, past 12 months	188 (72.31)	

^Of those with current HIV care clinic (*n* = 274).

were MSM (44). Almost half of participants (47.7%) had a high school degree, GED, or less, while 36.8% had completed at least some college, technical, or vocational school (84.56%). Most participants were unemployed (66.7%), while those who were employed had an annual household income less than \$40,000. Most participants had never been married (72.5%), and just under half had been partnered in the past 12 months (46.7%). Participants had been diagnosed with HIV a mean of 16.4 years ago (SD: 10.2) and had been engaged in care 14.2 years (SD: 9.1); of 96.5% with a current HIV care clinic, median time since they began receiving services at that clinic was 2 years (IQR:1). Most participants had been engaged in HIV care in the past 6 months (82.6%), but notably fewer had been engaged in care regularly over the past 24 months (44.2%). Eighty-six percent of the sample had been virally suppressed at some point during the 24 months prior to study enrollment, while 69.4% had been virally suppressed for the entire 24 months prior to enrollment. Similarly, just under 90% of participants had been virally suppressed at any point during the past 12 months, and 72.3% have been continuously virally suppressed.

3.2 Violence exposure

Prevalence of previous experiences of violence among the sample was variable by type of violence. All participants had experienced at least one adverse childhood experience (ACE), including at least one type of neglect (emotional or physical), while 93.8% had experienced some type of abuse (emotional, physical, or sexual) (Table 2). Almost 90% of participants had experienced lifetime intimate partner violence (IPV, 88.7%) or past-year IPV (87.4%, among those with past-year partnerships); experiences of IPV were largely similar between male and female participants. However, lifetime IPV resulting in injury was significantly higher among males when compared to females (38.8% vs. 20.8%, $p = 0.0331$). Ninety-seven percent of participants had experienced non-partner violence, with males assigned at birth reporting significantly higher prevalence of crime than females (81.7% vs. 53.4%, $p < 0.001$), and females reporting significantly higher prevalence of non-partner forced sex (50.0% vs. 33.5%, $p = 0.0084$). Males also reported higher lifetime and past year prevalence of hate crimes compared to women (96.9% vs. 85.2%, $p = 0.0003$, and 49.7% vs. 33.0% $p = 0.0086$, respectively). In analyses conducted by how participants currently identified their gender (Table 3) results were generally similar; all significant associations by sex assigned at birth retained significance, with the exception of IPV causing injury.

Among participants currently identifying as men, several significant differences in violence experiences were apparent by sexual orientation (Table 4). Prevalence of childhood emotional, physical, and sexual abuse varied significantly across sexual orientation, with gay men reporting the highest prevalence of each emotional (87.1%), physical (93.6%), and sexual abuse (74.3%), followed by bisexual men (84.6, 84.6, and 65.4%) and heterosexual men (68.3, 78.1, 39.0%, $p = 0.0300$, $p = 0.0200$, and $p = 0.0003$, respectively). Similar relationships were seen across non-partner forced sex, with 40.0% of gay, 36.0% of bisexual, and 12.2% of heterosexual men reporting previous experiences ($p = 0.0051$). By contrast, bisexual men were most likely to report previous experience of physical attack without a weapon (44.0%) or physical attack by a family member resulting in injury (32.0%) compared to gay men (18.0 and 28.8%) and heterosexual men (9.8% for both, $p = 0.0287$ and $p = 0.0040$, respectively). Finally, bisexual men were least likely to report a lifetime hate crime experience (88.5%) compared to heterosexual (95.1%) and gay men (100.0%, $p = 0.0040$).

4 Discussion

Over the past two decades, the link between experience of violence and poor HIV outcomes has been well-established (21, 23–25), with numerous national advisory groups and agencies calling for integration of violence screening and support within HIV services (45–47). The bulk of this literature has been in cis-gender women and has been limited to exploration of IPV and childhood abuse histories (11–13, 15–17, 30, 31, 48). The present study is the first study to our knowledge to comprehensively explore interpersonal and community forms of violence among PLWH across gender and sexual orientation, including both those retained and out of HIV care, in one sample. In doing so, it elucidates the many forms of violence health systems and ASOs should be equipped to screen and provide support for, and further emphasizes the importance of integrating trauma-informed care in these settings.

The experience of the various forms of violence reported in our study is similar and/or higher to other studies of PLWH. For example, 100% of our sample reported at least one ACE and nearly all (94%) reported experiencing physical, sexual, and/or emotional abuse as a child. In a study of 584 PLWH at risk for alcohol use disorders, the majority of whom were white men, 83% reported experience of at least one ACE and reporting of childhood abuse was lower than our sample (i.e., 46% vs. 80% for emotional abuse; 34% vs. 86% for physical abuse; 26 vs. 66% for sexual abuse) (31). A recent systematic review of global studies exploring impact of childhood sexual violence on antiretroviral therapy adherence, found reporting of childhood sexual violence ranged from 7–55% (30). Although tools used to assess violence experience differed, frequencies were substantially lower than that reported in our sample (30). In our sample, nine in ten reported lifetime and past-year IPV. These frequencies are also higher than estimates provided by a recent meta-analysis of 49 studies worldwide examining IPV among PLWH (39% vs. 89% any IPV; 28% vs. 86% emotional IPV; 26% vs. 41% physical IPV, and17% vs. 30% sexual IPV) (48). Experience of NPV in our sample is similar to other studies of PLWH. Specifically, over 90% of females in our sample reported experiencing NPV of some type, which is slightly higher, but in line with a sample of Canadian women with HIV reporting 81% experiencing NPV in their lifetime (49). It should be noted that the literature is very limited on NPV among PLWH, as most studies do not provide violence data by perpetrator, thus our findings add substantially to the field. Finally, experience of hate crimes among our sample was high (93% reported lifetime experience of a hate crime; 44% reported a past year experience of a hate crime), which is higher than reported in other studies of PLWH, including one study among transgender women reported 46% had experienced a transphobic hate crime, although this study only examined experiences of hate crimes related to being transgender and not other aspects of their identity such as race/ethnicity (50). Though we cannot ascertain why there are similarities and differences between our sample and others reported in the literature across an

TABLE 2 Violence Exposure among PLWH, All and by Sex Assigned at Birth, Atlanta, GA, 2021–2022 ($N = 285$).

	All, N (%) *N* = 285	Sex Assigned at Birth, *N* (%) *N* = 285		*p*
		Male n = 197	Female n = 88	
Any Adverse Childhood Experience (ACE)	269 (100.00)	187 (100.00)	82 (100.00)	–
Any ACE, Subtype: Neglect	279 (100.00)	194 (100.00)	85 (100.00)	–
Emotional Neglect	279 (100.00)	194 (100.00)	85 (100.00)	–
Physical Neglect	284 (100.00)	196 (100.00)	88 (100.00)	–
Any ACE, Subtype: Abuse	257 (93.80)	179 (94.71)	78 (91.76)	0.3500
Emotional Abuse	226 (80.43)	160 (82.47)	66 (75.86)	0.1965
Physical Abuse	241 (85.77)	170 (87.63)	71 (81.61)	0.1818
Sexual Abuse	185 (66.07)	126 (65.28)	59 (67.82)	0.6789
Any Lifetime Intimate Partner Violence (IPV)*	118 (88.72)	78 (91.76)	40 (83.33)	0.1399
Psychological IPV	116 (87.22)	76 (89.41)	40 (83.33)	0.3133
Physical Assault IPV	64 (48.12)	45 (52.94)	19 (39.58)	0.1387
Sexual IPV	46 (34.59)	33 (38.82)	13 (27.08)	0.1716
Injury IPV	43 (32.33)	**33 (38.82)**	**10 (20.83)**	**0.0331**
Any Past-Year Intimate Partner Violence (IPV)*	111 (87.40)	74 (90.24)	37 (82.22)	0.1926
Psychological IPV	111 (86.05)	73 (87.95)	38 (82.61)	0.4015
Physical Assault IPV	55 (41.35)	38 (44.71)	17 (35.42)	0.2961
Sexual IPV	40 (30.30)	29 (34.12)	11 (23.40)	0.1997
Injury IPV	34 (25.76)	26 (30.95)	8 (16.67)	0.0710
Any Non-Partner Violence (NPV)	267 (97.45)	184 (97.87)	83 (96.51)	0.6816
NPV: Crime	208 (72.98)	**161 (81.73)**	**47 (53.41)**	**<0.001**
NPV: Sexual Violence	192 (68.82)	132 (69.11)	60 (68.18)	0.8764
NPV: Forced Sex	109 (38.65)	**65 (33.51)**	**44 (50.00)**	**0.0084**
NPV: Unwanted Physical Touch	90 (32.03)	62 (32.12)	28 (31.82)	0.9593
NPV: Other Sexual Violence	32 (11.43)	22 (11.46)	10 (11.36)	0.9816
NPV: Physical Attack	111 (39.22)	70 (35.90)	41 (46.59)	0.0881
NPV: Physical Attack with a Weapon	100 (35.34)	70 (35.90)	30 (34.09)	0.7685
NPV: Physical Attack without a Weapon	54 (19.08)	39 (20.00)	15 (17.05)	0.5582
NPV: Family-Perpetuated Injury	63 (22.26)	48 (24.62)	15 (17.05)	0.1565
Ever Experience of a Hate Crime	262 (93.24)	**187 (96.89)**	**75 (85.23)**	**0.0003**
Past-Year Experience of a Hate Crime	125 (44.48)	**96 (49.74)**	**29 (32.95)**	**0.0086**

*Among partnered individuals, $n = 127$.

array of violence exposures, it is abundantly clear that in studies among PLWH, including ours, violence experiences are excessively common among this population.

Our study further expands the literature on violence experienced by PLWH by including individuals assigned male and female at birth in a single sample, thus allowing us to examine differences in violence experiences by sex. Overall, violence was ubiquitous and very few statistically significant differences were identified, with two notable exceptions. Crime (of various forms, including hate crimes) was experienced significantly more among individuals assigned male at birth than female at birth, and non-partner sexual violence was experienced more among individuals assigned female at birth than male at birth. Notably, rates of IPV were similarly high across males and females, with males reporting more IPV-associated injury requiring treatment than females.

National healthcare organizations including Health Resources and Services Administration (HRSA) have put forth recommendations for integrating IPV screening and intervention within healthcare settings, and the Affordable Care Act includes screening and brief counseling for IPV as part of required free preventive services for women. In support of the recommendation, HRSA cites the efficacy of IPV screening alongside provision of education about support services in enhancing support service utilization, mental and physical health, and safety, and reducing incident IPV (51, 52). Additionally, the HIV Primary Care Guidelines of the Infectious Diseases Society of America now recommend screening for IPV at initial evaluation and "periodic

TABLE 3 Violence Exposure by Gender Identity among PLWH, Atlanta, GA, 2021–2022 ($N = 281$).

	Gender, *N* (%)		
	Man *N* = 182	Cis/Trans Woman *N* = 99	*p*
Any Adverse Childhood Experience (ACE)	173 (100.00)	93 (100.00)	–
Any ACE, Subtype: Neglect	179 (100.00)	96 (100.00)	–
Emotional Neglect	179 (100.00)	96 (100.00)	–
Physical Neglect	181 (100.00)	99 (100.00)	–
Any ACE, Subtype: Abuse	166 (94.86)	88 (91.67)	0.3002
Emotional Abuse	148 (82.68)	74 (76.51)	0.1525
Physical Abuse	159 (88.83)	79 (80.91)	0.0602
Sexual Abuse	117 (65.36)	66 (67.35)	0.7388
Any Lifetime Intimate Partner Violence (IPV)*	70 (92.11)	46 (83.64)	0.1330
Psychological IPV	68 (89.47)	46 (83.64)	0.3265
Assault IPV	40 (52.63)	23 (41.82)	0.2215
Sexual IPV	28 (36.84)	17 (30.91)	0.4804
Injury IPV	27 (35.53)	14 (25.45)	0.2199
Any Past-Year Intimate Partner Violence (IPV)*	67 (90.54)	42 (82.35)	0.1781
Psychological IPV	65 (87.84)	44 (83.02)	0.4426
Assault IPV	33 (43.42)	21 (38.18)	0.5477
Sexual IPV	25 (32.89)	14 (25.93)	0.3929
Injury IPV	21 (27.63)	11 (20.37)	0.3436
Any Non-Partner Violence (NPV)	169 (97.69)	94 (96.91)	0.7044
NPV: Crime	**148 (81.32)**	**56 (56.57)**	**<0.001**
NPV: General Violence	169 (94.94)	92 (94.85)	0.9717
NPV: Sexual Violence	122 (69.32)	68 (68.69)	0.9134
NPV: Forced Sex	**59 (32.96)**	**49 (49.49)**	**0.0068**
NPV: Unwanted Physical Touch	56 (31.46)	34 (34.34)	0.6235
NPV: Other Sexual Violence	17 (9.60)	14 (14.14)	0.2523
NPV: Physical Attack	66 (36.67)	44 (44.44)	0.2034
NPV: Physical Attack with a Weapon	66 (36.67)	33 (33.33)	0.5777
NPV: Physical Attack without a Weapon	36 (20.00)	18 (18.18)	0.7130
NPV: Familial Injury	46 (25.56)	17 (17.17)	0.1090
Ever Experience of a Hate Crime	**173 (97.19)**	**85 (85.86)**	**0.0003**
Past-Year Experience of a Hate Crime	**89 (50.00)**	**33 (33.33)**	**0.0074**

*Among partnered individuals, $n = 127$. The bold indicated where there were significant statistical differences between groups.

intervals" thereafter (46), and the US Preventive Services Task Force recommends IPV screening of women of reproductive age with provision/referral to support services (53). However, as our data supports, IPV is experienced frequently by males as well and thus IPV screening should be recommended and conducted among all PLWH, not just women. Further, IPV is only one dimension of the total violence experienced by PLWH, and solely focusing on IPV screening and intervention may miss opportunities to address other forms of violence that could be determinantal to the wellness of PLWH.

The near universal experience of multiple forms of violence by our entire sample validates recent calls for HIV care settings to provide trauma-informed care. Specifically, the Health Resources and Services Administration Ryan White HIV/AIDS Program and National Alliance of State and Territorial AIDS Directors have called for integration of trauma-informed care into HIV services (45, 54). Trauma-informed care is defined by the Substance Abuse and Mental Health Service Administration as an organizational approach that "realizes the widespread impact of trauma and understands potential paths for recovery; recognizes the signs and symptoms of trauma in clients, families, staff and others involved with the system; and responds by fully integrating knowledge about trauma into policies, procedures, and practices and seeks to actively resist re-traumatization" (55). Based on the literature on which our study builds, coupled with our findings, trauma-informed care is urgently needed within all setting serving PLWH in Atlanta, and likely across the Southern US and beyond.

TABLE 4 Violence Exposure by Sexual Identity among Self-Identifying Men Living with HIV, Atlanta, GA, 2021–2022 (*N* = 179).

		Sexual Identity, N (%)			
		Bisexual n = 26	Gay n = 112	Heterosexual n = 41	p
Any Adverse Childhood Experience (ACE)		25 (100.00)	105 (100.00)	40 (100.00)	–
	Any ACE, Subtype: Neglect	25 (100.00)	111 (100.00)	40 (100.00)	–
	Emotional Neglect	25 (100.00)	111 (100.00)	40 (100.00)	–
	Physical Neglect	26 (100.00)	111 (100.00)	41 (100.00)	–
	Any ACE, Subtype: Abuse	24 (92.31)	102 (97.14)	37 (90.24)	0.1351
	Emotional Abuse	**22 (84.62)**	**95 (87.16)**	**28 (68.29)**	**0.0300**
	Physical Abuse	**22 (84.62)**	**102 (93.58)**	**32 (78.05)**	**0.0200**
	Sexual Abuse	**17 (65.38)**	**81 (74.31)**	**16 (39.02)**	**0.0003**
Any Lifetime Intimate Partner Violence (IPV)*		13 (100.00)	41 (89.13)	15 (93.75)	0.7138
	Psychological IPV	13 (100.00)	40 (86.96)	14 (87.50)	0.4954
	Assault IPV	9 (69.23)	24 (52.17)	6 (37.50)	0.2367
	Sexual IPV	7 (53.85)	16 (32.61)	5 (31.25)	0.3613
	Injury IPV	7 (53.85)	16 (34.78)	4 (25.00)	0.3026
Any Past-Year Intimate Partner Violence (IPV)*		13 (100.00)	38 (86.36)	15 (93.75)	0.4713
	Psychological IPV	13 (100.00)	37 (84.09)	14 (87.50)	0.3673
	Assault IPV	5 (38.46)	21 (45.65)	6 (37.50)	0.8041
	Sexual IPV	7 (53.85)	13 (28.26)	4 (25.00)	0.1732
	Injury IPV	4 (30.77)	13 (28.26)	4 (25.00)	1.0000
Any Non-Partner Violence (NPV)		25 (100.00)	103 (97.17)	38 (97.44)	1.0000
	NPV: Crime	23 (88.46)	92 (82.14)	30 (73.17)	0.3036
	NPV: General Violence	26 (100)	102 (93.58)	38 (95.00)	0.5409
	NPV: Sexual Violence	17 (68.00)	81 (74.31)	21 (53.85)	0.0605
	NPV: Forced Sex	**9 (36.00)**	**44 (40.00)**	**5 (12.20)**	**0.0051**
	NPV: Unwanted Physical Touch	10 (40.00)	38 (34.55)	7 (17.50)	0.0842
	NPV: Other Sexual Violence	4 (16.00)	11 (10.09)	2 (5.00)	0.3380
	NPV: Physical Attack	13 (52.00)	37 (33.33)	15 (36.59)	0.2165
	NPV: Physical Attack with a Weapon	13 (52.00)	37 (33.33)	15 (36.59)	0.2165
	NPV: Physical Attack without a Weapon	**11 (44.00)**	**20 (18.02)**	**4 (9.76)**	**0.0043**
	NPV: Familial Injury	**8 (32.00)**	**32 (28.83)**	**4 (9.76)**	**0.0287**
Ever Experience of a Hate Crime		**23 (88.46)**	**108 (100.00)**	**39 (95.12)**	**0.0040**
Past-Year Experience of a Hate Crime		17 (65.38)	49 (45.37)	20 (48.78)	0.1862

*Among partnered individuals, *n* = 127. The bold indicated where there were significant statistical differences between groups.

Our study findings must be interpreted in the context of the strengths and limitations of the study. Key study strengths include rigorous staff training on methods to establish interviewer-participant rapport, ensure interview privacy, and data confidentiality to promote participant safety as well as the validity of data captured. Additional strengths included the comprehensiveness of violence forms examined using validated instruments, inclusion of PLWH across gender, sexual minorities, and racial/ethnic minorities, and diversity of types of study settings from which participants were recruited (i.e., clinics, ASOs, and hospitals) to yield a diverse sample of PLWH – recognizing the forms, frequency and severity of violence experienced may vary by those who were well-retained in care versus out-of-care. Key study limitations are the low number of PLWH who were out of care in spite recruitment from ASO and hospital-based settings, who we expect would report higher levels and forms of violence experience than reported here, and the reliance on self-reported data only, which could introduce recall bias.

In conclusion, among our sample of PLWH at the epicenter of the US HIV epidemic, histories of interpersonal and community violence are common. Prior research from other samples linking IPV and childhood abuse to poor HIV (22–25) outcomes suggest the high levels of violence reported in the present study may help explain the significant shortcomings along the HIV care continuum in the US South. Our study findings emphasize the need for RWCs, ASOs, and hospital systems to be universally trained in trauma-informed approaches and have integrated onsite mental health and social support services. To help prioritize violence screening and support resources, our team will next be examining which forms of violence have greatest impact on retention in HIV care and viral suppression. However, the high levels of some forms of violence (i.e., childhood neglect, IPV), suggest extensive violence screening may in fact not be necessary but rather a universal trauma-informed approach should be employed with all patients and screening resources should be dedicated to assessment of danger or potential mediators in the violence to HIV outcome pathway (i.e., PTSD and/or substance abuse).

Data availability statement

The datasets presented in this article are not readily available because the study team is still actively analyzing this data. After we analyze the data for the primary purposed of our study, the analyzed dataset will be available upon reasonable request to the corresponding author. Requests to access the datasets should be directed to JS, jmcderm@emory.edu.

Ethics statement

The studies involving humans were approved by Emory University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JS: Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing. KA: Formal Analysis, Writing – original draft, Writing – review & editing. ML: Methodology, Supervision, Writing – review & editing. SG: Writing – original draft, Writing – review & editing. SH: Data curation, Project administration, Writing – original draft. ER: Project administration, Supervision, Writing – review & editing. MC: Writing – original draft, Writing – review & editing. AK: Conceptualization, Data curation, Funding acquisition, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Femicide in the United States: a call for legal codification and national surveillance

Patricia C. Lewis[1], Nadine J. Kaslow[2], Yuk Fai Cheong[3], Dabney P. Evans[4†] and Kathryn M. Yount[5*†]

[1]Department of Health Sciences, Sacred Heart University, Fairfield, CT, United States, [2]Department of Psychiatry and Behavioral Sciences, Emory University, Atlanta, GA, United States, [3]Department of Psychology, Emory University, Atlanta, GA, United States, [4]Hubert Department of Global Health, Emory University, Atlanta, GA, United States, [5]Hubert Department of Global Health, Department of Sociology, Emory University, Atlanta, GA, United States

EDITED BY
Toshikazu Kondo,
Wakayama Medical University, Japan

REVIEWED BY
Susan Giles,
University of Liverpool, United Kingdom
Rossana Cecchi,
University of Parma, Italy

*CORRESPONDENCE
Kathryn M. Yount
✉ kyount@emory.edu

†These authors share senior authorship

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Introduction

Femicide refers to the intentional gender-related killing of women and girls (1). Despite the high prevalence of female murder victimization in the United States (U.S.) (2, 3), the U.S. lags behind other nations in defining and documenting gender-related female homicides (4). While efforts are underway within the criminal justice and public health sectors to better track violent deaths, deficient surveillance systems limit efforts to estimate the annual incidence of femicide in the U.S. Here, we position femicide as a preventable death that should be treated as a social and public health problem and a distinct form of homicide in the legal code. This approach is especially salient, given the documented increase of non-lethal intimate partner violence (IPV) in major cities (5) and nationally (6) during the COVID-19 pandemic, demonstrating the collateral impacts of public-health crises on violence against women (VAW).

Making the invisible visible: efforts to name, define, criminalize, and document femicides in the U.S.

Feminist sociologist Diana Russell coined the term femicide in her testimony about misogynist murder before the 1976 International Tribunal on Crimes against Women (7). The act of naming by Russell and other scholars and activists brought femicide to the forefront of international movements to stop VAW (8). Yet, most countries, including the U.S., lack a legal definition of femicide, complicating its surveillance, and by extension, prevention and response (9). Countries throughout Latin America have led the way to criminalize femicide through legal statutes that mandate accountability (10). The U.S. does not have a separate penal code for gender-related killings (4), making it difficult to track femicides. According to the U.S. Federal Bureau of Investigation (FBI), an estimated 4,970 female victims were murdered in 2021, one third of whom were documented to have been killed by an intimate partner (2). This is likely an underestimate, as municipal reporting to the central system is not mandatory (6, 11, 12) and data from <63% of police agencies were included in the 2021 report (2). Other estimates utilizing multiple data sources suggest that half of female victims of homicide in the U.S. are killed by intimate partners (13, 14). Importantly, reports of women being murdered are not always categorized as a homicide

(15), and the motivations for a homicide and the victim's relationship to the perpetrator often go undocumented (16).

Calls for action on femicide in the U.S.

According to the World Bank (3), the U.S. ranks 34th worldwide for the intentional murder of females. Yet, such crimes are not categorized as femicides in the penal code, making it difficult to classify and to track the gender-based murder of women and girls. Lacking a clear legal definition of femicide in the U.S. and a surveillance system that identifies and classifies these murders accurately, such acts may appear isolated, hiding the scope of the problem and limiting public health prevention and legal response. Drawing from our experience researching VAW in the U.S. (5, 17, 18) and lessons learned from countries in Latin America (10, 19) and the UK (20–22), we call upon U.S. policy makers to implement three *urgent actions* regarding the legal conceptualization and surveillance of femicide data in the U.S.: (1) including a clear, comprehensive definition of femicide in the penal code; (2) improve the accuracy and completeness of data on femicide including perpetrators; and (3) increase the ability to disaggregate data on femicides to account for intersectional identities, for example, on the bases of race or ethnicity, class, country-of-origin, gender identity, and sexual orientation.

Include a clear, comprehensive definition of femicide in U.S. penal code

Building upon the efforts of feminist movements and other country contexts (10, 23) the U.S. can move toward improved surveillance capacity by adopting a definition that harmonizes with existing ones, allowing us to move toward global surveillance capacity. Femicide often is defined as gender-related killing of women and girls (1, 23) and is considered an extreme violation of a woman's right to self-determination (9), depriving her of fundamental human rights to life and bodily integrity, as protected by international law (24). While femicide takes multiple forms, the phenomenon often is grouped into: (1) *intimate femicide*—femicides perpetrated by a current or former intimate partner and (2) *non-intimate femicide*–familial femicide, human-trafficking-related femicide, sexual femicide, and crime-related femicide among others (1, 25). Including and clearly defining multiple forms of femicide in a legal definition is "essential to give visibility to the many forms of gendered killings" (10).

We call on the U.S. to follow the example of the Inter-American Model Law on the Prevention, Punishment and Eradication of the Gender-Related Killing of Women and Girls (Femicide/Feminicide) (19) and reform the penal code to include femicide as a form of aggravated homicide as has been done in Argentina, Brazil, and Uruguay (10). Modifications to U.S. criminal statues including a separate category for femicide and clear definitions of its multiple forms would facilitate classification of the gender-related killing of women and girls as femicides, setting critical groundwork for improved surveillance.

Improve accuracy and completeness of data on femicide including perpetrators

To catalog and analyze femicides under the new proposed penal code, existing data structures also need to be updated. Of note, the dynamics of female homicides differ from male homicides (13, 26), including that most female homicides take place in the private sphere (26, 27). As such, contextual information about each homicide is critical. Following guidance from the UN Office on Drugs and Crime on a statistical framework for measuring femicide (28) and research on male-perpetrated female homicides in Canada (23), we recommend that sex/gender-related motives/indicators (SGRMIs) be cataloged and assessed to ascertain whether the killing was a femicide. SGRMIs are characteristics that indicate whether the homicide was "rooted in perpetrators' misogynistic attitudes" (23) and can include factors such as current or past intimate relationship with the perpetrator, familial relationship, perpetrator history of IPV, evidence of sexual violence accompanying the killing, victim experienced human trafficking or involvement in sex work, bodily mutilation and/or public exposure, and evidence of the killing being motivated by hatred of women (23, 26, 28). Accurate and timely collection of the following additional contextual data is necessary to determine the gender-related nature of the killing: gender identity and sexual orientation of the victim, pregnancy status of the victim, perpetrator's history of restraining orders, economic activity status of the victim and perpetrator, and gender-related motive for the killing (28). Currently, the U.S. does not have a surveillance system that collects comprehensive information in these categories for all murder cases. The establishment of a review board, much like the domestic homicide reviews in the UK (20, 22), would be required to collect such data and determine whether a femicide has occurred.

Data on deaths in the U.S. exist under the aegis of public health and criminal justice surveillance systems. In the former, death due to assault can be tracked using vital statistics data from the U.S. Centers for Disease Control and Prevention (CDC) WONDER database. While violent female deaths/homicides are identifiable in these data, they provide limited information about the perpetrator (29). Criminal justice surveillance historically took place through the Uniform Crime Report (UCR), where the Supplementary Homicide Reports included contextual data. In 2021, the UCR was replaced with the National Incident-Based Reporting System (NIBRS), however only 66% of police agencies reported crimes to the new system in 2022 (17, 30), which is similar to the problem with the prior system (12).

The National Violent Death Reporting System (NVDRS), hosted by the CDC's National Center for Injury Prevention and Control, began tracking violent deaths in the U.S. in 2003. This surveillance system compiles facts from death certificates, coroner/medical examiner reports, law enforcement reports, and toxicology reports into one database (31). Where available, the NVDRS includes contextual information about the murder including the relationship between the victim and perpetrator (29, 32). Currently, the NVDRS collects data from 48 states, District of Columbia, and Puerto Rico. While the NVDRS provides the necessary linkages between criminal justice and public health data, the reporting of SGRMIs is not mandatory and known community-level correlates of non-lethal forms of VAW—such as neighborhood poverty, residential instability, and gender inequality (33–35)—are not tracked.

Figure 1 compares the tracked murders of females over time (1980–2020) using data from the CDC WONDER database and the FBI'S UCR. Also included are NVDRS data beginning in 2018, when at least 40 states were included in data collection. The trend lines indicate that the public health system (WONDER) consistently captures more female homicides than does the crime tracking system (UCR). While the crude rate of reported female homicides has decreased since the 1980s, an uptick in female homicides appeared in 2020 during the COVID-19 pandemic, which corroborates other studies (5, 17). Regarding intimate partner homicides, UCR data indicate that intimate partners perpetrate about one third of all female homicides; however, a substantial percentage of female homicides are missing information on victim-perpetrator relationship. Notably, for the years available, NVDRS data indicate higher rates of intimate partner homicides than captured in the UCR data. Finally, the gender identities of the victims are not reported, so some subgroups (e.g., transgender women) may be missing or subsumed into an ascribed category, rendering them invisible.

The NVDRS (black line in Figure 1) is the most comprehensive system to track femicides, and we propose that SGRMIs be included as mandatory fields in homicide reports. We also recommend linking the NVDRS homicide data with census data to detect community-level risk factors. Following the Inter-American Model Law on the Prevention, Punishment and Eradication of the Gender-Related Killing of Women and Girls (Femicide/Feminicide) (19), we further propose that improved NVDRS data be used to establish a femicide observatory that catalogs all cases of killings of women. Several other countries have successfully established femicide observatories; such observatories, run by civil society organizations play an important watchdog role providing contextual and nuanced analysis which supplements national data sources (36).

Improve ability to disaggregate femicides by intersectional identities

While an urgent need for improved accuracy in femicide data exists (17, 23, 37), once an adequate surveillance system is in place, questions on risk patterns must be addressed. Crenshaw (38) has emphasized the need to situate women's experiences of violence at the intersection of multiple social hierarchies. Thus, the ability to disaggregate data on femicide by marginalized social identities is critical to identify intersectional risks and impacts and to direct resources to the most vulnerable.

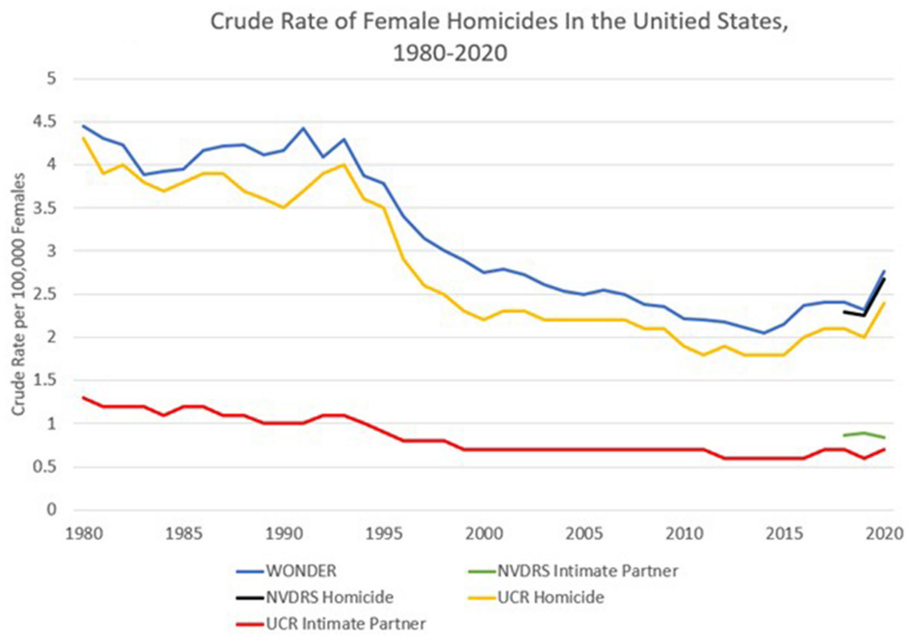

FIGURE 1
WONDER: the CDC's WONDER mortality database. Data includes all homicide victims categorized as females and were captured from the following files: "Compressed mortality, 1968–1978" using ICD-8 codes, E960-E969; "Compressed mortality, 1979–1998" using ICD-9 codes E960-E969; "Compressed mortality, 1999–2016 using ICD-10 codes Y87.1, X85-Y09; "About underlying cause of death, 2018–2021" using ICD-10 codes X85-Y09. NVDRS intimate partner: the national violent death reporting system (NVDRS). Data includes all homicide victims categorized female that had a reported intimate relationship with the perpetrator (current or former spouse, boyfriend/girlfriend or common-law partner). Importantly, the NVDRS data from 2018 excludes data from Arkansas, Hawaii, Idaho, Mississippi, Montana, North Dakota, South Dakota, Tennessee, Texas, and Wyoming. NVDRS data from 2019 excludes data from Arkansas, Idaho, Mississippi, New York, South Dakota, Tennessee, and Texas. NVDRS Homicide: NVDRS data on all female homicides, regardless of relationship to perpetrator. The same state exclusions apply as above. UCR homicide: the federal bureau of investigation's (FBI) uniform crime reporting (UCR) program's supplementary homicide reports (SHR). This data includes all reported homicide victims categorized as female from 1980 to 2020 regardless of relationship to perpetrator. UCR intimate partner: UCR data on all reported female homicides that were indicated as perpetrated by current or former intimate partner (spouse, boyfriend/girlfriend or common-law partner).

For example, recent research using the NVDRS, despite its limitations, indicates that indigenous women have higher rates of homicide victimization than all other ethnic groups (39). This finding prompted an executive order to address the crisis of missing and murdered Indigenous peoples (40). Black women in America also face a greater risk of being murdered (39, 41), particularly during pregnancy (42). The higher rates of homicide for Indigenous and Black women indicate that the murder of women of color takes place at the intersections of racism and sexism (43). Concerning country of origin, research suggests higher rates of homicide victimization among U.S.-born individuals; however, certain foreign-born groups, including those from Honduras, El Salvador, and Jamaica, have higher than average homicide victimization (44). Notably, these countries have high rates of homicide amidst complex historical legacies of colonialism, slavery, civil conflict, and weak governance (45). Data from Europe indicate that citizenship status is a risk factor for female homicide (46). To our knowledge, female homicide victimization by class or income has not been examined with NVDRS data. Finally, as gender identity and sexual orientation are not included in the aforementioned public surveillance data, the intersectional vulnerabilities of LGBTQ+ people to identity-related homicide are unknown at a national scale. The ability to disaggregate female homicides by other marginalized identities may inform more refined definitions of identity-motivated deaths in the penal code.

Conclusion: recommendations call to action

In the U.S., a clear definition of femicide is lacking, as is a surveillance system capable of identifying and classifying gender-related murders with attention to intersectional vulnerabilities. To address these gaps, we call on policymakers to (1) include a clear definition of femicide and its various forms in the U.S. penal code; (2) improve the accuracy and completeness of data on femicide including information on perpetrators; and (3) make documentation of expanded SGRMIs mandatory to allow for disaggregation of data on femicides according to other intersectional vulnerabilities. Practical steps would include a consensus process to inform a legal definition of femicide that draws on international successes, piloting changes to femicide surveillance systems in an initial handful of states, and with better data, estimating the costs of femicide to individuals, families, vulnerable communities, and society to clarify the benefits of prevention. Methodologically sound data ensures greater accuracy, validity, and reliability, which not only underpins rigorous research on femicide, but also aids in the creation of effective legal policies.

Each proposed change is critical for quantifying the incidence and costs of femicide and developing focused and life-saving prevention strategies so that femicide is no longer a major public health problem in the U.S. or globally. In addition, pertinent legislation is essential, such as ongoing authorization and associated appropriations for the violence against women act and U.S. National Action Plan to End Gender Based Violence (47), so there are improved prevention and intervention programs, more consistent application of evidence-based practices by law enforcement, and the requisite support for law enforcement to investigate and prosecute cases.

Author contributions

PL: Conceptualization, Methodology, Project administration, Visualization, Writing—original draft, Writing—review & editing. NK: Conceptualization, Funding acquisition, Writing—review & editing. YC: Methodology, Writing—review & editing. DE: Supervision, Writing—original draft, Writing—review & editing. KY: Conceptualization, Funding acquisition, Project administration, Supervision, Writing—original draft, Writing—review & editing, Methodology.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Dabney Evans,
Emory University, United States

REVIEWED BY
Lauren T. Shapiro,
University of Miami, United States
John Pascoe,
Wright State University, United States
Alexandre Morais Nunes,
University of Lisbon, Portugal

*CORRESPONDENCE
Melissa C. Osborne
✉ mcowart3@kennesaw.edu

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Firearm screening and secure storage counseling among home visiting providers: a cross-sectional study of SafeCare® providers in the U.S.

Melissa C. Osborne[1]*, Kate Guastaferro[2], Shelden Banks[3], Hari Vedantam[4] and Shannon Self-Brown[5,6]

[1]Wellstar School of Nursing, Wellstar College of Health and Human Services, Kennesaw State University, Kennesaw, GA, United States, [2]Department of Social and Behavioral Sciences, School of Global Public Health, New York University, New York, NY, United States, [3]Department of Social Work and Human Services, Wellstar College of Health and Human Services, Kennesaw State University, Kennesaw, GA, United States, [4]Department of Psychological Science, Norman J. Radow College of Humanities and Social Sciences, Kennesaw State University, Kennesaw, GA, United States, [5]Department of Health Policy and Behavioral Sciences, School of Public Health, Georgia State University, Atlanta, GA, United States, [6]National SafeCare Training and Research Center, Mark Chaffin Center for Healthy Development, School of Public Health, Georgia State University, Atlanta, GA, United States

Background: Firearms used in pediatric firearm deaths are most often obtained from the child's home, making secure firearm storage initiatives imperative in prevention efforts. Evidence-based home visiting (EBHV) programs are implemented with over 277,000 families annually, providing an opportunity for secure firearm storage counseling. The purpose of this study was to assess EBHV providers' experiences with firearm screening ("assessment"), secure storage counseling, and their perceptions for related training needs.

Methods: Providers in the U.S. from SafeCare®, an EBHV program often implemented with families experiencing increased risk of child neglect and physical or emotional abuse, were invited to participate in a survey to examine firearm assessment and attitudes toward and experiences with firearm safety counseling. Survey items were primarily Likert scale ratings to indicate level of agreement, with some open-ended follow-up questions. Descriptive statistics (i.e., frequencies and percentages) were used to report item-level agreement. A *post hoc* analysis was conducted using Spearman correlation to examine the association between assessment and counseling and provider-level factors.

Results: Sixty-three SafeCare providers consented to and completed the survey items. Almost three-quarters (74.6%) agreed/strongly agreed that they assess in-home firearm availability. However, 66.7% agreed/strongly agreed that they have not been adequately trained to discuss firearm safety topics. A substantial proportion (80.6%) indicated they would counsel more if materials and training on this topic were available. Response variability emerged by level of urbanicity. A *post hoc* analysis found that providers' self-reported frequency of assessment and counseling were associated with their comfort level discussing firearm safety and whether or not they had worked with families impacted by firearm injury.

Conclusion: SafeCare providers report a need for materials and training on secure firearm storage, and a willingness to provide more counseling with proper training to the families they serve. Findings illuminate the need for secure storage initiatives for EBHV programs, which have broad service reach to a substantial number of at-risk U.S. families annually.

KEYWORDS

home visiting, firearms, parenting, firearm safe storage, injury prevention, secure storage

Introduction

Firearms have surpassed motor vehicles as the leading cause of death among children in the U.S. with >2,500 deaths recorded and > 130,000 years of potential life lost in 2021 (1). Nearly 40% of all children in the U.S. live in a home with a firearm – a number that could be an underestimate considering a surge in firearm sales in response to the COVID-19 pandemic and other civil unrest in 2020 (2). Children as young as 3-years old have demonstrated the strength needed to pull a firearm trigger (3). Additionally, among 10-to 14-year-olds, suicide rates have more than doubled since 2006 (1), and the risk of suicide increases in the presence of highly lethal means, such as firearms (4). Child maltreatment victimization increases the risk of both firearm exposure and suicidality. Over 600,000 children were victims of substantiated child maltreatment in 2021, and an even greater number are estimated to have experienced maltreatment based on self-reported data (5, 6). Childhood physical and emotional abuse is associated with increased likelihood of firearm availability, thus increasing the risk of injury associated with living with a home with a firearm (7). Additionally, experiences of child maltreatment are a risk factor for suicidality (8, 9).

Though firearm storage encompasses a spectrum of behaviors that vary in risk, the most widely accepted and comprehensive definition of secure storage is when a firearm is stored unloaded, locked up, with ammunition locked separately (10). Secure firearm storage is estimated to prevent up to 32% of pediatric firearm-related deaths due to unintentional injury and suicide (11). However, only 44% of U.S. households report keeping all of their firearms unloaded and locked (2). Thus, prevention strategies directed toward parents or other caregivers of children (hereafter referred to as "parents"), especially among families experiencing cumulative risk factors for child maltreatment, to promote secure firearm storage will have a strong impact on pediatric firearm fatalities and should be a focus of prevention efforts.

Many parents who interact with child welfare due to increased risk for reports of child maltreatment or incidents of child maltreatment are referred to evidence-based home visiting (EBHV) programs that deliver educational and supportive services in the home setting, addressing issues from prenatal care to parenting practices to home safety. Home visiting allows for more personalized interventions and involvement of the whole family, and it eliminates common service barriers such as the need for transportation and childcare. There are a multitude of positive outcomes associated with parents' participation in EBHV programs, including reduced risk of future reports to child welfare, reduced parental depression, increased positive parenting skills, and improved child cognitive outcomes (12–16). Federal funding is dedicated to supporting EBHV programs in the U.S. through the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) program. MIECHV-funded programs served over 277,000 families in 2021 (17). Providers of EBHV programs are uniquely situated to both identify and respond to safety concerns in the home as they build a strong rapport with families, assess for strengths and risks firsthand, and tailor resources to meet the unique needs of each family they serve. This is especially important for secure firearm storage counseling because attitudes toward firearms may be deeply ingrained within families and vary across factors such as urbanicity (18). Home visitors have a wide range of educational backgrounds across professional fields which may or may not prepare them to discuss secure firearm storage counseling with families.

Prior studies have examined secure firearm storage counseling practices among pediatricians and social workers with results showing overall low rates of counseling and need for training across professions (19, 20). However, more research is necessary to better understand the frequency and opportunities for these messages to reach families, to ultimately contribute to a consistent message from child-and family-serving professionals regarding secure firearm storage. EBHV providers could contribute to this messaging. However, there is currently no formal guidance or curricula for firearm secure storage counseling specific to EBHV providers. Additionally, to-date, no published studies have examined secure firearm storage counseling practices of EBHV providers. EBHV providers have a wide range of educational backgrounds from paraprofessional training to undergraduate and graduate degrees in human services. The current educational and training requirements may not adequately prepare them to discuss culturally and politically charged topics, such as firearms, with the families they serve, who often have a variety of daily life challenges and may live in homes or communities in which there is exposure to violence. Thus, the aims of this study were to (1) examine the attitudes toward and experiences with firearm screening and secure storage counseling among EBHV providers and (2) to assess differences in these findings by level of urbanicity for the setting where the provider serves families.

Methods

Study design

This study used a cross-sectional design, involving an online survey, administered via Qualtrics. Providers of the EBHV program, SafeCare® were invited to respond to questions about several emerging topics in home visiting. SafeCare is an EBHV for caregivers of children ages 0- to 5-years old that, as of 2023, is implemented in 27 U.S. states and 8 countries outside the U.S. The curriculum consists of three modules (i.e., parent–child interaction, home safety, and child health), each delivered in six sessions (18 total sessions). The opportunity to participate in the online survey was offered to all certified SafeCare providers in the U.S. as of September 2019 ($N = 1{,}148$) via email with an anonymous link to the Qualtrics survey. The survey was open for 2 weeks total, and a reminder email was sent after 1 week. Survey topics included child nutrition (21), firearm safety, and recreational marijuana use among caregivers. The current study presents results related to the firearm section. While 1,148 providers were on the National SafeCare Training and Research Center's (NSTRC) certified provider list and would have received an email invitation to the survey, some providers may not have been actively employed at their agency at the time of distribution. For example, they may have left the organization in which they became SafeCare certified without updating their email address with NSTRC. Provider turnover is a challenge in EBHV (22, 23). It was not possible to follow up with non-responders, and, due to volume, we did not track emails that bounced back. For this reason, the precise denominator for response rate is difficult to define. The study was determined to be exempt from review by the Georgia State University Institutional Review Board.

Measures

Participant demographics

All participants were asked basic demographic questions including age, gender ("male," "female," "transgender," or "other [please specify]"), U.S. state, and urbanicity where they serve families. Urbanicity was captured as a mutually exclusive item with the following categories: rural (less than 2,500 people), urban cluster/suburban (2,500–50,000 people), or urban (50,000 people or more). These categories were based on the 2010 U.S. Census urban and rural classifications (24). Respondents self-reported their service area's level of urbanicity (rural, suburban, or urban).

Firearm-related items

Survey questions were adapted from a prior study examining factors associated with firearm assessment and secure storage counseling among social workers in a range of practice settings (20). The survey consisted of 20-items about attitudes, knowledge, and behaviors related to firearm assessment and secure storage counseling, considering the past 2 years of service. Survey respondents were asked to rate items on a 4-point Likert scale ranging from 1 ("Strongly Disagree") to 4 ("Strongly Agree"). For example, "I routinely assess if the parents I work with own and have access to guns;" "The families I work with are safer with a gun in the home;" and "There are more important topics to discuss than firearm safety." Comfort level discussing firearm safety was assessed with the item, "I am generally uncomfortable bringing up firearm safety with the parents I work with and/or their families." Binary variables were created to indicate either agreement (i.e., "Strongly Agree" or "Agree") or disagreement (i.e., "Strongly Disagree" or "Disagree.")

An additional five questions about firearm-related training or experiences were also part of the survey (20), including the following: (1) growing up with firearm (s) in the home (i.e., "Did your own parent or another household member ever have a gun when you were growing up?"), (2) training on firearm safety counseling (i.e., "Where have you received formal training/education in counseling clients about firearm safety?"), and (3) two questions asking the approximate number of families they have served in which fatal and non-fatal firearm injuries occurred. Participants were instructed to consider all of their years of experience when responding to these questions. Participants who indicated that a parent or other household member had a gun when they were growing up were asked an additional question regarding how that experience influenced their firearm safety counseling practices. Having grown up with a firearm was modeled as a binary variable (yes or no; note: a data point from one respondent who selected "Do not know" for this question was considered missing). Participants were provided with seven response options for the training question, including "I've never received training," a list of potential training resources (e.g., local police department or 4H), and an option to indicate "Other" and specify the training resource. If participants selected "Other" and specified that they were trained in firearm safety counseling in SafeCare training, they were considered to not have any formal training. The research team members with detailed knowledge of SafeCare training did not find the content delivered in SafeCare training to be "formal training/education in counseling clients about firearm safety." Additionally, the current study is interested in participants' formal training aside from SafeCare. That is, we were most interested in identifying participants who had formal training outside of SafeCare in order to get a sense of the extent of firearm training among providers. Finally, regarding the experience of having served a family in which a firearm fatal or nonfatal injury occurred, a single binary variable was created to indicate if any injury or fatality had occurred (1) or if none had occurred (0).

Analytic plan

Descriptive statistics were calculated, and frequencies and percentages were reported separately for each of the firearm-related items. Group differences were assessed by level of urbanicity, and chi-square or Fisher's exact tests were conducted to examine differences by group. Missing data were handled via list-wise deletion. Data were analyzed using SAS 9.4 (25). Results of inferential tests were considered statistically significant for *p*-values less than.05.

Post hoc analysis

Following analysis of the primary research questions, we conducted a *post hoc* analysis to explore potential correlates related to participants' self-reported firearm assessment and secure storage counseling. Specifically, we examined the correlations between assessment and counseling and the following variables: (1) comfort level discussing firearm safety, (2) having worked with a parent or child who had a firearm injury, (3) having grown up with a firearm in the home, and (4) having had training on firearm safety counseling. To preserve the variability in response to the Likert scale items, assessment, counseling, and comfort level were modeled as ordinal-level variables, with higher scores indicating stronger agreement that participants assess for firearms, counsel for firearm safety, and feel uncomfortable discussing firearm safety with families. Having known a family with a firearm injury, having grown up with a firearm in the home, and having had training in firearm safety counseling were all binary variables, reflecting either having had (1) or not having had (0) the experience. Spearman correlations were calculated due to the ordinal nature of the data.

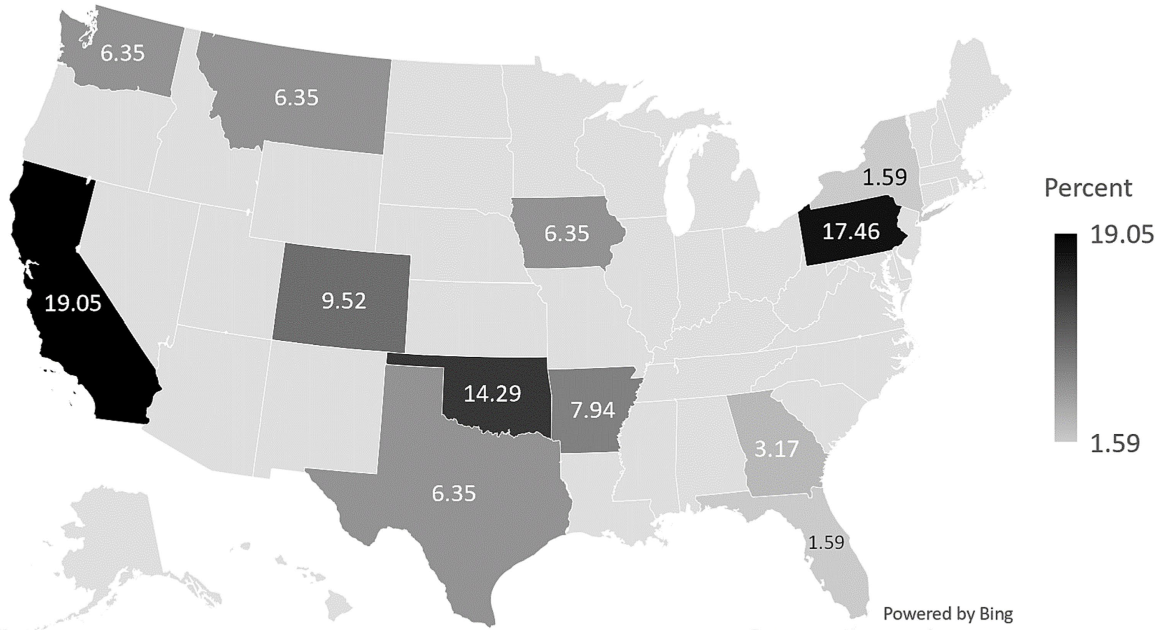

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FIGURE 1
Geographic distribution of survey participants (*N* = 63).

Results

Participant background

A total of 77 SafeCare providers consented to participate in the survey, and 63 providers completed the firearm survey section. Results are presented for these 63 participants. Survey participants were geographically distributed across 12 U.S. states (see Figure 1). The sample identified predominately as female ($n = 56$; 88.89%), with 6 identifying as male (9.52%), and 1 identifying as genderqueer (1.59%). Data on age were available for 51 providers; the average age was 40 years ($SD = 13$). With regard to urbanicity of the providers' service area was highest in the suburban areas ($n = 32$; 50.79%). The remaining providers were distributed between urban areas ($n = 19$; 30.16%) and rural areas ($n = 12$; 19.05%).

Of the 63 providers who completed the firearm survey section, 28.57% ($n = 18$) reported they had worked with at least 1 family in which a gun-related injury had occurred. Two-thirds ($n = 40$) of the providers grew up in homes with guns. Of those, 42.50% ($n = 17$) said that they would be more likely to counsel because of this history, and 47.50% ($n = 19$) said that they are more comfortable talking about gun safety with families because of this. Approximately three-fourths ($n = 45$; 73.77%) of the sample reported no "formal training" or "education" in counseling clients about firearm safety. The remaining 26.23% of those who did report training received from various sources such as an employer ($n = 8$), local police departments ($n = 6$), in college ($n = 3$), or in gun safety or hunter safety classes ($n = 2$).

Provider attitudes toward and experiences with firearm safety counseling

Overall, 74.61% of participants agreed or strongly agreed that they routinely assess for firearms. Two-thirds, reported routinely counseling the parents they work with about firearm safety. Two-thirds of providers agreed or strongly agreed that they had not been adequately trained to discuss firearm safety. An overwhelming majority reported that they would counsel more families about firearm safety if given educational material at their agency (80.64%) and that proper training would give them credibility with parents (72.59%). Finally, in the overall sample, 21.31% of participants, agreed or strongly agreed that families would be safer with a gun in the home. See Table 1 for more details.

Differences in attitudes and experiences by urbanicity

Survey item results were examined by the self-reported urbanicity of the providers' service area (rural, suburban, or urban). Assessment of firearms in the home ranged from 63.16% ($n = 12$) among providers in urban areas to 81.25% ($n = 26$) of providers in suburban areas; counseling ranged from 52.63% ($n = 10$) of providers in urban areas to 78.13% ($n = 25$) of providers in suburban areas. Chi-square test results indicated statistically significant differences by urbanicity for agreement on the following survey item: "I do not think my advice will change my clients' and/or their families' behavior regarding firearm safety," χ^2 (2, $N = 63$) = 6.28, $p = 0.04$. Approximately one-quarter of participants from urban ($n = 4$; 21.05%) and rural ($n = 3$; 25.00%) service areas agreed or strongly agreed with this statement. However, over half of providers from suburban areas ($n = 17$; 53.13%) reported agreement. While there were no other statistically significant differences by level of urbanicity, descriptive differences were observed for several items. For instance, one-third of providers in rural settings ($n = 41$) believe that families they work with are safer with a gun in the home; results from providers in urban environments were distinctly different, with only 5.56% ($n = 1$) of providers agreeing with this

TABLE 1 U.S. SafeCare providers' experiences with and attitudes toward firearm assessment and safety counseling ($N = 63$).

Item	Agreement, *n* (%)
I think counseling clients on firearm safety would be effective in reducing firearm-related injury, death, and suicide among the parents I work with and the children in their care.	51 (82.26)
I would counsel more families about firearm safety if handouts and educational material were available at my agency.	50 (80.64)
I think firearm violence has become a major public health issue.	47 (77.05)
I routinely assess if the parents I work with own and have access to guns.	47 (74.61)
Proper training on firearm safety would give me credibility with the parents I work with.	45 (72.59)
I routinely counsel the parents I work with about firearm safety.	42 (66.67)
I have not been adequately trained to discuss firearm safety.	42 (66.67)
I am likely to support gun control legislation.	33 (55.00)
There are more important topics to discuss than firearm safety.	26 (41.93)
I do not think the parents I work with would be truthful about their gun ownership and access.	26 (41.27)
The media's coverage of gun-related issues has motivated me to counsel more about firearm safety.	25 (39.68)
I do not think my advice will change my clients' and/or their families' behavior regarding firearm safety.	24 (38.10)
The parents I see and the children in their care are not at risk for using a firearm to harm someone.	23 (36.51)
The parents I see and the children in their care are not at risk for firearm injury.	20 (31.74)
The families I work with are safer with a gun in the home.	13 (21.31)
It is not the responsibility of program providers to talk about firearm safety with parents.	14 (22.22)
I am generally uncomfortable bringing up firearm safety with the parents I work with and/or their families.	11 (17.46)
I am not aware of the suicide, homicide, and injury risks associated with having a firearm in the home.	10 (16.13)
I'm concerned that I will offend the parents I work with and/or their families if I talk about firearm safety.	10 (15.87)
I do not have enough time during sessions to counsel the parents I work with about firearm safety.	9 (14.28)

Agreement indicates that participants agreed or strongly agreed with the item.

statement. Approximately half of all ($n = 10$; 52.63) providers in urban service areas surveyed believed that there were more important topics to discuss than firearm safety, while the proportion for providers in rural areas was considerably lower ($n = 2$; 16.67%). See Figure 2 for more details.

Post hoc analysis

There was a moderate, statistically significant, inverse correlation between participant comfort level with discussing firearm safety and both assessment ($r = -0.46$, $p < 0.001$) and counseling ($r = -0.34$, $p = 0.006$). On average, higher levels of discomfort were associated with lower levels of assessment and counseling. There was a moderate, statistically significant, positive correlation between having worked with a family with a firearm injury and assessment ($r = 0.34$, $p = 0.007$) and counseling ($r = 0.30$, $p = 0.02$). Working with such a family was associated with higher levels of assessment and counseling. There were no statistically significant correlations between having grown up with a firearm or having been trained in firearm safety counseling and self-reported assessment and counseling with families in the past 2 years. See Table 2 for details.

Discussion

This study examined EBHV providers' experiences with and attitudes toward firearm assessment and secure firearm storage counseling. We also explored associations between four provider-level factors and firearm assessment and secure storage counseling experience. Our findings indicate that almost 75% of SafeCare providers report assessing families they serve for firearm availability, and 67% report counseling families in firearm safety. Three-quarters of providers reporting firearm assessment is substantial and is comparable to or higher than rates reported by social workers (20) and pediatricians (19, 26). This may be due to the sample consisting of SafeCare-trained providers. SafeCare is the only EBHV program with a dedicated home safety module (27) and assessing the home for safety hazards is part of that module. Yet, 67% of the providers surveyed report that they have not been adequately trained to discuss firearm safety. Additionally, over 80% said they would counsel more families on secure firearm storage if given the proper materials and training. This presents an opportunity for researchers and community and professional organizations with expertise in secure firearm storage counseling for parents to work with EBHV program developers and purveyors to incorporate such content into their programs. This has the potential to reach hundreds of thousands of families with young children in the U.S.

Importantly, there was variability in provider survey responses by urbanicity, by comfort level, and by proximity to firearm injury. Notably, a substantially greater proportion of providers from rural areas indicated that families are safer with a gun in the home than urban providers. This is likely due to differences in gun culture between rural and urban areas. Research has found regional variation in firearm ownership in samples from both the general population (28, 29) and those at risk for child welfare involvement (7). Additionally,

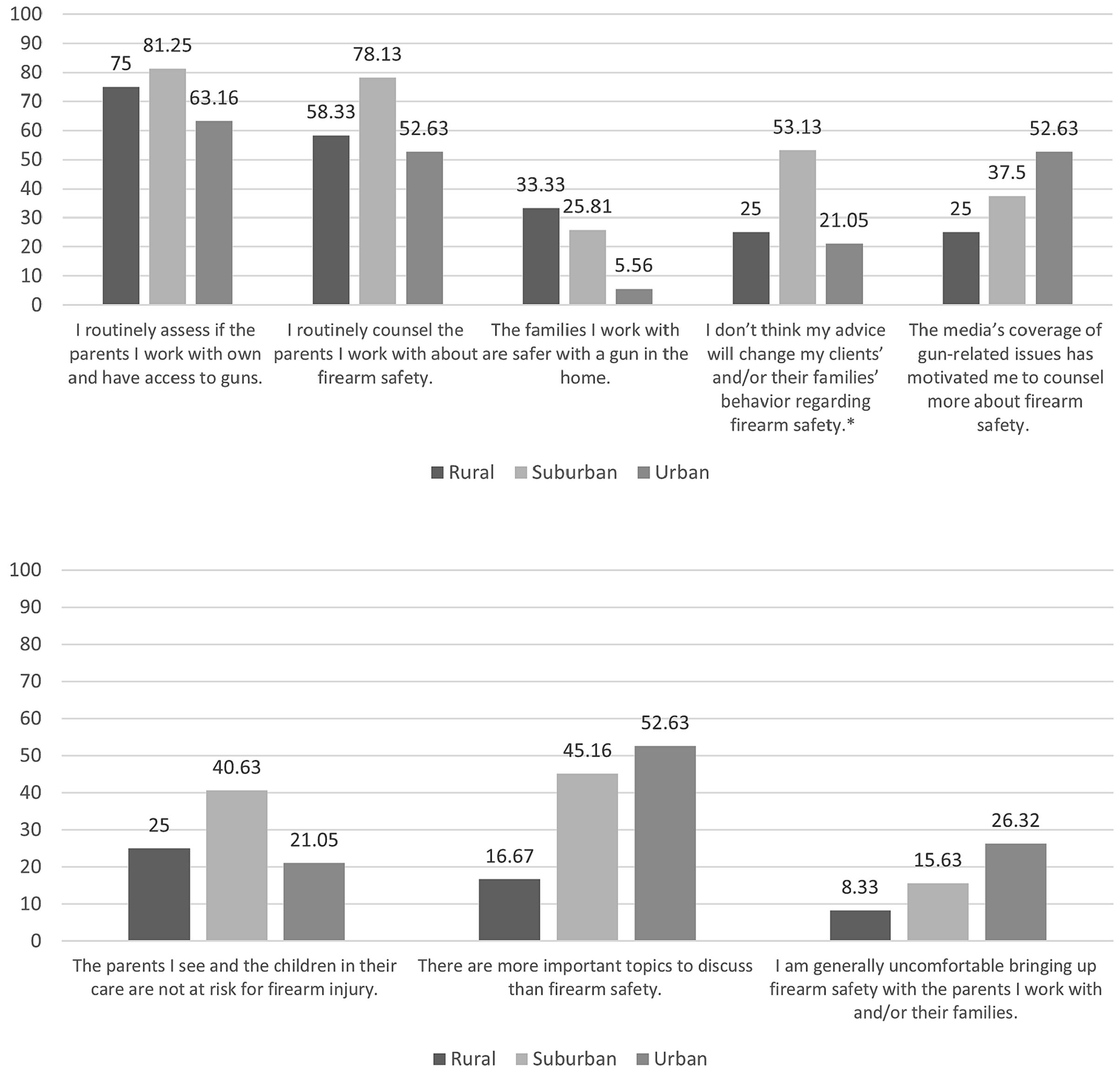

FIGURE 2
Agreement with survey items by urbanicity. *$p < 0.05$.

TABLE 2 Correlation matrix for firearm assessment, secure storage counseling, and related background factors.

	Assess	Counsel	Comfort level	Family injury	Grew up w/FA	Training status
Assess[a]	1.00					
Counsel[a]	0.56*	1.00				
Comfort Level[a]	−0.46*	−0.34*	1.00			
Family Injury[b]	0.34*	0.30*	−0.20	1.00		
Grew up w/FA[b]	0.12	0.003	0.01	0.06	1.00	
Training Status[b]	−0.12	0.02	−0.10	−0.23	0.03	1.00

Spearman correlation coefficients presented; Assess = "I routinely assess…;" Counsel = "I routinely counsel….;" Comfort Level = "I am generally uncomfortable bringing up firearm safety with parents…"; Family Injury = At least 1 parent or child the respondent worked with had been injured by a firearm; Grew up w/FA = Growing up, respondent's own parent or other household member had a gun; Training Status = Respondent reported receiving "formal training/education in counseling clients about firearm safety".

[a] 1 = Strongly disagree to 4 = Strongly agree.

[b] 1 = yes, 0 = no.

*$p < 0.05$.

self-reported social gun culture has been linked to gun ownership (30), and gun culture, which also varies regionally, may contribute to social norms surrounding the use of firearms for self-protection (31, 32). When developing secure firearm storage initiatives for EBHV programs, it may be important to tailor the focus of the messaging by urbanicity or by reason for firearm ownership, addressing both provider pre-existing barriers to counseling on secure storage and parent barriers to secure storage.

Findings also indicated that providers who reported greater comfort discussing firearm safety with parents were more likely to engage in firearm assessment and firearm safety counseling with families they serve. Increasing EBHV provider's likelihood of firearm assessment and secure storage counseling could begin with increasing their self-efficacy and comfort around these activities. This could easily be incorporated into EBHV workshop training, to include modeling conversations with parents around firearms and firearm storage and allowing home visitors to practice and receive feedback. Prior research has shown that training that includes vignettes, discussion, and suggestions for integration into practice has been found effective in increasing self-efficacy in secure storage counseling among medical students (33). This is in line with principles of social learning theory (34) that are used in training healthcare professionals (35). It could be applied to training EBHV providers in secure firearm storage counseling as well.

Finally, EBHV provider's experience of serving a family in which a firearm injury had occurred was associated with firearm assessment and safety counseling. It may be the case that a provider knowing a family that has experienced a firearm injury especially motivates them to engage in prevention efforts and opens up a natural opportunity for discussions and training on secure firearm storage; however, there is a lack of literature to confirm this assertion. Familiarity with a family impacted by firearm injury may be akin to hearing narratives or, "illustrative examples of others' experiences" (36, 37). No known research has examined the impact of narratives on provider behaviors; although experts in environmental health have noted the importance of including narratives in communication with healthcare providers to increase their engagement on this topic (38). Narratives have been found to impact behavior change at the patient level in health topic areas aside from firearm injury prevention, for example, youth substance use and hypertension (39, 40). However, the literature on narratives is mixed, as some studies have found that narratives have no effect on patient behavior (36). More research is needed to clarify how the impact of serving families with firearm injuries may drive the behavior of EBHV providers.

Related, the End Family Fire! Campaign, a firearm injury prevention campaign, prominently features "safe stories," a collection of stories of people who came close but did not die by firearm suicide because of secure firearm storage (41). Given the relationship between providers' exposure to family experiences of firearm injuries and their assessment and counseling practices, EBHV providers' likelihood of assessing for firearms and counseling on secure firearm storage could be increased by including such success stories in training. In the future, these training strategies should be developed and rigorously tested. Ultimately, more research on the use of narratives is needed in terms of their impact on provider secure firearm storage counseling and on parent storage behavior.

While not the focus of the current study, participants were also asked about the feasibility of firearm safety education as part of EBHV, in terms of the time they have with families for delivering this content. Specifically, participants were asked to rate the item, "I do not have enough time during sessions to counsel the parents I work with about firearm safety." on a scale from Strongly Disagree to Strongly Agree. Less than 15% of participants agreed with this statement, indicating that the vast majority of participants felt that firearm safety is a topic they have time to discuss. This is notable, because other professionals who deliver secure firearm storage counseling to parents, such as pediatricians, report the lack of time to devote to this issue as a primary barrier to implementation (19, 42). While EBHV providers work with a much smaller segment of the population than pediatricians do, children in the families receiving home visiting services may be at greater risk for firearm-related outcomes, based on their possible exposure to factors such as child maltreatment (4, 7, 8). EBHV providers also spend more time with the families they serve than other professionals, as services are commonly structured around weekly visits that span the course of months or years (17). Thus, EBHV providers are an important part of the collective response of child-and family-serving professionals to firearm injury prevention.

Findings from this study should be interpreted with some important limitations in mind. First, study participants were recruited through convenience sampling from a single EBHV program, SafeCare. This limits the generalizability of the conclusions, and future work should employ more representative samples. While many EBHV programs cover home safety topics on some level, SafeCare is the only EBHV program with a dedicated core module on home safety. Thus, this sample of providers may be stronger in discussing home safety topics with parents compared with EBHV providers who have not been trained to deliver SafeCare. Although, despite the training on home safety, two-thirds of providers reported feeling inadequately trained to discuss firearm safety. Future research should incorporate more rigorous sampling methods and expand recruitment to more EBHV program providers. However, some providers are trained to deliver multiple home visiting programs (43), and study participants were asked to reflect on all families for whom they delivered services in the last 2 years, not only SafeCare families. Thus, there may have been study participants who deliver SafeCare as well as other home visiting programs and who were considering families participating in programs other than SafeCare.

Additionally, this study is also subject to selection bias. It could be the case that providers who are more open to emerging topics in home visiting may also be more likely to participate in a survey about emerging topics, and those who are resistant to discussing challenging or controversial topics with parents are less likely to respond to such a survey. Also, while we invited all certified SafeCare providers in the U.S. to join the study, the primary firearm items asked participants to reflect on the past 2 years of service. Thus, some participants may have been new to service delivery and would have been reflecting on a time period of less than 2 years. This also means they would not have had as many opportunities to discuss firearm safety with families as more experienced participants had. Also, there was a low response rate to the survey, impacting generalizability of the findings. We are unable to define a denominator for response rate calculation due to in ability to track providers who may have no longer been employed with their agency but were still included in SafeCare records. Using the number of providers on the email list as a denominator ($N = 1,148$) as the most conservative approach, the response rate was 6.7%. However, it is important to note that numerous U.S. states and regions were represented by the respondents. Future work should include more rigorous sampling methods to improve generalizability to the broader population of EBHV providers. Finally, the use of the term "firearm safety" in the survey, as opposed to "secure firearm storage" or "safe storage" may have impacted the way the participants interpreted the items using that term, as firearm safety could encompass more than just secure storage. The survey used in this study was previously implemented with social workers (20) and items were altered only with regard to home visiting-specific terminology to maintain consistency. Future research would benefit from using more direct and commonly-used terminology.

Conclusion

This study examined EBHV providers' attitudes toward and experiences with firearm assessment and secure storage counseling, using a sample of SafeCare providers in the U.S. Three-fourths of SafeCare providers reported assessing for firearms in the home, and two-thirds reported counseling on firearm safety. This is not surprising given SafeCare's dedicated module on home safety. However, two-thirds of providers indicated that they were not adequately trained to discuss firearms, and over three-fourths said they would counsel more families if given the proper materials and training. This points to a training need for the EBHV workforce. EBHV providers are an important part of the response to pediatric firearm injury prevention, and more research is needed to develop and test strategies that prepare providers to discuss firearms with the families they serve.

Data availability statement

The datasets presented in this article are not readily available because the data supporting the findings of this study are available upon request from the authors. Requests to access the datasets should be directed to MO, mcowart3@kennesaw.edu.

Ethics statement

The studies involving humans were approved by Georgia State University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because the researchers did not interact with participants directly, and no identifying information was collected in the online survey.

Author contributions

MO: Conceptualization, Formal analysis, Methodology, Software, Supervision, Writing – original draft, Writing – review & editing. KG: Writing – review & editing, Conceptualization. SB: Writing – original draft, Writing – review & editing. HV: Visualization, Writing – original draft, Writing – review & editing. SS-B: Conceptualization, Resources, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Trends in pediatric firearm-related injuries and disparities in acute outcomes

Makda G. Mulugeta[1]*, Gabrielle Bailey[1], Kendall Parsons[1], Scott Gillespie[2], Laura M. Johnson[2], Kiesha Fraser Doh[1,2], Andrew Reisner[1,2,3] and Laura S. Blackwell[1,2]

[1]Children's Healthcare of Atlanta, Atlanta, GA, United States, [2]Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, United States, [3]Department of Neurosurgery, Emory University School of Medicine, Atlanta, GA, United States

EDITED BY
Sangmi Kim,
Emory University, United States

REVIEWED BY
Federica Mele,
University of Bari Aldo Moro, Italy
John Donohue,
Stanford University, United States

*CORRESPONDENCE
Makda G. Mulugeta
✉ makda.mulugeta@choa.org;
✉ Makda.g.mulugeta@gmail.com

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Background: Firearm-related injuries (FRI) are an increasing cause of death and injury in children. The etiology for this rise is multifactorial and includes socioeconomic factors. Despite its prevalence and documented increase over COVID-19, there is a paucity of research on disparities and the influence of social determinants of health (SDH) in pediatric FRI. This study aims to explore the epidemiology of this vulnerable population in Atlanta, trends over time and relevant dates such as COVID-19 and a state firearm law, and disparities in clinical outcomes.

Methods: Retrospective cohort of patients with FRI (0–20 years-old, $\bar{x}$=9.8, Median = 11) presenting to our hospital EDs from January 2014 to April 2023 (N = 701) and eligible for the Trauma Registry. This period includes two major events, namely the COVID-19 pandemic (March 2020), and passage of state law Constitutional Carry Act (SB 319) (April 2022), allowing for permit-less concealed firearm carry. Single series interrupted time series (ITS) models were run and clinical outcome differences between race and insurance groups were calculated unadjusted and adjusted for confounders using inverse propensity treatment weights (IPTW). The primary outcome was mortality; secondary are admission and discharge.

Results: Majority of FRI involved patients who were male (76.7%), Black (74.9%), publicly insured (82.6%), ≤12 years-old (61.8%), and injured by unintentional shootings (45.6%) or assault (43.7%). During COVID-19, there was a sustained increase in FRI rate by 0.42 patients per 1,000 trauma visits per month (95% CI 0.02–0.82, p = 0.042); post-SB 319 it was 2.3 patients per 1,000 trauma visits per month (95% CI 0.23–4.31, p = 0.029). Publicly insured patients had 58% lower odds of mortality than privately insured patients (OR 0.42, 95% CI 0.18–0.99, p = 0.047). When controlled for race and mechanism of injury, among other confounding factors, this association was not significant (p = 0.652).

Conclusion: Pediatric FRI are increasing over time, with disproportionate burdens on Black patients, at our hospitals. Disparities in mortality based on insurance necessitate further study. As social and economic repercussions of COVID-19 are still present, and state firearm law SB 319 is still in effect, assessment of ongoing trends is warranted to inform preventative strategies.

KEYWORDS

pediatric, firearm, COVID-19, health disparity, social determinants of health, firearm-related injuries

1 Introduction

Firearm-related injuries (FRI) are an increasing cause of morbidity and mortality among children and adolescents in the United States (U.S.). More than 3,900 children and adolescents die from FRI annually, and thousands more surviving children and adolescents are left with varying degrees of both physical and emotional injuries (1–3). Children and adolescents in the U.S. are estimated to be 36.5 times more likely to die from FRI compared to similar-aged children in other high-income countries (4).

In recent years, FRI surpassed motor vehicle collisions (MVCs) and became the leading cause of pediatric mortality in the U.S. (5, 6). Although pediatric trauma rates remained the same or even decreased, pediatric FRI continued to increase during the COVID-19 pandemic (7, 8). To further complicate this narrative, one study found that nonfatal *per capita* injuries in pediatrics have been decreasing while fatal injuries have been increasing in recent years (3). Taken together, these studies may indicate that while overall trauma rates have been decreasing over time, a greater proportion of injuries may be related to FRI. In 2021, 4,752 children and adolescents died from FRI, which translates to an average of 13 children every day (1). While it is likely that the COVID-19 pandemic contributed to this increase with economic instability, school closures, and social isolation (9, 10), additional factors such as state firearm regulation laws (11) and record setting firearm purchases (12, 13) also likely contributed. Recently in Georgia, a law passed, SB 319, that allowed for concealed carry of firearms without a permit (14). Both COVID-19 and this firearm law relate to and potentially impact pediatric FRI in our hospital system located in Atlanta, Georgia.

There is a paucity of literature that focus on populations most at risk. Regarding demographic groups, males, older adolescents, and children from minoritized groups (15) are known to have higher rates of FRI (1, 16). Black children are over 70% more likely to be hospitalized for FRI than White children; Hispanic children are 20% more likely to be hospitalized than White children (17). Regardless of neighborhood income level, Black children still have higher rates of FRI compared to White children (17). Within the U.S., Southern states have a disproportionately high volume of pediatric firearm incidents (18, 19).

Social determinants of health (SDH), the non-medical, environmental, and social conditions we live in, drive health inequalities in disease and injury (20) and FRI is no exception. Recent studies have shown that neighborhood poverty and deprivation associates with increased pediatric FRI risk and mortality (1, 19, 21, 22). Additionally, prior studies have shown that insurance associates with mortality following FRI (23) and in pediatric trauma (24, 25). Although these studies are few in number, they point to an urgent need to address the impact of SDH on pediatric FRI. As injuries are preventable, identifying trends in FRI in relation to SDH can inform preventative strategies (26).

The aims of this study are: (1) to characterize the trends in pediatric FRI with respect to patient demographics prior to and during the COVID-19 pandemic in our exclusive pediatric hospital system; (2) to examine the incidence of these injuries with respect to COVID-19 and a recent Georgia firearm law; (3) examine how SDH (race and insurance) relate to acute outcomes following FRI.

2 Materials and methods

2.1 Procedures

This study is a retrospective analysis using a hospital-based trauma registry of pediatric patients who presented to Children's Healthcare of Atlanta's (CHOA) Level I or Level II pediatric trauma centers between January 2014 and April 2023 with FRI as identified by the International Classification of Diseases (ICD) 9th and 10th revision codes. CHOA has the only pediatric trauma centers in Georgia's capital, Atlanta, and are two of three pediatric trauma centers in the state (27). Thus, our patient population covers a large portion of the state. Both ICD-9 and 10 codes were included as the transition from ICD-9 to ICD-10 took place on July 2015, during the study timeline. CHOA's Institutional Review Board approved this study.

The hospital-based trauma registry included patients who qualify for the National Trauma Data Standards (NTDS). Inclusion criteria for this registry included patients who sustained a traumatic injury within 2 weeks of their first hospital encounter, had at least one ICD-9 or ICD-10 code identifying traumatic injury, and either died as a result of injury in the Emergency Department (ED), were transferred from one acute care hospital to another via Emergency Medical Services (air or ground transportation), or were admitted to one of our two pediatric trauma centers (Scottish Rite and Egleston). Exclusion criteria in the NTDS included specific codes (such as superficial injury), traumatic injuries that occurred during the hospital encounter, and admissions for elective or planned surgeries. In addition to the NTDS, the hospital-based trauma registry included all trauma-related deaths and patients with trauma-related mechanisms of injury who were admitted or transferred to/from another acute care hospital.

Patients with ICD codes indicating injury from firearms (e.g., handgun, rifle, shotgun, etc.), gas, air, or spring-operated guns, were included in the study. Non-powder guns have been included due to their capacity to cause significant injury in children (28, 29). From the patients that fit the aforementioned criteria, the study dataset was formed using the following trauma registry variables: demographics (age, race, ethnicity, and gender), injury circumstance (mechanism of injury), acute outcomes (discharge from the Emergency Department [ED], hospital discharge destination, mortality, and Injury Severity Score [ISS]), and insurance. Ethnicity and race were recorded in the trauma registry as separate variables, and thus will be reported in this manner. Mechanism of injury was classified into assault, unintentional, intentional self-infliction, undetermined (unable to determine intent due to lack of information), legal intervention (police/law enforcement shooting), child abuse, or other based on keywords from ICD External Cause Codes (E-Codes) (30).

Patients were categorized by age groups identified in prior literature to reflect developmental subgroups (31–34). Age groups were as follows; 0–6 years, 7–12 years, 13–15 years, and 16–20 years. We chose to separate the adolescent age group into younger (13–15 years) and older (16–20 years) categories due to the varying mechanisms of FRI that have been shown to impact these age groups within the literature (35). The sample did not have any patients aged 21 years, despite eligibility. Discharge from ED was categorized into admitted to hospital (floor, Intensive Care Unit [ICU], Operative

Room [OR], or direct admit to hospital), discharged home, died, or discharged to another hospital. Hospital discharge destination was categorized into home, another hospital/intermediate care facility (e.g., psychiatric hospital, short-term general hospital, etc.), died, N/A (patients who were never admitted into the hospital), court/law enforcement, and inpatient rehabilitation. Insurance was classified into private (government or private/commercial), public (Medicaid or Medicaid type insurances), and uninsured (self-pay). Insurance and race serve as the SDH for this study based on the available data within our dataset. For contextual analysis, a dataset of all patients in the trauma registry over the study period (January 2014 to April 2023) was formed with variables including hospital admission date and race.

To examine changes in rates of FRI during the COVID-19 pandemic, this study utilized a cut-off date of March 13th, 2020, the official U.S. emergency declaration date (36). This study examines a recent state firearm law, the Constitutional Carry Act (SB 319), to assess FRI trends in relation to firearm laws (14). Effective on April 12th, 2022, this law allowed for the concealed carry of firearms without a permit (14, 37, 38).

2.2 Statistical analyses

All analyses were performed in SAS v.9.4 (Cary, NC) and CRAN R v.4.3 (Vienna, Austria), and statistical significance was evaluated throughout at the 0.05 threshold. As aforementioned, patients were grouped by race and ethnicity separately based on the database. First, single series interrupted time series (ITS) models were run to evaluate the rate of FRI per 1,000 trauma visits over 9 years of data. Overall trauma visits were used as the comparison to differentiate FRI and general trauma rates over time, assuming that general trauma numbers at our hospital may vary year to year. Then, clinical outcome (e.g., acute outcome) differences between Black and White races for patients with FRI were calculated unadjusted and adjusted for confounders using inverse propensity treatment weights (IPTW). Steps for ITS included statistical tests and visual inspection for autocorrelation and seasonality, and regression results were based on piecewise linear equations (intercepts and slopes) calculated pre- and post-interruptions for COVID-19 era (March 2020) and Constitutional Carry Act era (April 2022). Two individual and one combined time series were performed. A combined time series analysis was performed to assess for the combined effects of both events.

For the clinical outcomes analysis, which considered binary outcomes, Firth logistic regression was employed and reported by odds ratios with 95% confidence intervals (CI) and *p*-values. Firth's Penalized Likelihood was utilized to account for the bias that can occur with rare outcomes. All outcomes analysis, demographic, SDH, and clinical differences between Black and White patients and insurance groups, were balanced using IPTW derived from the *twang* v.2.5 package in CRAN R. Specifically, average treatment effect (ATE) weights were calculated with a gradient boosted model (GBM) using 10,000 trees, interaction depth at 3, and a stop method based on mean effect size. Final IPTW were stabilized to approximately match the original study sample size and trimmed at the 1 and 99%. Checking of confounders with IPTW demonstrated balance when standardized mean differences (SMD) <0.25. All outcome analyses between the patient groups by race and insurance status were weighted with IPTW. Insurance was only examined with mortality due to insurance's effect on patient hospital course (secondary outcomes) (39).

3 Results

3.1 Demographic characteristics

In total, 701 children and adolescents were treated for FRI at our hospitals between January 2014 and April 2023. Annual number of patients increased 381% over the 9-year study period ($n = 27$ in 2014 vs. $n = 130$ in 2022) (Table 1). The cohort was predominantly male (76.7%), Black (74.9%), Non-Hispanic/Latino (93.2%), and publicly insured (82.6%). Patient ages range from 0 to 20 years. The largest age group was 7–12 year-olds (33.5%), followed by 13–15 year-olds (29.5%), 0–6 year-olds (28.3%), and 16–20 year-olds (8.7%) (average = 9.8, median = 11). Over 2020, Black patients with FRI increased (63.2% in 2019, 75.5% in 2020, 83.9% in 2021) while White patients with FRI decreased (31.6% in 2019, 17.6% in 2020, 11% in 2021). Over time, patients were increasingly publicly insured (70.4% in 2014, 93.1% in 2022), and decreasingly privately insured (25.9% in 2014, 6.1% in 2022). The most common mechanisms of injury were unintentional shooting (45.6%) and assault (43.7%). As of April, 65.6% of all patients in 2023 were injured by assault – twice the proportion of patients in 2014 (33.3%).

3.2 Time series analysis

3.2.1 COVID-19 time series

A baseline level of 14.5 firearm patients per 1,000 trauma visits (95% CI 8.18–20.91, $p < 0.001$) was observed pre-COVID-19 (January 2014 to February 2020) (Figure 1). The increase in rate of FRI pre-COVID-19 was not significant ($\beta = 0.12$, 95% CI -0.03-0.26, $p = 0.130$). At the start of COVID-19, there was an increase in FRI rate by 8.3 patients per 1,000 trauma visits, although this level change was not statistically significant (95% CI -2.65-19.2, $p = 0.140$). Rates of FRI during COVID-19 increased significantly by 0.42 patients per 1,000 trauma visits each month (95% CI 0.02–0.82, $p = 0.042$), although this slope did not significantly differ compared to the pre-COVID-19 slope ($\beta = 0.12$ vs. 0.42, 95% CI -0.13-0.73, $p = 0.171$). During the pandemic, the predicted number of patients with FRI per 1,000 trauma visits increased from approximately 32 in March 2020 to nearly 47 in March 2023. For additional information, please see Supplementary Table S1.

3.2.2 SB 319 time series

The pre-SB 319 era (January 2014 to March 2022) had an initial baseline of approximately 10 firearm patients per 1,000 trauma visits (95% CI 4.60–15.75, $p = 0.001$) (Figure 2). Pre-SB 319, FRI increased significantly at a monthly rate of 0.27 patients per 1,000 trauma visits (95% CI 0.17–0.36, $p < 0.001$). In the post-SB 319 era, FRI increased significantly by 2.3 patients per 1,000 trauma visits each month (95% CI 0.23–4.31, $p = 0.029$). One month after SB 319 was in effect, there were nearly 32 predicted patients with FRI per 1,000 trauma visits. One year after SB 319 was in effect, this prediction rose to 57 patients with FRI per 1,000 trauma visits. The difference in slopes between the

TABLE 1 Participant characteristics by year (*N* = 701).

Characteristic, *N* (col. %)	2014 *N* = 27	2015 *N* = 38	2016 *N* = 30	2017 *N* = 61	2018 *N* = 56	2019 *N* = 77	2020 *N* = 103	2021 *N* = 118	2022 *N* = 130	2023 *N* = 61
Sex										
Female	6 (22.2%)	12 (31.6%)	7 (23.3%)	19 (31.1%)	14 (25%)	15 (19.5%)	29 (28.2%)	24 (20.3%)	25 (19.2%)	12 (19.7%)
Male	21 (77.8%)	26 (68.4%)	23 (76.7%)	42 (68.9%)	42 (75%)	62 (80.5%)	74 (71.8%)	94 (79.7%)	105 (80.8%)	49 (80.3%)
Race, *N* = 694										
Black	19 (70.4%)	27 (71.1%)	20 (69%)	46 (75.4%)	40 (71.4%)	48 (63.2%)	77 (75.5%)	99 (83.9%)	99 (78.6%)	50 (82%)
White	8 (29.6%)	10 (26.3%)	5 (17.2%)	14 (23%)	11 (19.7%)	24 (31.6%)	18 (17.6%)	13 (11%)	20 (15.9%)	8 (13.1%)
Mixed/Other Race	0 (0%)	1 (2.6%)	4 (13.8%)	1 (1.6%)	5 (8.9%)	4 (5.2%)	7 (6.9%)	6 (5.1%)	7 (5.5%)	3 (4.9%)
Unknown	0	0	1	0	0	1	1	0	4	0
Ethnicity, *N* = 700										
Hispanic/Latino	0 (0%)	3 (7.9%)	2 (6.7%)	3 (4.9%)	3 (5.4%)	7 (9.1%)	7 (6.8%)	7 (5.9%)	9 (7%)	6 (9.8%)
Non-Hispanic/Latino	27 (100%)	35 (92.1%)	28 (93.3%)	58 (95.1%)	53 (94.6%)	70 (90.9%)	96 (93.2%)	111 (94.1%)	120 (93%)	55 (90.2%)
Unknown	0	0	0	0	0	0	0	0	1	0
Age										
0–6	8 (29.6%)	10 (26.3%)	10 (33.3%)	13 (21.3%)	15 (26.8%)	22 (28.6%)	24 (23.3%)	42 (35.6%)	37 (28.5%)	17 (27.9%)
7–12	10 (37%)	16 (42.1%)	14 (46.7%)	24 (39.3%)	20 (35.7%)	29 (37.6%)	26 (25.2%)	30 (25.4%)	46 (35.4%)	20 (32.8%)
13–15	6 (22.2%)	10 (26.3%)	4 (13.3%)	22 (36.1%)	19 (33.9%)	26 (33.8%)	42 (40.8%)	31 (26.3%)	34 (26.1%)	13 (21.3%)
16–20	3 (11.2%)	2 (5.3%)	2 (6.7%)	2 (3.3%)	2 (3.6%)	0 (0%)	11 (10.7%)	15 (12.7%)	13 (10%)	11 (18%)
Insurance, *N* = 697										
Private	7 (25.9%)	4 (10.8%)	2 (6.7%)	8 (13.1%)	5 (8.9%)	10 (13%)	12 (11.8%)	14 (12.1%)	8 (6.1%)	0 (0%)
Public	19 (70.4%)	30 (81.1%)	24 (80%)	47 (77.1%)	40 (71.3%)	54 (70.1%)	82 (80.4%)	102 (87.9%)	121 (93.1%)	60 (98.4%)
Uninsured	1 (3.7%)	3 (8.1%)	4 (13.3%)	6 (9.8%)	11 (19.6%)	13 (16.9%)	8 (7.8%)	0 (0%)	1 (0.8%)	1 (1.6%)
Unknown	0	1	0	0	0	0	1	2	0	0
Mechanism of injury										
Unintentional	15 (55.6%)	18 (47.4%)	15 (50%)	34 (55.7%)	27 (48.2%)	44 (57.1%)	43 (41.7%)	47 (39.8%)	60 (46.2%)	17 (27.9%)
Assault	9 (33.3%)	11 (28.9%)	9 (30%)	19 (31.1%)	25 (44.6%)	28 (36.4%)	50 (48.5%)	51 (43.2%)	64 (49.2%)	40 (65.6%)
Child Abuse/Legal Intervention	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1.8%)	0 (0%)	0 (0%)	1 (0.8%)	0 (0%)	0 (0%)
Intentional Self-infliction	0 (0%)	1 (2.6%)	1 (3.3%)	4 (6.6%)	1 (1.8%)	2 (2.6%)	1 (1%)	8 (6.8%)	3 (2.3%)	3 (4.9%)
Other/Undetermined	3 (11.1%)	8 (21.1%)	5 (16.7%)	4 (6.6%)	2 (3.6%)	3 (3.9%)	9 (8.7%)	11 (9.4%)	3 (2.3%)	1 (1.6%)

pre- and post-SB 319 was 2.00, nearing significance ($\beta = 0.26$ vs. 2.26, 95% CI -0.04-4.05, $p = 0.058$). See Supplementary Table S2 for additional information.

3.2.3 Combined COVID-19 and SB 319 time series

Consistent with the COVID-19 individual analysis, the time series started with an initial monthly rate of 14.5 patients with FRI per 1,000 trauma visits (95% CI 8.22–20.86, $p < 0.001$) (Figure 3). During COVID-19 and before SB 319 (March 2020–March 2022), the trend in monthly FRI rate was not significant ($\beta = 0.42$, 95% CI -0.33-1.17, $p = 0.270$). After SB 319 was put into effect, there was the previously documented significant, sustained increase of 2.3 additional patients with FRI per 1,000 trauma visits each month (95% CI 0.28–4.26, $p = 0.026$). This slope did not statistically differ with the pre-SB 319 slope ($\beta = 0.42$ vs. 2.26, 95% CI -0.28-3.98, $p = 0.092$). See Supplementary Table S3 for more information.

3.2.4 Relationship between patient race and FRI outcomes

Sex, ethnicity, age, insurance status, and mechanism of injury correlated with Black and White race ($p < 0.05$) (Table 2). Black patients were more publicly insured compared to White patients (86.4% vs. 72.5%), and less privately insured (8.2% vs. 19.1%). Black patients suffered more assault injuries (49.1% vs. 23.7%), less unintentional injuries (40.9% vs. 61.8%), and less intentional self-inflicted injuries than White patients (2.7% vs. 6.1%). A larger percentage of Black patients were in the youngest cohort (0–6 years-old) compared to White patients (30.5% vs. 19.8%).

Differences in unweighted versus weighted models over COVID-19 and SB 319 were not found, and for the sake of brevity, will not be reported. Mortality rate in the overall sample is 5.4%. Race was not found to affect mortality odds (OR 1.46, 95% CI 0.68–3.16, $p = 0.334$) (Table 3). Race was also not found to affect admission odds (OR 0.83, 95% CI 0.53–1.30, $p = 0.427$) (Supplementary Table S4).

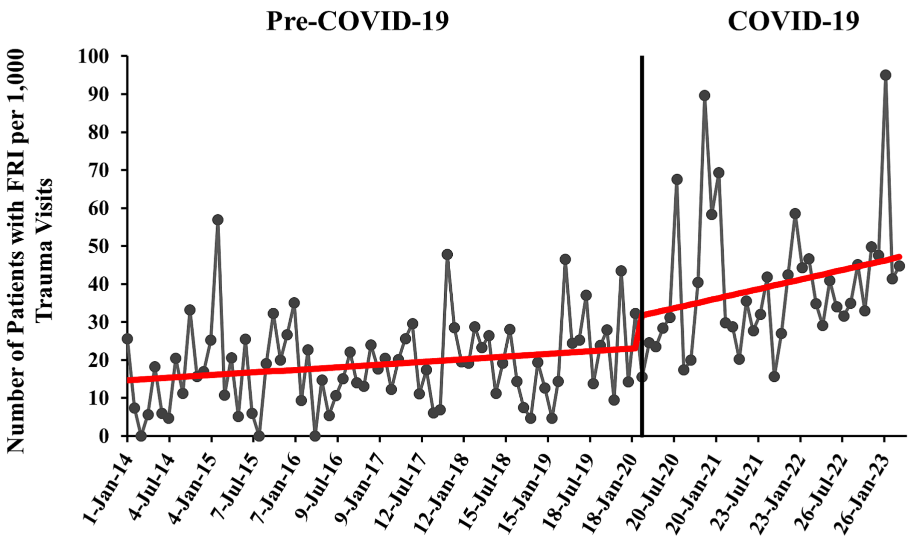

FIGURE 1
Monthly rate of pediatric patients with firearm-related injury (FRI) pre- versus during COVID-19 with overlaid interrupted time series (ITS) trend (red line). Rate of patients with FRI is calculated per 1,000 patient visits to our EDs that were qualified for and were registered in the trauma registry (trauma visits).

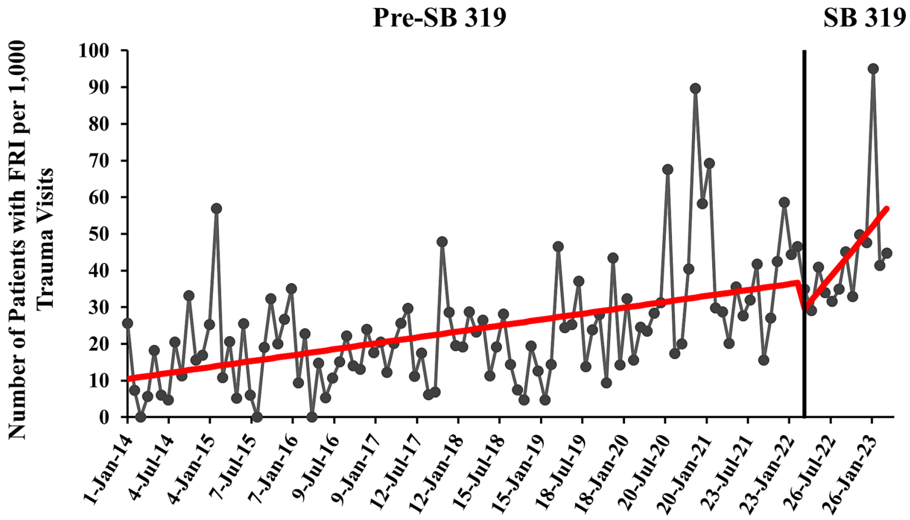

FIGURE 2
Monthly rate of pediatric patients with firearm-related injury (FRI) pre- and post-Constitutional Carry Act (SB 319) with overlaid interrupted time series (ITS) trend (red line). Rate of patients with FRI is calculated per 1,000 patient visits to our EDs that were qualified for and were registered in the trauma registry (trauma visits).

Likewise, race did not affect odds of being discharged to rehabilitation (OR 0.76, 95% CI 0.36–1.58, $p = 0.459$) (Supplementary Table S5).

3.2.5 Relationship between insurance and mortality

Majority of patients had public insurance (82.6%), followed by private (10%), and self-pay (6.8%). Race ($p < 0.001$) and ethnicity ($p = 0.04$) associated with patient insurance (Table 4). Private insurance had the largest proportion of White patients (35.7% vs. 23.4% uninsured vs. 16.6% public). Privately insured patients had the highest mortality rate (10%), followed by uninsured patients (8.3%), and publicly insured patients (4.7%) (Table 5). In the unweighted model, publicly insured patients had 58% lower odds of death than privately insured patients (OR 0.42, 95% CI 0.18–0.99, p = 0.04). When controlled for age, sex, race, ethnicity, mechanism of injury, ISS, and year of injury, differences between mortality rates were not found (OR 0.76, 95% CI 0.23–2.53, $p = 0.65$). The remaining temporal analysis is exploratory as cell counts are less than 5. Privately insured patients had a lower mortality rate during COVID-19, not statistically different from that of publicly insured patients. Uninsured patients had a higher mortality rate during COVID-19, statistically different from that of privately insured patients.

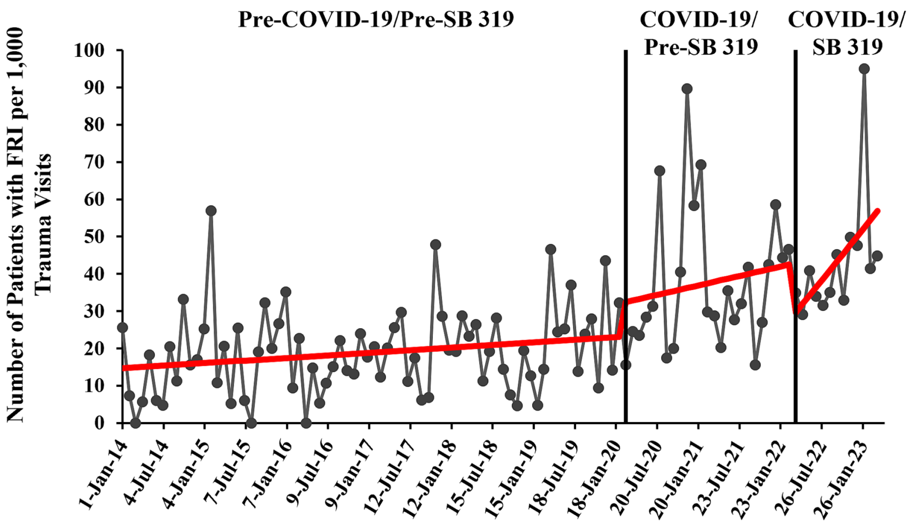

FIGURE 3
Monthly rate of pediatric patients with firearm-related injury (FRI) pre- and during COVID-19 and pre- and post-Constitutional Carry Act (SB 319) with overlaid interrupted time series (ITS) trend (red line). Rate of patients with FRI is calculated per 1,000 patient visits to our EDs that were qualified for and were registered in the trauma registry (trauma visits).

TABLE 2 Participant characteristics by race (Black versus White, *N* = 656).

Characteristic, Raw *N* (col. %) or Median (IQR)	Black Race, *N* = 525	White Race, *N* = 131	*p*-value	Unweighted SMD[a]	IPTW SMD[b,c]
Sex					
Female	132 (25.1%)	22 (16.8%)	**0.044**	0.206	0.053
Male	393 (74.9%)	109 (83.2%)			
Ethnicity					
Hispanic/Latino	4 (0.8%)	21 (16%)	**<0.001**	0.573	0.206
Non-Hispanic/Latino	521 (99.2%)	110 (84%)			
Age					
0–6	160 (30.5%)	26 (19.8%)	**0.004**	0.359	0.189
7–12	158 (30.1%)	61 (46.6%)			
13–15	161 (30.7%)	34 (26%)			
16–20	46 (8.7%)	10 (7.6%)			
Insurance, *N* = 652					
Private	43 (8.2%)	25 (19.1%)	**0.001**	0.357	0.105
Public	450 (86.4%)	95 (72.5%)			
Uninsured	28 (5.4%)	11 (8.4%)			
Mechanism of injury					
Unintentional	215 (40.9%)	81 (61.8%)	**<0.001**	0.570	0.213
Assault	258 (49.1%)	31 (23.7%)			
Child Abuse/Legal intervention	2 (0.4%)	0 (0%)			
Intentional Self-infliction	14 (2.7%)	8 (6.1%)			
Other/Undetermined	36 (6.9%)	11 (8.4%)			
ISS, *N* = 641	5 (1, 13)	4 (1, 10)	0.078	0.120	0.067

[a] SMDs < 0.25 are considered balanced.
[b] IPTW SMDs are calculated using stabilized ATE IPTW, truncated at 1 and 99%.
[c] Unweighted and IPTW weighted SMD are 0.417 and 0.089 for year, respectively.
Bold values indicate significance at the 0.05 level.

TABLE 3 Unweighted and weighted mortality models, using Firth Logistic Regression *N* = 656.

Characteristic	Alive, *N* = 621 Raw *N* (row %)	Deceased, *N* = 35 Raw *N* (row %)	Unweighted OR (95% CI)	*p*-value	IPTW OR (95% CI)[a]	*p*-value
Race						
Black	499 (95%)	26 (5%)	Reference	0.334	Reference	0.266
White	122 (93.1%)	9 (6.9%)	1.46 (0.68, 3.16)		1.61 (0.70, 3.75)	
Pre-COVID-19, *N* = 281						
Race						
Black	196 (95.6%)	9 (4.4%)	Reference	0.223	Reference	0.583
White	70 (92.1%)	6 (7.9%)	1.91 (0.68, 5.39)		1.47 (0.37, 5.82)	
COVID-19, *N* = 375						
Race						
Black	303 (94.7%)	17 (5.3%)	Reference	0.812	Reference	0.244
White	52 (94.6%)	3 (5.4%)	1.16 (0.35, 3.82)		1.85 (0.66, 5.21)	
Pre-SB 319, *N* = 523						
Race						
Black	390 (94.7%)	22 (5.3%)	Reference	0.398	Reference	0.635
White	103 (92.8%)	8 (7.2%)	1.43 (0.63, 3.24)		1.27 (0.48, 3.36)	
SB 319, *N* = 133						
Race						
Black	109 (96.5%)	4 (3.5%)	Reference	0.528	Reference	0.081
White	19 (95%)	1 (5%)	1.87 (0.27, 13.1)		4.44 (0.83, 23.7)	

[a] IPTW weights are calculated using GBM with *N* = 10,000 trees, stabilized and trimmed at 1 and 99%; Weights adjust for sex, ethnicity, age, insurance, mechanism of injury, ISS, and year as confounding covariates.

4 Discussion

Our study highlights an alarming rise in pediatric FRI in pediatric level I and level II trauma centers in Atlanta, Georgia over the last 9 years. Results revealed distinctions in the rates of FRI during two notable dates, the start of the COVID-19 pandemic and the effective date of state firearm law SB 319. These findings are consistent with other studies documenting similar increases over time, some in relation to the start of COVID-19 (9, 10, 13, 40) and others not (1, 18). In the present study, and consistent with past literature, patients in our sample were majority male, Black, publicly insured, and injured by assault and unintentional shootings (19). Our sample was younger in age compared to national samples, where a majority of pediatric patients with FRI are in the older adolescent age group (19, 41). This is due, in-part, to our trauma center's proximity to adult trauma centers; patients 15 years-old and older are often routed to adult centers.

Before the COVID-19 pandemic, a significant trend in pediatric firearm rate was not found. During COVID-19, there was a sustained increase of an additional 0.42 pediatric patients with FRI per 1,000 trauma visits each month. This increase, however, was not statistically different from pre-COVID-19. Moreover, when the COVID-19 period was separated into pre- and post-SB 319, the COVID-19/Pre-SB 319 slope was insignificant. We have two possible hypotheses for these findings. First, this may suggest that the increase in FRI rates during COVID-19 was driven by the introduction of SB 319 in our state. Alternatively, prior studies that observed increased FRI rates during COVID-19 analyzed a shorter period of time, typically 6-months to 1.5-years after the start of COVID-19 (9, 10, 13, 40). Increased rates of FRI were associated with acute changes during the start of the pandemic, such as school closures and record-setting firearm purchases (9, 10, 13). Today, there are arguably less societal and economic disruptions resulting from the pandemic.

A unique contribution of this manuscript was the inclusion of The Constitutional Carry Act, a Georgia law effective since April 2022 that allows for concealed carry of firearms in public without a permit. A recent study in West Virginia found that after a concealed firearm carry law was enacted, monthly firearm mortalities in the state increased, along with brief spikes in firearm sales and homicide (42). This suggests that concealed carry laws directly impact how people purchase and use guns and may lead to increases in firearm-related assaults. In our study, there was a sustained increase in pediatric FRI by 2.3 additional patients per 1,000 trauma visits each month after the law was in effect. Given the restricted timeline (12-months post-law) and nature of the study assessing one hospital system, outliers may be exaggerating this association. Over time, we will be able to assess the association of the law and pediatric FRI more accurately. However, in the year after the law was in effect, even the lowest predicted rates of pediatric FRI are remarkably high, unlike in previous periods. This concerning trend necessitates intervention and continued evaluation of incidence rates.

Studies have found that among the U.S., Southern states have the highest rates of pediatric FRI incidence (19), have worsening pediatric FRI mortality rates (1), and have one of the highest rates of pediatric

TABLE 4 **Participant characteristics by insurance (Private versus Public versus Uninsured, *N* = 697)**[d].

Characteristic, Raw *N* (col. %) or Median (IQR)	Private, *N* = 70	Public, *N* = 579	Uninsured, *N* = 48	*p*-value	Unweighted SMD[a]	IPTW SMD[b,c]
Sex						
Female	17 (24.3%)	135 (23.3%)	10 (20.8%)	0.905	0.055	0.072
Male	53 (75.7%)	444 (76.7%)	38 (79.2%)			
Race, *N* = 690						
Black	43 (61.4%)	450 (78.5%)	28 (59.6%)	**<0.001**	0.480	0.080
White	25 (35.7%)	95 (16.6%)	11 (23.4%)			
Mixed/Other Race	2 (2.9%)	28 (4.9%)	8 (17%)			
Ethnicity, *N* = 696						
Hispanic/Latino	1 (1.4%)	40 (6.9%)	6 (12.5%)	**0.048**	0.304	0.183
Non-Hispanic/Latino	69 (98.6%)	538 (93.1%)	42 (87.5%)			
Age						
0–6	14 (20%)	175 (30.2%)	8 (16.7%)	0.250	0.261	0.211
7–12	26 (37.1%)	192 (33.2%)	17 (35.4%)			
13–15	22 (31.4%)	164 (28.3%)	19 (39.6%)			
16–20	8 (11.4%)	48 (8.3%)	4 (8.3%)			
Mechanism of injury						
Unintentional	35 (50%)	261 (45.1%)	23 (47.9%)	0.087	0.314	0.179
Assault	23 (32.9%)	264 (45.6%)	19 (39.6%)			
Child Abuse/Legal Intervention	0 (0%)	2 (0.4%)	0 (0%)			
Intentional Self-infliction	7 (10%)	15 (2.6%)	1 (2.1%)			
Other/Undetermined	5 (7.1%)	37 (6.4%)	5 (10.4%)			
ISS, *N* = 679	5 (1, 17)	5 (1, 10)	4 (1, 9)	0.341	0.163	0.062

[a] SMDs < 0.25 are considered balanced.

[b] IPTW SMDs are calculated using stabilized ATE IPTW, truncated at 1 and 99%.

[c] Unweighted and IPTW weighted SMD are 1.023 and 0.788 for year, respectively.

[d] Four patients who had unknown insurance (*N* = 3) and other insurance (*N* = 1) were excluded.

Bold values indicate significance at the 0.05 level.

firearm homicide (16). It has been estimated that 49% of Georgia households own a firearm (43). Southern states have high rates of firearm ownership and unsafe storage (44), as defined by storing firearms loaded and unlocked. Households where children and adolescents suffered unintentional injuries or intentionally self-inflicted injuries are more likely to have unlocked, loaded firearms in the home that were stored with ammunition (45). One study found that Black households are more likely than White households to store firearms loaded and unlocked (44). Almost half of the children and adolescents injured by firearms in our sample were injured unintentionally. This often looks like a child getting ahold of an unlocked, loaded firearm at home, playing with it, and accidentally injuring themselves or another child (16, 45, 46). Consistent with the literature, it is possible that many of the pediatric FRI in our sample occurred due to the availability of firearms, and non-powder guns, within the household.

Although we did not find statistical differences in mortality odds between racial groups, there were four times as many Black patients with FRI than there were White patients in our sample. The disproportionate increase in Black patients seen over time is corroborated in other studies as well (19), although our cohort appears to have more Black patients than national studies (74.9% vs. 50%) (1, 19). This may be due in-part to the racial profile of Atlanta. However, further review of the trauma registry data did not show similar racial distributions nor differences in rates of trauma over time, suggesting a discrepancy in rates of FRI in Black children and adolescents compared to White. Studies have found that deprived (21) or low-income areas correlate with higher pediatric FRI risk (19) and mortality rates (1). Studies have shown that Black and other minoritized race groups come from low socio-economic backgrounds that put them at increased risk for injuries (26). Future studies should investigate the correlation between neighborhood-level SDH, race, and FRI in Atlanta.

We did not find differences in acute outcomes based on race. A national analysis of pediatric FRI mortality data found that Black patients suffer 4 times the mortality rate of White patients (34), while another looking at national hospitalizations found that Black patients had lower odds of mortality than White patients (41). These mortality disparities often relate to mechanism of injury; a recent study found that White patients had higher odds of mortality due to higher rates of intentional self-inflicted injuries (32). Concurrent with national trends, Black patients in our sample suffered more assault injuries and less unintentional and intentional self-inflicted injuries than White patients did (32, 41, 47). The uneven distribution of race in our sample may have contributed to our lack of findings in mortality disparities. In addition, mortality was difficult to model as it was a rare outcome.

TABLE 5 Unweighted and weighted mortality regression models, using Firth Logistic Regression $N = 697$.

Characteristic	Alive, $N = 659$ Raw N (row %)	Deceased, $N = 38$ Raw N (row %)	Unweighted OR (95% CI)	p-value	IPTW OR (95% CI)[a,b]	p-value
Insurance[c]						
Private	63 (90%)	7 (10%)	Reference		Reference	
Public	552 (95.3%)	27 (4.7%)	0.42 (0.18, 0.99)	**0.047**	0.76 (0.23, 2.53)	0.652
Uninsured	44 (91.7%)	4 (8.3%)	0.86 (0.25, 2.96)	0.806	2.08 (0.37, 11.6)	0.404
Pre-COVID-19, $N = 298$						
Insurance						
Private	35 (87.5%)	5 (12.5%)	Reference		Reference	
Public	208 (95.4%)	10 (4.6%)	0.33 (0.11, 0.98)	**0.046**	0.67 (0.13, 3.54)	0.640
Uninsured	39 (97.5%)	1 (2.5%)	0.25 (0.04, 1.61)	0.144	0.60 (0.04, 10.3)	0.726
COVID-19, $N = 399$						
Insurance						
Private	28 (93.3%)	2 (6.7%)	Reference		Reference	
Public	344 (95.3%)	17 (4.7%)	0.58 (0.14, 2.35)	0.714	0.68 (0.14, 3.33)	0.639
Uninsured	5 (62.5%)	3 (37.5%)	7.26 (1.05, 50.3)	**0.045**	6.67 (0.73, 60.8)	0.093
Pre-SB 319, $N = 552$						
Insurance						
Private	58 (89.2%)	7 (10.8%)	Reference		Reference	
Public	418 (94.8%)	23 (5.2%)	0.44 (0.18, 1.05)	0.063	0.74 (0.22, 2.52)	0.629
Uninsured	43 (93.5%)	3 (6.5%)	0.63 (0.16, 2.40)	0.496	1.30 (0.18, 9.43)	0.795
SB 319, $N = 145$						
Insurance						
Private	5 (100%)	0 (0%)	NA		NA	
Public	134 (97.1%)	4 (2.9%)	Reference		Reference	
Uninsured	1 (50%)	1 (50%)	0.03 (0.002, 0.63)	**0.023**	0.05 (0.004, 0.68)	**0.024**

[a] IPTW weights are calculated using GBM with $N = 10{,}000$ trees, stabilized and trimmed at 1 and 99%; Weights adjust for sex, race, ethnicity, age, mechanism of injury, ISS, and year as confounding covariates.

[b] IPTW weighted models additionally include year as a continuous covariate due to post-weight SMD imbalance (Weighted SMD = 0.788).

[c] Four patients who had unknown insurance ($N = 3$) and other insurance ($N = 1$) were excluded.

Bold values indicate significance at the 0.05 level.

The study sample's unique characteristics may have contributed as well, such as the large proportion of younger children and adolescents.

Patients with private insurance had significantly higher odds of mortality than patients with public insurance. However, when controlled for confounding factors such as race, year of injury, and mechanism of injury, this difference was not found. As this analysis was more exploratory in nature, further investigation is needed to understand what is driving this change. Privately insured patients suffered more intentional self-inflicted injuries compared to publicly insured patients (10% vs. 2.6%); this mechanism is known to be more severe and lethal than other mechanisms and may help to explain differences in mortality between these groups (41). Other FRI studies that examined insurance have found disparities in mortality between uninsured and insured patients (19, 23). To our knowledge, we are among few studies that found disparities between private and public insurance, particularly in pediatric FRI. One pediatric trauma study found that insurance, rather than race, predicted mortality (25); another found that a combination of both is necessary to understand disparities (24). The disparities found in the present study are likely better explained by SDH; future investigations are needed to understand the intricacies between race, insurance, other SDH, and acute outcomes following FRI. Notably, insurance is an important SDH; it can serve as a proxy to socioeconomic status (SES), and it affects hospital-based care and care-seeking behaviors (39). However, it mainly reflects individual-level factors. Future studies will benefit from examining neighborhood-level SDH, such as neighborhood depravity. Additionally, mortality rates in our sample were found to have fluctuated across COVID-19 in privately insured patients but not publicly insured patients. This suggests a need for continued investigation into temporal differences.

There are several limitations within our study that are worth noting. Race and insurance analysis were balanced by mechanism of injury, among other factors, to avoid its potential confounding effects with the outcome. As such, the effects of mechanism of injury could not be included as a predictor in the regression analysis but should be addressed in future studies. As an outcome, mortality was a rare occurrence and presents challenges for constructing and interpreting models. Older adolescents are often sent to a neighboring adult Level I trauma center in Atlanta; thus, our older adolescent group is likely smaller and less representative of the adolescent population with FRI in our area. This study is also limited to available trauma registry data, which only collects acute outcomes, rather than long-term outcomes. Patients who were not at our hospitals (i.e., patients that passed away at the scene) are not included in this study. Notably, we did not validate trauma registry data with review of electronic medical records. Mechanism of injury, which is taken from ICD E-code, could be inaccurate (48). There may also be an overrepresentation of Medicaid insurance in the Trauma registry, as our institutional trauma registry defaults insurance type to Medicaid if the field is not entered. Additionally, race and ethnicity are pulled from medical records, which are entered by hospital staff who register patients upon entry. There is a possibility that given the busy nature of the hospital and severity of these injuries that some of the race and ethnicity fields could have been assumed based on phenotype rather than inquired of the patient or their family. Finally, our study was limited to single center design and may not be representative of the rest of our state or national pediatric rates of FRI. There may be a chance our hospital systems are receiving more of the state's proportion of pediatric patients with FRI over time, this can be assessed in a future study examining state-wide pediatric FRI.

5 Conclusion

The observed increase of FRI in children and adolescents at our trauma centers is highly concerning. Both COVID-19 and the Constitutional Carry Act (SB 319) were followed by significant sustained increases in pediatric patients with FRI. The continual increase of children and adolescents injured by firearms requires both evidence-based interventions and continued research to evaluate trends and inform interventions. The high concentration of Georgian children and adolescents injured necessitates interventions in the Atlanta and surrounding area, such as violence prevention programs and safe firearm storage training (49). Further investigation into SDH and pediatric FRI are needed to understand the observed insurance-based differences in mortality odds and to identify factors driving the increased FRI incidence among Black children and adolescents. Although racial disparities were not found in acute outcomes, majority of pediatric patients survive FRI, thus necessitating research into long-term outcomes, including long-term physical, cognitive, and emotional functioning. With further research into FRI, acute and long-term outcomes, disparities, and the intersection of SDH, we can address the increase in pediatric FRI at its source and help children and adolescents live high-quality lives.

Data availability statement

The datasets presented in this article are not readily available due to concerns regarding patient confidentiality. Requests to access the datasets should be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Children's Healthcare of Atlanta Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians because this study is a retrospective chart review and thus consent was not required.

Author contributions

MM: Conceptualization, Data curation, Investigation, Writing – original draft, Writing – review & editing. GB: Conceptualization, Writing – original draft. KP: Writing – original draft. SG: Formal analysis, Methodology, Visualization, Writing – review & editing, Software. LJ: Formal analysis, Methodology, Visualization, Writing – review & editing, Software. KD: Writing – review & editing. AR: Project administration, Resources, Writing – review & editing. LB: Conceptualization, Investigation, Project administration, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1339394/full#supplementary-material

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Receptivity of providing firearm safety storage devices to parents along with firearms safety education

Kiesha Fraser Doh[1,2,3]*†, Zhana Bishop[1,2], Trishanne Gillings[4], Jonathan Johnson[1], Angela Boy[1,4], Rabbia S. Waris[1,2], Amina M. Bhatia[1,5], Matthew T. Santore[1,5] and Harold K. Simon[1,2,3]

[1]Children's Healthcare of Atlanta, Atlanta, GA, United States, [2]Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, United States, [3]Department of Emergency Medicine, Emory University School of Medicine, Atlanta, GA, United States, [4]Emory University School of Medicine, Atlanta, GA, United States, [5]Department of Surgery, Emory University School of Medicine, Atlanta, GA, United States

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EDITED BY
Dabney Evans,
Rollins School of Public Health,
Emory University, United States

REVIEWED BY
Susan M. Swider,
Rush University, United States
Karen Sheeha,
Ann & Robert H. Lurie Children's Hospital of Chicago, United States
Kelsey Gastineau,
Vanderbilt University Medical Center,
United States

*CORRESPONDENCE
Kiesha Fraser Doh
✉ kiesha.fraser@emory.edu

†PRESENT ADDRESS
Pediatric Trauma Societies,
Houston, TX, United States

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Background: In the United States, 33% of households with children contain firearms, however only one-third reportedly store firearms securely. It's estimated that 31% of unintentional firearm injury deaths can be prevented with safety devices. Our objective was to distribute safe storage devices, provide safe storage education, evaluate receptivity, and assess impact of intervention at follow-up.

Method: At five independent, community safety events, parents received a safe storage device after completing a survey that assessed firearms storage methods and parental comfort with discussions regarding firearm safety. Follow-up surveys collected 4 weeks later. Data were evaluated using descriptive analysis.

Result: 320 participants completed the surveys, and 288 participants were gunowners living with children. Most participants were comfortable discussing safe storage with healthcare providers and were willing to talk with friends about firearm safety. 54% reported inquiring about firearm storage in homes their children visit, 39% stored all their firearms locked-up and unloaded, 32% stored firearms/ammunition separately. 121 (37%0.8) of participants completed the follow-up survey, 84% reported using the distributed safety device and 23% had purchased additional locks for other firearms.

Conclusion: Participants were receptive to firearm safe storage education by a healthcare provider and distribution of a safe storage device. Our follow up survey results showed that pairing firearm safety education with device distribution increased overall use of safe storage devices which in turn has the potential to reduce the incidence of unintentional and intentional self-inflicted firearm injuries. Providing messaging to promote utilization of safe storage will impact a firearm safety culture change.

KEYWORDS

safe storage, firearm, pediatric, gun, safety device

Introduction

Firearm injury is the leading cause of death in children and teenagers throughout the United States (1). Public health initiatives that promote tools for safe storage of firearms are essential to successfully combat this epidemic. It is estimated that 3,607 children between the ages of 0–18 years lost their lives because of a firearm in the United States in 2021 (1). Unintentional injuries in children are frequently associated with access to loaded firearms (2). The #NotAnAccident Index recorded that 2,800 unintentional injuries and deaths occurred between 2015 and 2022 due to children gaining access to firearms and these incidents occur daily (3). A national survey of parents revealed that one in three households with children had a firearm and among gun-owning households with children, approximately 2 in 10 gunowners reported storing at least one firearm in the least safe manner, loaded and unlocked (4). Furthermore gun owning families surveyed in a Southeastern United States Children's Hospital Emergency Department, reported storing about 53% of their firearm in an unsecure manner (5). Unintentional firearm injuries primarily occur in the homes of the child victims themselves and with firearms belonging to family members (3, 6). Data show that if 20% of families who previously stored their firearms unlocked were motivated to safely store firearms securely, potentially 32% of adolescent deaths due to suicide could be prevented annually (7).

Education on the frequency of pediatric firearm injuries and the importance of safe firearm storage have been effective in increasing the likelihood that firearms will be stored securely (8, 9). Thus we sought to combat the rise in children gaining access to firearm by providing firearm safe storage education and firearm safety devices at community safety events. We hypothesized that parents would be receptive to education about firearm safety by healthcare providers and would be willing to utilize firearm safe storage devices when paired with educational intervention.

Materials and methods

Study setting

Data were collected by surveys at five separate community safety events in 2018 and 2019. The events included 3 safety fairs, one children's hospital lobby tabling event and one pediatric urgent care tabling event. Two of the three safety fairs were organized by fire departments one in a suburban county the other a suburban city. The third safety fair was coordinated by an urban mental health awareness coalition. The three safety fairs organizers invited the children's hospital injury prevention team to participate in the fair. The children's hospital is in an urban area and the urgent care in a suburban area of the metropolitan region. Both the children's hospital and urgent care are healthcare sites within the organization that received the grant to distribute the lockboxes. All safety fairs occurred in a region that is considered the 8th largest US metropolitan area. Participants provided verbal consent before completing the in-person survey. A follow-up survey was completed via telephone at least 4 weeks later to assess the usage of storage devices given at the events. This study was approved by the Institutional Review Board of Emory University.

Educational intervention

Each participant who approached the giveaway event table was given an educational handout with information about the importance of safe storage along with a brief educational intervention. The educational intervention was provided by trained clinicians who were taught to explain in the detail the information that was provided in the handout. The education entailed an explaining to the participants how to safely store their firearms: unloaded, locked-up and separate from ammunition. In addition, participants with a firearm in their home and those without where all educated about the importance of asking about the presence of unsecured firearms in homes their children visited. Each participant was given a handout that was developed by the American College of Emergency Physicians (see Appendix 1).

Inclusion and exclusion criteria

This study included a convenient sample of caregivers of anyone presenting to our booth at the community events. Caregivers voluntarily agreed to participate by approaching the table where we had signage regarding firearm safety and safe storage device giveaway. Inclusion criteria were participants who were at least 18-year-old, English-speaking with children in the home. Exclusion criteria were those without children in the home and non-English speaking. Each participant agreed to provide contact information for the follow-up survey.

Data collection

Data were managed using REDCap, an electronic data capture tool hosted at Children's Healthcare of Atlanta. REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for data integration and interoperability with external sources (10, 11). Trained volunteers were present at the booth to assist participants with survey completion. All patient demographics were de-identified except for their phone numbers and emails. Electronic surveys were the primary source of data collection but if a paper survey was used the participants survey was then subsequently transcribed by research assistants into the REDCap software Paper surveys were used only when Wi-Fi access was inconsistent. Email and phone numbers were solely utilized to contact participants if they consented to participate in the follow-up survey. The-29-item survey included questions on demographics, presence of firearms, firearm storage and firearm safety discussions. The initial survey contained 8 demographic questions, 17 questions regarding gun ownership and secure storage and 4 questions to coordinate future surveys. The follow-up survey was brief with a total of 7 questions that focused on presence of firearms and their storage, use of storage devices given at the events, buying new storage devices, and inquiring about safe firearm storage in other homes where their children visit. Participants who consented to respond to an electronic follow-up survey received a 5$ gift card for participating. The gift card was only provided to participants once the follow-up survey was completed. The gift card was sent electronically via the provided participant email after completion of the follow-up survey. Initial survey questions and follow-up survey questions were modified from previous work done at community events by Simonetti and colleagues (8).

Statistical analysis

Survey responses are reported as percentages. Data were analyzed using descriptive analysis. Percent difference from follow-up survey was calculated using the (follow-up value) −(initial survey value).

Results

A total of 320 participants completed the initial survey with 288 participants identifying the number of children in their home under 18 years in their home. 32 participants did not identify the number of children in their home although they did state they had children in their home. Of the participants 39% reported firearms currently were unloaded and locked away, 32% stored their firearms and ammunition separately and 25% did not have a secure storage device for their firearms. Firearm storage or firearm presence in the homes their children visited had been inquired upon by 54% of those surveyed. Most parents were comfortable with healthcare provider education on safe storage (Table 1).

Just over 1/3 ($n = 121$, 37.8%) of participants completed the follow-up survey. Of those participants, 85% had asked about the presence of firearms in the homes their children visited which is a + 23.4% rise compared to the initial survey. When asked if all their firearms were stored locked and unloaded there was a + 27.6% increase in storing firearm securely. Furthermore, 23% of participants had purchased additional locks for other firearms (Tables 2, 3).

TABLE 1 Initial survey.

Initial survey, *n* = 320	Total *N*	%
Gender (Female)	184	57.5
Age (years)		
18–24	11	3.4
25–39	129	40.3
40–60	145	45.3
Over 60	35	10.9
Ethnicity		
White	124	38.8
Hispanic/Latino	21	6.6
Black/AA	155	48.4
Native American/Indian	6	1.9
Asian/Pacific Islander	1	0.3
Other	10	3.1
Children living in the home (n = 288)*		
1	82	25.6
2	94	29.4
2+	64	20.0
Have you ever inquired about firearm storage in the homes your children visit?	172	53.8
All firearms are locked-up and unloaded (yes)	126	39.4
Firearms and ammunition stored separately (yes)	102	31.9
Do you have alarm system in home (yes)	170	53.1
What kind of safety device do you currently use?		
Firearm safe	103	32.2
Firearm lock box	58	18.1
Trigger	57	17.8
Cable	43	13.4
Other	26	8.1
None	81	25.3
Would you be willing to talk to friends and colleagues about firearm safety?	298	93.1
Would you be comfortable discussing with healthcare providers?	292	91.3

*32-participants did not identify number of children in home.

Discussion

Healthcare providers recommendation a valuable tool for safe storage promotion

This study demonstrates that parents presenting to a community safety event, overwhelmingly appear comfortable with healthcare providers offering guidance on safe storage of their firearms (91%). This is important to note as many healthcare providers feel parents would not be receptive and therefore are reluctant to educate. But studies have consistently shown that both gun owners and non-gunowners feel that it is appropriate for physicians and other healthcare professionals to provide gun safety education (12). Some physicians also report feeling that it is forbidden to have these conversations by either legislation or HIPAA. Laws that have previously proposed such as a law in Florida that was enacted in 2011 have been struck down (13). Furthermore, there are not any provisions in Health Insurance Portability and Accountability Act or Affordable Care Act (ACA) that states that healthcare professionals cannot talk about gun safety. In fact, within the ACA there are requirements for the collection of firearm information by "wellness and health promotion" programs (14). Furthermore, after an increase in firearm-related injuries presenting to EDs in 2010–2019, and an unprecedented increase in firearm injuries occurring in 2020 (15, 16) the American Academy of Pediatrics released an expansive policy statement encouraging pediatricians to educate parents about firearm safety (17). Thus, our community firearm injury prevention program is actually encouraged by federal law and the largest professional organization of physicians who care for children.

Safety education as a tool for behavioral modification

During the initial survey, 54% of participants reported that they inquired about firearm storage in the homes their children frequented.

TABLE 2 Follow-up survey.

Follow up survey, $n = 121$	Total N	
Have you inquired about the presence of unlocked firearms in the homes that your children frequent?	85	70.2
Did you find it to be an easy conversation to initiate?	101	83.5
Are all your firearms locked and unloaded?	81	66.9
Is all your ammunition stored locked?	86	71.1
Is your ammunition stored separately from your firearm?	78	64.5
Did you buy any firearm locks for your other firearms?		
Yes	28	23.1
No	41	33.9
N/A	37	30.6
Have you been using the device that was distributed at the Safety Fair? Yes	102	84.3

TABLE 3 Comparison of participants.

Additional questions	Initial survey ($n = 320$)	Follow up survey ($n = 121$)	Percentage change
Do you inquire about firearms in homes that your children visit?	172 (53.8)	85 (77.2)	23.4
Are all your firearms stored locked and unloaded?	126 (39.4)	81 (66.9)	27.5
Are your firearms and ammunition stored separately?	195 (60.9)	78 (64.5)	3.6

This increased by 16.5% when reassessed in the 4-week follow-up survey. This highlights the potential impact of educational intervention geared toward parents that can motivate a culture change and reduce access to unsecured firearms and therefore unintentional injuries. Our study revealed that parents are potentially amenable to change in behavior with 84% of our participants finding it easy to have conversations about unlocked firearms in homes that their children visit after the four-week follow up. While there was a general script as described in methods (educational intervention) that was followed for counseling at each of the five events there were numerous volunteers whose diversity of age, gender and experience impacted the way the survey was administered but our results suggest that interacting at the safety fairs may have influenced parents to inquire about other opportunities where their children may have access to loaded firearms. Previous work by our group and others has shown that after receiving education on the importance of asking about unsecured firearms most participants report feeling comfortable asking if there were a firearm in homes prior to their child's visit (18).

Decreasing youth access to firearms is important as our local data shows that at least 14% of teens could access a firearm within 24 h (5). A national survey of parent–child dyads described even greater access and demonstrated that while 70% of parents believed their child would not be able to access a firearm, 37% of adolescents said they could within an hour (19). One study that demonstrates the ineffectiveness of just telling children not to handle a firearm was performed at our institution where boys were left in a room with a firearm that was engineered for safety unbeknownst to the participants; 76% of the boys handled the firearm and 48% pulled the trigger despite most of the participants previously receiving firearm safety instructions (20). These studies highlight the importance of parental awareness of the significance of safe, secure consistent locked up storage of firearms. One probability study depicted that up to 32% of unintentional and suicide related firearm deaths could be reduced with motivating caregivers to store firearms safely (7).

Encouraging results of parental utilization of safety device

After the four-week follow-up, 102 of 121 (84%) of participants reported using the safe storage device they were given. In addition, there was an increase of participants who reported having all their firearms locked and unloaded: 39% (126, $n = 240$) during the initial survey and 76% (81, $n = 121$) during follow-up 4 weeks later. This is consistent with other studies that have shown effectiveness of interventions to promote safe storage that are paired with counseling and distribution of safe storage device compared to interventions without distribution of safe storage device (9). Our group distributed free safe storage lock boxes or trigger locks which have been established to be the preferred methodology over providing devices at a reduced cost (21). In addition other studies have indicated that parents would be more inclined to use a firearm lock box than cable lock or trigger lock (22). This may be because families are increasingly purchasing firearms for their protection, as 72% of US gun owners cite security as their major reason to own a firearm and lock boxes add ready access to their firearms (23). To our knowledge this study is one of the only studies to gauge receptiveness to health care provider delivered messages on firearm safety at a community-based safety event. Furthermore, to our knowledge, we are the only program describing this type of education in the Southeastern United States. It is a crucial area to target it in a region with historically high gun ownership and therefore above average rates of unintentional pediatric firearm injury (8, 24–26).

Limitations

This study has some limitations. First, only participants who spoke English were approached to complete the surveys. This may have introduced a sampling bias and thus is not representative of all families who own firearms in our region or in the United States. Second, this study used a convenience sample as only those who visited our booth at the safety fair events were included. Caregivers who attend a fair that is focused on health and well-being may be preconditioned to adhere to and or be more receptive to the education that was provided. Thus, self-selection probably occurred and is a major limitation to this study, but the lockboxes were free thus open to all who approached our table and met inclusion criteria. Third, self-reported surveys have potential for social desirability bias this was mitigated by writing clear concise non-leading questions many questions giving respondents the opportunity to free text responses on some questions. Fourth, there was a reduced number of initial survey participants who consented to follow-up survey contact and subsequently proceeded to complete the follow-up survey which could lead to nonresponse bias. We opted to incorporate a more diverse array of survey participants and a broader perspective by integrating findings from both the initial and follow-up surveys. This decision was made despite not obtaining consent from all initial survey respondents for the follow-up survey. This approach left the study open to a significant non-response bias, the extent of which remains uncertain.

Fifth, with follow-up after only 4 weeks, we were not able to assess the long-term effectiveness and sustainability of our intervention measures.

Finally, this study relied on self-reported follow-up responses and may not reflect actual practices, however, the receptivity of onsite education and receiving a safety lock was demonstrated. Future large-scale studies conducting long-term follow-up research to track the impact of utilization of firearm safe storage and education on reducing unintentional firearm injury are supported by this pilot study.

Conclusion

Our findings support previous studies that show participants with children in their household are receptive to education on firearm storage and using firearm safety devices. Furthermore, it underlines the efficacy of pairing counseling with safe storage device distribution. Unintentional and self-inflicted intentional injury in children due to unlocked or loaded firearms stored unsafely can be mitigated through education, counseling, and safety devices. Therefore, more research is needed to determine effective methods of dissemination. Continued research can focus on evaluating different dissemination strategies, assessing their impact on various demographics, and identifying barriers to implementation. Additionally, longitudinal studies tracking the outcomes of households that receive education, counseling, and safe storage devices can provide valuable insights into the long-term effectiveness and sustainability of these interventions. Conducting more research in this area can assist policymakers, healthcare professional, and educators that inform evidence-based programs and policies aimed at reducing firearm-related injuries and death in youth.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Emory University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KF: Conceptualization, Data curation, Formal analysis, Funding acquisition, Writing – original draft, Writing – review & editing. ZB: Writing – original draft, Writing – review & editing. TG: Data curation, Formal analysis, Writing – review & editing. JJ: Conceptualization, Investigation, Methodology, Project administration, Writing – review & editing. Data curation. ABo: Conceptualization, Investigation, Methodology, Project administration, Writing – review & editing, Data curation. RW: Conceptualization, Methodology, Writing – review & editing. ABh: Conceptualization, Data curation, Funding acquisition, Investigation, Writing – review & editing. MS: Methodology, Writing – review & editing, Project administration. HS: Conceptualization, Supervision, Visualization, Writing – review & editing.

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Conflict of interest

JJ was employed by Medically Home.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1352400/full#supplementary-material

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EDITED BY
Dabney Evans,
Emory University, United States

REVIEWED BY
Isain Zapata,
Rocky Vista University, United States
Shweta Pathak,
University of North Carolina at Chapel Hill,
United States

*CORRESPONDENCE
Nicholas A. Giordano
✉ ngiorda@emory.edu

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Opioid utilization after orthopaedic trauma hospitalization among Medicaid-insured adults

Nicholas A. Giordano[1]*, Guantao Zhao[2], Manvitha Kalicheti[2], Mara L. Schenker[3,4], Yolanda Wimberly[4], Cammie Wolf Rice[5] and Nicoleta Serban[2]

[1]Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA, United States, [2]H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, United States, [3]Department of Orthopaedics, School of Medicine, Emory University, Atlanta, GA, United States, [4]Grady Memorial Hospital, Atlanta, GA, United States, [5]The Christopher Wolf Crusade, Atlanta, GA, United States

Opioids are vital to pain management and sedation after trauma-related hospitalization. However, there are many confounding clinical, social, and environmental factors that exacerbate pain, post-injury care needs, and receipt of opioid prescriptions following orthopaedic trauma. This retrospective study sought to characterize differences in opioid prescribing and dosing in a national Medicaid eligible sample from 2010–2018. The study population included adults, discharged after orthopaedic trauma hospitalization, and receiving an opioid prescription within 30 days of discharge. Patients were identified using the International Classification of Diseases (ICD-9; ICD-10) codes for inpatient diagnosis and procedure. Filled opioid prescriptions were identified from National Drug Codes and converted to morphine milligram equivalents (MME). Opioid receipt and dosage (e.g., morphine milligram equivalents [MME]) were examined as the main outcomes using regressions and analyzed by year, sex, race/ethnicity, residence rurality-urbanicity, and geographic region. The study population consisted of 86,091 injured Medicaid-enrolled adults; 35.3% received an opioid prescription within 30 days of discharge. Male patients (OR = 1.12, 95% CI: 1.07–1.18) and those between 31–50 years of age (OR = 1.15, 95% CI: 1.08–1.22) were found to have increased odds ratio of receiving an opioid within 30 days of discharge, compared to female and younger patients, respectively. Patients with disabilities (OR = 0.75, 95% CI: 0.71–0.80), prolonged hospitalizations, and both Black (OR = 0.87, 95% CI: 0.83–0.92) and Hispanic patients (OR = 0.72, 95% CI: 0.66–0.77), relative to white patients, had lower odds ratio of receiving an opioid prescription following trauma. Additionally, Black and Hispanic patients received lower prescription doses compared to white patients. Individuals hospitalized in the Southeastern United States and those between the ages of 51–65 age group were found to be prescribed lower average daily MME. There were significant variations in opioid prescribing practices by race, sex, and region. National guidelines for use of opioids and other pain management interventions in adults after trauma hospitalization may help limit practice variation and reduce implicit bias and potential harms in outpatient opioid usage.

KEYWORDS

opioid, trauma, injury, pain, emergency medicine, orthopaedic trauma & surgery

1 Introduction

Pain after orthopaedic injury is complex, pervasive, and debilitating when undermanaged. Orthopaedic trauma is a leading form of injury in America, with 21% of injured patients requiring hospitalization (1). Up to one-third of patients report experiencing chronic pain months after discharge following orthopaedic injury (2, 3). Optimizing acute pain after orthopaedic injury is vital to attenuating the pain response, mitigating the development of chronic pain, and reducing psychological symptom severity (2, 4, 5). Given pain is the common complaint for individuals seeking emergency department (ED) care (6, 7), adequately addressing patients' pain management needs after orthopaedic injury may impact subsequent care outcomes and opioid utilization.

Opioids are the mainstay of pain management. Guidelines recommend clinicians prescribe opioid medications to optimize acute pain following orthopaedic trauma (8–10). While declines in opioid prescribing to manage pain have been observed in other care settings and specialties, orthopaedic trauma care pain management continues to be centered around opioids (11, 12). Up to two-thirds of patients require an opioid refill after undergoing surgery following orthopaedic trauma (13). Yet access to opioid medications throughout recovery, when pain can still persist, is not equitable. Substantial differences in opioid prescribing and dosing have been noted across other patient populations based on race and geographic locations (14–16). Despite the prevalence of orthopaedic trauma and subsequent burden of pain, there remains a dearth of research elucidating national prescribing trends and potential differences.

Nationally representative data on opioid prescribing and utilization after orthopaedic trauma are needed to discern demographic and clinical factors that may influence prescribing. Previously, investigations have sought to elucidate opioid prescribing trends and care utilization in older adults and privately-insured general orthopaedic patients (14, 17). The preponderance of studies examining opioid prescribing and pain needs after orthopaedic injury have been conducted at single care centers, with few larger database studies focusing exclusively on single site fractures or joint replacements (12, 18–20). Less is known regarding prescribing after orthopaedic trauma. This study sought to characterize differences in opioid prescribing and dosing over a 30 and 90 day period in a national Medicaid eligible sample following hospitalization due to orthopaedic trauma. It was hypothesized that differences in prescribing patterns would be noted based on patient clinical characteristics and demographics.

2 Methods

2.1 Data source

The primary data source consists of 2010–2018 Medicaid claims data acquired from the Centers for Medicare and Medicaid Services, including identifiable individual-level claims with information on service utilization for all Medicaid-enrolled beneficiaries. Included for each claim were data entries specifying the identification of each Medicaid enrollee, demographics, service date, the International Classification of Diseases (ICD-9, ICD-10) codes, Current Procedural Terminology codes, National Drug Codes (NDCs) along with days of supply, and dosage. Using CDC Opioid MME Conversion Factors (12, 20, 21) we translated NDCs to obtain information about their corresponding drugs.

All data derived from the Medicaid files meet a minimum cell size of 11 enrollees according to the Data Use Agreement. This study was approved by the Institutional Review Board of Georgia Institute of Technology (protocol #H11287).

2.2 Study population

The study population included national Medicaid enrollees ages 18–65 with a trauma-related inpatient visit. We used the inpatient claims to identify Medicaid enrollees with trauma-related diagnosis codes (Supplementary Tables S1–S3). Since some patients had multiple trauma-related records, we included those with up to two trauma-related hospitalizations to exclude patients with severe repeated trauma. We excluded pregnant women and Medicaid enrollees not enrolled 30 days after discharge from the study population. Rural-Urban Continuum Codes (RUCC) specified the rurality-urbanicity of the patients' residence. Demographics including age, race/ethnicity, region, Medicaid eligibility and sex were extracted.

2.3 Opioid prescribing outcomes

Opioid outcomes were based on published CDC guidelines and previous research to evaluate opioid use (4, 22, 23). All opioid claims of each patient in the study population were considered throughout a 30 day or 90 day period after the trauma-related inpatient discharge date, called herein *opioid-monitoring period*. The individual-level outcomes derived over the opioid-monitoring period included:

1. *Filled-prescription outcome*: a binary indicator specifying whether an opioid prescription was recorded.
2. *Opioid dosage outcome*: sum of Morphine milligram equivalents (MME) across all prescriptions divided by the number of prescription days (MED).

2.4 Explanatory factors

Explanatory factors included length of hospitalization in days, as a proxy of trauma severity, history of traumatic hospitalization, year of injury, age, sex, race/ethnicity, rurality-urbanicity of beneficiary residence, region where treatment was delivered (e.g., Southeastern, etc.) and Medicaid eligibility criteria (e.g., disability, income-based).

2.5 Statistical analysis

Logistic regression was used to examine how the explanatory factors were associated with the odds ratio of opioid prescription filled within the opioid-monitoring period. Linear regression models examined factors linked to variability in the log of the MED for patients with recorded opioid use within the opioid-monitoring period. To focus on patients with appropriate dosages, we excluded individuals with a MED greater than or equal to 90 defined as those as being in the "very high risk" category as outlined by CDC guidelines (24). To improve the distributional properties of the linear regression, a log transformation was applied to the MED values.

To correct for "inflated" statistical significance due to large sample size (25, 26), we applied the regression models to 100 different sub-samples, each sub-sample consisting of 30% subsample of the study population. The number of significant *p*-values ($p \leq 0.05$) was counted for each predictor across the 100 replicates. Statistical significance was established if 90% or more of the *p*-values in the 100 model replicates showed significance. We present the mean odds ratio (opioid use) and predicted mean (opioid dosage) across these 100 model replicates. The 95% confidence interval (CI) for the regression coefficients was derived using the 2.5th percentile for the lower bound and the 97.5th percentile for the upper bound of each transformed regression coefficient (e.g., odds ratio) across the model replicates.

3 Results

A total of 86,091 Medicaid-enrolled adults were identified as having had an eligible trauma-related hospitalization during the study period (Table 1). Among them, 30,361 (35.3%) patients received an opioid prescription <30 days after discharge, and 36,553 (42.5%) patients received an opioid prescription <90 days after discharge (Supplementary Table S4). Notably, the demographic distribution revealed that patients aged 51–65 constituted a significant proportion, accounting for 39,167 individuals (45.5%), while female patients represented 44,077 cases (51.2%) receiving an opioid. Furthermore, most patients identified as white (49.9%). The average MED was 8.4 (SD: 9.2) and the average total MME prescribed was 109.3 (SD: 160.0).

3.1 Opioid prescription receipt

Differences in prescribing were observed based on patient race (Table 2). Compared to the white patients, Black patients had lower odds of having a prescription filled <30 days after discharge (OR = 0.87, 95% CI: 0.83–0.92). This indicates that Black patients had 13% lower odds of the outcome compared to white patients. Similarly, Hispanic patients had 28% lower odds of filling a prescription compared to white patients (OR = 0.72, 95% CI: 0.66–0.77). Individuals categorized as "other" race did not statistically differ in receipt of opioid compared to white patients (OR = 0.86, 95% CI: 0.77–0.96).

Patient demographics, including age, gender, and Medicaid eligibility were found to be linked to receipt of an opioid prescription after injury. Compared to those between ages 18–30, individuals aged 31–50 had higher odds of filling a prescription <30 days after discharge (OR = 1.15, 95% CI: 1.08–1.22). Alternatively, being between the ages of 51–65 was not significantly associated with having a prescription filled <30 days after discharge (OR = 0.99, 95% CI: 0.92–1.05). Male Medicaid beneficiaries had increased odds of having a prescription filled <30 days after discharge, 12%, compared to females (OR = 1.12, 95% CI: 1.07–1.18). Individuals eligible for Medicaid due to disability were observed with lower odds ratio for opioid receipt < 30 days (OR = 0.75, 95% CI: 0.71–0.80). This indicates that individuals who qualified for eligibility based on disability had lower odds of having a prescription filled <30 days after discharge compared to those who were Medicaid eligible based on income.

Further, year of injury was associated with odds of opioid receipt. Patients injured between 2013–2014 had higher odds of having a prescription filled <30 days after discharge (OR = 1.56, 95% CI: 1.44–1.71). This indicates that compared to 2010–2012, patients hospitalized from 2013–2014 were associated with an increased odds of receiving an opioid. Similarly, the years 2015–2016 (OR = 1.94, 95% CI: 1.81–2.10) and 2017–2018 (OR = 2.03, 95% CI: 1.88–2.22) were also significantly associated with higher odds of having a prescription filled <30 days after discharge.

No significant difference in the odds of having a prescription filled <30 days after discharge were observed between the urbanicity categories (OR = 1.10, 95% CI: 1.04–1.18). Similarly, no differences in opioid receipt were noted by region compared to the Midwest. Previous traumatic injury requiring hospitalization was not associated with receipt of prescription (OR = 1.11, 95% CI: 0.99–1.24).

Similar trends were noted in the 90 day models for opioid prescription receipt (Supplementary Tables S5–S7).

3.2 Opioid dosage analysis: 1 month period

MED differed by race in the study population (Table 3). Black patients received lower doses, on average −0.10 log-transformed MED, than white patients (95% CI: −0.16, −0.05). Similarly, Hispanic patients were found to receive significantly lower MED compared to white patients ($\beta = -0.18$, 95% CI: −0.24, −0.11). No differences were observed in MED between white patients and patients who identified as "other" races.

Differences in opioid dosing were noted across patient age groups, patients' residence regions, and the year of injury. Compared to patients 18–30 years of age, individuals between 51–65, received a prescription dose of −0.19 log-transformed MED (95% CI: −0.24, −0.14). No differences were observed between those 31–50 and those between 18–30 years of age. Patients in the Southeast received lower prescription doses compared to the Midwest ($\beta = -0.11$, 95% CI: −0.17, −0.06). Conversely, patients in the Northeast were found to have higher log-transformed MED compared to the Midwest ($\beta = 0.14$, 95% CI: 0.09, 0.19). No differences in MED were observed between the Western and the Southwestern regions compared to the Midwest. From 2015 to 2018, patients received higher MED compared to the reference group of 2010–2012, with patients seen in 2015–2016 receiving an average of 0.14 higher MED (95% CI: 0.07, 0.22) and those seen between 2017–2018 receiving even higher doses ($\beta = 0.25$, 95% CI: 0.18, 0.32). No differences in MED were seen by gender, urbanicity, length of stay, Medicaid eligibility, nor based on history of traumatic hospitalization.

Similar trends were observed in the 90 days model (Supplementary Table S8).

4 Discussion

In this national sample of Medicaid eligible patients hospitalized following orthopaedic trauma, over a third of patients received an opioid prescription within 30 days after discharge, and 42.5% received an opioid prescription within 90 days after discharge. Substantial

TABLE 1 **Sample characteristics.**

	Total *N* = 86,091	Opioid prescription *N* = 37,020	No opioid prescription *N* = 49,071	*p*-value[a]
Age, y, *n* (%)				
18–30 **(Base)**	14,241 (16.54)	6,157 (16.63)	8,084 (16.47)	0.544
31–50	32,683 (37.96)	15,177 (41.00)	17,506 (35.67)	<0.001
51–65	39,167 (45.50)	15,686 (42.37)	23,481 (47.85)	<0.001
Sex, *n* (%)				
Female **(Base)**	44,077 (51.20)	18,308 (49.45)	25,769 (52.51)	<0.001
Male	42,014 (48.80)	18,712 (50.55)	23,302 (47.49)	<0.001
Race/ethnicity, *n* (%)				
White **(Base)**	42,946 (49.88)	19,021 (51.38)	23,925 (48.76)	<0.001
Black	17,076 (19.83)	7,085 (19.14)	9,991 (20.36)	<0.001
Hispanic	9,655 (11.21)	3,592 (9.70)	6,063 (12.36)	<0.001
Other	3,547 (4.12)	1,460 (3.94)	2087 (4.25)	0.025
Rurality-Urbanicity, *n* (%)				
Metro counties **(Base)**	66,402 (77.13)	28,022 (75.69)	38,380 (78.21)	<0.001
Nonmetro counties	14,466 (16.80)	6,395 (17.27)	8,071 (16.45)	0.001
Region, *n* (%)				
Midwest **(Base)**	19,522 (22.68)	7,538 (20.36)	11,984 (24.42)	<0.001
Southeast	16,706 (19.41)	7,063 (19.08)	9,643 (19.65)	0.036
Northeast	21,646 (25.14)	10,320 (27.88)	11,326 (23.08)	<0.001
West	18,844 (21.89)	8,098 (21.87)	10,746 (21.90)	0.939
Southwest	9,373 (10.88)	4,001 (10.81)	5,372 (10.95)	0.522
Year of hospitalization, *n* (%)				
2010–2012 **(Base)**	23,368 (27.14)	7,014 (18.95)	16,354 (33.33)	<0.001
2013–2014	10,188 (11.83)	4,233 (11.43)	5,955 (12.14)	0.002
2015–2016	21,840 (25.37)	10,740 (29.01)	11,100 (22.62)	<0.001
2017–2018	30,695 (35.66)	15,033 (40.61)	15,662 (31.92)	<0.001
Length of stay, d, mean (SD)	7.03 (7.17)	6.77 (6.51)	7.23 (7.63)	0.999
Eligibility criteria, *n* (%)				
Income-based **(Base)**	52,507 (60.99)	25,459 (68.77)	27,048 (55.12)	<0.001
Disability	33,584 (39.01)	11,561 (31.23)	22,023 (44.88)	<0.001
History of traumatic hospitalization, *n* (%)	4,563 (5.30)	2040 (5.51)	2,523 (5.14)	0.017

SD, standard deviation.[a]In the context of a two-sample proportion test (two separate samples were compared to ascertain if their proportions showed a significant difference). A significance level of 95 indicated that the conclusions were intended to maintain a 95 confidence level.

differences in opioid prescribing and dosing have been observed across various patient populations based on race and geographic locations (14–16). However, nation wide claims-based studies on variations in opioid prescribing and utilization following orthopaedic trauma have not been published to date. Previous estimates of opioid prescribing after orthopaedic trauma vary widely, between 4.3–68.4% (13, 21). Uniquely, this work builds upon previous research that has been limited to single institutional investigations or retrospective reviews based on a single anatomical injury site or orthopaedic surgery type (12, 13, 21, 27). In this national sample, substantial differences in opioid receipt and dosage were observed based on patient demographics and clinical characteristics.

Receipt of an opioid prescription after injury differed across patient populations in this sample. Most notably, inequities in opioid receipt were noted among Black and Hispanic patients compared to white patients even when adjusting for acuity (e.g., length of stay). Black patients in this sample were observed to have 13% lower odds ratio compared to white patients in receiving an opioid prescription after injury while Hispanic patients had a 28% lower odds ratio. Further, Black and Hispanic patients received lower doses of medication compared to injured white Medicaid beneficiaries. These findings reflect those by other investigators utilizing Medicare claims (16) where Black and white patients were found to have similar receipt of opioid prescriptions, yet Black patients received 36% lower doses.

TABLE 2 Estimated odds ratios and their statistical inference using the multivariable logistic regression for the opioid use binary outcome analysis with after discharge one month opioid-monitoring period ($N = 86{,}091$).

	Odds ratio	95 CI lower bound	95 CI upper bound	Percent of p-values <0.05[a]
Age, years				
18–30 **(Base)**	–	–	–	–
31–50	1.15	1.08	1.22	**97**
51–65	0.99	0.92	1.05	4
Sex				
Female **(Base)**	–	–	–	–
Male	1.12	1.07	1.18	**100**
Race/ethnicity				
White **(Base)**	–	–	–	–
Black	0.87	0.83	0.92	**99**
Hispanic	0.72	0.66	0.77	**100**
Other	0.86	0.77	0.96	57
Rurality-Urbanicity				
Metro counties **(Base)**	–	–	–	–
Nonmetro counties	1.10	1.04	1.18	81
Region				
Midwest **(Base)**	–	–	–	–
Southeast	0.95	0.88	1.01	25
Northeast	0.97	0.91	1.04	12
West	1.01	0.94	1.08	3
Southwest	1.00	0.92	1.09	2
Year of hospitalization				
2010–2012 **(Base)**	–	–	–	–
2013–2014	1.56	1.44	1.71	**100**
2015–2016	1.94	1.81	2.10	**100**
2017–2018	2.03	1.88	2.22	**100**
Length of stay, days	0.99	0.99	0.99	**97**
Eligibility criteria				
Income-based **(Base)**				
Disability	0.75	0.72	0.79	**100**
History of traumatic hospitalization	1.12	0.99	1.24	34

CI, confidence interval. Bold p-value indicates statistical significance. [a]A logistic regression was used to examine how the explanatory factors explain the odds ratio of opioid prescription filled versus not filled within the opioid-monitoring period. To correct for "inflated statistical significance" due to a large sample size, the regression was estimated in 100 sub-samples that included 30% of the population. The mean odds ratio is presented from these 100 replicates, and the 95% confidence interval is derived using the 2.5th percentile for the lower bound and the 97.5th percentile for the upper bound of the estimated odds ratio across the 100 model replicates. The percent of p-values for each covariate that were significant in these 100 sub-samples is presented in the far-right column.

Findings from the present analysis underscore that stigma may persist when dispensing opioids to patients in need of analgesia (28) after injury. Racial bias by clinicians in the assessment and management of pain, specifically towards Black patients, is well documented in other clinical settings and hinders equitable access to opioid prescriptions (29, 30). Findings illustrate, for the first time, possible inequitable prescribing exists, nationally, among clinicians caring for patients on Medicaid after orthopaedic injury. However, future research examining prescribing in samples with a variety of insurance coverage (e.g., Medicaid, private claims, etc.) are warranted to better discern prescribing patterns after injury while accounting for biological, environmental, and social factors that may influence prescribing.

Other notable differences in opioid prescribing were seen based on patients' sex, age, length of hospitalization, as well as year and location at time of injury. In outpatient settings both female patients and those older than 25 have been found to have a greater likelihood of filling their opioid prescriptions (31). To date, this trend has not been examined following orthopaedic trauma. In the present study, injured male Medicaid beneficiaries had 12% higher odds ratio of receiving an opioid compared to females. Compared to those aged <31, adults aged 31–50 had a 15% higher odds ratio of being prescribed an opioid after injury, but at lower doses. Surgical team prescribing has been found to vary by length of stay, with longer hospitalization linked to higher doses (32). While no difference in doses were observed based on length of stay in this analysis, patients with longer hospitalizations had decreased odds ratio of receiving an opioid prescription. In other non-trauma specific studies, patients with disabilities were found to receive higher incidence of continuous opioid use and significantly greater amounts (33). These differences by patient characteristics indicate the unique differences in opioid prescribing, and potentially pain management needs, after injury that may not be reflective of larger non-diagnosis specific analyses. Evidence-based opioid prescribing guidelines have been found to reduce the quantity of opioids prescribed after surgery but less is known on whether they reduce inequities in prescribing while optimizing pain outcomes (34, 35). National guidelines for use of opioids in adults after trauma hospitalization that also highlight the utilization of medications and nonpharmacological interventions, may help limit practice variation, and reduce implicit bias and potential harms in opioid usage.

Prescribing and dosing of opioid medication for injured patients in this national dataset changed over time. Despite the decline in the odds ratio of receiving an opioid prescription over time, the average MME increased from 2015–2018. These findings may reflect restrictions in prescribing seen across specialties, nationally, following the release of the 2016 CDC Guidelines for Prescribing Opioids for Chronic Pain (36). While receipt of opioids did not differ by region in this sample, dosing was significantly lower in the Southeast and higher in the Northeast. Other investigators have found national declines in opioid prescribing and dosage across clinical settings but note substantial variation in state level prescribing patterns persist (31, 37). To date, regional differences in prescribing across trauma patient populations have not been examined. These findings show the potential utility of tailored trauma specific pain management guidelines to facilitate equitable prescribing by surgical teams to injured patients during and after hospitalization.

There are limitations to this analysis. Because this study was conducted using an administrative claims database, we did not have a control group. We are unable to observe a range of other factors which may be associated with the outcomes of interest; these include measures of clinical injury severity and the state of each adult's

TABLE 3 Estimated coefficients and their statistical inference using log-transformed linear regression of the opioid dosage outcome with recorded opioid use within the one-month opioid-monitoring period ($N = 30{,}361$).

	Coefficients	95% CI lower bound	95% CI upper bound	Percent of p-values $<0.05^a$
Age, years				
18–30 **(Base)**	–	–	–	–
31–50	−0.07	−0.11	−0.02	55
51–65	−0.19	−0.24	−0.14	**100**
Sex				
Female **(Base)**	–	–	–	–
Male	0.05	0.00	0.09	41
Race/ethnicity				
White **(Base)**	–	–	–	–
Black	−0.10	−0.16	−0.05	**93**
Hispanic	−0.18	−0.24	−0.11	**100**
Other	0.07	−0.02	0.18	18
Rurality-Urbanicity				
Metro counties **(Base)**	–	–	–	–
Nonmetro counties	−0.02	−0.06	0.03	5
Region				
Midwest **(Base)**	–	–	–	–
Southeast	−0.11	−0.17	−0.06	**93**
Northeast	0.14	0.09	0.19	**100**
West	0.03	−0.04	0.09	8
Southwest	−0.06	−0.12	0.01	19
Year of hospitalization				
2010–2012 **(Base)**	–	–	–	–
2013–2014	0.06	−0.03	0.15	26
2015–2016	0.14	0.07	0.22	**99**
2017–2018	0.25	0.18	0.32	**100**
Length of stay	−0.01	−0.01	0.01	18
Eligibility criteria				
Income-based **(Base)**	–	–	–	–
Disability	−0.05	−0.11	−0.01	33
History of traumatic hospitalization	0.01	−0.07	0.09	2

CI, confidence interval. Bold p-value indicates statistical significance. The coefficients is presented from these 100 replicates, and the 95% confidence interval is derived using the 2.5th percentile for the lower bound and the 97.5th percentile for the upper bound of the predicted difference in visits across the 100 model replicates. The percent of p-values for each covariate that were significant in these 100 sub-samples is presented in the far-right column. [a]Linear regression was used to examine how the explanatory factors explain the variability in the log of the average MME per-day for patients with recorded opioid use within the opioid-monitoring period. To correct for inflated statistical significance' due to a large sample size, the regression was estimated in 100 sub-samples that included 30% of the population.

environment that could directly or indirectly impact opioid utilization. Causality cannot be inferred from this analysis. Another limitation is the study period, not including the most recent years; we have no *a priori* reason, however, to believe that the associations of interest would have changed since the timeframe we examined in the data (38). During the study period, the Medicaid claims data have experienced changes in the data format from MAX, MAX-T to TAF files (39, 40), changes in the diagnosis coding (ICD-9 and ICD-10) (41) and changes in the procedure codes (42). Our diagnosis and procedure coding captured much of the study population, but may have missed some trauma cases, potentially adding bias in our sample because several states or regions may have been faster in accurately coding diagnoses and procedures. Further, this study was unable to control for potential comorbidities that may influence prescribers. Because of the changes in recording the Medicaid claims data, some of the factors in our analysis include null values for zip code and race/ethnicity. We have created algorithms to capture this information, but several states have large percentages of missing values particularly for more recent years (43). Medicaid claims data accounted for fulfilled prescriptions and relied on the conversion of prescriptions to MME for analysis, hence it is not possible to determine the appropriateness of opioid prescriptions nor the actual use of opioids in the study. The

Medicaid dataset did not include acuity, such as Injury Severity Score, but the analyses included hospitalization stay as a proxy for severity. Future research incorporating severity metrics is warranted. While findings are generalizable to injured Medicaid beneficiaries, future research with commercial claims is needed to determine if trends are consistently observed across traumatically injured patient populations regardless of insurance status. Despite these limitations, this study is among the first to leverage national data over a longitudinal period to elucidate prescribing trends across injured populations with Medicaid coverage.

5 Conclusion

This study is the first to leverage a national data repository to examine longitudinal opioid prescribing trends across patient populations and regions following orthopaedic trauma. Injured patients with disabilities, prolonged hospitalizations, and both Black and Hispanic patients, relative to white patients, were less likely to receive an opioid prescription. Further, Black and Hispanic patients received lower opioid doses compared to white patients after injury. These inequitable differences in opioid prescribing persists nationally after orthopaedic injury among adult Medicaid beneficiaries. Research is needed to elucidate nuances in prescribing differences and inform the development of scalable interventions, such as guidelines, to mitigate inequities in opioid prescribing practices after injury.

Data availability statement

The datasets presented in this article are not readily available because this project used deidentified data from the Centers for Medicare and Medicaid Services Health Services. Data from the Centers for Medicare and Medicaid Services does not belong to the authors but is provided to the authors through a Data Use Agreement. Data sharing will be at the discretion of Centers for Medicare and Medicaid Services and will require a specific data use agreement between third party interested data users and Centers for Medicare and Medicaid Services. The authors are committed to work with anybody interested in accessing the data to facilitate the process. Requests to access the datasets should be directed to NS, nicoleta.serban@isye.gatech.edu.

Ethics statement

The studies involving humans were approved by Georgia Institute of Technology IRB. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

Author contributions

NG: Investigation, Writing – original draft, Writing – review & editing. GZ: Data curation, Formal analysis, Investigation, Methodology, Software, Writing – review & editing. MK: Data curation, Formal analysis, Investigation, Methodology, Software, Writing – review & editing. MS: Funding acquisition, Investigation, Writing – review & editing. YW: Writing – review & editing. CR: Funding acquisition, Writing – review & editing. NS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

CR is the founder and CEO of the Christopher Wolf Crusade.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1327934/full#supplementary-material

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EDITED BY
Dabney Evans,
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REVIEWED BY
Susan M. Swider,
Rush University, United States
Anthony R. Carlini,
Johns Hopkins University, United States

*CORRESPONDENCE
Devon Ziminski
✉ devon.ziminski@rutgers.edu

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A social problem analysis of the 1993 Brady Act and the 2022 Bipartisan Safer Communities Act

Devon Ziminski[1,2]*

[1]School of Social Work, Rutgers University, New Brunswick, NJ, United States, [2]New Jersey Gun Violence Research Center, School of Public Health, Rutgers University, Piscataway, NJ, United States

In June 2022, the U.S. federal government passed its first major firearm policy since the Brady Handgun Violence Prevention Act of 1993, the Bipartisan Safer Communities Act (BSCA). Summative content analysis was used to explore how the social problem of firearm violence was outlined in both policies, with the goal of extracting the social issue's definition from the policies' approaches to solving it. Both policies do not outline the various types of firearm violence, nor the disproportionate effect of firearm violence on certain populations. This work informs the role of federal policy in defining and monitoring firearm violence as a public health issue, identifying both individual and structural risk and protective factors from an asset-based lens, and allocating preventative efforts in communities that are most affected.

KEYWORDS

firearm injury prevention, gun violence, content analysis, social problem awareness, issue definition, federal policy making, social problem analysis

Introduction

Approximately 100,000 Americans are shot and injured, and over 1,800 children are killed each year by firearms (1). Firearm violence results in the loss of life and induces immense trauma in the lives of individuals and in communities where tragedies occur. As firearm violence continues to affect communities across the U.S., there remains a need to appropriately and collectively define the social problem to draw aligned conclusions and support equitable appropriations in subsequent policies. Scholars (2–4) have pointed to the importance of social issue framing within the of the advocacy and policy processes yet note that focus on social problem definition and positionality is limited in existing public health literature. Issue definition, the way social problems and their policy issues are understood, is critical for public discourse and legislative processes (5–7). The current view of the problem of firearm violence as it's outlined in policies (federal and local) does not always align with the daily realities of firearm violence's toll. This brief presents a social problem analysis of the two most comprehensive U.S. federal firearm policies in the last 30 years (The Brady Handgun Violence Prevention Act (8) – Brady Act and The Bipartisan Safer Communities Act – BSCA) and the ways that the policies broadly and specifically focus on populations affected by firearm violence.

Policy background

The goal of this work is to outline the social problem of firearm violence, consider the ideological frameworks that undergird the Brady Act and BSCA, and explore how the policies' text may underemphasize the social realities of U.S. firearm violence. Key takeaways focus on extracting the social issue's definition from the policies' approaches to solving it; generating a shared understanding of the problem of firearm violence, including its varying types and who is affected; and identifying ways to support equity in future federal firearm policy interventions and their implementations.

The social problem of firearm violence represents a complex and sometimes divisive area of inquiry due to deep seated political beliefs, cultural norms, and existing policies. Despite this, the social problem of firearm violence permeates American life, warranting a comprehensive outline and understanding of the scope of the social issue [(9), 6]. And this issue is deepening, with firearm violence increasing over the recent decades [(10), 1–3; (11), 4]. Despite the continuing violence, there at times exists a disparity in how firearm violence is conceptualized publicly and outlined in federal policy.

In any conversation on firearm violence, it is critical to denote the various types of firearm violence as they are often conflated, yet each type has distinct causes, consequences, populations affected, and solutions. Firearm violence is violence that occurs with the use of a firearm, which includes homicide (including community violence and mass shootings), other interpersonal violent crimes (e.g., gun assaults, non-fatal shootings), police violence, intimate partner violence, suicide and attempted suicide, and unintentional death and injury (12). In 2021, 54 percent of all firearm-related deaths in the U.S. were suicides (26,328), 43 percent were homicides (20,958) (13, 14), and the remaining firearm deaths were unintentional (549), involved law enforcement (537), or had undetermined circumstances (458). Suicides by firearm most often occur among often older white men, while firearm homicides are disproportionately concentrated among young Brown and Black men [(1, 15), 3–6]. Black people are 10 times more likely, and Hispanic/Latino residents are more than twice as likely, to be killed by firearm than white residents (1, 13, 14). Firearm violence is the leading cause of death for Black males ages 15–34 (1, 13, 14).

There are multiple determinants of firearm violence, predominantly rooted in structural inequities and intentional disinvestment in certain places and among groups of people, which cultivates conditions for intrapersonal, interpersonal, and/or community (among non-intimately involved individuals) Firearm violence to occur. Many of the neighborhoods affected by firearm violence are also affected by systemic inequities (e.g., income inequality, poverty, and underfunded public housing and public/social services), with these inequities stemming directly from racism [(16–18), 833–841]. As such, many deep social structural disadvantages combined with easy access to guns (both legal and illegal) can contribute to varying conditions of firearm violence [(19), 85–90; (20, 21)]. The most sweeping federal firearm policy prior to the Brady Act was the 1968 Gun Control Act (GCA) that followed the assassinations of President John F. Kennedy, Attorney General and U.S. Senator Robert F. Kennedy, and Reverend Dr. Martin Luther King, Jr. The GCA repealed and replaced the Federal Firearms Act of 1938 (22). Following the 1981 assassination attempt of President Ronald Reagan where White House Press Secretary Jim Brady was also gravely injured, Jim and Sarah Brady led a multi-year long effort that led to the 1993 passage of the Brady Bill. The Brady Act amended the GCA and required state and local law-enforcement officials to perform background checks during the five-day waiting period before a federally licensed firearms dealer (FFL) could sell a handgun to a potential purchaser (23). In 1998, the electronic National Instant Criminal Background Check System (NICS) debuted to aid in the processing of background checks (23, 24).

The most substantial piece of federal firearm legislation since the Brady Act passed Congress in June 2022 – the Bipartisan Safer Communities Act (BSCA). Spurred into action by the horrific mass shootings in Buffalo, NY and Uvalde, Texas in May and June 2022, the Act is both a reaction to public outcry and an example of quick bipartisan effort and collective action. This legislation expanded resources for crisis intervention programs including red flag laws (known as Extreme Risk Protection Orders - ERPOs), which allow law enforcement or courts to temporarily take firearms from someone believed to be a danger to themselves or others (25, 26). The legislation also requires more people who sell guns as primary means of income to register as FFL dealers, encourages states to include juvenile records in the NICS, and denies access to firearms (for 5 years) for people who are convicted of [committing] violence while in dating relationships.

Policy analysis

In evaluating the alignment of the social problem of firearm violence with the two most recent comprehensive federal firearms policies, the Brady Act and BSCA, two main aims are: identify the problematization of firearm violence, and explore how the purported problem framing and definitions may align or diverge from the realities of U.S. firearm violence [(27), 63–70], both within and between the two policies.

A summative content analysis (through NVivo14) was used to explore how the social problem of firearm violence was outlined in both the Brady Act and BSCA S.1536, (8, 28). The summative approach directly assesses text to understand the contextual use of its words (7, 29). Codes were developed based on established terms associated with social issue definitions from the policy analysis literature (7, 30–32) and words were coded by the author. The four codes to assess the social problem definition included causes, context, and contributing factors; definitions; populations affected; and magnitude. Because neither text had an explicit section outlining the social problem or issue definition, the developed codes highlighted elements of the policy that refer to any components of a problem definition. Words and phrases categorized related to the issue framing were examined for the four areas of: any phrases that discussed the context of where or how firearm violence happens; any explicit phrasing of any definition of a term in the text; any text referencing a specific group of people or population(s); and any text referencing; and any text noting the magnitude or size of the issue of firearm violence (in people, cost, or other numbers). References in texts were tabulated within each text and between the two texts, and reference percentages were compared by the combination of words and phrases that accumulated for each code. Validity was increased by multiple readings and inclusion of multiple codes for the capturing the inclusion or outline of a problem definition in each text.

The Brady Bill had three coded references across the entire document, a mere 5.6% of the policy's content, and the BSCA had 31 coded references across the document, one-fifth of the available text (19.3%). Of note here are the low percentages of coded references in each text, very limitedly capturing two of four codes both in and between the two texts. The four problem definition classifications overall did not work well for the two texts because the problem definition and related concepts around the social issue were not included in the texts, hence the multiple 0%s of the 267 and 2,543 reference coded words seen in Table 1. We might expect some supporting background around firearm violence definitions in policies, yet this information is not explicitly included in the Brady Bill or BSCA.

In looking at the codes associated with defining or understanding the social problem – we see that both policies have 0% references to causes, context, and contributory factors, and magnitude of the problem. In the Brady Bill, the 55.81% (two references coded) for definition are with regards to definitions of "handgun" and "licensee." The 44.19% (one reference coded) for population refers the population of prohibited persons ("a fugitive from justice; an unlawful user of or addicted to any controlled substance; has not been adjudicated as a mental defective or been committed to a mental institution; is not an alien who is illegally or unlawfully in the US; has not been discharged from the Armed Forces under dishonorable conditions; and is not a person who has been a citizen of the US, and renounced such citizenship," p3) which helps identify the populations deemed incapable of firearm ownership or use.

While 72.04% (20 phrases coded) in BSCA falls under the definition code, these references are not directly related to the problem definition of what firearm violence is but define concepts such as "engaged in the business," "drug trafficking crime (used to explain straw purchasing), "dating relationship," and also outline the parameters of the established Federal Clearinghouse on School Safety Evidence-based Practices. The elucidation of "trafficking crimes" and "dating relationship" (as it pertains to people who may engage in abusive behavior) further explains the types of prohibited persons that are barred from firearm ownership or use, and contributes to the policy's outlining of these individuals being in some way potentially associated with the occurrence of firearm violence.

Similarly, the population code (27.96%, 11 phrases coded) in BSCA refers to populations that are mentioned in the bill that are either receiving funds/support or identified in the bill for another reason as part of the policy intervention. For example, Sec.11002, Medicaid and Telehealth, refers to improving medical services "including addressing the needs of individuals with disabilities, medically underserved urban and rural communities, racial and ethnic minorities such as American Indians and Alaska Natives, individuals with limited English proficiency, and individuals of different age groups including children, young adults, and seniors" (p5). While this phrasing points to where resources from the policy might be allocated, no individuals or groups were noted with relation to the social problem of firearm violence or who it affects. The following words were not included (or defined) in either texts: "firearm injury/injuries," "mass shooting," "gun violence," and firearm violence."

Ideally a problem analysis would reveal framing or definitions around historical context and determinants of a social problem, which inherently are often laden with values and ideologies in how a problem is both conceptualized and thus defined. For instance, the background section of this article outlined firearm violence through structural and systemic factors, and identified people who are disproportionately affected by the issue. The term and phrase definitions included in Brady and BSCA mainly focused on individuals (prohibited persons) who may be presumed to be associated with firearm violence but did not outline how or to whom this violence happens. Oftentimes, without a social problem's explicit denotation in text, readers are left to deduce underlying theories and relational assumptions about what problems exist and for whom they exist, coded through implicit language and phrases (31, 32). As such, for this analysis, implicit language around the problem of firearm violence can be chronicled through textual examples that highlight values and relational assumptions around firearm violence, as no direct mentions to the social problem are included.

Implicit values around individual firearm rights are reinforced in both Brady and BSCA through specific provisions. For example, the Brady Bill text provides procedures for rectifying wrongful denial of a firearm background check (Sec. 108.); and in the BSCA, detailed procedures for due process in Extreme Risk Protective Orders cases (Sec. 12,003), 5-year time limits on domestic abuser firearm restrictions (Sec. 12,005), and sunsetting of inclusions of juvenile records in the NICS after 10 years (n, SEC. 12,001) are included. Both texts include specific references to restrictions on the establishment of a federal system of registration of firearms. Furthermore, underlying theories and assumptions related to firearm violence are largely veiled as criminality of prohibited persons in the Brady Act and shift to additional individual criminal acts in BSCA (e.g., straw purchasers, those convicted of domestic violence), with mental illness also implicitly being noted as a driver of violence. For example, this relational assumption in BSCA is that increasing mental health resources and law enforcement in schools may reduce firearm violence (Subtitle C – Luke and Alex School Safety Act of 2022). While there are complex interplays to consider when discussing criminal intent, deterrence methods, and mental illness, the connection drawn between these concepts as both potential an all-encompassing cause and panacea to firearm violence is insufficient and can easily be misconstrued [(33), 31; (34), 275–282].

A key limitation to this policy analysis is the differing lengths of the two policy texts, hence the higher coded percents in BSCA compared to Brady Bill in Table 2. Another limitation is the single coder, introducing a lack of inter-coder reliability and no explicit review of codes by content experts (29). Additionally, traditional policy analyses review a larger number of documents (e.g., congressional hearings) (7, 35). Future analyses should include multiple coders, more specific definitions of codes, and expand the number of federal and/or state firearm policies included in analysis.

Actionable takeaways

The stated goals of the Brady Act were: to "provide for a waiting period before the purchase of a handgun, and for the establishment of a national instant criminal background check system to be contacted

TABLE 1 Within policies explicit coded words.

	Brady Act (4,738 total words)	BSCA (13,209 total words)
Total reference coded words (267 and 2,543 words coded)	5.6% (267 coded words)	19.3% (2,543 coded words)
1: Causes, Context, & Contributing Factors	0% (0 of 267 coded words)	0% (0 of 2,543 coded words)
2: Definitions	55.81% (149 of 267 coded words)	72.04% (1,832 of 2,543 coded words)
3: Population(s) Affected	44.19% (118 of 267 coded words)	27.96% (711 of 2,543 coded words)
4: Magnitude	0% (of 267 coded words)	0% (0 of 2,543 coded words)

TABLE 2 Between policies explicit coded words.

	Brady Act (4,738 total words)	BSCA (13,209 total words)
Total reference coded words (2,810 words coded)	9.5% (267 words coded)	90.5% (2,543 words coded)
1: Causes, Context, & Contributing Factors	0% (0 of 2,810 coded words)	0% (0 of 2,810 coded words)
2: Definitions	7.52% (211 of 2,810 coded words)	92.48% (2,599 of 2,810 coded words)
3: Population(s) Affected	14.23% (400 of 2,810 coded words)	85.77% (2,410 of 2,810 coded words)
4: Magnitude	0% (0 of 2,810 coded words)	0% (0 of 2,810 coded words)

by firearm dealers before the transfer of any firearm," and for BCSA: to "make our communities safer." The goal of any bill is to outline policy addressing a social problem, and not necessarily to outline the problem itself; however, social problem definition remains essential to lay context for a bill's goals and can both support issue framing and provide implementation direction, particularly among social issues that are contentious like firearm violence (2). Both policies explored conflate all firearm violence by neither addressing the types of firearm violence nor who is most affected by each or any type. Issue definition absence can muddle policy options or lead to claims of policy ineffectiveness when policies are not explicit about who or what social issue they aim to address. Also, it can be challenging to re-frame and disseminate definitions once existing frames are in play, further emphasizing the importance of identifying definitions and circulate it widely to increase awareness (5, 6, 36).

Firearm violence is mainly driven by suicides and then homicides. Daily incidents of firearm suicide, community firearm violence, and intimate partner firearm violence affect young Black and Brown men, older men, rural populations, veterans, LGBTQIA+ people (especially transgender people of color), and people affiliated with certain religions, disproportionately - and these disparities in firearm violence can often be overlooked or melded together [(10, 15, 17, 37–41), 154–167]. To contribute to both narrative and tangible change, the distinct effects of firearm violence can be better elucidated in public discourse and records - especially in policy. The research provided, resources needed, and policies proposed to address suicide among older white men will be different than intimate partner firearm situations within heterosexual romantic relationships, which will be different than community firearm violence involving young Black men.

Both policies allude to individual criminal acts or mental state as key drivers of firearm violence; excluding, among multiple other drivers, the structural elements and historical inequities that contribute to firearm violence [(42), 224–241; (43), 165; (44), 253–266]. The absence of socioecological context, how it connects social determinants of health and firearm violence, and mention of who is most disproportionately affected by each strain of this social issue distances both policies from the issue's causes and contexts, potentially from its solutions rooted within the realities of people and communities who are affected (31, 32, 45, 46).

The Brady Act's and BSCA's vagueness around firearm violence could be perceived as a political maneuver for claims of future policy ineffectiveness or ambiguous accountability associated with their provisions, as examples of imperfect yet essential compromises in political process, or a combination of both. Regardless, how policy goals are operationalized through allocation, delivery, and finance will be critical for BSCA implementation in 2024 and 2025, a task assigned to the recently created White House Office of Gun Violence Prevention.

Federal policies can continue to move toward defining and monitoring the problem of firearm violence at the policy level in ways that align with the problem's magnitude (35). The complexity of this issue warrants a widely purported problem definition and dissemination to spur sustained action (12). A movement toward asset-building and resource investment in communities as a public health approach, public safety model, and firearms violence solution remains needed [(47), 201–230; (48, 49); 2,169–2,178]. To support this outcome, the research community can continue to engage in research translation toward more pointed policy and practice approaches.

Conclusion

Issue definitions should aim to outline the realities of social problems. The Brady Act and BSCA conflate various types of firearm violence, illustrating a focus on individual level factors without inclusion of structural elements that contribute to the critical socioecological context of self-inflicted, interpersonal, and community firearm violence.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Dabney Evans,
Emory University, United States

REVIEWED BY
Carinne Brody,
Touro University California, United States
Jigyansa Ipsita Pattnaik,
Kalinga Institute of Medical Sciences (KIMS), India

*CORRESPONDENCE
Michaella Baker
✉ michaella.baker@gmail.com

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The 988 suicide hotline—Lifeline or letdown? A pre-post policy analysis

Michaella Baker* and Juliet Sorensen

Pritzker School of Law, Northwestern University, Chicago, IL, United States

Suicide has emerged as an urgent threat in recent years as COVID-19 impaired the health and economic wellbeing of millions of Americans. According to the Centers for Disease Control and Prevention, the impact of COVID-19 and the ongoing opioid epidemic has "taken a mental, emotional, physical, and economic toll on individuals, families, and communities," increasing the need for innovative solutions to prevent suicide on a national scale. The National Suicide Hotline Designation Act of 2020 established 988 as the universal telephone number for suicide prevention and represents a key federal intervention to address this crisis. However, research on 9-8-8's effectiveness is limited, given the Act's recent enactment and implementation at the federal and state levels. This policy analysis investigates how and to what extent the mental health crisis system in Georgia has improved since the implementation of the 2020 Act as well as the implications of state law on population-level mental health outcomes. Georgia is used as a nationally representative case study for two reasons: (1) Georgia had a robust statewide suicide hotline prior to 2020, providing solid infrastructure on which federal expansion of a suicide hotline number could be built, and (2) the conflicting characteristics of Georgia's mental health system represent several different pockets of the U.S., allowing this analysis to apply to a broad range of states and locales. The paper draws on takeaways from Georgia to propose state and national policy recommendations for equitable interventions to prevent and respond to this form of violence.

KEYWORDS

suicide, 988, hotline, Lifeline, policy, mental health, legislation

Introduction

Suicide is an urgent threat to public health and the lives of millions of Americans (1). While suicide has presented a significant challenge in the United States for years, suicide rates have increased dramatically in the past two decades. From 2000 to 2020, suicide rates rose by 30% (2). In 2021 alone 1 year into the COVID-19 pandemic-—12.3 million American adults age 18 and older seriously thought about suicide, 3.5 million planned suicide, and 1.7 million attempted suicide (3). According to the Centers for Disease Control and Prevention (CDC), the impact of COVID-19 and the ongoing opioid epidemic has "taken a mental, emotional, physical, and economic toll on individuals, families, and communities," increasing the need for innovative solutions to prevent suicide on a national scale (4).

However, suicide only represents a portion of the problem. The U.S. lacks a robust mental health crisis system that can provide immediate de-escalation services to assist someone experiencing a mental health crisis. Americans are substantially more likely to receive treatment in ambulatory settings like emergency departments (EDs) for non-fatal self-harm, like suicide attempts, than in mental health treatment centers and hospitals (4). From 2008 to 2017, the rate of ED visits related to suicidal ideation or suicide attempts rose consistently for all age groups (5). Unfortunately, EDs are often not equipped to address mental health crises, given the often over-crowded, over-stimulating, and time-pressured environment and limited qualified mental health staff. As a result, people often wait hours or even days to access care when they may not have the luxury of time (6).

Before individuals in mental health crises arrive in an ED, they often interact with law enforcement, mainly because their caregivers or bystanders have few options in times of crisis other than calling 911. As a result, roughly one in 10 individuals with mental health disorders have interacted with law enforcement before receiving any kind of psychiatric care (7). The interaction with law enforcement almost always takes place in a police vehicle, many times in handcuffs—a scenario that contradicts the central tenets (safety, trustworthiness, choice, collaboration, and empowerment) (8) of trauma-informed mental health care (9). Police involvement has been found to escalate the presenting situation, intensify distress, and increase public stigma and criminalization of mental illness.

The National Suicide Hotline Designation Act of 2020 aimed to change this cascade of events. In October 2020, the Federal Communications Commission (FCC) and Congress designated a new three-digit dialing code (988) for Americans to reach the National Suicide Prevention Lifeline (Lifeline) and required states to adopt the Lifeline by July 16, 2022 (10). 988 was intended to build on the infrastructure of the existing toll-free Lifeline number (1-800-273-TALK) but with an easier-to-remember number and broader directive: to provide 24/7 phone or text support for anyone experiencing a mental health crisis or in need of suicide prevention services (9). Thus, rather than calling 911 when someone is in mental distress, 988 enables access to mental health crisis support without involving law enforcement. This not only has the potential to decriminalize mental health care, but also it empowers individuals to avoid unnecessary law enforcement and medical emergency department visits and to initiate psychiatric assessment and treatment sooner (9). In fact, early research in Tuscan, Arizona revealed that 80% of Lifeline calls were resolved without dispatching mobile crisis teams, law enforcement, or emergency medical services, showcasing the advantages of a robust crisis system (3).

In the 6 months after the launch of 988 on July 16, 2022, the Lifeline received over 2.1 million contacts—consisting of over 1.43 million calls, over 416,000 chats, and more than 281,000 texts (11). While the volume of calls and texts is encouraging, the potential for 988 to improve mental health care can only be effective if it operates in a linked fashion, not only providing a number to call, text, and chat but also services along a continuum of care. In other words, a trained call-taker must exist on the other end of the line to de-escalate a crisis and have access to mobile crisis teams with specialists trained for the job as well as mobile crisis centers. Without each step along the continuum of care, states cannot provide a reliable response for 988 callers.

While the federal government made investments in 988's launch and implementation, the responsibility for ongoing funding depends on state and local governments. However, to date, states have been slow to adopt legislation to address the increased demand in callers seeking mental health services. For example, the 2020 Act specified that states may collect cellphone fees on customers' phone bills, similar to 911, to sustainably fund the local 988 call centers. However, only eight states have enacted such legislation (California, Colorado, Nevada, Oregon, Virginia, Delaware, Washington, and Minnesota) (12, 13). Five states are approaching final legislative approval (Ohio, West Virginia, Maryland, Pennsylvania, and New York) (13). Trust fund appropriations have been set up by some states to support 988 crisis centers including Illinois, Indiana, Utah, and New Hampshire, but it is unclear whether these initiatives can support 988 and corresponding crisis centers' long-term funding needs (12, 13). The 2020 Act created a path forward for states to bolster their continuum of mental health crisis services, yet determining the accessibility, quality, and impact of 988 requires additional research into states' crisis systems.

Research objectives

Given that the effectiveness of 988 will vary by state, this paper will focus on Georgia's legislative actions and policies pertaining to suicide prevention. Georgia provides an interesting case study for two key reasons. First, Georgia had a robust statewide suicide hotline prior to 2020, providing solid infrastructure on which federal expansion of a suicide hotline number could be built. In fact, the Substance Abuse and Mental Health Services Administration (SAMHSA) poached Monica Johnson, who served as the Interim Commissioner for the Georgia Department of Behavioral Health & Developmental Disabilities, to lead the 988 & Behavioral Health Crisis Coordinating Office because of her experience overseeing and successfully implementing programs funded through SAMHSA in Georgia (14). Evaluating Georgia will allow us to consider the impact of 988 in a system potentially more advanced and with more resources than other states. The successes and shortcomings Georgia has experienced in scaling up its Lifeline can serve as both a lesson and a warning for states starting from scratch.

Second, when it comes to the state's mental health response, Georgia is an early adopter in some respects and a late adopter in others. The conflicting characteristics of Georgia's mental health system represent several different pockets of the U.S., allowing this analysis to apply to a broad range of states and locales. For example, despite its current crisis response and suicide prevention infrastructure, in 2021, Georgia had one of the highest percentages of 988 call abandonment, which represents a shortfall in answering calls from help-seekers (15). Especially given that 988 is advertised on nearly every CDC and Georgia state health webpage that mentions mental health or substance abuse, it is essential to know whether the Lifeline's performance has improved since new legislation passed and the interplay of federal vs. state governments in scaling up state-level planning (16).

Further, Georgia's mental health coverage gap is significant. Georgia has an uninsured rate of 13.7%, which is the third highest in the country (17). If 988 calls are dropped, many Georgians would have nowhere to receive mental health services, as many do not have access to insurance that covers any health expenditure, let alone behavioral health. Because the state has opted not to accept federal funding to expand its Medicaid program under the Affordable Care Act (ACA), many people are too poor to obtain private health insurance but not poor enough to receive coverage under Medicaid. Closing the mental health coverage gap by providing affordable, accessible mental health care can significantly strengthen mental health and addiction treatment and services in the state.

In this paper, we begin with an overview of national suicide prevention efforts in the U.S. over the past 50 years and the reforms and legislation that made way for the National Suicide Hotline Act of 2020 and its subsequent implementation. We then detail how 988 operates on a national and state level to set the foundation for a Georgia-specific analysis. The pre-post policy analysis will evaluate Georgia's statewide suicide hotline number and the federal Lifeline before the National Suicide Hotline Designation Act of 2020 was passed and whether the performance of the Lifeline improved after the Act's passage and implementation. The paper ends with policy recommendations and a call to action—to be applied to Georgia and the U.S. broadly highlighting effective interventions to prevent and respond to this form of violence.

A brief history of national suicide prevention efforts

The U.S. has historically neglected to implement a robust mental health crisis system. Divisions in responsibility between the states and federal government coordination problems rooted in federalism and separation of powers—exacerbate the lack of effective legislation and response (18). For example, President Kennedy's Community Mental Health Centers Act of 1963 (19). stipulated federal funding for community mental health centers to provide crisis care—yet most communities never received funds (20). Kennedy envisioned that each state would build mental health facilities based on geographic availability, state-specific inpatient and outpatient needs, and deployment of professional staff, with virtually no federal oversight (21). However, requirements for crisis care all but disappeared when the program was converted to a block grant in 1981 (18). Without a federal directive and funding, most states did not develop adaptive solutions. The Community Mental Health Centers Act illustrates the challenges created by federalism. A national structure that requires state-led implementation creates an inherent tension between policy and practice: states have a level of autonomy to direct policy initiatives within a national statutory scheme.

Nonetheless, in the early-80s, suicide prevention started to garner national attention. In 1983, the CDC established a violence prevention unit to spotlight rising youth suicide rates (22). A few years later, the HHS Secretary established a Task Force on Youth Suicide, which reviewed existing evidence and issued recommendations (22). However, it was not until the mid-1990s that suicide became a central issue, marked with two congressional resolutions—S. Res. 84 and H. Res. 212 of the 105th Congress—which recognized suicide prevention as a national priority (22). Building on this momentum, in 1999, Surgeon General David Satcher issued *The Surgeon General's Call to Action to Prevent Suicide*, which introduced the blueprint for suicide prevention in the U.S. and called for a comprehensive national strategy (1), and in 2005, SAMHSA established the National Suicide Prevention Lifeline (1-800-273-TALK) (3).

SAMHSA aimed for 1-800-273-TALK to serve people at risk of suicide by providing de-escalation services through a national network of local call centers (3). This objective was based on early research showing that telephone crisis services reduced the crisis state of callers in mental distress (23). In the years after the Lifeline was established, researchers established proof of concept (24). Madelyn Gould, a psychiatric epidemiologist at Columbia University, assessed 1,085 callers between 2003 and 2004 expressing suicidality to the Lifeline call center and found a significant decrease in suicidality, psychological pain, and hopelessness during the telephone session (25). Benefits persisted when researchers interviewed a sample of the same callers within 3 weeks after the initial call (25). Nonetheless, nearly 10 years after SAMHSA instituted the Lifeline, analyses found it was underutilized, and the quality of services varied widely (26). While there were several national strategies and federal policy initiatives in the ensuing years (22), the rate of suicide across the U.S. continued to increase (27). The nation still had no template for what crisis systems should look like (1).

In 2016, the landscape changed. A Task Force of the National Action Alliance for Suicide Prevention (the "Task Force") surveyed best practices across the country and found that to achieve optimal results, a more robust system of crisis care was needed on a state and regional basis (28). The Task Force recommended that this system include regional or statewide call centers, mobile crisis teams, and crisis care facilities. New research expanded the understanding of how to implement equitable suicide prevention practices in healthcare systems and communities. New partners became engaged in suicide prevention, including organizations and businesses not previously invested in suicide prevention, such as Instagram and its parent company, Facebook (29). Although funding still did not reflect suicide's grave and wide-reaching impact, throughout the late 2010s, suicide prevention efforts expanded and multiplied (1).

Paving the way for the 2020 National Suicide Hotline Act

The aforementioned trends made way for the FCC to propose 988 as the three-digit telephone number for national suicide prevention and mental health crisis in 2019. The following year, the National Suicide Hotline Act (30) was signed into law, incorporating 988 as the new Lifeline. Building on the infrastructure established in 2005, the legislation provided an updated framework to run 988. For example, it required 988 to become operational in all states by July 16, 2022, via call, text, and chat. It instructed that states finance call centers using state, local, and private funding, and enabled states to add a fee to phone bills, much like 911, to expand, support, and improve 988 services (3). It also designated Vibrant Emotional Health (Vibrant) (31)—a non-profit organization that offers confidential emotional support through state-of-the-art crisis services and contact center operations to oversee the Lifeline through a cooperative agreement administered by SAMHSA (3). Like Kennedy's 1963 Community Mental Health Act, the Act was the equivalent of a national directive that requires state-led implementation.

Operationally, the FCC proposed that 988 would route callers experiencing a mental health crisis to the nearest local call center based on area code. If the local crisis call center is unavailable or the wait is too long, callers are redirected to a subnetwork of contracted national backup call centers. Federal funds were also used to augment text and chatting capabilities at national call centers, as local caller centers are not equipped to address this form of outreach (3). Still, despite the overflow system and specialized text and chat centers, as of 2020, Lifeline capacity was only sufficient to address approximately 85% of calls, 56% of texts, and 30% of chats (3).

HHS published an updated *Call to Action* in 2021, which further substantiated the case for 988. The report advocated for improving crisis infrastructure to enable 988 to triage calls, deliver important phone intervention services, and coordinate connections to additional support. Specifically, HHS called for the federal government to address "gaps, opportunities, and source needs to achieve standardization across crisis centers," optimize "systems financing for 988 as the hub of an enhanced, coordinated crisis system," and encourage "health care insurers to provide reimbursement for crisis services" (1).

Upon implementation in July 2022, 988 was connected to a network of over 200 local- and state-funded crisis centers (12). Although the Lifeline had been fielding calls through 1-800-273-TALK since 2005, call centers observed an immediate spike after 988 implementation. The combined number of calls, texts, and chats into 988 increased by 43%, with text volume alone representing a 700% increase compared to the year prior (12). As of December 2022, people who reached out to 988 spent less time waiting on hold for a counselor than in December 2021—the average wait time for all methods combined decreased from 2 min and 52 seconds to 44 seconds (12). From implementation to December 2022, the Lifeline has received over 2.1 million contacts, representing more than 1.43 million calls, 416,000 chats, and 281,000 texts (12).

Recent efforts have aimed to encourage more action from states, as data suggests that state investments in crisis services may impact 988 performance (for example, in-state answer rates vary widely across states from 51% to 98%, which may imply state investments are linked to crisis service performance) (12). One such effort was the Consolidated Appropriations Act (32) passed in December 2022, which included several provisions to improve coordination, standardization, and evaluation of 988 across states. Specifically, the Consolidated Appropriations Act established SAMHSA's Behavioral Health Crisis Coordinating Office and spearheaded the identification and publication of the behavioral health crisis response continuum best practices. However, given that the Consolidated Appropriations Act is still in its very early stages, it is challenging to discern how much it will move the needle. Especially in some states without long-term funding strategies, it is unclear whether, even in the short term, local Lifeline call centers can maintain their pace as federal funding decreases and demand increases (33).

Accessibility & affordability of mental health services in Georgia

Georgia had a scopious network of call centers before the FCC designed 988 as the National Suicide Hotline number in 2020. In fact, its crisis system had been decades in the making. Since the mid-1990s, the Georgia Department of Behavioral Health and Developmental Disabilities (DBHDD) has been building a system of community-based crisis stabilization sites, including behavioral health crisis centers and crisis stabilization units, to support individuals needing psychiatric stabilization or substance use detoxification (34). In 2006, the Georgia Department of Human Resources Division of Mental Health, Developmental Disabilities, and Addictive Diseases developed a statewide suicide hotline number—the Georgia Crisis and Assess Line (GCAL) (35). The hotline was created in response to Georgia taking in evacuees from Hurricane Katrina in 2005 and attempting to help people new to the city navigate the crisis system (36). Designed to create a consistent telephonic response to those experiencing a mental health or substance use crisis, GCAL was equipped to provide assessment, brief telephonic crisis intervention, and referral services for individuals in Georgia.

The modern scaffolding for Georgia's behavioral health care system arose from a 2010 settlement agreement with the U.S. Department of Justice (DOJ). In 2009, the DOJ sued Georgia for violating the Americans with Disabilities Act (ADA) and the 1999 Supreme Court decision in *Olmstead v. L.C* (37). The plaintiffs in Georgia alleged that Tommy Olmsted, the commissioner of the Georgia Department of Human Resources, was responsible for the state's failure to serve individuals with mental illnesses and intellectual and developmental disabilities. They advocated for the right to community-based mental health care rather than institutions and hospitals. The Supreme Court held that retaining people with mental health challenges in institutional settings equated to unjustified segregation of people with disabilities, and thus a violation of Title II of the ADA (37). Georgia settled with the U.S., acknowledging its failure to serve its constituents due to the state's lack of mental health infrastructure.

The settlement agreement spelled out specific requirements for Georgia, within precise timeframes, to prevent unnecessary hospitalizations and allow people to be served in their communities (38). For example, it required Georgia to "have 18 crisis apartments," "establish 12 crisis respite homes," "provide peer support services to individuals," and "establish six Crisis Services Centers by July 1, 2015," along with a range of other crisis management services (38). In response, Georgia not only updated GCAL to provide real-time access to available crisis and detox beds throughout Georgia, but also added the MyGCAL app for text, chat, and linkage with the national Lifeline (34).

While Georgia made significant strides in behavioral health crisis services before the 988 Act passed in 2020, its services are inherently limited because it has not expanded Medicaid under the ACA (39). As of November 2023, Georgia is one of the 10 remaining states that have refused the federal government's offer to increase access to health insurance for low-income residents in exchange for federal funding (40). Georgia Governor Brian Kemp reasoned that expansion "would shift a significant number of Georgians away from private coverage, only exacerbating the financial challenges faced by hospitals" (41). Conversely, Medicaid has been shown to improve hospital finances by extending coverage to uninsured patients who would otherwise qualify for hospital charity care or be unable to pay their bills (42). Beyond reducing financial hardship, studies suggest that hospitals in Medicaid expansion states have a larger amount of mental health treatment facilities and reimbursable psychotropic medications than non-expansion states (43).

The drawbacks of non-expansion are palpable. Across Georgia, caregivers point to limited mental health resources within their communities and challenges that prevent them from efficiently securing mental health treatment, including high costs, poor coordination between providers, difficulty identifying providers that accept their insurance, and other coverage barriers (44). More than 96% (44) of Georgia's counties are designated as Mental Health Professional Shortage Areas (MHPSAs) (45). In 2019, Georgia only had one mental health care provider for every 690 people living in the state (46). The pandemic has only aggrandized pressure on what was already a strained system (44). Accordingly, the impact of GCAL can only go so far when Georgia's continuum of care is interrupted by the paucity of services.

When the 2020 Act was passed, Georgia determined that GCAL would answer calls from 988 for numbers with a Georgia area code but planned to continue promoting GCAL as the predominant form of crisis response. Mental health policymakers in the state predicted that Georgia would not see a large increase in callers because it already had a statewide system (36). Recent projections of growth in call volume to GCAL, however, tell a different story, which we will investigate further in the pre-post policy analysis.

Recently, Georgia acknowledged its need to advance behavioral health even beyond instituting a crisis system like 988. During the 2022 state legislative session, the Georgia General Assembly voted unanimously to pass the Mental Health Parity Act, which aims to hold the state accountable for enforcing parity in insurance coverage for behavioral health care for the first time (47). The Mental Health Parity Act intends to help Georgians access affordable mental health and substance use disorder treatment, with the hope that adequate reimbursement of providers by insurers will address the gaps in the mental health workforce. During the same year, the state legislature passed a bill that provides for co-responder teams composed of peace officers and behavioral health professionals. While these laws are nascent and implementation is in the early stages, they will hopefully bolster the state's future 988 crisis response.

Pre-post policy analysis of the Lifeline's effectiveness in Georgia

The pre-post policy analysis supports this paper's research objectives by answering the following question: has the performance of the suicide and mental health crisis system in Georgia improved since the implementation of 988, and what is the law's impact in improving or not improving performance? Below, we discuss the answer to this question using publicly available data from Vibrant, SAMHSA, and DBHDD. Over the past 2 years, DBHDD has published several webinars discussing the state's rollout of 988, including preliminary data that serve as key data points in our analysis. Our analysis is stratified by the time immediately before the passage of the 2020 Act, between the Act's passage and implementation, and the months after implementation.

TABLE 1 Comparison of callers into Georgia's lifeline number, FY20 and FY21.

	Pre-passage (FY20)	Post-passage/ Pre-implementation (FY21)
Calls, texts, and chats received by GCAL + 988 (49)	209,000 calls, texts, and chats (49)	275,000 calls, texts, and chats (49)

Pre-passage of the 2020 Act (October 17, 2020)

In the year before the passage of the National Suicide Hotline Designation Act of 2020, Georgia Governor Nathan Deal and the state legislature included an additional $20.6 million in the proposed 2019 budget to improve and expand children's behavioral health services (48). Out of that appropriation, $1,092,000 was directed to suicide prevention efforts, which went in part toward expanding GCAL (48). Compared to the FY22 state budget, which allotted $114,000 for 988 planning, $302,000 for technology upgrades, and a combined $5 million in federal funding from the American Rescue Plan Act and SAMHSA, Georgia's funding for suicide prevention efforts in FY19 was limited (49).

Data is also limited in assessing the number of calls, texts, and chats to GCAL immediately preceding the 2020 Act. Table 1 below reflects the number of calls, texts, and chats received by GCAL call centers in Georgia in FY20 and FY21 where FY20 is based on the calculated increase in FY21 callers from DBHDD. The numbers reflect calls received by GCAL via help-seekers contacting both GCAL and 988, as calls to 988 were (and still are) routed through GCAL (50).

In a perfect world, the 24% increase in number of calls, texts, and chats in FY21 compared to FY20 would prove the passage of the National Suicide Hotline Designation Act of 2020 alone was effective in expanding the number of people accessing suicide prevention services. To make this assertion, historical growth trends or growth trends that would have been anticipated even in the absence of the transition to 988—must be assessed. According to SAMHSA, from calendar year 2007 to 2020, national call volume to the Lifeline increased an average of 14% per year, reflecting the ongoing promotion of the Lifeline by mental health and suicide prevention organizations (3). The number of total calls, texts, and chats to GCAL and 988 in FY21-—275,000 in total or a 24% increase from FY20—represents the highest call volume since GCAL's inception (49). While historical trends for GCAL were not accessible, the surge in call volume in Georgia after the passage

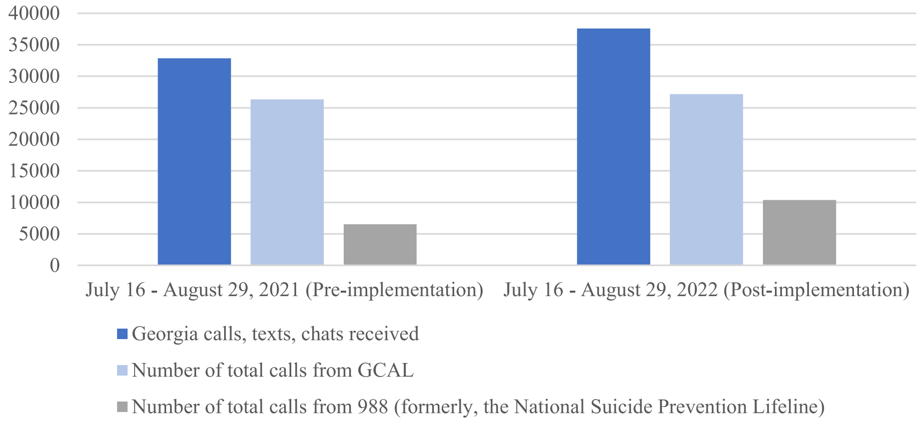

FIGURE 1
Comparison of calls, texts, and chats in the first 45 days of 988 rollout (16).

of the Act suggests a higher growth rate than the 14% calculated by SAMHSA.

One explanation for the increase in call volume could be that it reflects the increase in the national suicide rate at the time. If this were the case, the swell in callers would track alongside suicidality rates nationally. However, the national suicide rate increased by 4% between 2020 and 2021 (51), while the increase in callers to GCAL was six times this percentage (noting that FY20 and calendar year 2020 and FY21 and calendar year 2021 is not exact, but sufficient for the purposes of this paper). This points to more people potentially calling the Lifeline because of the FCC's passage of the 988 legislation and the political pressure put on states to ramp up the delivery of suicide prevention services.

Pre-implementation of the 2020 Act (October 17, 2020–July 16, 2022)

After the Act was passed on October 17, 2020, Georgia had 20 months to prepare for the rollout of 988. The 2020 Act required Georgia to enhance its current system's ability to respond to those in crisis by ensuring a call-taker was available 24/7 to respond to calls, texts, and chats; offering peer-run warm lines for emotional support; establishing additional mobile crisis units, crisis service centers, crisis stabilization units, inpatient beds, outpatient services, and detox and substance abuse disorder treatment statewide; and coordinating with 911 and emergency medical services when appropriate (49).

Instead of implementing monthly fees on telecommunications bills to pay for 988-related expenditures, Georgia leveraged one-time COVID-19 relief funds and available state dollars to prepare for the launch (52). Specifically, Georgia invested $20.5 million—a combination of appropriations from the General Assembly and federal COVID-relief funds in 988 related expenditures (52). Further, SAMHSA announced in December 2021 that Georgia would spend approximately $3,756,750 on 988 Lifeline implementation with $996,008 for other crisis-related services over the next 4 years in Mental Health Services Block Grants (MHBG), MHBG-COVID funds, and MHBG-American Result Plan (ARP) funds (3).

Figure 1 shows that the majority of outreach to the Lifeline before implementation between July 16 and August 29, 2021, were received by GCAL (80.19%) (16). This decreased immediately after implementation (72.39%) during the same time period in 2022 (16). Total calls, texts, and chats rose from 32,843 between July 16 and August 20, 2021, to 37,561 in 2022, representing a 14% increase (16). The upsurge in callers may indicate that post-passage and pre-implementation, national efforts to educate people about the Lifeline were underway, as federal and state dollars were already flowing into establishing the number and advertising it as a resource. It may also reflect that the easy-to-remember 988 number helped socialize information about suicide prevention resources. Other explanations for the increase in call volume to GCAL could be a direct result of the impact of COVID-19, the rise in opioid-related drug overdoses, and other sociocultural factors such as living in rural vs. urban areas, occupational hazards, sexual identity, social media, and more.

Post-implementation of 2020 Act (July 16, 2022)

The 2020 Act was nationally implemented on July 16, 2022 nearly 2 years after its passage. Implementation refers to the deadline indicated in the Act by which states must implement the infrastructure to provide 988 services. The data in Table 2 illustrates a direct comparison between calls, texts, and chats received to GCAL in October through December 2021, before 988 implementation, compared to the same time 1 year later, after the official 988 implementation as designated in the Act. Table 2 also includes information related to the average in-state 988 answer rate and the average in-state call abandon rate using data consolidated by Vibrant. The abandon rate means the number of calls that disconnect prior to being engaged by a counselor at a state or territory's centers. Disconnection may happen for several reasons if the caller changes their mind about seeking care at that moment,

TABLE 2 988 outreach volumes and answer rates, October–December 2021 vs. 2022.

	October–December 2021 (pre-implementation)	October–December 2022 (post-implementation)
Calls, texts, and chats received by a GCAL call center (53)	63,314	69,380
Average in-state 988 answer rate ("Answered In-State" calls divided by all calls "Received" to the state) (54)	63%	81.33%
Average in-state abandoned calls (54)	1,241.33	624.33

no longer feels they have privacy or safety in their environment, or experiences a technical service interruption, which may occur due to internet instability or carrier glitches (54).

On first glance, the performance of 988 in Georgia between October and December 2021 to October through December 2022 is encouraging. The number of calls grew from 63,314 to 69,380, representing a nearly 10% increase in total number of callers. Table 2 also indicates a surge in the average in-state 988 answer rate, representing a nearly 30% increase. The reduction in abandoned calls tracks alongside the answer rate after 988 implementation, with a sharp decrease in the number of received calls that disconnect prior to engaging with a trained call-taker. While there are a variety of reasons for disconnect, including the caller changing their mind about receiving care, technical glitches in the system, service interruption, and more, the lower number of abandoned calls likely points to more people receiving care from a trained call-taker.

While the numbers in Tables 1, 2, Figure 1 paint a picture of how the 2020 Act impacted Georgia's expansion of 988 based on available information, they do not include the multiple confounding factors that may affect volume, such as the extent and duration of public promotion and marketing of 988. Significant increases in call volume have also been observed with major media attention devoted to the Lifeline number. For example, in 2017, American hip-hop artist Logic released a song called "1-800-273-8255," named after the 10-digit Lifeline number. One study suggests that Logic's song was responsible for a 6.9% increase in calls to the Lifeline during the 34-day period when public attention to the song was substantial (55). Although the 2020 Act made way for additional funding to expand access to crisis services, in many ways, incorporating 988 into the 10-digit Lifeline number landscape was little more than an advertising scheme. An easy-to-remember three-digit number is far simpler to communicate than the previous 10-digit Lifeline number. Though it is unclear at this point the extent in Georgia (given the state's 988 marketing campaign, to date, is not yet underway), broadly advertising the Lifeline has influenced help-seeking behaviors among callers.

The political dynamics around 988 implementation add further nuance to this story. Policymakers have admitted there was a period where GCAL was not picking up calls from the national Lifeline. When 988 was first rolled out, centers were getting paid to answer the local line, but not the national Lifeline. In fact, some would get penalized if they answered national calls, so they would prioritize local calls. It was not until funding arrived for 988 that call centers, like GCAL, had more agency to answer 988 calls. Thus, the increase in the percentage of calls into GCAL from 988 may not be explained by the increase in call center capacity as a direct result of the new legislation, but rather by people calling 988 no longer being deprioritized and neglected in state call centers. This adds texture to our understanding of the interplay of federal vs. state governments in improving 988 performance.

Nonetheless, the pre-post analysis points to a correlation between the performance of the Lifeline in Georgia and the implementation of 988, given the surge in callers (the increased number of people who know about the Lifeline and use its services) and the increased answer rate (representing more people receiving mental health crisis services from qualified call-takers) after implementation. Still, it is critical to note the major investment needed to ensure uninterrupted continuity of care. Although previous studies suggest that 80% of calls can be resolved without dispatching mobile crisis teams, the remaining 20% who need crisis services will only get larger with higher volumes of callers (3). Federal projections for Georgia estimate that 56,460 mobile crisis responses were dispatched in FY23, which is an increase of 176% from FY21 (49). Accordingly, bed capacity in Georgia would have needed to increase by 105% to address the 67,137 predicted admissions to community crisis beds in FY23 (up from 32,700 in FY21) (49).

While funding has expanded between 2022 and 2023 (49), sustainable financing mechanisms must be implemented in Georgia to account for the increased capacity. We suggest several policy recommendations in the section below to ensure that well-trained personnel can provide future callers with adequate, affordable services from the moment they call 988 to when they are released from a crisis center, should their mental health require it.

Results of pre-post analysis: policy recommendations

Based on the results of the pre-post analysis, we have identified Georgia-specific policy recommendations to improve 988 performance and ensure more people can access the mental health care they need. The three key recommendations for Georgia include: (1) address the statewide mental health workforce scarcity, (2) sustainably increase funding for 988, and (3) consider expanding Medicaid to ensure more people at and below the poverty line can equitably access services. In addition, we underscore several key learnings from Georgia that are critical to the future success of 988 nationwide.

First, Georgia must address its current behavioral health workforce scarcity, especially given the increase in number of potential care-seekers because of 988 (56). The pre-post policy analysis makes clear that the number of people contacting GCAL and 988 via call, text, and messaging will increase, especially after

Georgia begins its 988 marketing campaign in late-2023 (49). As of 2022, 76 of Georgia's 159 counties did not have a licensed psychologist and 52 counties were without a licensed social worker (57). These numbers are lower than the national average. According to the 2022 Report published by the Georgia Mental Health Policy Partnership and Behavioral Health Services Coalition, Georgia ranked 48th among all states in access to mental health care (57). Without increasing the number of mental health professionals in the state proportionally, Georgia will see wider gap between the number of care-seekers and the number of professionals able to provide services. Demand, as a result, will only continue to exceed capacity.

Georgia not only must find ways to increase its behavioral health professional capacity, but also the state has a duty to increase call center capacity both for Georgia constituents and callers nationwide. If the state call center does not have the capacity to support a caller, that caller will be transferred to a national call center. This may result in long wait times when seconds and minutes—let alone hours may mean the difference between life and death. Even more, when a person, regardless of their area code, texts, or chats 988, the message will be directed to whichever state is next in the queue to respond via the federally funded call center (3). This is important because if the number of people texting or chatting from Georgia spikes dramatically without corresponding increases in state message-taking capacity, it prevents people nationwide from getting the same level of service as those calling in. While this system will ideally improve with more funding, in the interim, it represents a patchwork solution and furthers the argument of ramping up capacity.

Thus, to expand the behavioral health workforce and call center capacity, there are several measures Georgia and states generally can take. Legislatures should make it more economically feasible for people to become mental health providers and stay in their roles despite the exhaustion that results from an extreme lack of capacity. For example, in Georgia, policymakers can provide loan forgiveness for those who work in areas impacted by workforce shortages, explore opportunities to develop and implement state loan repayment programs (such as Physicians and Dentists Rural Assistance Programs), and expedite the licensure of mental health clinicians, including qualified foreign-born clinicians who can help develop a culturally competent behavioral health workforce (57). Evidence-based, cost-effective interventions can expand the behavioral health workforce and empower the community. For instance, community-initiated care is a concept that depends on the "task-shifting" model of services. In this way, mental health care is not dependent on licensed clinicians but rather on non-specialized healthcare workers and even lay members of the community who are trained with the knowledge, skills, and competencies necessary to deliver behavioral health support (58).

Georgia must also consider ramping up the number of call-takers within GCAL and 988 call centers. While projecting changes in the volume of callers into 988 presents difficulties and therefore makes it challenging to predict exact staffing needs, the trends thus far indicate that expanding capacity is critical. Call centers in Georgia and nationwide must be mindful of recruitment, training, and retention among call-takers. Strategies to increase workforce capacity include accelerating the license review process for behavioral health providers, allocating more funds to salary raises, and providing flexible and remote work options for call-takers. By investing in behavioral health and call center infrastructure, states can enable more people in crisis who call 988 to receive mental health care—reducing suicide rates overall and promoting a more mentally healthy society.

Next, policymakers cannot discuss increasing capacity in Georgia without a discussion of funding. Given that money for Georgia's 988 rollout currently comes from COVID-19 emergency relief efforts, the state needs a sustainable financing mechanism to continue paying for the Lifeline after emergency funds dry up. Multiple sources of funding could be used to support the anticipated demand for Lifeline services. On the federal side, the SAMHSA Suicide Lifeline grant supports the infrastructure of network operations, and the MHBG funds provide technical assistance on the use of funds, allocations of funding, and recommended changes to the data reporting system. Georgia can also impose and collect telecommunication fees to support 988 operations authorized by the 2020 Act. The fees would be collected from each subscriber of commercial landline telephones, cellphones, and IP-enabled voice services, and the revenue generated would be expanded only in support of 988 services or enhancements of such services. In a recent presentation by DBHDD, one representative stated, "While other states have rushed to pass fees, Georgia leaders will continue to assess actual call volume to determine how best to approach funding this long-term transformation of Georgia's crisis infrastructure" (49). However, early adopters of telecom fees, such as Virginia and Washington, reported collecting between 3.6 and 4.5 million in 988 telecommunication fees during FY2021 (12), suggesting that passing legislation enabling fees generates significant revenue to fund the call line (59). Thus, without state legislation and adequate funding and staffing of the Lifeline, Georgia—along with the majority of other states that have not passed telecom fees—cannot convalesce its crisis response performance and continuum of care.

Some states have used Medicaid to support elements of the crisis continuum and expand capacity through plan amendments, waivers, and demonstrations. Medicaid managed care payers cover several aspects of crisis services—more typically crisis intervention and stabilization services, not call response. To date, private payers have provided limited coverage of crisis services (3). However, as a non-Medicaid expansion state, Georgia's ability to explore the use of Medicaid funding is limited.

As such, our final recommendation requires Georgia and other non-Medicaid expansion states to assess their Medicaid status. Ramping up Georgia's behavioral health crisis system requires not only increasing capacity, such as allocating additional funding to expand the mental health professional workforce, but also it means ensuring that people across the state can receive adequate and affordable care. Studies show that without sufficient participation in Medicaid among psychiatrists, Medicaid enrollees with behavioral health needs may be unable to find a doctor who accepts Medicaid patients and, even if they do, likely experience long waits for intake appointments (60).

Expanding Medicaid in Georgia would mean that the income threshold for Medicaid would increase, allowing more people who make at or below the poverty line to receive coverage. By enabling

Medicaid to cover a higher percentage of people, Georgia can ensure that more of its constituents have access to affordable behavioral health services. The four other states that, like Georgia, have uninsured rates of 12% or more—Florida, Oklahoma, Texas, and Wyoming have not expanded Medicaid eligibility and may benefit from following suit (61).

Even more, evidence shows that Medicaid coverage expansion improves access to care and medications for those with behavioral health challenges (62). When more people have access to affordable and quality care, they also have access to preventative health screenings, leading to a decrease in delaying and forgoing necessary care altogether. Coverage expansion contributes to widened access to behavioral health services by increasing mental health provider capacity. The more likely providers are to receive adequate reimbursement for their services, the greater their capacity to accept various forms of coverage. With greater access to affordable mental health services, people are less likely to delay seeking treatment until they are in crisis.

Georgia recently narrowly expanded Medicaid to cover more low-income adults in its "Pathways to Coverage" program but limited it to individuals working or volunteering for at least 80 h per month. Experts at George Washington University argue that this legislation both costs more and covers fewer people than a full Medicaid expansion, as it resulted in the denial or termination of anyone failing to document 80 h of work or equivalent activities *every* month (63). As a result, it excludes hundreds of thousands of eligible Georgians from the assistance they would otherwise receive under the ACA and creates a narrow coverage pathway only few can navigate. Thus, Georgia must consider further legislation to close the Medicaid coverage gap to improve access to needed mental health care.

Discussion

Overall, this analysis shows that the performance of the crisis system in Georgia improved since the implementation of 988. That there was an existing behavioral crisis mechanism in place given the already-developed GCAL network likely allowed Georgia to address increased call volumes more quickly. However, sustainable state funding mechanisms must be instituted to ensure the sustainability and effectiveness of the Lifeline going forward. Further, Georgia's non-Medicaid expansion state designation prevents a coordinated continuum of care, as many people do not have access to affordable behavioral health services and refrain from engaging with the broader healthcare system as a result. Thus, Georgia along with many other states in similar positions must formalize additional funding sources and ensure there is an adequate workforce to address growing behavioral health needs.

Limitations of the pre-post policy analysis

There are unavoidable limitations in our pre-post analysis and policy recommendations. First, and most notable, is the lack of data. Several policy experts with whom we consulted in drafting this paper made clear that the lack of publicly available data is deeply troubling. While call volume, wait times, and other metrics from 988 provide some insights into accessibility and demand for 988, they do not tell the whole story. State-to-state comparisons could be useful for understanding the difference between successful strategies and interventions that fall short. For example, a deep dive into Medicaid expansion states' crisis response and continuum of care could provide useful metrics for non-Medicaid expansion states, like Georgia. Furthermore, specific research evaluating the equitable impact of 988 on vulnerable and minority populations, especially populations living with disabilities and Veteran populations, could benefit communities that often have the most challenging experiences accessing services. Additional state and national crisis center metrics help inform the 988 implementation and future program improvements and allow researchers to understand how 988 has impacted the continuity of care.

Moreover, geolocation obfuscates the 988 policy recommendations. When a user calls 988, they are routed to a local call center based on their area code vs. their geographic location (33). Area code routing results in less precise emergency response service deployment and coordination, and call center operators tend to be less knowledgeable about care systems outside their state (33). According to mental health and crisis counseling experts, getting the caller to the geographically appropriate local crisis center is key to the Lifeline's approach to providing services to those in need of public health and safety resources (64). However, many policymakers and advocates oppose geolocation as a requirement for 988 implementation, citing issues related to privacy and confidentiality (65).

Consequently, the numbers used in the pre-post policy analysis do not demonstrate if callers into Georgia's lifeline require crisis services in the state of Georgia or elsewhere. If most people calling with Georgia area codes are physically in locales outside of Georgia, the policy recommendations would likely look different. While Georgia has considered leveraging currently available 911 capabilities and infrastructure to serve as a model for Lifeline geolocation, most states have not (49).

Further, this analysis does not stratify by different demographic groups who may receive specialized services via 988. For example, Veteran or active military callers can dial 988 then press 1, which connects them to the Veteran Crisis Line, and American Indian and Alaska Native Communities can dial 988 then press 4 to be connected to the Native and Strong Lifeline. Thus, future research can look to other crisis lines such as the National Domestic Violence Hotline and offshoots of 988 such as the Veteran Crisis Line and the Native and Strong Lifeline to understand the hurdles implementers and policymakers have considered in addressing specific populations (66).

Relatedly, there are several outcomes this paper could have evaluated but did not. Such outcomes include assessing the impact of 988 on mental health stigma, health-seeking behavior, young adult mental health, and more. Provided that the laws are nascent, there will likely be other outcomes to evaluate that are not yet on researchers' and policymakers' radars. Future research papers could address such outcomes.

National implications

Has the performance of the suicide and mental health crisis system in the U.S. improved since the implementation of 988? For the reasons stated above, Georgia offered us insight into the national implications of the 988 crisis line given its designation as a nationally representative state, providing a window into how states can assess progress and shortcomings of the Lifeline. Still, the impact and effectiveness of 988 on a national level remains one of the largest open questions in crisis intervention services in the U.S. (67). While researchers have begun looking into the effectiveness of third-party callers (68) and chat interventions (69) and preliminary implementation guidance has been published by SAMHSA (3), peer-reviewed literature examining the nationwide effectiveness of the 988 suicide hotline post-rollout has yet to be published.

Nonetheless, there have been studies that evaluated the success of 988 on a national scale before the number was implemented. For example, a recent national survey of 180 behavioral health directors assessed whether they felt prepared for a national transition to 988 in the lead-up to implementation (70). Survey respondents stated that the most common challenges they encountered in their 988-planning process were insufficient mental health workforce and a lack of funding (70), both of which were found in our analysis of Georgia as well. The researchers found that local, state, and regional behavioral health systems across the country require greater investments to support 988 and mental health crisis care, regardless of whether they have expanded Medicaid under the ACA (70). However, the states that have not expanded Medicaid under the ACA, like Georgia, create additional barriers for people to access affordable and quality mental health care.

Beyond evaluating 988 for its effectiveness in preventing suicide, researchers may also look to existing national hotlines targeting issues such as child abuse, child trafficking, and domestic violence, which, similar to mental health crises, tend to be socially condemned and stigmatized. Evaluation of such national hotlines may offer researchers a glimpse into effective strategies to improve hotline performance on a national level for socially treated issues. Additionally, given that suicide is higher among violence-involved individuals (71), hotlines like the National Domestic Violence Hotline and the Intimate Partner Violence hotline may attract similar callers. Training national hotline workers who support violence-involved individuals in suicide prevention strategies and referral to care may also be an effective way to approach mental health crises and should be explored further (71).

Call to action

The interplay between the federal and state governments in Georgia largely works to improve the performance of the Lifeline. Still, with the federal government's plan to market 988 more broadly in 2023, more states will require the government's guidance on how to advertise 988 on a local level. With a more sophisticated system often comes more complexity. National, state, and local governments must ensure that each is not operating in a silo and work in tandem with stakeholders, such as law enforcement. More research that proves the Act's effectiveness will hopefully provide a positive reinforcement loop to encourage continued legislative action.

It is vital to note that while the 2020 Act was a step in the right direction in enforcing mental health parity, it is by no means enough. Federal, state, and local governments have a necessary role to play in providing affordable and accessible mental health care to their constituents. However, governments should not focus solely on addressing moments of crisis. Ultimately, in addition to 988, governments must also invest in in pre-crisis mental health care. Public education campaigns should inform people about warning signs to help identify mental health challenges in the early stages. Schools should implement mental health and drug use screening protocols and require the presence of emotional support systems for students. Availability of warm lines should be expanded to prevent full-blown crises and offer post-crisis counseling and care. And, of course, this should all be done while ensuring people with lived experience have a seat at the decision-making table.

The nation's focus on suicide prevention is a key step forward. But, waiting until suicidal ideation or attempts occur to act is indicative of a system that has already failed its constituents. 988 will be a letdown—not a lifeline—if policymakers wait for suicide to act.

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EDITED BY
Dabney Evans,
Department Center for Humanitarian Emergencies, Emory University, United States

REVIEWED BY
Abolfazl Ghahramani,
Urmia University of Medical Sciences, Iran
Nicola Mucci,
University of Florence, Italy

*CORRESPONDENCE
Amy Zeidan
✉ ajzeida@emory.edu

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"Caminando Con Riesgo": perceptions of occupational injury, workplace safety and workers rights among Spanish-speaking hospitalized patients

Amy Zeidan[1]*, Juliana Cortes[2], Hannah Marcovitch[3], Roxana Chicas[2], Randi N. Smith[4], Alessandra Stevens[5], Elizabeth Zambrana[5] and Shelly Anand[5]

[1]Department of Emergency Medicine, Emory University School of Medicine, Atlanta, GA, United States, [2]Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA, United States, [3]Emory University School of Medicine, Atlanta, GA, United States, [4]Department of Surgery, Emory University School of Medicine, Atlanta, GA, United States, [5]Sur Legal Collaborative, Atlanta, GA, United States

Introduction: Occupational health disparities are well documented among immigrant populations and occupational injury remains a high cause of morbidity and mortality among immigrant populations. There are several factors that contribute to the high prevalence of work-related injury among this population and those without legal status are more likely to experience abusive labor practices that can lead to injury. While the work-related injuries and experiences of Spanish-speaking workers have been explored previously, there is a paucity of literature documenting injury among hospitalized patients. Additionally, there are few documented hospital-based occupational injury prevention programs *and* no programs that implement workers rights information. The purpose of this study was to further explore the context of work related injuries primarily experienced by Spanish speaking patients and knowledge of their rights in the workplace.

Methods: This was a semi-structured qualitative interview study with Spanish speaking patients admitted to the hospital for work related injuries. The study team member conducting interviews was bilingual and trained in qualitative methodology. An interview guide was utilized for all interviews and was developed with an immigrant workers rights organization and study team expertise, and factors documented in the literature. Participants were asked about the type and context of the injury sustained, access and perceptions of workplace safety, and knowledge of participants rights as workers. All interviews were conducted in Spanish, recorded, transcribed in Spanish and then translated into English. A codebook was developed and refined iteratively and two independent coders coded all English transcripts using Dedoose. Interviews were conducted until thematic saturation was reached and data was analyzed using a thematic analysis approach.

Results: A total of eight interviews were completed. All participants reported working in hazardous conditions that resulted in an injury. Participants expressed a relative acceptance that their workplace environment was dangerous and acknowledged that injuries were common, essentially normalizing the risk of injury. There were varying reports of access to and utilization of safety information and equipment and employer engagement in safety was perceived as a facilitator to safety. Most participants did have some familiarity with Occupational Safety and Health Administration (OSHA) inspections but were not as familiar with OSHA procedures and their rights as workers.

Discussion: We identified several themes related to workplace injury among Spanish speaking patients, many of which raise concerns about access to workplace safety, re-injury and long-term recovery. The context around immigration is particularly important to consider and may lead to unique risk factors for injury, recovery, and re-injury both in the workplace and beyond the workplace, suggesting that perhaps immigration status alone may serve as a predisposition to injury. Thus, it is critical to understand the context around work related injuries in this population considering the tremendous impact of employment on one's health and financial stability. Further research on this topic is warranted, specifically the exploration of multiple intersecting layers of exposure to injury among immigrant populations. Future work should focus on hospital-based strategies for injury prevention and know your rights education tailored to Spanish speaking populations.

KEYWORDS

occupational injury, occupational health, workers rights, immigration, Occupational Safety and Health Administration

Introduction

It has been suggested that immigration status alone *is* a social determinant of health (1). Indeed, immigration status impacts all areas of an individual's life, including access to safe and healthy work environments (2). Occupational health disparities are more prevalent among immigrant populations who are at an increased risk of workplace morbidity and mortality (3). Immigrant populations, especially those without legal status, are more likely to work in physically demanding jobs that are hazardous, such as construction, agriculture, maintenance, and service occupations that have high incidence rates of nonfatal occupational injuries and illnesses (4, 5). Additionally, the workplace fatality rate is nearly 50% higher for Latino workers than their non-Latino counterparts (6).

As immigrant populations in the United States continue to expand, they will likely account for an increasing percentage of those working under high risk labor conditions. In the state of Georgia, one in eight workers is an immigrant, primarily concentrated in sectors with hazardous working conditions (e.g., manufacturing, construction) (7). Similarly, a retrospective review conducted at a high-volume Emergency Department in Atlanta revealed that of 267 non-English-speaking individuals hospitalized for an injury, nearly 25% were hospitalized for a work-related injury; 95% of whom were Spanish speaking (8). The high rate of work-related injuries among immigrant populations is likely multifactorial, including but not limited to language and communication barriers, lack of immigration status, discrimination and structural barriers to labor protections, training, provision, and use of safety equipment (4, 9). Those without legal status are more likely to be subject to predatory and exploitative labor practices due to fears of reports to immigration enforcement (10). Relatedly, immigrant populations make up a larger percentage of labor trafficking survivors, with the agricultural industry being the largest perpetrator, followed by domestic work and construction (11). It is important to note that immigrants are protected under federal laws. Occupational Safety and Health Administration (OSHA) protections apply to all workers, regardless of their legal status (12). Some states have 'state plans' that add additional protections to workers but that is note the case for the state in which this study occurred (Georgia) (13). Employers are thus responsible for following federal OSHA standards (12). OSHA has clearly defined worker rights and protections, noting that under OSHA standards, employees have the right to a safe and healthy work environment and protections from retaliation if advocating for this (14). This includes the right to file a complaint against an employer and be protected from relation via 'whistleblower' protections. The challenge is that not all of these protections are enforced and state laws protecting immigrant workers vary such that in some states, an individual without legal status may still face risks of 'discovery' by immigration enforcement if attempting to pursue a case (4). Accountability, enforcement, and weak penalties have also been cited as challenges at OSHA. The current OSHA budget does not appropriately cover staffing to process and enforce regulations and there are concerns about their actual ability to protect workers from retaliation (15). Despite existing initiatives that attempt to reach immigrant workers, including the development of Spanish-Language Compliance Assistance Resources and dedicated 'Hispanic Outreach' tools (training resources, compliance programs, etc.), immigrant workers remain exceptionally vulnerable and experience a disproportionate amount of work related injuries (16–18).

Experiences of safety and injury among Spanish-speaking workers has been studied previously however few studies explore perspectives of hospitalized patients. Prior studies have resulted in important interventions; however, despite the frequency with which patients present to the hospital for work related injuries, hospital-based interventions are lacking (19, 20). Additionally, interventions largely focus solely on injury prevention rather than emphasizing both injury prevention *and* Know Your Rights (KYR) training. Hospital settings may represent an important and understudied point of intervention for injury prevention and KYR programming. In collaboration with a local community organization, Sur Legal Collaborative (Sur Legal), we designed a study to characterize the contextual factors around work-related injuries requiring hospitalization, as well as knowledge of OSHA and workers rights among Spanish-speaking patients admitted to the hospital for a work related injury.

Methods

Study design

This was a qualitative semistructured interview study with Spanish-speaking individuals admitted to the hospital for a work-related injury between June and August 2023. This method was chosen as a means of exploring contextual factors within the work environment that led to injury and hospitalization, barriers and facilitators to workplace safety, and knowledge of the OSHA and workers rights.

Study setting and population

Participants were eligible for this study if they were adults (≥18 years of age) admitted to the hospital for a work related injury and were Spanish speaking, including those who were bilingual. Patients were excluded if they were unable to provide consent. This study was conducted at a large, academic, public hospital in Georgia; this center is the only level 1 trauma and emergency care center in Atlanta. The hospital is a public safety-net hospital serving a largely un-and underinsured population, with over 140,000 ED visits and 7,500 trauma activations annually. According to the hospital's language interpretive services department, 13% of patients receiving care at the hospital have a non-English Language Preference (NELP), the majority of whom speak Spanish (7%). The study was reviewed and approved by the University's Institutional Review Board and complies with the consolidated criteria for reporting qualitative studies (COREQ).

Study protocol

Participants were approached in person by a bilingual research assistant in the Emergency Department or inpatient Trauma service. The research assistant screened patients admitted to the trauma service via the Electronic Medical Record to identify their preferred language and mechanism of injury. Participants were approached in their private hospital room, consented, and all interviews occurred in the participant's room. Participants were selected purposively to include those with Spanish as their preferred language and who were admitted for a variety of work related injuries. All interviews were conducted using an interview guide which was developed, piloted and refined by the study team. The study team has content expertise in occupational health, environmental health, nursing, public health, emergency medicine, trauma surgery and critical care, injury prevention, labor law, and workers rights. Questions were developed to explore contextual factors related to the workplace environment, safety procedures, and knowledge of OSHA and workers rights. Participant demographics were collected at the end of the interview and included gender, race/ethnicity, age, country of birth, years living in the United States, preferred language, other languages spoken, number of years in current job, highest education level completed, and whether they had health insurance. We did not ask about immigration status as this question may have been a barrier to establishing trust and/or discouraged workers from participating in this study.

Interviews were conducted in-person with a bilingual study team member with qualitative interviewing experience (JC) who had recently completed her masters in public health. The interviewer had no previous interaction with study participants, although she did have experience enrolling patients at the study site for trauma specific studies (none of which included the participants from this study). All interviews were recorded, professionally transcribed and translated, and conducted until thematic saturation. Thematic saturation is generally reached at 6 to 12 interviews (21). All participants provided verbal consent at the beginning of the interview and were informed that they could terminate at any time, although no participants did so. Interviews lasted approximately 45–60 min. Three additional individuals were approached but the study team ultimately determined they were not appropriate for inclusion given persistent confusion (related to their injury). Participants were provided language concordant Know Your Rights Information developed by the Sur Legal Collaborative if desired.

Data analysis

We adopted a thematic analysis approach to analyze all qualitative data, as detailed by Braun and Clarke (22). Following review of the English transcripts, study team members with experience in qualitative analysis developed an initial codebook and coded a sample of transcripts (AZ, JC, HM). The same study team members met throughout the coding process to refine and finalize codes and all coding differences were resolved by consensus. All transcripts were coded independently by two team members (JC and HM) using Dedoose, a qualitative coding software. Themes were derived using a semantic approach, whereby patterns are identified explicitly, but latent concepts were also assessed in order to explore foundational ideas. Given the potential for inherent beliefs and biases that can influence interpretation, the study team prioritized reflexivity to ensure these did not impact data analysis.

Community partnership

An important component of this study was the development of all study components in partnership with Sur Legal. Founded in October 2020, Sur Legal is a woman of color-run and led legal nonprofit organization based in Georgia working at the nexus of labor rights, immigrant rights, and mass decarceration. Sur Legal Collaborative was founded in response to COVID-19 by a career trial attorney with the US Department of Labor who witnessed immigrant workers and low income workers of color being designated as essential workers but knowing nothing about their labor rights, particularly under the

OSHA. The mission of the organization is to democratize legal knowledge so that immigrant and working class communities are empowered with the tools they need to hold abusive employers accountable. Sur Legal contributions were invaluable in the development of the study design, interview guide, and interpretation of findings.

Results

A total of eight interviews were completed with seven men and one woman. Participants self-identified as Latino or Hispanic and were from Mexico ($n=3$), Guatemala ($n=3$), Honduras ($n=1$) and El Salvador ($n=1$). The mean age was 39 with a range of 23–69 years old. The mean number of years living in the U.S. was 14 with a range of 3–30 years. All participants reported Spanish as their preferred language and two reported also speaking an indigenous language. They had worked in their current job for a range of 3 months to 8 years with a mean of 3.3 years. The highest level of education completed varied from 10 years of age (primary school) to 1 year of college with 14 years old being the mean age of highest education completed. Most did not have insurance ($n=6$). See Table 1 for Themes and Representative Quotes.

Participants interviewed describe their work as the following: construction (framing the exterior of houses, installing sheetrock), ironing clothes (using a hand iron to iron clothes), landscaping/hardscaping (demolishing existing outdoor structures and building outdoor kitchens and decorative walls), sandblasting (cleaning/smoothing hard surfaces with a dedicated machine), painting (painting both inside and outside surfaces of residential houses/apartments), torchcutting (cutting metal materials with fire using a torch, roofing removing the existing roof and/or siding of residential buildings and replacing with new roof/siding). The mechanisms of injuries were highly variable and reported as the following: the participant working in landscaping/hardscaping noted his foot was run over by a large machine used to transport heavy materials; the participant working in sandblasting noted he was on a ladder pouring sand when he was struck by the material causing him to fall off a 10 foot ladder; the participant working as a torchbearer was attempting to remove aluminum that was stuck in his machine when it exploded because of the heat; the participant working as a painter reported falling from a ladder that became unsteady while he was painting; the participant working in construction noted he was on a ladder replacing sheetrock inside a house when the ladder became unstable and moved, causing him to fall; the participant who irons clothes described a steam burn from ironing; one of the participants working as a roofer describes falling from a room because the rope for his harness ran out while the other participant working as a roofer experienced a similar problem when the rope holding him to his harness slipped out from where it was tied, causing him to fall to the ground.

TABLE 1 Themes and representative quotes.

Theme	Representative quote
Hazardous Workplace Conditions	*Any tool, no matter how small and harmless it may seem, is dangerous and can cause damage, perhaps minimal, but it will cause damage […] Construction is not just about coming in and saying, you know what, I'm going to start working. No, you have to know what you are going to do during the day, plan yourself as a person and what you are going to need as tools. All construction is dangerous. Everything is dangerous. 50–55 year old Man, Landscaper* *Being alone and on top of a ladder, at any moment it can move. It's not like when you have someone holding it or something like that. 40–45 year old Man, Construction Worker*
Acceptance of Hazardous Workplace Conditions	*Well, I walk with risk […] all the time we walk with unsureness because we work with heights. 20–25 year old man, Roofer* *Because I do not have any papers. So, since we immigrants are here in the United States, we come to work whatever we can get. We work in construction, all that. That's where we get the most work, like us. 25–30 year old Man, Torch Cutter*
Perception of Recovery and Return to Work	*But if you lower your morale and become negative, I do not see how anyone is going to have a success or a good result. I have to be strong and get ahead, because I have obligations in life. 50–55 year old Man, Landscaper* *One is out of fear. Fear and nothing more. Second, because I'm not going to withstand anymore. It has affected me because I am not doing my normal functions as I have always done. –29 year old Man, Torch Cutter* *Because now I see it's already dangerous. I do not want to this to happen again. 20–25 year old Man, Roofer*
Workplace Safety	*We never talk about safety. We just go and talk about work. 40–45 year old Man, Construction Worker* *That's why you do not use security, because you trust that it's low, nothing happens to me. 25–30 year old Man, Construction Worker*
Employer Engagement	*There is a good relationship between employer and workers. There are talks about work, how to take care of ourselves, how to protect ourselves and how to use the work tools and protections to take care of our bodies. 50–55 year old Man, Landscaper*
Knowledge of OSHA and Workers Rights	*I used to work in building construction and there, yes, they require you to wear boots, helmet, glasses, gloves and they are always saying if you look at them without a helmet: "Put on your helmet, if OSHA comes, they will give us a ticket." 25–30 year old Man, Construction Worker* *These people never talk to you about rights, they talk to you about work, just that you have to work and arrive early or arrive at the time you have to arrive. But they do not tell you: "If you hit this right" or, "We are going to give you this, if this happens to you" no, almost never. I do not think any employer almost offers you rights, most employers never offer you anything almost. 40–45 year old Man, Construction Worker*

Workplace conditions

Hazardous workplace conditions

All participants described their work environment as hazardous or 'risky.' Many work with equipment that can cause serious injury if the equipment were to malfunction or if an accident were to happen and/or an environment where an accident could potentially be lethal (e.g., working at heights). One participant highlights this risk:

> *Being alone and on top of a ladder, at any moment it can move. It's not like when you have someone holding it or something like that.*

Acceptance of hazardous workplace conditions

When describing their work environments, respondents conveyed a general *acceptance* of working in hazardous conditions. They regularly commented on the constant risk at work (e.g., working in extreme weather, at heights, with heavy machinery), saying that 'this is just what happens' when describing work related injuries. Some noted that they felt they had few other options in terms of access to work:

> *Because I don't have any papers. So, since we immigrants are here in the United States, we come to work whatever we can get. We work in construction, all that. That's where we get the most work, like us.*

For most participants, the current injury was their first serious injury; however, many commented on several instances where they had minor injuries in which they did not seek medical care (e.g., cuts, falls, burns), acknowledging that minor injuries are common in their environment. Most respondents noted that their injury was not anticipated but was also not surprising given the nature of their high risk work environments. Most injuries were a result of an accident or equipment malfunction, generally perceived to be a known risk of their job:

> *Well, I walk with risk […] all the time we walk with unsureness because we work with heights.*

Several also commented on observing co-workers experience both major and minor injuries.

Perceptions of recovery and return to work

When describing their current injury and anticipated recovery, participants were seemingly pragmatic about their injury and recovery. They often responded with statements about the factual components of their recovery as told to them by their medical teams (e.g., surgical plan, recovery timeline) and/or responded with forward-focusing comments; the need to be optimistic or 'strong' in order to get through their recovery. One participant describes this sentiment:

> *But if you lower your morale and become negative, I don't see how anyone is going to have a success or a good result. I have to be strong and get ahead, because I have obligations in life.*

Participants described a range of feelings about returning to work, some noting they had not thought about their return, others expressing the desire to return quickly, and others describing the inability to return to work (due to fear or physical challenges). One participant describes fear of returning to a dangerous environment:

> *Because now I see it's already dangerous. I do not want to this to happen again.*

The desire to return to work was most often out of necessity. Some expressed interest in returning to work because of the unique and highly specialized skills they had related to their occupation (describing it as an 'art'):

> *I will try because I like this job. For me it is an art. Very well, yes, and I have no other type of work in mind, but I am going to try.*

Workplace culture

Workplace safety

Despite working in hazardous conditions, there were varying levels of workplace safety precautions described. Some participants commented that there were almost no precautions at work, while others noted they had daily safety checks and were sent home if they did not have the right safety equipment. One participant describes the lack of safety precautions at work:

> We never talk about safety. We just go and talk about work.

Participants described several processes they and/or their coworkers follow to ensure safety at work but these were not necessarily employer driven. There were also varying levels of safety equipment used, some provided by employers and others that employees were required to provide. Many described instances in which they opted not to use some of their safety equipment because it was uncomfortable or made their job more difficult.

Employer engagement

Participants described employer engagement as a facilitator to ensuring a safe environment. Feeling safe at work was often related to whether their employer prioritized safety. Employees perceived safer work environments if their employer emphasized safety as part of their workplace culture.

> *There is a good relationship between employer and workers. There are talks about work, how to take care of ourselves, how to protect ourselves and how to use the work tools and protections to take care of our bodies.*

On the contrary, participants expressed more concern about their safety if their employer was absent and/or did not prioritize safety precautions.

Knowledge of OSHA and workers rights

When asked about OSHA, participants had some awareness of OSHA as a monitoring organization but had limited knowledge of

OSHA standards or requirements. Similarly, they had limited knowledge of their rights and could not comment on any of their rights as workers. Most participants had not received any information about OSHA or their rights as workers and most had very limited access to safety information or training. One participant highlights this:

> *These people never talk to you about rights, they talk to you about work, just that you have to work and arrive early or arrive at the time you have to arrive. But they don't tell you: "If you hit this right" or, "We are going to give you this, if this happens to you" no, almost never. I don't think any employer almost offers you rights, most employers never offer you anything almost.*

Notably, respondents described limited formal training in general, noting that informal or 'on the job' training was the norm with varying levels of safety training incorporated into their formal or informal training. Most participants felt there could be more precautions in place to make their workplace safer.

Participant driven suggestions

Participants were asked for suggestions about improving workplace safety and commented on several potential opportunities including a brochure or booklet about safety and their rights as workers, a website or organization that provided safety information, a class or video on how to avoid accidents, short daily trainings on how to avoid accidents, and more safety training in general. They commented on the desire for their employer to be more invested in safety and to provide necessary safety equipment and support for workplace safety.

Discussion

In this study, Spanish-speaking patients hospitalized for a work related injury acknowledged and essentially normalized the constant risks they face at work. The level of workplace safety procedures varied from strict daily procedures to no precautions and employer engagement in safety was a facilitator for creating a culture of workplace safety. Most participants had limited knowledge of OSHA and their rights as workers, many expressing an interest in wanting to work in safer environments.

Our findings are similar to other studies conducted in community settings in which Spanish-speaking workers acknowledged working in hazardous conditions, often out of necessity (23–25). Similarly, the employer's commitment to safety was crucial yet the incorporation of safety procedures was highly inconsistent (24, 25). A study by Roelofs et al. explored perceptions of OSHA in more detail, noting that workers had varying opinions about the actual influence of OSHA standards on safety (24). This is important considering existing OSHA policies related to 'workers rights' clearly define the rights and protections of employees, requiring employers to maintain a workplace that is free of hazards.[1] Our findings suggest that OSHA regulations are not appropriately followed, leaving immigrant workers particularly vulnerable to injury. One minor theme that was noted in our study and reflected in others is the responsibility workers take for their own safety, recognizing employer limitations and the need and desire to protect themselves (23). Our findings combined with others suggest that employers can play a critical role in creating a culture of safety. However, we recognize that employers have varying levels of interest and incentives to do this and OSHA requirements appear to be poorly enforced.

Immigrant workers experience different layers of structural vulnerabilities, suggesting that perhaps immigration status *is* itself a risk factor for injury. The extraordinary unsafe occupational conditions Spanish-speaking workers face are not new and occupational disparities are well documented among this population (4–6). National organizations such as the Centers for Disease Control and Prevention (CDC) and National Institute for Occupational Safety and Health (NIOSH) have called for more research and tailored interventions specific to immigrant workers and several interventions have been documented. For example, a structured safety curriculum and mobile based video in Spanish with dairy workers at their work site, dissemination of safety posters, brochures and videos at the Mexican consulate, and a short educational video intervention in the community (19, 20, 26, 27). Multi-sector and multi-faceted strategies may be a key component in ensuring interventions address all levels, from individual to structural interventions; a true public health approach. To our knowledge, no hospital-based occupational injury prevention interventions for immigrant populations have been described.

Hospitals and health systems are increasingly recognized as having an important role in addressing social determinants of health and upstream factors that influence health (28). Hospital based injury prevention programs have been efficacious at reducing injury and violence *at* the point of care (29, 30). Implementing hospital based occupational injury prevention programs may be another important tool in addressing workplace injury. As noted at this study site, Spanish-speaking individuals routinely present to our hospital for work related injuries yet no culturally or linguistically tailored injury prevention intervention exists, leaving individuals who can return to work exposed to the same unsafe conditions that caused their injury. In addition to injury prevention strategies, it may be important to incorporate KYR training into a hospital based injury prevention toolkit given that participants had limited knowledge of their rights as workers. While KYR trainings have not been widely integrated in health settings, they are a routinely used strategy by civil liberties organizations (31, 32). This may be an important area for future research as few existing workplace interventions have incorporated KYR information. If individuals are unaware of their rights as workers, it may be difficult for them to advocate for safer work environments.

Limitations

There are several limitations of our study. Interviews were conducted at a single hospital and thus may not be generalizable to other hospitals. Nonetheless, the hospital is the only Level 1 trauma and safety-net hospital, with a diverse patient population. Participants included were those who suffered a severe injury requiring hospitalization and themes may not necessarily reflect the experiences of those with injuries not requiring hospitalization or those who have not suffered an injury; however, the participants discussed previous

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[1] https://www.osha.gov/sites/default/files/publications/osha3021.pdf

injuries for which medical care was not sought. Interviews were conducted during the acute and/or subacute phase of the injury and may not capture the long term emotional and physical impacts of the injury. Most patients admitted to the hospital during this time period for work related injuries identified as men and only one woman was included in this study. Over half of immigrant women in the United States participate in the labor force, most commonly working in healthcare, hospitality, and food service. Immigrant women are also exposed to hazardous conditions, often work in informal sectors with woefully inadequate safety procedures or protection, and experience injury types that are different than men (33–35). The experiences of immigrant women are relatively understudied thus it is important that future studies explore the intersectionality of different identities (gender, race, ethnicity, immigration status) to better understand the experiences of all immigrant workers. Additionally, our study focused on traumatic work related injuries and did not explore non-injury related conditions. Previous studies have demonstrated that immigrant workers experience other occupational risks and occupational diseases with infectious diseases and metabolic cardiovascular disease being the most common (36). We did not include injured workers who spoke languages other than Spanish, who may face similar and unique challenges. Future studies should explore the experiences of diverse populations to better develop culturally and linguistically appropriate injury prevention and KYR resources. Finally, interviews were conducted in Spanish, transcribed, and translated into English thereafter. Coding and thematic analysis were performed utilizing English transcripts. As a result, it is possible that some words or concepts did not directly translate into English and therefore may have been unintentionally mistranslated and not incorporated into the analysis. However, this is unlikely as a professional transcription and translation service was used and coders were bilingual.

Conclusion

The role of Immigration as a Social Determinant of Health is important to consider when identifying injury and violence-related public health threats. Often, an individual's immigration status can dictate their options for *and* access to employment. The occupations that may be accessible to immigrants are high risk, hazardous jobs, where injuries are common. Indeed, based on our findings, immigrant workers continue to normalize working in hazardous, injury prone conditions feeling that safety is their own personal responsibility, rather than their employers. Participants voiced how important it is for employers to have a culture of safety to protect workers and how that would add to their feeling of safety at the workplace. Yet, injury prevention mechanisms and protections are highly variable. The inconsistent safety training and safety procedures at work places suggest that OSHA and agencies have a bigger role to play in protecting workers. Moreover, it suggests that public health approaches to injury prevention must account for this, recognizing that immigration status alone is a risk factor for injury and thus a threat to public health. The first step when considering a public health approach to injury prevention is to define the problem and then identify risk and protective factors. In this study, we suggest that immigration, an important social determinant of health, may be a risk factor for injury requiring a public health approach to address the problem. Hospital settings are an important location for injury prevention strategies yet few hospital-based injury prevention interventions specific to immigrant populations exist. Future studies are needed to develop and test hospital-based injury prevention strategies that protect workers from injury. As few workers are aware of their rights, interventions that incorporate rights based education, particularly for high-risk jobs, will be an important component to empower and protect workers. Implementing hospital based occupational injury prevention programs may be another important public health tool in addressing workplace injury and requires further research.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Emory Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AZ: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. JC: Conceptualization, Data curation, Formal analysis, Investigation, Software, Writing – review & editing. HM: Formal analysis, Investigation, Software, Writing – review & editing. RC: Conceptualization, Formal analysis, Funding acquisition, Methodology, Resources, Supervision, Writing – review & editing. RS: Conceptualization, Formal analysis, Funding acquisition, Investigation, Resources, Supervision, Writing – review & editing. AS: Conceptualization, Formal analysis, Funding acquisition, Investigation, Project administration, Resources, Writing – review & editing. EZ: Conceptualization, Formal analysis, Funding acquisition, Investigation, Resources, Writing – review & editing. SA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Visualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1347534/full#supplementary-material

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EDITED BY
Ursula Kelly,
Emory University, United States

REVIEWED BY
Hariharasudan A.,
Kalasalingam University, India
Melissa Osborne,
Kennesaw State University, United States

*CORRESPONDENCE
Tasfia Jahangir
✉ tasfia.jahangir@emory.edu

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"There's room to do more": a mixed-methods study of the Temporary Assistance for Needy Families (TANF) diversion program and intimate partner violence in Georgia

Tasfia Jahangir*, Conjay Dahn, Ria Devakottai,
Melvin D. Livingston and Briana Woods-Jaeger

Department of Behavioral, Social and Health Education Sciences, Rollins School of Public Health, Emory University, Atlanta, GA, United States

Introduction: Intimate partner violence (IPV) is a risk factor for homicides and suicides. As poverty is both a predictor and a consequence of IPV, interventions that alleviate poverty-related stressors could mitigate IPV-related harms. Temporary Assistance for Needy Families (TANF), a monthly cash assistance program, is one such potential intervention. In the state of Georgia, the TANF diversion program, which provides a non-recurrent lump-sum payment to deter individuals from monthly TANF benefits, is an understudied component of TANF that may influence the effectiveness of state TANF programs in supporting IPV survivors.

Aim: This study quantifies and qualifies the role of Georgia's TANF diversion program in shaping IPV-related mortality.

Methods: This study relies on a mixed-methods sequential explanatory design. Using data from the Georgia Violent Death Reporting System (GA-VDRS), an interrupted time series analysis was conducted to estimate the effect of TANF diversion on IPV-related homicides and suicides. Semi-structured interviews were then administered with TANF policy experts and advocates, welfare caseworkers, and benefit recipients ($n = 20$) to contextualize the quantitative findings.

Results: The interrupted time series analysis revealed three fewer IPV-related deaths per month after implementing TANF diversion, compared to pre-diversion forecasts (coefficient = −3.003, 95%CI [−5.474, −0.532]). However, the qualitative interviews illustrated three themes regarding TANF diversion: (1) it is a "band-aid" solution to the access barriers associated with TANF, (2) it provides short-term relief to recipients making hard choices, and (3) its limitations reveal avenues for policy change.

Discussion: While diversion has the potential to reduce deaths from IPV, it may be an insufficient means of mitigating the poverty-related contributors to IPV harms. Its limitations unveil the need for improved programs to better support IPV survivors.

KEYWORDS

intimate partner violence, welfare, policy, time-series, mixed-methods

1 Introduction

Intimate partner violence (IPV), defined as "physical, psychological, or sexual abuse or aggression that occurs in a current or former romantic relationship" (1), is a pressing public health and policy concern. In its most severe forms, IPV can culminate in homicides or suicides of the victim, perpetrator or other individuals (i.e., corollary victims) (2). Since gender-based violence was decreed a political issue in the 1960s and 1970s (3), much of the public and legislative dialogue around government protections against IPV in the U.S. emphasized measures that were more reactive than preventive in nature. The most well-known of these include the Violence Against Women Act of 1994, which supported the criminalization of IPV and sought to equip victims with resources; the #MeToo movement, which increased awareness of sexual violence victimization; and, most recently, the ongoing advocacy for strengthening state-level anti-sexual assault statutes in response to Dobbs v. Jackson (2022), where the Supreme Court overturned the constitutional right to abortion (3–6). Relatively less attention has been paid to the factors that can *initiate* IPV, such as material hardship or economic stress (7–15).

A nascent body of both peer-reviewed and gray literature demonstrates how economic policies (such as the Earned Income Tax Credit, Section 8 housing vouchers, paid family leave, pandemic stimulus payments, and cash assistance from the Temporary Assistance for Needy Families program) can serve as primary and secondary prevention tools against various forms of violence (11, 16–26). Such efforts are critical for intervening early and curtailing violence before it begins or interrupting a cycle of violence. Additionally, because such policies are already in place in many cases, it can be resourceful and cost-effective to understand whether they have incidental effects on IPV (25) and elucidate possible areas for improvement to better respond to the needs of those in vulnerable circumstances. For instance, there is inconclusive evidence on whether TANF is currently reaching its full potential in addressing the needs of violence survivors (23). Examining the specific components of TANF may therefore allow researchers and policymakers to delineate the factors that promote or hinder TANF's potential to support families and protect against IPV. This paper examines one such understudied policy in the state of Georgia: TANF diversion. As detailed in the literature review below, Georgia holds contextual value and public health significance for the study of welfare and IPV, given its notable prevalence of material hardship and violence victimization. Accordingly, this study aims to understand the role of TANF diversion in shaping IPV outcomes by (1) quantitatively estimating the effect of Georgia's TANF diversion policy on IPV-related mortality with an interrupted time-series design and (2) qualitatively contextualizing Aim 1 findings through semi-structured interviews with key informants with TANF experience and expertise.

1.1 Literature review

The toll of IPV is both physical and psychological (1), impacting an estimated 10 million people in the U.S annually (27). In addition to being a significant public health problem that increases the risk of chronic disease, sexually transmitted infections, mental illness, substance use, and injury (28, 29), IPV is a risk factor for both homicides and suicides (2, 30). Roughly 1 in 5 homicide victims are killed by an intimate partner (1). Although studies on IPV-related suicides have largely taken place at state- and municipal-levels (31, 32), it is estimated that there may be over 2,900 IPV-related suicides occurring annually at the national level (31). Since IPV is underreported, even these grave prevalence figures likely underestimate the severity of the public health issue (33, 34).

Two decades of research demonstrate that poverty is both a predictor and a consequence of IPV, exerting mutually reinforcing effects (7–15, 35). For example, lower incomes may increase the likelihood of IPV exposure and IPV exposure may lower the survivor's likelihood of remaining financially independent or escaping poverty (36, 37). This potential feedback loop suggests that interventions that alleviate poverty-related stressors could also be avenues for mitigating IPV-related harms. Indeed, 50 to 60 percent of IPV survivors participate in economic security programs (38), lending opportunities for intervention in such contexts. The Family Stress Model is a widely applied theoretical framework that can elucidate such levers for intervention; this model describes how financial stressors contribute to family economic pressure, which can impair mental health, and, in turn, produce relationship conflict or distress (12). The FSM has been directly applied to intimate partner violence (IPV) in a handful of studies (23, 24, 39), and an abundance of prior research implicitly demonstrates its applicability to IPV. For instance, there is evidence that economic hardship in the family can be a risk factor for caregiver depression, relationship dissatisfaction, relationship conflict, and aggression toward an intimate partner (12). Although the FSM extends beyond relationship conflict or IPV to issues related to child development, the present study focuses solely on IPV to better understand potential interventions for this specific pathway (Figure 1).

Temporary Assistance for Needy Families (TANF), a federal block grant program that provides monthly cash assistance to families in poverty, is one such intervention with the potential to reduce IPV-related harms (23, 40). However, the effectiveness of TANF has been subject to debate. In 1996, the United States Congress held a bipartisan agreement that welfare should neither disincentivize work nor promote dependency (41). This resulted in the passage of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), which concluded a 60-year-old program for qualified families to receive cash assistance (42). Legal researchers acknowledge that PRWORA dramatically reshaped the culture of public benefits in the United States, aligning with then-president Bill Clinton's campaign pledge to "end welfare as we know it." (41, 42). Specifically, one of the decreed objectives of the policy was to "end the dependence of needy parents on government benefits by promoting job preparation, work, and marriage." (43) To meet this statutory goal, the New Deal-era cash assistance program, Aid to Family Dependent Children (AFDC) as well as other welfare programs were abolished, and TANF was introduced in their stead as a "workfare" program. TANF is a fixed block grant from the federal government that provides approximately $16.5 billion to states, the District of Columbia, U.S. territories, and federally recognized tribes. The stated goals of TANF are four-fold: (1) *Provide assistance to needy families so that children can be cared for in their own homes or in the homes of relatives;* (2) *End the dependence of needy parents on government benefits by promoting job preparation, work, and marriage;* (3) *Prevent and reduce the incidence of out-of-wedlock pregnancies; and* (4) *Encourage the formation and maintenance of two-parent families* (43). The block grant funding structure of TANF

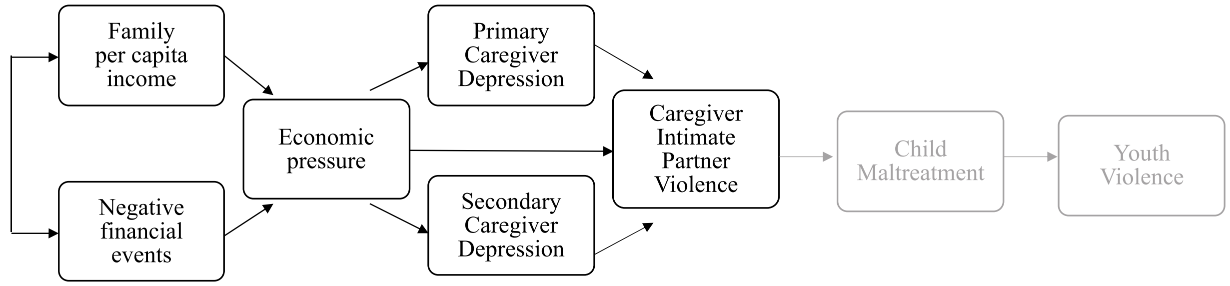

FIGURE 1
Family stress model adapted for violence (26).

substantially differs from that of the AFDC, where the federal government contributed at least $1 in matching funds for every dollar states spent (43). In contrast, the TANF block grant transformed welfare into a program that afforded states considerable discretion on how they used their TANF funds (43). Furthermore, while the AFDC was almost exclusively a cash assistance program, states are free to use TANF funds for services and non-cash benefits (44). For example, besides cash, states can provide childcare vouchers and job training programs to those who qualify based on income and asset limits, as well as legal residency status (43). The discretion granted to states has led to wide variations in the use of TANF funds on basic cash assistance and reduced spending on basic cash assistance over time (43). For instance, state-level differences lie in who qualifies for TANF receipt, how much in cash assistance one can receive on a monthly basis, who is mandated to fulfill work requirements, if recipients are privy to benefit reductions for not fulfilling work requirements (i.e., sanctions), the maximum number of months recipients are eligible for benefits (i.e., lifetime limits), reductions in benefits after receiving payments for a certain period (i.e., benefit reduction limits), and penalties for having an additional child while receiving TANF (i.e., family caps) (23, 45, 46). This warrants additional research on specific components of TANF that may be helping or harming TANF's potential to support families in general, and survivors of IPV in particular.

Diversion, a non-recurrent lump-sum payment aimed at diverting individuals from ongoing TANF benefits, is another component of TANF policy (45). In states such as Georgia, a diversion payment renders a TANF recipient ineligible for monthly assistance for up to 12 months; in others, the ineligibility period depends on the number of months' worth of benefits the family received as a diversion payment (45, 47). The potential impact of TANF diversion on IPV is inconclusive because diversion has received less research attention compared to other TANF policy components, such as sanctions (23, 24, 48–51), and time limits (23, 24, 50, 52, 53). Currently, the District of Columbia and 32 states have a diversion policy in place, including Georgia (45). In 2020, a total of 642 individuals in Georgia received some form of diversion payment, and the average diversion payment per client was $168.72 (54), but can be as high as 4 months' worth of cash benefits received through the regular TANF program (55). In contrast, the regular monthly TANF cash assistance payment is $223 for a family of three (or $2,676 per year if uninterrupted) (56).

Economic hardship and IPV are both pressing public health concerns in the state of Georgia. Its 14% poverty rate and $34,516 *per capita* income (55), coupled with its sharp 49% increase in IPV-related fatalities since 2020 (57) warrant policy-relevant solutions. The state experiences numerous racial and ethnic disparities in both poverty and IPV. For instance, the poverty rate of Hispanic, Black, and American Indian/Alaska Native individuals in Georgia are 19.7%, 20.3%, and 27% respectively, compared to the 9.5% poverty rate among White individuals (58). Additionally, Black women are disproportionately impacted by IPV in Georgia, at a rate that is 35% higher than that of White women and 2.5 times the rate of women of other races (59). As such, the state of Georgia deserves greater attention in the TANF literature to address these disparities.

Among the small handful of studies that do examine diversion policies, all but one (23) predate the last decade (60–64). Moreover, only one of these studies addresses Georgia, albeit limitedly, and the diversion policy discussed is different from the state's present-day diversion program (64). Furthermore, only Spencer et al. (23) estimate the impact of diversion on IPV outcomes in 20 cities (with null results), but these are outside of Georgia. This study contributes to the literature by using evidence from Georgia to study the downstream influence of the current TANF diversion program on IPV.

1.2 Study hypothesis

Cash assistance programs and policies are widely held as effective anti-poverty measures that provide social protection and promote well-being (65). They can be lump-sum or recurring, and conditional versus unconditional (21). They operate in many countries across the world, with replicable evidence pointing to their capacity to inhibit IPV, even when such reductions are not an explicit objective of their programming (65, 66). For example, a review of 22 studies found that cash transfer programs in low- and middle-income countries (LMICs), whose focus was primarily poverty reduction, led to a decrease in some form of IPV (emotional, physical, sexual) in 73% of the cases examined (67). Similarly, a meta-analysis of 14 evaluation studies of cash transfer programs in LMICs found, on average, decreases in all types of IPV (68). In the context of contemporary American social policy, the effects of cash or near-cash transfers on IPV are less conclusive. While some studies have found that the Earned Income Tax Credit can improve the material well-being and relationship quality in low-income families (69, 70), others have not observed a relationship between EITC and IPV (16, 71). Relatedly, while studies in the early 2000s suggest that more generous TANF policies may be protective against IPV (72–75), a more recent analysis found that fewer TANF restrictions increased coercive victimization (23).

Similarly, in the present study, TANF diversion has the potential to either act as a facilitator or a barrier in reducing IPV-related harms. On one hand, a diversion payment can support IPV survivors with an immediate crisis without requiring them to undergo a strict, time-intensive application process to qualify for monthly TANF benefits. On the other hand, the reduced access to regular cash benefits may increase their financial strain and exacerbate IPV-related harms. As much of the evidence and the Family Stress Model (12) point to financial support as a protective factor for IPV, it was hypothesized that TANF diversion, which is aimed at reducing access to monthly TANF benefits, will increase the incidence of IPV-related deaths in Georgia.

2 Methods

This study utilized a mixed-methods explanatory sequential design (76) comprised of two phases: (1) an interrupted time-series analysis to estimate the effect of Georgia's TANF policy on IPV-related mortality, and (2) semi-structured qualitative interviews with 20 key informants to contextualize the quantitative findings.

2.1 Phase 1 (quantitative): Interrupted time series design

2.1.1 Data sources

The exposure of interest was the implementation of TANF diversion policy. The Urban Institute's Welfare Rules Database (77) was referenced to determine July 2011 to December 2019 as the time period for analysis. Georgia's ongoing diversion policy period began in February 2015. Before this, the state had another diversion policy in place from April 2006 to June 2011. Thus, July 2011 was used as the starting point to allow for a true "no policy" baseline, and December 2019 was used as an endpoint to avoid contamination of effects related to the COVID-19 pandemic. The dataset was split into two 'before' and 'after' periods based on the February 2015 start date of Georgia's ongoing diversion policy. There were 1,278 observations in the 43 months prior to the implementation of the diversion policy (hereafter referred to as pre-diversion), and 1,579 observations in the 59 months following policy implementation (hereafter referred to as post-diversion).

The outcome of interest was intimate partner violence (IPV)- and intimate partner problem (IPP)-related mortality in the state of Georgia. Restricted state-level data on IPV- and IPP-related deaths, as well as decedents' demographic information (age, sex, race, ethnicity), were obtained from the Georgia Violent Death Reporting System (GA-VDRS) through the Georgia Department of Public Health (78). The GVDRS consolidates data on violent deaths abstracted from death certificates, law enforcement records, coroners' and medical examiners' records, and Emergency Medical Services (EMS) reports. In this dataset, data are organized at the decedent level (i.e., one victim per observation). IPV- and IPP-related deaths were defined as homicides or suicides related to immediate or ongoing conflict or violence between current or former intimate partners. IPV- and IPP-related deaths were inclusive of corollary victims (for example, ex-husband kills his ex-wife's new boyfriend, the child of an intimate partner, friend of the victim, or bystander). GA-VDRS defined an intimate partner as a current or former girlfriend/boyfriend, dating partner, ongoing sexual partner, or spouse, and is inclusive of same-sex partners. From July 2011 to December 2019. the dataset consists of 2,857 reports of IPV- and IPP-related deaths.

2.1.2 Analysis

To understand the demographic makeup of the dataset, univariate analysis of race, ethnicity, gender, and age variables was conducted. An interrupted time series design estimated with an ARIMA (Autoregressive Integrated Moving Average) model was then used to analyze the effect of Georgia's TANF diversion policy on reports of IPV- and IPP-related deaths. ARIMA is a modeling technique with a time-dependent outcome variable, a function of past counts of the variable and error values. It can be used for evaluating the impact of policy-level interventions on time-dependent outcomes as it controls for underlying trends, autocorrelation, and seasonality (79). It consists of four model components: autoregressive (AR) model, moving average (MA) model, seasonal model, and differencing. An ARIMA model is constructed by combining the four model components and is notated as ARIMA ($p, d, q; P, D, Q$). Here, p is the lag value of the AR component, d is the differencing interval, and q is the lag value of the MA component, and P is the seasonal lag value of the AR component, D is the seasonal differencing interval, and Q is the seasonal lag value of the MA component (79).

The model was used to examine the number of IPV- and IPP-related violent deaths at monthly time points from July 2011 to December 2019. Indicator variables for diversion were assigned to separate pre- and post-diversion data. The Box-Jenkins approach was followed (79), and an initial ARIMA model was developed to fit only the pre-diversion data. After establishing that the series was stationary prior to the introduction of TANF diversion, the optimal ($p, d, q; P, D, Q$) values for the ARIMA model were determined by examining the autocorrelation (ACF) and partial autocorrelation functions (PACF). Upon performing diagnostic checks of the residual ACF and PACF, the optimal ($p, d, q; P, D, Q$) values of the best-fitting model that achieved white noise were $(0,0,3; 0,0,1)_9$. The ARIMA model was re-estimated for the entire time series, including the post-diversion data. A coefficient test was performed to estimate the effect of the diversion policy on the number of IPV- and IPP-related deaths.

2.2 Phase 2 (qualitative): Semi-structured interviews and thematic analysis

2.2.1 Recruitment and consent

To contextualize the findings from Phase 1, in-depth semi-structured interviews (80) were conducted with key informants possessing experience and expertise in TANF. Eligible interviewees met one or more of the following criteria: (1) having a history of in-depth engagement with Georgia's TANF policy through research and direct action, (2) bearing a professional responsibility to identify and refer eligible clients to TANF, or (3) being a current or former recipient of any TANF benefit in Georgia. Due to the recruitment challenges associated with a stigmatized, hard-to-reach group, as well as the rapidly declining population of TANF recipients in the state, eligibility criteria were not limited to TANF recipients with a history of receiving TANF diversion or experiencing IPV.

The study team's existing relationships with community-based organizations and policy research institutes were instrumental in facilitating recruitment. Using purposive and snowball sampling methods (81), key informants were contacted from four child and family advocacy groups, one policy research organization, a school district, and a safety net hospital, all located in Georgia. Additionally, one interviewee was recruited from a policy research organization operating at the federal level. These initial touchpoints allowed the study team to engage TANF policy experts and caseworkers responsible for referring eligible individuals to TANF (e.g., *pro-bono* attorneys and a school-based specialist) as interviewees. The interviewees then disseminated a study flyer within their networks to aid the recruitment of current and former TANF recipients. TANF recipients contacted the study team via phone or email to express their interest and eligibility in participating in an interview. The final sample of interviewees consisted of six policy experts, three caseworkers, and 11 TANF recipients ($n = 20$).

All interviewees provided informed consent. Two members of the study team read a verbal consent document, provided an opportunity for interviewees to ask questions, and asked the interviewees to reiterate key components of the consent document to confirm their understanding of the study terms: *Would you describe in your own words what you are being asked to do? What would happen if you decided to stop the study?* Interviewees' consent to participate and permission to record interviews were then documented. Following the interview, all interviewees received a $50 gift card as remuneration.

2.2.2 Study instruments and data collection

All interviews were held over Zoom. Interviewees who did not have access to a computer joined the call using a teleconferencing number. To document the interviews, study team relied on Zoom's record feature (preserving only the audio recordings) and professional transcription services. All interviews were anonymized. Table 1 summarizes the content of each study instrument administered during the interviews.

Surveys of Sample Characteristics. Each interview began with an interviewer-administered survey via Qualtrics. Survey questions were tailored based on the grouping of the interviewee as a policy expert, caseworker, or TANF recipient (Table 1). All interviewees were asked about their age, race, ethnicity, and education level. TANF policy experts and caseworkers were additionally queried about the number of years in current role. The questions for TANF recipients were also tailored to include questions about marital status, household size, work history for the past 2 weeks, other forms of government assistance, perceived sufficiency of funds at the end of the month, as well as self-rated physical and mental health (1–10 scale).

TABLE 1 Summary of study instruments administered during the qualitative interviews (Phase 2).

Instrument	Content	Policy experts	Case-workers	TANF recipients
Survey of sample characteristics	Age	✓	✓	✓
	Race and ethnicity	✓	✓	✓
	Education level	✓	✓	✓
	Years in current role	✓	✓	
	Marital status			✓
	Household size			✓
	Work history for the past two weeks			✓
	Other forms of government assistance			✓
	Perceived sufficiency of funds at the end of the month			✓
	Self-rated physical and mental health (1–10 scale)			✓
Interview guides	Personal/professional relationship to TANF	✓	✓	✓
	Knowledge/understanding of TANF diversion policy	✓	✓	✓
	Perceived benefits and harms of the TANF diversion policy	✓	✓	✓
	How diversion may impact survivors of IPV	✓	✓	✓
	Potential avenues for policy improvements	✓	✓	✓
	Slideshow and reflection of findings from Phase 1	✓		
	If and how clients are referred to diversion		✓	
	Relationship to finances			✓
	Reasons for applying for TANF			✓
	Learning about TANF			✓
	Overall impressions of TANF			✓
	Reflections on the utility of the diversion program (framed retrospectively for recipients of diversion payment(s), and hypothetically for others)			✓

Interview Guides. The survey of sample characteristics was followed by an in-depth semi-structured interview. Based on theory (23, 24, 39, 82) and prior research on TANF and violence (23, 24), three interview guides were developed for each group of interviewees: policy expert, caseworker and TANF recipient (Table 1). All interviewees were asked about their personal or professional relationship to TANF, their understanding of TANF diversion policy, perceived benefits and harms of the TANF diversion policy, and recommendations. Policy experts were delivered a slideshow of findings from Phase 1 and asked to reflect on the implications of the results in relation to their own knowledge and experience of TANF. TANF caseworkers were asked if and how they referred participants to the TANF diversion program. TANF recipients were queried about their relationship to their finances (i.e., their current financial support system, whether finances are a source of stress, their income in relation to their expenses), their reasons for applying for TANF, how they learned about TANF, and their overall impressions of TANF. In addition, two distinct sets of questions related to the diversion program were drafted for recipients, which were to be used based on their experience with diversion. For those who had received a diversion payment, a set of retrospective questions were developed to understand their experience and perceptions of the diversion program. For TANF recipients without exposure to TANF diversion, a set of hypothetical questions asked to reflect on circumstances where they would benefit from a one-time diversion payment over the monthly TANF schedule, and vice-versa. Since none of the recruited interviewees received a diversion payment, only the hypothetical questions were utilized.

2.2.3 Analysis

Univariate analysis was conducted to summarize the data from demographic surveys. Interview transcripts were analyzed using an iterative thematic approach (83) in a series of steps. First, codes and subcodes were developed using a combination of inductive and deductive approaches. Inductive codes were borne out of the first four transcripts, whereas deductive codes stemmed from the interview guide. To ensure that the codes were meaningful and consistent, the first, second, and third authors collaborated on a codebook that standardized each code with definitions and constructs. The first and second authors then referenced the codebook to designate codes to all interview transcripts. To capture new concepts as they emerged, codes were revised iteratively until saturation (i.e., until the codes fully represented all the relevant information in the transcripts). Two coders then coded each transcript and met to reconcile codes and resolve discrepancies. Based on the patterning of the codes, salient themes were derived and substantiated with quotations.

3 Results

3.1 Quantitative Phase 1: Interrupted time series design

3.1.1 GA-VDRS sample description

Table 2 summarizes the demographic makeup of Georgia's IPV and IPP mortality data reported on the NVDRS from 2011 to 2019.

3.1.2 Findings from interrupted time series analysis

With the inclusion of post-diversion mortality data, the ARIMA $(0,0,3\ 0,0,1)_9$ model revealed 3 fewer observed deaths per month, compared to pre-diversion forecasts (coefficient = −3.003, 95%CI [−5.474, −0.532], $p = 0.017$). As such, the findings did not support the study's initial hypothesis (i.e., that diversion will result in an increase in IPV-related mortality). Figure 2 illustrates the change in IPV- and IPP-related mortality trends after the 2015 diversion policy and compares the forecasted pre-diversion mortality trend to the observed post-diversion mortality trend.

TABLE 2 Demographic characteristics of IPV and IPP-related mortality cases in the GA-VDRS.

Variable	Value
Age, mean (SD)	40.46 (14.54)
Gender[1], *n* (%)	
Male	1999 (69.67)
Female	858 (30.03)
Race, *n* (%)	
White	1948 (68.18)
Black or African American	760 (26.60)
Asian	5 (0.18)
Native Hawaiian or Other Pacific Islander	56 (1.96)
American Indian or Alaska Native	57 (2.00)
Unspecified	31 (1.09)
Ethnicity, *n* (%)	
Hispanic or Latino	4.66 (131)
Unspecified	1 (0.04)

[1] GVDRS labels as "sex at time of incident," with options "male," "female," "unknown."

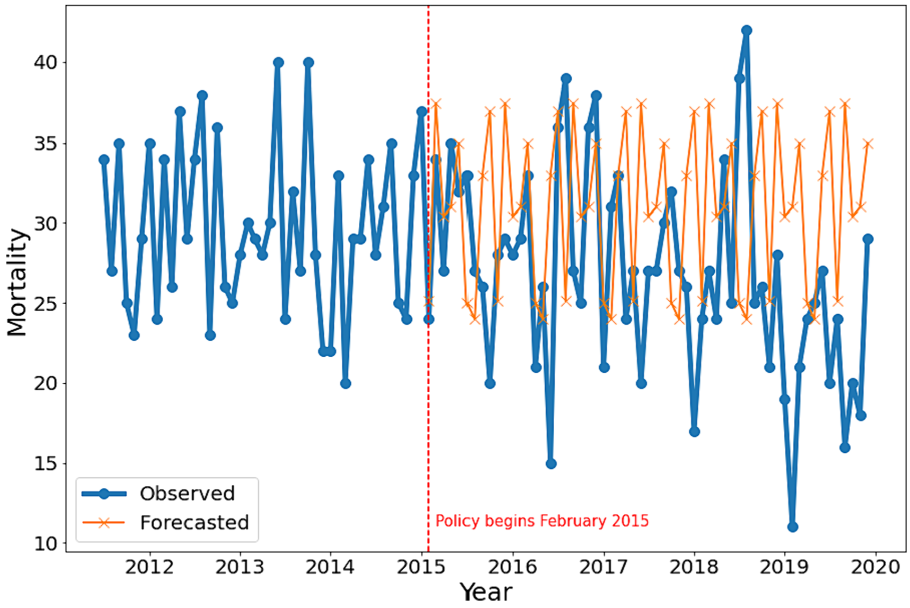

FIGURE 2
Comparison of observed and forecasted IPP and IPV-related mortality before and after TANF diversion policy implementation in 2015 (2012–2019).

3.2 Qualitative Phase 2: Semi-structured interviews

3.2.1 Interviewee sample description

Table 3A summarizes the demographic information of the policy experts, caseworkers and TANF recipients interviewed about TANF diversion. Table 3B provides information on additional details gathered from TANF recipients.

3.2.2 Findings from thematic analysis of semi-structured interviews

Theme 1: Diversion as a "band aid" solution for the access barriers to receiving monthly TANF payments

Subtheme 1.1: Diversion disincentivizes seeking public assistance

Despite the quantitative findings on the protective effects of diversion payments on IPV-related mortality, diversion payments were largely considered unfavorable by interviewees because they offered a smaller one-time payment than what the recipients would have received with regular TANF payments over the course of a year.

Caseworkers described diversion as a deliberate effort to turn individuals away from receiving their fair share of public assistance:

> *"Cynically, it is an effort to pay off poor people with one little bit of money, foregoing some other little bit more money."* (Caseworker)

Multiple interviewees described that there was little benefit to receiving a small amount of assistance through a one-time TANF diversion payment:

> *"For my clients to benefit from TANF, the amounts need to be livable [….]. My clients need easier accessibility. My clients need childcare. My clients need child support services. My clients need accessible healthcare and resources that help them with their food insecurity. Diverting them to try and put a lump sum of some smaller amount [….] would not be helpful for my clients. [….] I can't see any helpfulness except from my clients' perspective that any funds to help them immediately is better than the anticipation of long-term help, which they never see."* (Caseworker)

Subtheme 1.2: Potential harms of diversion

According to some policy experts, the diversion program may even be harmful because it disqualifies TANF recipients from accessing other TANF benefits and the monthly TANF payments for the next 12 months:

> *"To have the one-year pause seems like it's a lot. It seems like that might be overkill. If there was a way to lessen that, I think it might be beneficial. I mean, again, the reason why people are in the program is because they are needy. That's the N part of [TANF]. To think that this one-time payment is going to overcome the year in the future? I do not know. I just think that that's too long."* (Policy Expert).

According to one interviewee, the harms of TANF diversion go beyond losing access to monthly cash payments:

> *"What happens when you get a diversion payment is you lose access to some of the other services that TANF provides. So, if there is case management services, if there is childcare assistance, if there is help with the things you need to go to work, you lose access to all of those. So, what you're getting is a short-term cash payment, but nothing else."* (Policy Expert)

TABLE 3A Demographic information of all interviewees.

	Policy experts (*n* = 6)	Caseworkers (*n* = 3)	TANF recipients (*n* = 11)
Number of years in current role, mean (SD)	4.83 (4.61)	11 (12)	N/A
Age, mean (SD)	44.17 (11.44)	43 (19.08)	26.9 (5.54)
Race/Ethnicity, *n* (%)			
Asian American or Pacific Islander	0	1 (33%)	
Black or African American	3 (50%)	0	9 (81.82%)
White	2 (33%)	2 (66%)	1 (9.10%)
Mixed	0	0	1 (9.10%)
Other	1 (17%)	0	0
Hispanic or Latino	1 (17%)	0	0
Education Level, *n* (%)			
No formal schooling	0	0	1 (9.10%)
Some high school	0	0	1 (9.10%)
High school diploma	0	0	1 (9.10%)
Some college or 2-year degree	0	0	5 (45.45%)
Bachelor's degree	0	0	2 (18.18%)
Graduate or professional degree	6 (100%)	3 (100%)	1 (9.10%)

TABLE 3B Additional characteristics of TANF recipients.

Variable	Value
Household size, mean (SD)	3.27 (1.10)
Worked for pay in the past 2 weeks, *n* (%)	6 (54.45%)
Applied or received other sources of public assistance in the past 12 months, *n* (%)	
Supplemental Nutrition Assistance Program (SNAP)	9 (81.82%)
Supplemental Security Income (SSI)	6 (54.45%)
Social Security Disability Insurance	1 (9.10%)
Finances at the end of the month, *n* (%)	
Some money left over	2 (18.18%)
Just enough to make ends meet	1 (9.10%)
Not enough to make ends meet	7 (0.64%)
Self-rated mental health (1–10 scale), mean (SD)	6.55 (1.81)
Self-rated physical health (1–10 scale), mean (SD)	7.73 (1.49)

Another interviewee also perceived TANF diversion to have harmful implications from a broader population health perspective:

> *"I could see it deterring health equity. I think whenever you have these programs that say, "I'm happy to help you now, but that means I can't help you in the future". People who are going to take you up on that offer are going to be the ones that are the most vulnerable. And, by definition, [….], they're the highest risk for health disparities and health inequities. So I definitely feel like this has a potential to be harmful, just even despite seeing your graphs about the deaths."* (Policy Expert)

Subtheme 1.3: Barriers to accessing traditional TANF payments

Interviewees also highlighted multiple barriers to receiving the "traditional" monthly TANF payments, suggesting that this was not an easily accessible resource. One policy expert described how such barriers may be particularly detrimental to IPV survivors:

> *"Georgia is famous for having really extreme barriers in order to access cash. And it's really unfortunate because if you are in a situation where you are potentially under threat of violence or have already experienced violence, […] moving quickly and accessing resources quickly to either get out of that circumstance is essential so that that's the harm, basically, you have this resource, but you're making it putting up so many barriers that it's almost as if the resource may not available to you, right, if you don't need these certain conditions. And to me, [that] should not be the point of a cash assistance program."* (Policy Expert)

Logistical hurdles during the TANF application process, such as depending on public transportation to the Department of Child and Family Services (DCFS) and lengthy office wait times, made the application process itself more difficult to access. Recipients also noted the unfavorable conditions of the DCFS facilities, lack of resources, and unreliable staff assistance as additional barriers, citing employee burnout and insufficient staffing as potential reasons for the difficulties during the process:

> *"I'm very serious when I say I think they are burned out and no one wants to do that job anymore because I remember standing in lines where women have two or three children. It's hot, they have barely any AC. The lines are out the door. And then the computers break down."* (TANF Recipient)

Application completion and processing times were cited as barriers to accessing the monthly TANF benefits. One participant recounted the length of time it took for them to complete the application, and the time it took for them to receive an update on their application status:

> *"If people still are getting benefits, I would like to see how they're doing it. Maybe they're taking a whole day off to go there because that's basically what you have to do now. You can't just go in for 30 minutes and leave. It's a whole day job going to the DFCS [Division of Family and Children's Services] office. […] It took like a whole – like a month for them to process everything and then for them to send me out a letter to tell me when I was approved. It took like 30 days."* (TANF Recipient)

Additionally, recipients described excessive documentation requirements, including those that may not be readily on-hand, which delayed their time to complete the application:

> *"You've got to have, first, the kids' information, like their birth certificates, social security numbers, stuff like that. I can't say it was easy. […] When I was doing [the application] I did get a little frustrated, 'cause I was like, […] "dang, y'all ask for so much stuff. Why y'all ask for all this stuff?" And I had to take stuff back up because some stuff I didn't have at the time; I had to go get it and take it back up there. So that really made the process even a little longer."* (TANF Recipient)

Many recipients expressed being denied TANF benefits multiple times and having to complete two or more applications before being approved. Interviewees were dissatisfied by caseworker communication and the extensive amount of time it took to be followed-up with on their application. One interviewee also described never being contacted about their application status or the reason for the final decision:

> *"Oh my God. It was kind of rough and stressful. Cause the first time that I applied a caseworker never called and contacted me. She didn't ever get in contact. And I checked my gateway account and I was denied. But she didn't ever tell me why. So it was stressful cause I could never get in contact with her."* (TANF Recipient)

Subtheme 1.4: Diversion as an alternative (albeit imperfect) solution for barriers to accessing traditional TANF payments

Given these and other potential hurdles to receiving monthly TANF payments, policy experts contended the one-time diversion payment be a more readily-available alternative in these circumstances:

> *"The hassle factor in TANF programs is really high and significant. And so, [diversion] gives families who need small amounts of income […] a better source of help than going through the onerous requirements that what they'd otherwise have to go through."* (Policy Expert)

Interviewees deemed TANF diversion as a possible mechanism to overcome eligibility criteria that may not always be easy for IPV survivors to meet, such as work requirements:

> *"So, I think [diversion] could be helpful for families who have pretty significant barriers who can't meet the work rate. So, they're going to lose assistance, then they might actually get some assistance rather than not getting anything."* (Policy Expert)

Thus, although TANF diversion in and of itself is not a desirable policy, the challenges associated with receiving the monthly TANF payments suggest that TANF diversion might be operate as a "band aid" solution to these barriers. This may explain the findings on the protective effect of diversion on IPV-related mortality in Phase 1, as suggested by policy expert interviewees:

> *"Georgia's TANF program is so horrendous in terms of allowing people to access it […] because their program is so bad that diversion payments actually offer an alternative."* (Policy Expert)

Theme 2: Diversion as short-term relief to recipients making hard choices

All interviewees agreed that the main benefit of diversion, especially to victims of IPV, is that the one-time payment may overcome some of the hurdles of the regular TANF application by providing quicker assistance. One caseworker explains the need for IPV victims to have immediate access to resources:

> *"We have discovered that victims of domestic violence need the financial resources they can gather before they can leave. The fewer resources that they have at their fingertips, the less likely it is that they and their children will be able to escape beatings, abuse, and murder without those resources."* (Caseworker)

Other policy experts described how diversion can play a role in providing this short-term relief:

> *"If we're thinking about people who are in crisis and need access to cash supports, diversion is one mechanism that could be helpful. So instead of going through, which might be perhaps more a little bit more rigorous of an application process, diversion could be a way to more quickly get access to those cash supports to help somebody in crisis to quickly just address needs of safety and economic stability."* (Policy Expert)

Another interviewee similarly described the temporary utility of this relief in assisting an IPV survivor escaping crisis situations:

> *"I imagine that our patients do need cash assistance, especially because a lot of times people need safety transfers. They come in and they're injured close to their home or someplace where they don't feel safe going back and they do need cash assistance to help them out of that situation and get rid of those environmental stressors. I can see where the benefit would be just to have this money easily or hand it to them. That's the only benefit because I think in the long term, if they're not having a whole year after that, it can be pretty detrimental, especially if people are relying on that assistance. I think the risk will outweigh the benefit, though, in the long term."* (Policy Expert)

This was corroborated by a TANF recipient who suggested that diversion can help survivors transition away from dire circumstances:

> *"Since they'll try to use these funds to make their ends meet, at least they can settle with it and at least move on from their problems or what they have gone through."* (TANF Recipient)

Beyond this, it was challenging for interviewees to perceive other, more long-term benefits to diversion. One caseworker suspected diversion to be a mechanism of absolving the TANF program of its responsibilities to provide for families in the long-term:

> *"This sounds like a big cost-cutting effort that would prey on desperately needy and desperately poverty-stricken women who need money immediately to feed their children or get them through some kind of emergency. I would assume that was the purpose of it and to cut the cost of it."* (Caseworker).

Consistent with the quote above, caseworkers contended that diversion particularly affects individuals making hard choices. During these periods of vulnerability, individuals may opt for quick access to the one-time payment, even if the dollar amount is lower than what they may have received over the course of 12 monthly payments:

> *"Exactly. If you have to pay your rent, you have to do what you have to do to keep yourself and your child from going homeless. It's not a hard choice. You would make it. I would make it. Any parent would make it to keep their child from being homeless or from being hungry or from being sick."* (Caseworker).

These difficult circumstances were similarly acknowledged by another interviewee:

> *"I think about the families that I serve, if you're stuck between a rock and a hard place, you are likely going to take this big lump sum, I would think."* (Caseworker)

Theme 3: Limitations to TANF diversion reveal avenues for policy change.

There was consensus among interviewees that Georgia's TANF program, and diversion specifically, are fraught with limitations. Accounting for these challenges, TANF recipients, caseworkers, and policy experts shared several avenues for policy advocacy to improve the material conditions of IPV survivors. Some proposed ways of improving Georgia's implementation of TANF, whereas others cited policy alternatives that may be better suited for curtailing IPV. Table 4 summarizes these recommendations.

4 Discussion

Findings did not support the hypothesis that diversion will increase the number of IPV-related deaths in Georgia. Instead, three fewer deaths per month were observed after the implementation of TANF diversion. However, the qualitative findings suggest that diversion (1) is a "band-aid" solution to the access barriers associated with TANF, (2) only provides short-term relief to recipients making hard choices, and (3) has limitations that reveal avenues for policy change.

Our quantitative findings suggest that TANF diversion in Georgia carries the potential to reduce IPV-related harms. These findings stand in contrast to the literature demonstrating the protective effects of ongoing cash assistance on IPV (11, 16–26). Further investigation is necessary to determine whether TANF diversion is only reducing the escalation to death in incidences of IPV, or mitigating IPV more broadly.

As documented previously, there are numerous hurdles to receiving TANF benefits in Georgia, including but not limited to stringent eligibility criteria (84), 45-day-long application processing times (85), 30-hour work requirements, and 48-month time limits (43). This is also evidenced in the historically low TANF-to-poverty ratio in Georgia, wherein for every 100 families living in poverty, only five receive assistance through TANF; this TANF-to-poverty ratio has declined 77 points since the mid-1990s (86, 87). Indeed, in 1994, there were 141,596 families in Georgia receiving TANF assistance; last year, in 2022, only 5,734 families received assistance – a 96% decline in TANF receipt (88). Therefore, for many, a diversion payment may be the only route for cash assistance, and it cannot be assumed that monthly TANF payments are a readily available alternative. Additionally, to receive a diversion payment, an individual would not have to subject themselves to the potentially challenging work requirements associated with the recurring monthly TANF benefits (89), which may facilitate access to cash benefits. These lower barriers to accessing diversion payments relative to traditional TANF monthly benefits may potentially explains some of the protective effects observed in the time-series analysis.

Coupled with the results from the time-series analysis, the qualitative findings on the role of diversion as short-term relief suggest that many individuals may opt for a diversion payment to curb an acute stressor before their challenges intensify, such as emergency assistance to pay rent, utility bills, repairs, other housing- or vehicle-related costs, or domestic violence services. This has been suggested by other examinations of TANF diversion at the national level (47). Additionally, there is broad recognition among psychologists that IPV is associated with psychological stress of varying intensities and durations (24, 90–93). For example, IPV survivors may endure long-term or chronic stress from continual violence and intimidation, as well as short-term stressors that culminate over time, such as becoming unemployed or lacking the transportation to escape (24, 93–95). Therefore, administering short-term interventions have been identified as an important element of coordinated community responses to IPV (96). However, the current evidence on short-term IPV interventions prioritizes psychotherapeutic modalities and shows greatest promise for intrapsychic needs – and even then, the effects of these short-term interventions are known to attenuate over time (96). While there is some exploratory evidence on the role of small amounts of cash for short-term (yet insufficient) relief among IPV survivors who are TANF recipients (24) and women living with HIV (97), there is a need for additional research to conclusively determine whether quick material support (such as a one-time payment) can specifically function as a short-term intervention against acute stressors. It is also critical to examine how these short-term resources can be paired with more durable, long-term interventions that relieve more chronic concerns and sustain the well-being of IPV survivors.

While some scholars have coined TANF a failure due to its limited reach and the barriers noted above (41, 86), TANF's past and present suggest that the policy may be functioning as intended, with unlimited discretion at the state level. Considering (a) the program's original goal of keeping families off welfare rolls (98) without accountability for ensuring their self-sufficiency (41), (b) its efforts to divert individuals from receiving monthly benefits (45), (c) its marginalization of Black

TABLE 4 Avenues for policy advocacy identified by interviewees.

Category	Recommendation	Example quote(s)
TANF-specific	Increase the dollar amount of both one-time and recurring cash payments	*"I think for my client population, the amounts are so low monthly. If the amount could be increased..."* (Caseworker)
		"TANF, being a block grant, it has not increased. Even social security gets a small cost of living adjustment and the amounts of TANF have not increased." (Caseworker)
		"I mean, think certainly we can do more research, but I think there is indications that point to get access to cash, one has positive outcomes and we do not need to have so many barriers in place to getting the access to cash. And in fact, the barriers may undermine the improvements that the cash itself could have." (TANF Expert)
		"I cannot foresee any negative consequences about giving people money, except that it just would not be enough." (TANF Expert)
		"Just having a decent lump sum, like a thousand or a couple thousand dollars to get you over whatever this hump is, whether it be rental arrears or paying a credit card down. So your credit score will go up and then you can be eligible to buy a home. These are the things that actually generate wealth. These are the things that keep people safe. The number one reason that people return to abusive situations is based on economic precarity. And when people do not have to worry about how they are going to be housed, where their income is coming from, whether or not they are going to be able to take their care of their child, they are so much less likely to return to abusive situations. So yeah, if it were funded well, I think it could do a lot of good." (TANF Expert)
	Allow recipients of TANF diversion to continue accessing monthly TANF benefits	*"Having something that's similar to this crisis payment, but not without the repercussions of that diversion payment that somewhere you are disqualified for TANF..for monthly benefits."* (Caseworker)
	Improve case management by investing in manpower and resources	*"Just trying to really invest in the people who work there, invest in their employees, invest in […] the community. […] Now you cannot even talk to anyone on the phone. I do not know how people are still getting benefits."* (TANF Recipient)
		"Georgia needs to do better with resources. They need to do better with case management. When it comes to benefits they need to just to do better. They need to do better, they need to do better. And they need to start putting their clients' best interests, instead of getting mad that the clients see the benefits"
	Destigmatize TANF	*"If you think about what it takes to prove all of the different things that they are asking […] to prove that you are compliant with the work requirements or the other "acceptable" activities, the way that these DFCS workers are living in poverty themselves essentially, and are often the people receiving the brunt of the frustration about how the system is working, and how then that informs how they treat the people that they are interacting with. So, in addition to the policies, there's the actual practice and that is another layer of how harmful the experience can be for people […] So, even people who do potentially qualify do not receive it or they think it's not worth it, because it's so painful […] And if we thought about it in terms of everybody needs a little bit of help sometimes and we should make it feel good and feel like a community, And so that's the way that I envision like how we could talk about these benefits and make them feel good for people. The more that we can shift the rhetoric around it I think it will inform the policy."* (Policy Expert)
		"The stigmas and the other pieces that are heavily associated with cash have created the very weak program that we have today." (Policy Expert)
	Conduct more research to identify and tackle barriers	*"Because there are a lot of harmful policies in TANF that you can focus on hat I think it would be interesting to parse out. Like which of the policies are most harmful? Then that can inform policy change."* (Policy Expert)
		"I think that research done with near misses basically. Like people who almost qualified for TANF, but did not, versus *people who have qualified for TANF. And seeing what the qualitative research around what their quality of life looks like because they did not receive it or because they did receive it would be helpful in for us in terms of being able to share with policy makers, "This is the difference TANF can make for a family.""* (Policy Expert)
		"And I think that programs like TANF and a diversion payment and all of this, like they are great, but I think that more data and information needs to be out. […] I just think about all of these support programs and they are great, but there's room to do more." (Caseworker)
General	Take a preventive, non-adversarial approach by accounting for the material and structural drivers of IPV	*"We were focusing pretty heavily on policies that kind of protect the physical bodies of survivors. And there was a very heavily criminal legal component to it. And we have been making the shift over the last maybe four or five years towards non carceral solutions and looking at the real drivers of domestic violence, which tend to be the more structural issues, more things like access to healthcare or lack of affordable housing, lack of a living wage, all of those things are the biggest drivers of gender-based violence."* (Policy Expert)
	Raise the floor for wages	*"I do believe that this entire government should at least -- if they are not going to be dependable with these resources --then they should just increase the wages for people so that at least with mothers who are single, they are making enough money."* (TANF Recipient)

and Latinx families (87, 99), (d) states' redirection of TANF funds to other programs (100), (e) states' accumulation of TANF surplus funds, (e.g., $2.2 million in Georgia) (87) and (f) the paucity of federal oversight as states carry out these activities (100, 101) suggests that TANF's inertia in lifting families out of poverty may be systemic. Indeed, TANF closely represents neoliberal philosophy: government responsibility is relegated and decentralized to lower administrative units that determine the roles and implementation, and eligibility for aid is determined through the lens of economic productivity and exchange (i.e., work requirements), rather than broader social and systemic forces (102). Accordingly, TANF should not be considered a panacea for alleviating poverty (101). However, it is one of the only income-support programs of its kind in the U.S. since Unemployment Insurance and Supplemental Security Income have more precise eligibility criteria, and EITC would be insufficient as the sole anti-poverty program. Because TANF still provides relief to a small proportion of families in poverty, it is important not to abandon the policy without introducing structural reforms that remedy the inequities and material conditions forcing families to seek TANF in the first place.

4.1 Limitations and strengths

Although this study moves the TANF literature forward by examining an understudied policy component, several limitations must be acknowledged. Beyond the possibilities noted above, other unexplored factors may be shaping the relationship between TANF diversion and IPV-related mortality. With limited data availability, and the inability to randomize diversion payments, an interrupted time-series design was the most robust alternative for examining the outcomes of interest. The results from this analysis may be nullified should other confounders occur near the time that TANF diversion policy went into effect. Of note, the COVID-19 pandemic assistance relief is not one of these confounders, as the study does not use mortality data from 2020. One potential confounder may be state legislation that extended unemployment benefits to IPV survivors in 2015 (103). As more data becomes available, future research should model the effect of both policies simultaneously.

Additionally, the study only examines TANF diversion in Georgia. Because the association between TANF diversion and IPV-related mortality may vary by contextual factors and state-level differences in the implementation of TANF policy, findings may not be generalizable to other states implementing a TANF diversion policy. As such, future research should replicate these analyses in other states.

Despite these limitations, there are multiple strengths to this study. Population-level studies of the impact of social and economic policies on violence are only recently receiving research attention in the U.S. The study contributes to this growing body of evidence by investigating a specific element of a welfare policy that can influence its effectiveness in supporting disadvantaged families. Because TANF is a complex program, malleable to social and political conditions at the state level, this natural experiment lends an opportunity to evaluate the impact of a TANF policy component within the "real world."

Additionally, the focus on mortality data in the interrupted time series analysis responds to a recent call in the injury and violence field to examine the forms of IPV that culminate in lethal outcomes (2). According to this call, these instances of IPV represent missed opportunities to intervene before the escalation to fatalities, either due to ineffective interventions or a complete lack thereof (2). These fatal cases of IPV, therefore, deserve greater research attention to identify alternative mechanisms of prevention. However, the field may also benefit from additional research that characterizes the effect of TANF diversion on incidences of IPV that do not necessarily result in deaths to clarify whether the program prevents IPV more broadly, or merely its escalation. The qualitative work for the present study can lay the groundwork for understanding potential mechanisms that may also apply to non-fatal forms of IPV.

Overall, this analysis is strengthened with the mixed-methods approach. Although quantitative methods such as ARIMA modeling can serve as robust tools for examining whether specific policies can impact health outcomes, they do not necessarily capture complex phenomena in their entirety. In these instances, combining quantitative and qualitative methods with a mixed-methods design can allow researchers to contextualize and explain quantitative findings.

5 Conclusion

This study estimated the role of Georgia's TANF diversion policy in shaping IPV. There was an observed decrease in the IPV-related morality in Georgia after the TANF diversion policy went into effect. However, policy experts, caseworkers, and TANF recipients engaged in this study revealed that the TANF diversion policy is likely fraught with limitations, despite the short-term relief it may provide to vulnerable recipients. Few studies examine the impact of social and economic policies on violence-related inequities. This study underscores the importance of paying close attention to the caveats of social policy, wherein seemingly inconsequential or previously unobserved policy elements can have critical implications for the health and well-being of families in poverty. It also highlights the importance of context: no two state-level TANF policies are alike, and state-level case studies of TANF policy components are vital for proposing tailored interventions and policy alternatives.

While this study elucidates the potential implications of TANF diversion for violence prevention, it is merely a starting point. More information can be gleaned by comparing the effects of TANF diversion policy to that of other states and states that have no TANF diversion programs in place. Future work may also consider examining the effects of the program on non-fatal IPV, as well as other forms of violence (e.g., community violence). It may also be valuable for the field to understand whether TANF diversion has differential effects across demographic groups.

Lastly, the benefits of community-engaged research for triangulating qualitative and quantitative data are widely recognized (104, 105). Policy researchers are encouraged to tap into these strengths, while broadening their definition of "experts" to account for communities beyond the research setting that frequently interact with policies of interest. Such an approach may facilitate a stronger understanding of the social mechanisms observed in natural experiments.

Data availability statement

The dataset from Phase 1 is not readily available because an application to the Georgia Department of Public Health is required to obtain the data. Deidentified qualitative data from Phase 2 can be made available upon reasonable request. Requests to access the datasets should be directed to tasfia.jahangir@emory.edu.

Ethics statement

The study involving human participants were reviewed and approved by the Emory University Institutional Review Board. Participants of Phase 2 provided their verbal informed consent to take part in this study.

Author contributions

TJ: Conceptualization, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing. CD: Formal analysis, Writing – original draft, Writing – review & editing. RD: Formal analysis, Writing – review & editing. MDL: Conceptualization, Formal analysis, Resources, Supervision, Validation, Writing – review & editing. BWJ: Conceptualization, Resources, Supervision, Validation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Dabney Evans,
Center for Humanitarian Emergencies at Emory, Emory University, United States

REVIEWED BY
Annalyn DeMello,
University of Texas Medical Branch at Galveston, United States
Ashley D'Inverno,
Centers for Disease Control and Prevention (CDC), United States

*CORRESPONDENCE
Sofia Chaudhary
✉ sofia.s.chaudhary@emory.edu

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Reducing firearm access for youth at risk for suicide in a pediatric emergency department

Sofia Chaudhary[1,2,3]*, Kiesha Fraser Doh[1,2,3], Emilie Morris[4], Caroline Chivily[5], Donnetta S. Washington[3,6], Scott E. Gillespie[1], Andrew Jergel[1], Sarah Lazarus[3,7,8], Angela Costa[3,7,8], Nathan Call[1,3], Jonathan Rupp[2] and Harold K. Simon[1,2,3]

[1]Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, United States, [2]Department of Emergency Medicine, Emory University School of Medicine, Atlanta, GA, United States, [3]Children's Healthcare of Atlanta, Atlanta, GA, United States, [4]Department of Pediatrics, University of Utah, Salt Lake City, UT, United States, [5]Emory University School of Medicine, Atlanta, GA, United States, [6]School of Social Work, The University of GA, Athens, GA, United States, [7]Pediatric Emergency Medicine Associates, Atlanta, GA, United States, [8]Morehouse School of Medicine, Atlanta, GA, United States

Background: Firearm-related suicide is the second leading cause of pediatric firearm death. Lethal means counseling (LMC) can improve firearm safe-storage practices for families with youth at risk of suicide.

Objectives: This study aims to evaluate the feasibility of pediatric emergency department (ED) behavioral mental health (BMH) specialists providing LMC to caregivers of youth presenting with BMH complaints and to test for changes in firearm safety practices, pre-post ED LMC intervention, as measures of preliminary efficacy.

Methods: Prospective pilot feasibility study of caregivers of youth presenting to a pediatric ED with BMH complaints. Caregivers completed an electronic survey regarding demographics and firearm safe-storage knowledge/practices followed by BMH specialist LMC. Firearm owners were offered a free lockbox and/or trigger lock. One-week follow-up surveys gathered self-reported data on firearm safety practices and intervention acceptability. One-month interviews with randomly sampled firearm owners collected additional firearm safety data. Primary outcomes were feasibility measures, including participant accrual/attrition and LMC intervention acceptability. Secondary outcomes included self-reported firearm safety practice changes. Feasibility benchmarks were manually tabulated, and Likert-scale acceptability responses were dichotomized to strongly agree/agree vs. neutral/disagree/strongly disagree. Descriptive statistics were used for univariate and paired data responses.

Results: In total, 81 caregivers were approached; of which, 50 (81%) caregivers enrolled. A total of 44% reported having a firearm at home, 80% completed follow-up at one week. More than 80% affirmed that ED firearm safety education was useful and that the ED is an appropriate place for firearm safety discussions. In total, 58% of participants reported not having prior firearm safety education/counseling. Among firearm owners (n=22), 18% reported rarely/never previously using a safe-storage device, and 59% of firearm owners requested safe storage devices.

At 1-week follow-up (n = 40), a greater proportion of caregivers self-reported asking about firearms before their child visited other homes (+28%). Among firearm owners that completed follow-up (n = 19), 100% reported storing all firearms locked at one week (+23% post-intervention). In total, 10 caregivers reported temporarily/permanently removing firearms from the home.

Conclusion: It is feasible to provide LMC in the pediatric ED via BMH specialists to families of high-risk youth. Caregivers were receptive to LMC and reported finding this intervention useful, acceptable, and appropriate. Additionally, LMC and device distribution led to reported changes in safe storage practices.

KEYWORDS

firearm, safe storage, lethal means, emergency department, pediatrics

Introduction

Suicide is the second leading cause of death among the US youth aged 10–14 years and the third leading cause of death among those aged 15–24 years (1). From 2010–2021, 17,444 youth aged 10–17 years died by suicide, representing a 75.4% increase in suicide deaths over this period, with more than 40% resulting from firearms, the most lethal means (1, 2).

Access to household firearms is associated with an increased risk of youth suicide that can be modified with firearm safe storage (3–6). Currently, approximately 30 million US youth live in households with firearms, with 4.6 million (15%) of these homes reportedly storing at least one firearm, loaded and unlocked, the least safe method (7). The onset of the COVID-19 pandemic caused a significant increase in firearm sales, with more firearms being available and accessible in youth households (8–10). Both increased firearm access and the worsening mental health (MH) crisis during this period were significant risk factors for youth suicide (11, 12). From 2011 to 2020, there was a 5-fold increase in pediatric emergency department (ED) suicide-related visits, and from March to October 2020, ED MH-related visits increased by 24% for children aged 5–11 years and 31% for children aged 12–17 years compared to the year prior (11, 13). Furthermore, during the first year of the pandemic, there were significantly more suicides among younger children and minoritized youth, as well as more firearm suicides than expected (14). In October 2021, the American Academy of Pediatrics (AAP), American Academy of Child and Adolescent Psychiatry (AACAP), and Children's Hospital Association (CHA) declared a national emergency in child MH (15). Soon after, the Surgeon General issued an advisory about the youth MH crisis (16). Pediatric EDs, often the first point of care for a child's MH emergency, have seen the worsening MH crisis and increased suicide rates first-hand and necessitated an opportunity to intervene (11, 12, 17–19).

Lethal means counseling (LMC), where families are advised to reduce access to lethal means, including firearms and medications, is one suicide prevention strategy that has shown promising results in both adult and pediatric ED settings (20–24). One multi-center ED controlled trial that conducted an LMC intervention with the distribution of firearm storage devices for caregivers of at-risk youth found that twice as many caregivers improved firearm storage post-intervention (24). Similarly, a single pediatric hospital intervention study found that offering firearm storage devices along with training to household members of youth presenting with MH complaints improved firearm storage practices (23). Outside of these ED-based studies, firearm safety interventions in clinics and community settings that pair counseling with device distribution are the most effective in improving storage practices in contrast to offering to counsel alone (25–27).

This study aimed to explore the introduction of an LMC initiative in a tertiary southeastern United States (US) pediatric ED in a period of increasing rates of behavioral mental health (BMH) visits for suicidality. Our study objectives were to evaluate the feasibility and acceptability of pediatric ED BMH specialists providing LMC to caregivers of youth presenting with BMH complaints and to test for reported changes in firearm safety practices, pre-post ED LMC intervention, as measures of preliminary efficacy.

Materials and methods

Study design and data sources

We conducted a prospective pilot feasibility study of a convenience sample of parents and legal guardians (caregivers) of youth presenting to a pediatric emergency department with a BMH complaint between 14 January 2022 and 31 January 2023. Caregivers were enrolled in a 54-bed free-standing pediatric emergency department of a leading southeastern US tertiary pediatric healthcare system. This is a regional catchment hospital with an annual ED volume of 81,492 visits in 2022; of which, 1,821 (2.2%) were BMH encounters. This study was approved by the institutional review board at Emory University.

Participants were eligible for inclusion in the study if they were an English-speaking caregiver of a child of <18 years of age presenting with a BMH complaint or a BMH concern was raised during the ED visit, and the child was evaluated by an ED BMH specialist. Caregivers were eligible if the patient lived with them for any period during weeks/weekends.

Three ED BMH specialists (one licensed clinical social worker and two licensed professional counselors), each trained in LMC using the Counseling on Access to Lethal Means (CALM) online course detailed below, consented and enrolled caregivers for our study (20). These ED BMH specialists invited caregivers to participate in the study after providing their initial BMH assessment for the patient's primary BMH concern(s). Enrollment occurred during their clinical shifts in an area separate from the child or teen patient whenever possible. Two of these three ED BMH specialists enrolled caregivers during a mix of weekday and weekend daytime hours (6:00 AM–6:30 PM) throughout the full study period; the third ED BMH specialist enrolled caregivers during nighttime hours (6:30 PM–6:00 AM), only during the last half (6 months) of the study period. All study consents were collected electronically via iPads and managed using Research Electronic Data Capture (REDCap) tools hosted at our institution. REDCap is a secure web-based software platform designed to support data capture for research studies (28, 29).

Study on-boarding and intervention were adapted for our study population based on a previous study by Miller and Salhi et al., including online training for ED BMH to facilitate LMC counseling, distribution of educational handouts and offsite storage handouts, and distribution of firearm safe storage devices (24, 30).

Study on-boarding

Study ED BMH specialists all completed mandatory training up to 2 weeks before enrollment, including a free, 2 h, online course, CALM through Zero Suicide (20). Additionally, ED BMH specialists participated in a virtual study training session where the research team reviewed the scope of local pediatric firearm injuries and suicide risk and associated mortality data, study aims, an overview of the study LMC protocol, and types of firearm safe storage devices. The training session reiterated key points from the CALM course, including primarily recommending offsite firearm storage, especially when the child or teen is in a period of crisis. If the family reported being unable to store offsite, the recommendation was secure firearm storage, including storing all guns locked and unloaded with ammunition stored separately and locked. Additional recommendations included locking up all prescription medications (especially narcotics, sleep aids, and analgesics) except those that may be life-saving (20). Offsite firearm storage considerations and those of triple safe storage are consistent with recommendations from the recent American Academy of Pediatrics (AAP) policy statement and technical report (31, 32). Finally, all study ED BMH specialists were required to complete institutional CITI-training certification so they could enroll and consent patients for the study. This was done to minimize any disruptions in care for BMH patients. All ED BMH specialists were given a study outline document with sample conversation scripts for LMC and summarized key messages from CALM training, as detailed above, to have on hand during enrollment.

ED BMH specialists were selected to conduct the study intervention of LMC since they are the primary resource in our ED, and they routinely introduce the topic of restriction of lethal means in their assessment and during discharge planning of BMH patients. Partner meetings between ED, nursing, BMH, and social work leadership were conducted over a period of months before study implementation to discuss the need for the intervention, receive feedback, and develop an informed approach regarding study logistics. The study was also introduced at an ED division meeting before enrollment so that all ED team members were aware of the study and that there would be minimal disruptions to patient care or flow. Study investigators checked in monthly, either via meetings or email, with BMH specialists to identify and address any challenges or concerns with more frequent engagement in the first few weeks of study enrollment.

Study intervention

Initial visit

During the ED visit, caregivers completed a self-administered 31-question baseline electronic survey developed and beta-tested by the investigative team via REDCap on a study iPad. This baseline survey questions were on self-reported demographics and reported firearm safe-storage knowledge and practices (Appendix A). After this initial questionnaire, ED BMH specialists provided a 5-min LMC intervention verbally and asked about the presence of firearm(s) in the home. Caregivers were advised to store all firearms away from home, even if only temporarily during crisis periods. If caregivers could not store offsite, they were advised to secure all firearms by triple safe storage, storing all firearms: (1) unloaded, (2) locked, and (3) with ammunition stored separately and locked to help reduce unauthorized access. If the caregiver endorsed having a firearm in the home, they were offered a free firearm safe storage device(s), a combination lock box [Bulldog (BD1126)], and/or a combination trigger lock [Bulldog (BD8000)]. The lock box retailed for $32.99, had a 3-digit combination code, a cable for anchoring, and could hold one handgun. The trigger lock retailed at $17.99, had a 3-digit combination code, and could be used on handguns or long guns. Caregivers were allowed to take up to one of each safe storage device depending upon their preference and type of firearm. These safe storage devices were chosen as they did not utilize a key that could potentially be found and were the same devices that were well-received by gun owners at our institutional community firearm safe storage events. Previous studies in community and ED settings suggest that lockboxes and gun safes are preferred but that device preference may vary according to gun type and gun purpose (24, 26, 33, 34). ED BMH specialists recorded responses in a baseline electronic survey for gun access at home, the type of safe storage device taken, and reasons for taking a particular type of device. If a trigger lock was taken, caregivers were still recommended to lock firearms in a firearm safe after the placement of the trigger lock. All caregivers were provided educational handouts, including an institutional firearm safety handout, a BeSMART handout discussing pediatric firearm suicide, and a local offsite firearm storage location handout developed by the study team (35). After receiving LMC, caregivers completed the final part of the baseline electronic survey that included reporting acceptability of the ED intervention and viewing a 30-s embedded video "#1 Secure" by BeSMART reiterating firearm secure storage recommendations (36). Patient demographic data (age and gender) and ED BMH-related discharge diagnoses were obtained by study investigators via chart review. ED BMH discharge diagnoses were categorized according to their *International Classification of Diseases, Tenth Revision* (ICD-10), diagnosis codes for either suicidal ideation (R45.851) or suicide attempt (T14.91XA) with all other remaining BMH ED discharge diagnoses grouped as other BMH issue.

Follow-up

All caregivers were emailed a link to the 1-week follow-up REDCap electronic survey (Appendix B) and copies of the educational handouts given in the ED. The survey gathered self-reported data on firearm safety practices and intervention acceptability. All participants who completed the one-week follow-up survey were emailed a $5 Amazon gift card for participation. Caregivers who reported gun ownership were invited to participate in a subsequent one-month follow-up 30-min Zoom interview with study team members by random sampling. Study team members conducting Zoom interviews completed the 2 h online CALM course and a training session with lead study investigators reviewing scripted messaging and motivational interviewing techniques before conducting interviews (20). These Zoom interviews were conducted to visualize how the caregiver was storing their firearm(s) post-intervention, provide feedback as needed, and obtain input regarding the ED intervention. All interview responses were recorded in REDCap. All participants who completed the 1-month Zoom follow-up were emailed an additional $5 Amazon gift card. For each of the 1-week and 1-month follow-up time points, the study team provided up to four reminders, each 2 days apart. Two reminders were automated via REDCap and two reminders were via the study team's phone, text, or email.

Study measures

Feasibility measures

Feasibility outcomes were as follows: (1) Accrual of participants, as measured by the acceptance rate [(number of accepted participants/number of approached participants) X 100] and percentage of the enrolled sample that was gun owning [(gun owning participants/number of enrolled participants) X 100]; (2) Attrition of participants, as evaluated by study completion rate (number of completing participants/number of enrolled participants) X 100; (3) Caregiver acceptability of the LMC intervention as indicated by a response of "Agree" or "Strongly Agree" on a two-item, 5-point Likert scale measure, indicating if study procedures were informative and the space appropriate. Barriers to the acceptability and feasibility of the intervention, as reported by ED BMH specialists, were monitored throughout the study period.

Efficacy measures

Preliminary efficacy outcomes included self-reported change in firearm safety practices. This included asking or planning to ask about guns in the home before child/teen drop off, frequency of safe storage device use, and storage practices of storing guns locked and unloaded, with ammunition stored separately. Questions regarding safe storage practices were adapted from the previous study by Simonetti et al. (26).

Statistical analysis

Feasibility benchmarks were manually tabulated. For acceptability feasibility measures, Likert-scale acceptability responses were dichotomized to strongly agree/agree (affirmative) vs. neutral/disagree/strongly disagree. For preliminary efficacy measures, descriptive statistics were used for univariate and paired data responses, and mean ± Standard Deviation (SD) was calculated where appropriate. Group comparisons between firearm owners and non-firearm owners were performed using Pearson's Chi-squared test (Fisher's exact test where appropriate) for categorical variables and two-sample *t*-test for continuous variables. Several variables were collapsed for statistical testing only. First, those with "Prefer not to say" were marked as NA (only in the variables gender, ethnicity, and race). Second, the location of firearm counseling collapsed as follows: ED/Doctor vs. Community Event/Police Department/Family/Friends vs. Other (includes gun shop/place of purchase, website, and others). The *p*-values of less than 0.05 were considered statistically significant. The absolute and relative change was calculated to determine self-reported practice changes overall and among firearm owners and non-firearm owners. All data cleaning and statistical testing were performed in R Statistical Software (v4.2.1; R Core Team 2022).

Results

Sample characteristics

In total, 50 caregivers enrolled in the study. The majority of caregivers were female (96%), Black (52%), non-Hispanic (76%), with a mean age of 40 (±8.12), and cared for 3 or more children regularly (52%) (Table 1). Among them, 22 endorsed having a firearm in their home. The mean age of the child presenting with the caregiver at the ED was 13 (± 2.66), and 62% were female. In total, 54% of presenting youth had a primary ED discharge diagnosis of suicidality (either suicidal ideation or suicide attempt).

There were no statistically significant differences between participant demographics and baseline characteristics when comparing non-firearm owners and firearm owner caregivers except for the age ranges of children cared for within the home. Firearm owner caregivers cared for a higher percentage of 15–17-year-olds within the home ($p = 0.033$).

Feasibility outcomes

For accrual, there was an 81% acceptance rate with 50 out of the 62 caregivers approached that met eligibility criteria enrolling (Figure 1). In total, 44% ($n = 50$) of caregivers reported having a firearm at home (Table 2). For attrition, 80% of participants who completed the initial ED intake survey completed the 1-week follow-up; while 28% of randomly sampled firearm owners ($n = 11$) completed the 1-month Zoom follow-up. For acceptability, more than 80% of participants agreed both immediately after the ED education intervention and 1 week later that the education given was useful and appropriate in the ED setting. For procedural fidelity, protocol deviations were low overall ($n = 3$ out of 50 patient encounters). For the ability to manage the study and implement the intervention, there were no reported disruptions to patient care or flow. Study check-ins with ED BMH specialists throughout the study period revealed barriers such as technical challenges with the iPad during the ED caregiver survey and the length of time for the study consent process. ED BMH specialists reported the following facilitators for conducting the intervention: pre-intervention training, taking the CALM course training, and the ability to provide immediate resources (educational material and devices) in hand during the LMC conversation.

Self-reported baseline firearm safety knowledge and practices

In total, 29 of all caregivers (58%, $n = 50$) and 11 of the caregivers with a firearm(s) at home (45%, $n = 22$) reported having not received prior education or counseling on firearm safe storage (Table 3). Only 12% of all caregivers reported having received prior firearm safety counseling from their child's doctor's office and 6% from their child's prior ED visits. At baseline, 58% of all caregivers and 45% of caregivers with a firearm(s) at home reported not asking about firearms before their child/teen visited other homes. There were no significant differences between non-firearm owner caregivers and firearm owner caregivers for baseline firearm safety knowledge and the practice of asking about firearms in the home.

Among firearm owners ($n = 22$), 59% reported having one firearm at home; however, one-third of firearm owners reported having 3 or more guns at home (Table 4). Handguns ($n = 18$) were the most common type of firearm owned, followed by a shotgun ($n = 9$). Gun safes were the most commonly used type of safe storage device, followed by gun lock boxes. In total, 64% of firearm owners reported

TABLE 1 Participant demographics and characteristics.

Caregiver characteristics	Overall N = 50[a]	No firearm at home N = 28[a]	Firearm(s) at home N = 22[a]	p-value[b]
Gender				0.189[†]
Female	48 (96%)	28 (100%)	20 (91%)	
Male	2 (4%)	0 (0%)	2 (9%)	
Prefer not to say	0 (0%)	0 (0%)	0 (0%)	
Ethnicity				0.254[‡]
Hispanic or Latino	3 (6%)	3 (11%)	0 (0%)	
Non-Hispanic or Latino	38 (76%)	21 (75%)	17 (77%)	
Other	5 (10%)	1 (4%)	4 (18%)	
Prefer not to say	4 (8%)	3 (11%)	1 (5%)	
Race				0.102[‡‡]
Black or African American	26 (52%)	17 (61%)	9 (41%)	
White	15 (30%)	5 (18%)	10 (45%)	
Asian	1 (2%)	0 (0%)	1 (5%)	
American Indian or Alaskan Native	0 (0%)	0 (0%)	0 (0%)	
Native Hawaiian or Pacific Islander	0 (0%)	0 (0%)	0 (0%)	
Other	1 (2%)	1 (4%)	0 (0%)	
Prefer not to say	7 (14%)	5 (18%)	2 (9%)	
Age	39.70 (8.12)	39.50 (8.50)	39.95 (7.80)	0.845
Child's age	12.70 (2.66)	12.29 (2.64)	13.23 (2.65)	0.218
Child's gender				0.833
Female	31 (62%)	17 (61%)	14 (64%)	
Male	19 (38%)	11 (39%)	8 (36%)	
How many children live in your home or do you care for regularly?				0.798
1	8 (16%)	4 (14%)	4 (18%)	
2	16 (32%)	10 (36%)	6 (27%)	
3 or more	26 (52%)	14 (50%)	12 (55%)	
*Age ranges of children at home**				
0–4 years	20 (40%)	11 (39%)	9 (41%)	0.754
5–9 years	21 (42%)	13 (46%)	8 (36%)	0.474
10–14 years	41 (82%)	23 (82%)	18 (82%)	>0.999
15–17 years	19 (38%)	7 (25%)	12 (55%)	0.033
Child's ED discharge diagnosis				0.349
Suicidal ideation	23 (46%)	15 (54%)	8 (36%)	
Suicide attempt	4 (8%)	1 (4%)	3 (14%)	
Other behavioral mental health issues	23 (46%)	12 (43%)	11 (50%)	

[a] *n* (%); Mean (SD).

[b] Fisher's exact test; Welch Two-Sample t-test; Pearson's Chi-squared test.

*Multiple responses allowed. †*p*-value is derived from the comparison: male vs. female. ‡*p*-value is derived from the comparison: Hispanic/Latino vs. Non-Hispanic/Latino. ‡‡*p*-value is derived from the comparison: White vs. Black/AA vs. Other (Categories "Asian" and "Other" with only one individual each were combined into Other).

always using a safe storage device, while 14% never used one. A total of 77% of firearm owners reported storing all firearms currently locked, 72% storing firearms unloaded, and 77% with ammunition stored separately. Approximately one-third of firearm owners reported having stored firearms outside of their home when their child has been in a period of crisis.

Study intervention

In total, 13 firearm owners (59%, $n=22$) requested a study safe storage device (Table 4). Among these firearm owners who requested a study safe storage device, 62% reported at baseline storing all firearms locked and 69% reported storing firearms unloaded. In comparison, for

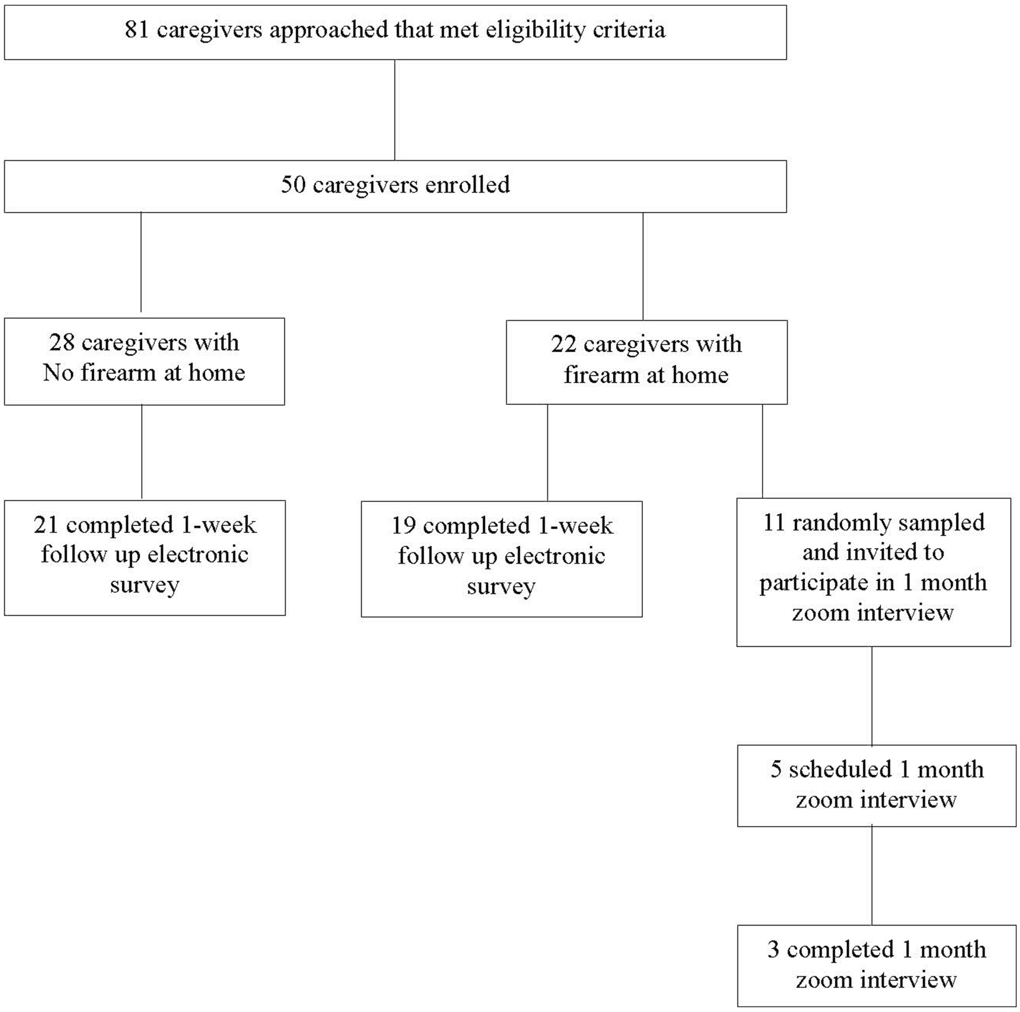

FIGURE 1
Study enrollment and follow up. Caregivers are parents/legal guardians of a child or teen who presented to the pediatric emergency department with a behavioral mental health complaint.

TABLE 2 **Feasibility benchmarks.**

Domain	Benchmark	Actual
Accrual		
All participants	>50% acceptance	81% (50/62)
Firearm owners	25–50% of study sample	44% (22/50)
Attrition		
Follow-up at 1 week (All)	>50% complete pre/post survey	80% (40/50) (All) 75% (21/28) among non-firearm owners 86% (19/22) among firearm-owners
Follow-up at 1 month (Firearm owner random sample)	>50% complete post zoom interview	28% (3/11)
Acceptability		
Informative	>75% agree/strongly agree	• 90% (45/50) immediately after ED intervention • 85% (34/40) at 1 week follow-up
Appropriate place	>75% agree/strongly agree	• 84% (42/50) immediately after ED intervention. • 85% (34/40) at 1 week follow-up

TABLE 3 **Baseline caregiver firearm safety knowledge and firearm access.**

Characteristic	Overall, N = 50[a]	No Firearm at Home, N = 28[a]	Firearm(s) at Home, N = 22[a]	p-value[b]
Received prior firearm safety counseling/education	21 (42%)	9 (32%)	12 (55%)	0.111
*Location of Counseling**				0.286[†]
Doctor's office- child	6 (12%)	3 (11%)	3 (14%)	
Doctor's office- parent	0 (0%)	0 (0%)	0 (0%)	
Prior ED visit- child	3 (6%)	1 (4%)	2 (9%)	
Prior ED visit- parent	1 (2%)	1 (4%)	0 (0%)	
Community event	3 (6%)	2 (7%)	1 (5%)	
Police Department	2 (4%)	1 (4%)	1 (5%)	
Family, relative, or friend	4 (8%)	3 (11%)	1 (5%)	
Gun shop or place of purchase	4 (8%)	1 (4%)	3 (14%)	
Website	3 (6%)	2 (7%)	1 (5%)	
Other	5 (10%)	1 (4%)	4 (18%)	
Child visits other homes with firearms	15 (30%)	6 (21%)	9 (41%)	0.136
Knowledge of how these firearms are stored	8 (53%)	2 (33%)	6 (67%)	0.315
Ask about firearms prior to the child visiting other homes	21 (42%)	9 (32%)	12 (55%)	0.111
If no, reasons for not asking:				0.125
Never thought about asking	20 (69%)	13 (68%)	7 (70%)	
The child does not go on play dates or to other homes	7 (24%)	6 (32%)	1 (10%)	
A family member or someone they trust	2 (7%)	0 (0%)	2 (20%)	

[a]*n* (%). [b]Fisher's exact test; Welch Two Sample t-test; Pearson's Chi-squared test.

*Multiple responses allowed. †*p*-value is derived from the comparison: ED/Doctor vs. Community Event/Police Department/Family/Friends vs. Other (includes gun shop/place of purchase, website, and other).

firearm owners who did not request a study device (n=9), 100% reported at baseline storing all firearms locked and 78% storing firearms unloaded. In total, 15 safe storage devices were distributed over the course of the study, including 10 lock boxes and 5 trigger locks (Table 5).

Preliminary efficacy outcomes

At the 1-week follow-up, a greater proportion of all caregivers (+28%) and a greater proportion of firearm owners (+13%) self-reported that they had asked about firearms in the home before their child/teen visited other homes (Table 6). Overall, more than 85% of caregivers self-reported at baseline and 1-week post-study intervention that they will inquire in the future about firearms in other homes before their child/teen visits. Gun safety information from the ED intervention was reported to be shared with others by 45% of all caregivers (n=40) in follow-up, including 74% of firearm (n=19) owners. Changes in firearm storage practices at follow-up included a greater proportion of firearm owners reported storing all firearms currently locked (+23%). In total, 10 firearm owner caregivers self-reported in follow-up that they have removed firearms either temporarily or permanently from their homes. These firearm owners stated that keeping their children safe was the most common reason for removing their firearms. Among these firearm owners who reported removing a firearm from their home (n=10), at baseline, 60% stored all firearms locked and 70% stored firearms unloaded. In comparison, for firearm owners who did not remove their firearms from their homes (n =12), at the baseline, 89% stored all firearms locked and 70% stored firearms unloaded.

Three firearm owner participants completed the 1-month follow-up Zoom interview (Table 2; Figure 1). One of the three participants showed the study team where and how they stored their firearms at home via Zoom. Two of the three had taken a study lockbox and were currently using it to store their firearm locked. When asked what type of safe storage device we should provide to families, all three participants primarily recommended lockboxes.

Discussion

In this pilot feasibility study, we found that caregivers of youth presenting with acute BMH complaints were receptive to receiving an LMC intervention. There were self-reported improvements in caregiver firearm safety and storage practices post-intervention. To the best of our knowledge, this is one of the first studies after the onset of the COVID-19 pandemic evaluating an LMC intervention in a Southeastern United States high-volume pediatric ED. This was done in a period of increasing risk from acute BMH crisis and firearm(s) ownership. Given our findings and that of prior work, we believe a brief LMC intervention with the provision of firearm safety devices should be offered routinely for families presenting with youth at risk for suicide (21, 23, 24, 37).

Most (81%) of our caregivers who were approached and met eligibility criteria received LMC from our ED BMH specialists,

TABLE 4 Baseline caregiver self-reported firearm storage practices.

Characteristic	Firearm at home, *N* = 22[a]
How many firearms are in the home?	
1	13 (59%)
2	2 (9%)
3 or more	7 (32%)
*Location of firearm storage**	
Within the living spaces (including the bedroom)	13 (59%)
Basement	4 (18%)
Attics	3 (14%)
Garage/Shed	4 (18%)
Car	0 (0%)
Other	10 (45%)
*Types of firearms**	
Handguns (including revolvers and pistols)	18 (82%)
Rifles	6 (27%)
Shotguns	9 (41%)
Assault/Military-style weapons (example AR 15)	0 (0%)
Other	0 (0%)
Purpose of firearm	
Safety/Protection	15 (68%)
Recreational (sport, hunting, or shooting range)	4 (18%)
Job: Armed forces, Law enforcement, Security	2 (9%)
Display/Decoration	0 (0%)
Family Heirloom	1 (5%)
Other	0 (0%)
*Type of safe storage device**	
None	4 (18%)
Trigger lock	5 (23%)
Cable lock	5 (23%)
Gun lockbox	7 (32%)
Gun safe	10 (45%)
Other	1 (5%)
How often are safe storage devices used?	
Always	14 (64%)
Most of the time	2 (9%)
Sometimes	2 (9%)
Rarely	1 (4%)
Never	3 (14%)
Firearms currently stored locked at home	
Yes, all are stored locked	17 (77%)
Yes, some are stored locked	1 (5%)
None of the guns are stored locked	3 (14%)
I do not know	1 (5%)
Firearms stored unloaded	16 (72%)
Ammunition stored separate from the firearm	17 (77%)
Firearm ever stored outside of the home if the child is in crisis	7 (32%)
Requested safety device	13 (59%)
The main reason for the device request	
To keep people in my home safe	12 (92%)
To keep guns from being stolen	1 (8%)
To store other valuables (not guns)	0 (0%)
Plan to immediately use the device	13 (100%)

[a] *n* (%).
*Indicates multiple responses allowed.

illustrating the feasibility of this intervention in our pediatric ED. Study onboarding, training, and divisional/institutional buy-in were critical for the success of enrollment. CALM online training and study scripted messaging utilized in our study were reported by our ED BMH specialists to be accessible and to improve their comfort and self-efficacy in approaching families and delivering the LMC intervention uniformly (20). This is consistent with a prior community-based mental healthcare worker survey demonstrating that those who did the CALM training had increased comfort in and rates of providing LMC (38). Similarly, previous studies in two single-center high-volume sites in different regions of the US, Mueller et al. reported in an adult academic ED utilizing the CALM course and Runyan et al. reported in a pediatric ED utilizing online training based on CALM principles, also found their LMC interventions feasible with 77 and 81% enrollment rates, respectively (21, 22). Our study utilized ED BMH specialists, given their knowledge, expertise, and 24-h coverage for our ED BMH patients. Although behavioral health providers are more likely to ask about the presence of firearms in comparison to ED providers, this staffing model may not be available to all emergency departments (39). Brief online LMC training, such as CALM, or adapted training, such as those in the studies cited above, could provide critical resources for emergency departments to scale up LMC via ED physician providers or other appropriate clinical staff. Furthermore, emergency departments with written standard practice guidelines or protocols for discharge safety planning have been shown to have higher rates of LMC for all suicidal patients (40).

Caregivers found our ED LMC intervention during their child's acute MH visit acceptable and appropriate. This supports the findings by Mueller, Runyan, and colleagues in their ED LMC intervention studies (21, 22). In our study, ED BMH specialists addressing the patient's primary BMH concern first may have built trust and receptivity among caregivers for the LMC intervention. Second, the LMC intervention was designed with nursing, BMH, and ED partner input to reduce disruptions to routine patient care and flow. Caregiver receptivity did not change when moving from only daytime enrollment to daytime and overnight enrollment. Despite technology barriers, we could still enroll a convenience sample of caregivers. Reporting of firearm access was consistent between the initial ED survey caregiver self-reporting and subsequent verbal reporting with ED BMH specialist LMC conversation. Additionally, the majority of our firearm owners were receptive to taking safe storage devices. Our study's in-service session, focusing on training for safe storage devices,

TABLE 5 Baseline caregiver firearm storage practices, BMH specialist verbal interview.

Characteristics	$N = 22^a$
Firearms in the home	22 (100%)
Request firearm safe storage device	13 (59%)
Reason for declining device	
Already have a device	9 (41%)
Prefer a different device than what was offered	1 (5%)
Do not want to lock up their gun	0 (0%)
Lockbox requested	10 (77%)
Trigger lock requested	5 (38%)

[a] *n* (%).

was reported to increase the comfort of BMH specialists in device distribution and may have contributed to caregiver receptivity. A prior study comparing BH provider vs. ED provider LMC practices found that most of the participants in either group did not believe they had received enough training regarding firearm safe storage devices and that training would help them support patients in firearm access and storage decisions (39).

We had a good overall response rate (81%) to electronic 1-week follow-up surveys, with rates being high for both firearm owner and non-firearm owner subgroups. Gift card remuneration and the flexibility of doing surveys on their own time via email or text link may have incentivized participants. Response rates (28%) for 1-month Zoom interviews among a subgroup of firearm owners were much lower. There were some technical challenges with connectivity over Zoom, and some were either lost to follow-up after scheduling an interview date or non-responders. The requirement of being at home for the study team to visualize and validate self-reporting of firearm storage may have been challenging for participation. Additionally, phone or computer/tablet access for Zoom participation may not have been possible for all caregivers. This is, however, to the best of our knowledge, the first study that has utilized Zoom interviews to try to confirm firearm storage practices. As this was an exploratory measure in our study, future work should involve caregiver firearm owner input on the best ways to optimize this type of interview.

Overall, self-reported firearm safety practices improved from the initial ED LMC intervention to the 1-week follow-up. This demonstrates that it is possible to get positive reported behavior change with LMC education and the distribution of free firearm safe storage devices. This is consistent with the work from prior single-center ED studies and a multi-center controlled ED trial (21, 23, 24). In our study, firearm owners who responded to follow-up reported storing all firearms locked. This is encouraging as Monteaux et al. found that even modest adaptations of locking all household firearms could result in significant reductions in youth firearm suicides (6). More families were also asking or planning to ask about firearms and how they are stored before their child visits other homes after our intervention. Prior work in our population has shown that a majority of children are unable to recognize the difference between a toy gun and a real gun; thus, this question could be life-saving (41). Unexpectedly, 10 families reported either temporarily or permanently removing firearms from their homes after our ED LMC intervention. The risk of youth suicide is increased by 2-5x when firearms are present in the home, and reducing ready access to this most lethal means of suicide with barriers, such as offsite storage, can increase chances of survival (42–44). Key messaging from the CALM course of offsite storage is that storing firearms offsite is the safest while the child/teen is in a crisis period, and the delivery of messaging by our BMH specialists may have facilitated this reported caregiver behavior.

Limitations

There are several cautions when interpreting the findings of our study. First, the outcomes were self-reported and susceptible to recall and social desirability bias as participants may have misremembered or not been forthcoming regarding firearm ownership and firearm safety practices. Second, the small sample size and data being collected from a single center in the Southeastern US may not be generalizable to other populations. However, this is a region with both increasing suicide and firearm ownership rates. Third, while this was a convenience sample and potentially not reflective of firearm ownership rates, the reported gun ownership of 44% is only slightly lower than our state firearm ownership rates. Fourth, caregiver participants who reported access to firearms at home may not have been the primary firearm owners. Given our low video follow-up rates among firearm owners, we were unable to fully validate self-reporting. Fifth, being a convenience sample of participants identified by ED BMH specialists, the population enrolled may not be reflective of all caregivers of youth at risk for suicide. Sixth, our center had 24 h BMH specialist coverage and thus cannot determine if our training and implementation of LMC intervention would have the same results in emergency departments with different staffing models. However, the CALM program can be used and adopted by non-BMH providers. Seventh, we did not further categorize the BMH concern for which the child was diagnosed outside of suicidal thoughts or suicide attempts. Future work should evaluate the different types of BMH issues that youth are presenting with to better understand the population. Given that children with mental health disorders are at increased risk of suicide, we had our ED BMH specialists include all BMH complaints for the LMC intervention and not only those presenting with active suicidal thoughts or after a suicide attempt (45, 46). Finally, caregiver inclusion was limited to English speakers only, as our educational materials were not available in other languages.

Conclusion

Our study, one of the first in the Southeastern US, a high-risk region for both BMH concerns and firearm ownership, suggests that a brief lethal means counseling intervention for caregivers of youth at risk of suicide is a feasible and acceptable measure and resulting in reported positive behavior changes. As we continue to see increasing rates of ED youth MH visits for suicidality, increased accessibility of firearms, and escalating rates of youth firearm suicide, this intervention is promising (1, 8, 11, 12). Furthermore, brief suicide interventions in acute care settings are associated with decreased repeat suicide attempts and increased MH care follow-up (47). Future efforts of our study team will include scaling our LMC intervention for widespread implementation among all ED BMH visits at each of our three pediatric ED sites in our tertiary healthcare system. Continued research is needed to assess the longitudinal impacts of these ED-based interventions in different populations with a variety of ED staffing models to help provide a framework for best practices.

TABLE 6 **Caregiver self-reported practice changes.**

Characteristic (All caregivers)	Initial ED Encounter N = 50[a]	1-Week Follow-Up, n = 40[a]	Absolute Change (%)	Relative Change (%)
Currently asks about firearms in other homes	21 (42%)	28 (70%)	28	67
Will ask about firearms in other homes*	46 (92%)	35 (88%)	−4	−4
Firearm safety education useful*	45 (90%)	34 (85%)	−5	−6
ED appropriate location to discuss firearm safety*	42 (84%)	34 (85%)	1	1

Characteristic (No firearm at home)	Initial ED Encounter N = 28[a]	1-Week Follow-Up, n = 21[a]	Absolute Change (%)	Relative Change (%)
Currently asks about firearms in other homes	9 (32%)	15 (71%)	39	122
Will ask about firearms in other homes*	26 (93%)	18 (86%)	−7	−8
Firearm safety education useful*	27 (96%)	19 (90%)	−6	−6
ED appropriate location to discuss firearm safety*	23 (82%)	18 (86%)	4	5

Characteristic (Firearm(s) at home)	Initial ED Encounter N = 22[a]	1-Week Follow-Up, n = 19[a]	Absolute Change (%)	Relative Change (%)
Currently asks about firearms in other homes	12 (55%)	13 (68%)	13	24
Will ask about firearms in other homes*	20 (91%)	17 (89%)	−2	−2
Firearm safety education useful*	18 (82%)	15 (79%)	−3	−4
ED appropriate location to discuss firearm safety*	19 (86%)	16 (84%)	−2	−2
Frequency of using a safe storage device				
Always	14 (64%)	15 (79%)	15	23
Most of the time	2 (9%)	3 (16%)	7	78
Sometimes	2 (9%)	0 (0%)	−9	−100
Rarely	1 (4%)	1 (4%)	0	0
Never	3 (14%)	0 (0%)	−14	−100
Guns currently locked				
Yes, all are stored locked	17 (77%)	19 (100%)	23	30
Yes, some are stored locked	1 (5%)	0 (0%)	−5	−100
None of the guns are stored locked	3 (14%)	0 (0%)	−14	−100
I do not know	1 (5%)	0 (0%)	−5	−100
Firearms stored unloaded	16 (73%)	14 (74%)	1	1
Ammunition stored separately from the firearm	17 (77%)	16 (84%)	7	9

*Post ED Education and Likert Scale responses for agreed or strongly agreed.

[a] n (%).

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Emory University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

SC: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. KD: Conceptualization, Writing – review & editing. EM: Investigation, Project administration, Writing – review & editing. CC: Investigation, Project administration, Writing – review & editing. DW: Investigation, Writing – review & editing. SG: Formal analysis, Writing – review & editing. AJ: Formal analysis, Writing – review & editing. SL: Writing – review & editing. AC: Writing – review & editing. NC: Writing – review & editing. JR: Conceptualization, Supervision, Writing – review & editing. HS: Conceptualization, Resources, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

The handling editor DE declared a shared affiliation with the author(s) at the time of review.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1352815/full#supplementary-material

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EDITED BY
Gunnur Karakurt,
Case Western Reserve University,
United States

REVIEWED BY
Melissa Osborne,
Kennesaw State University, United States
Jason Whiting,
Brigham Young University, United States

*CORRESPONDENCE
Dabney P. Evans
✉ dabney.evans@emory.edu

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"And then the person sort of just drops off the radar…": barriers in the transition from hospital to community-based care among survivors of intimate partner violence in Metropolitan Atlanta

Dabney P. Evans*, Jocelyn Pawcio, Kathryn Wyckoff and Lee Wilkers

Hubert Department of Global Health, Emory University, Atlanta, GA, United States

Introduction: Hospitals and community-based organizations (CBOs) provide the service-base for survivors of intimate partner violence (IPV), particularly those in acute crisis. Both settings face discrete challenges in meeting survivors' needs. In hospitals these challenges include the pressures of a fast-paced work setting, and a lack of trauma-informed and survivor-centered care. Connections to community care are often unmeasured, with relatively little known about best practices. Often IPV survivors who receive hospital care fail to connect with community-based services after discharge. Despite the critical role of CBOs in supporting IPV survivors, there is limited research examining the perspectives and insights of CBO staff on the challenges and opportunities for improving care coordination with hospitals. The purpose of this study was to address this knowledge gap by characterizing CBO staff perceptions of IPV care coordination between hospital and community-based organizations in Metropolitan Atlanta.

Methods: We used a qualitative study design to conduct a cross-sectional examination of the perceptions and experiences of staff working at CBOs serving IPV survivors in Metropolitan Atlanta, Georgia. The adapted in-depth interview (IDI) guide was used to explore: (1) IPV survivor experiences; (2) Survivors' needs when transitioning from hospital to community-based care; (3) Barriers and facilitators to IPV care coordination; and (4) Ideas on how to improve care coordination. Data analysis consisted of a thematic analysis using MAXQDA Analytics Pro 2022.

Results: Participants ($N = 14$) included 13 women and one man who were staff of CBOs serving IPV survivors in Metropolitan Atlanta. CBO staff perceived that: (1) IPV survivors face individual-, organizational-, and systems-level barriers during help seeking and service provision; (2) Care coordination between hospitals and CBOs is limited due to siloed care provision; and (3) Care coordination can be improved through increased bidirectional efforts.

Conclusion: Our findings highlight the multi-level barriers IPV survivors face in accessing community-based care following medical care, the limitations of existing hospital-CBO coordination, and opportunities for improvement from the perspectives of CBO staff. Participants identified silos and inconsistent communication/relationships between hospital and CBOs as major barriers to care connections. They also suggested warm handoffs and a Family Justice Center to support care connection.

KEYWORDS
intimate partner, community based organization, coordinated care, violence, hospital

Background

Intimate partner violence (IPV), emotional, physical, and/or sexual violence tactics perpetrated by current or previous intimate partners, impacts up to 753 million women worldwide (1, 2). In the US, IPV is common, with more than 35% of women and 28% of men reporting lifetime IPV (3). Emergency departments (EDs) provide vital and often life-saving care to people experiencing IPV. Because of social stigma, self-blame, and the emotional trauma associated with relationship violence, those experiencing abuse may not seek health care immediately and may do so primarily after serious physical injury (4–9). As a result, EDs may serve as the first point of contact for IPV survivors who make up at least 5% of all ED visits nationwide—with many cases going undetected due to the limits of using diagnostic codes as the exclusive markers of abuse (10–14).

Where EDs meet the acute medical care needs of IPV survivors, networks of community-based organizations (CBOs) specializing in violence response support the short- and long-term needs of people leaving violent relationships by connecting survivors to an array of essential social services such as safe housing, legal assistance, and psychological counseling (14, 15). Yet both settings face discrete challenges in meeting survivors' needs. In hospitals these challenges include the pressures of a fast-paced work setting, staff shortages, provider misperceptions of IPV experiences, and lack of trauma-informed and survivor-centered care (16). IPV screening, service referral, and connections to community care are often unmeasured, with relatively little known about efficacy or best practices in hospital settings (15, 17–21). Concurrently, CBOs face funding and sustainability challenges, demand for services which routinely outpaces availability, and the need for comprehensive cross-sectoral services to meet the co-occurring social support needs of survivors (22–24). Taken together, hospitals and CBOs provide the service-base for IPV survivors, particularly those in acute crisis where according to one study ($n = 1{,}268$) nearly 20% of women seeking care across 24 emergency departments had experienced physical violence or severe physical abuse (13).

Often IPV survivors who receive hospital care fail to connect with community-based services after discharge. In a sample ($n = 245$) of hospitalized IPV survivors (97% women; mean age 37 years) discharged from a safety-net hospital in Atlanta in 2019 with sporadic CBO services in the hospital, 40% were discharged with no identified safe shelter (defined as discharge to a shelter, a family/friend, or known safe location without a perpetrator present); only 6% were discharged to placement in a shelter (25). In a related study during the COVID-19 pandemic, after accepting the opportunity to stay in an extended observation unit to optimize the chance for social work intervention, 70.7% of IPV survivors received a safe discharge—including 31% to a shelter—suggesting that increased coordination between hospital- and community-based systems have promise in meeting survivor needs (25). Despite the critical role of CBOs in supporting IPV survivors, there is limited research examining the perspectives and insights of CBO staff on the challenges and opportunities for improving care coordination with hospitals. The purpose of this study was to address this knowledge gap by characterizing CBO staff perceptions of IPV care coordination between hospital and community-based organizations in Metropolitan Atlanta.

Methods

Study setting

This study took place in Metropolitan Atlanta, Georgia. Georgia is located in the southern US and is one of only ten states who have opted not to participate Medicaid expansion, a federal program that provides health insurance coverage to poor people (26). In 2022, there were 129,528 crisis calls to Georgia's certified family violence and sexual assault agencies, a 13% increase from 2021 (27). The GCFV found a 42% increase in family violence-related fatalities in Georgia from 2012 to 2022 (27). These data align with an increase in IPV calls and cases attributed to the COVID-19 pandemic suggesting a "new normal" for family and intimate partner violence in Atlanta (28).

Metropolitan Atlanta consists of eleven counties that are home to eleven million people. Accessing IPV resources can be challenging for survivors given that survivor needs vary and are inherently complex. There are no formally established care coordination programs between Atlanta hospitals and community-based organizations serving IPV survivors. In most hospital settings standard care includes the provision of informational resources with no follow-up. Outside hospital settings, multiple community-based organizations serve survivors of IPV, providing specialized and non-IPV-specific support services. The Georgia Coalition Against Domestic Violence (GCADV) is a statewide coalition that provides a 24-hour hotline and services such as crisis counseling, support groups, and legal assistance, and includes 63 organizations based in Georgia (29). The GCADV coordinates with other organizations within the state and found shelter for over 5,000 survivors and their children in fiscal year 2021 (29); notably in the same year 4,200 survivors and their children were turned away from shelters due to a shortage of beds. The GCADV hotline connects with state-certified shelters, with calls being forwarded to the closest shelter based on area code. The hotline also offers language interpretation for survivors. In addition to shelter, local CBOs offer counseling, legal aid, financial assistance, safety planning, and support groups among other supportive social services (30, 31); some agencies focus on specific populations such as Latinx, South Asian and immigrant survivors (32–34).

Design

We used a qualitative study design to conduct a cross-sectional examination of the perceptions and experiences of staff working at a community-based organizations (CBOs) serving IPV survivors in Metropolitan Atlanta, Georgia. We were specifically interested in care coordination between hospitals to community-based organizations, and care and interactions between IPV survivors and the professionals serving them. This study focused on the perspectives of individuals working in CBOs and their experiences serving IPV survivors. In-depth interviews (IDIs) were selected for use given the sensitivity of IPV as a topic. Moreover, IDIs support rapport-building and were appropriate for the study given the potential for discussion of experiences serving IPV survivors which might not be disclosed in other settings. The use of IDIs also provided for the protection of confidentiality given power and organizational dynamics within and between CBOs serving IPV survivors. Emory University's Institutional Review Board deemed this study exempt from review based on its nature as a public health practice.

Instrument

An existing in-depth interview guide (IDI) was adapted for use among CBO staff. The original guide was used among healthcare professionals providing hospital-based care to IPV survivors in Metropolitan Atlanta during the COVID-19 pandemic (35). Adaptations included a reframing of the guide to CBO settings (e.g., What barriers does your organization face in serving IPV survivors?). The adapted IDI guide consisted of questions to gather perceptions and experiences about several domains: (1) IPV survivor experiences; (2) Survivors' needs when transitioning from hospital to community-based care; (3) Barriers and facilitators for IPV care coordination; and (4) Ideas on how to improve care coordination between hospital and community-based organizations. The guide was divided into six sections and included 23 questions, including probes. The first section included quantitative demographic information. The second section asked qualitative and quantitative questions about social service employment history. The next section consisted of health and support-seeking behaviors with quantitative and qualitative questions about IPV and what training CBO had staff received. We also asked for an estimate of how many IPV survivors the CBO staff saw within 1 day. Section four revolved around community-based care, the support CBOs offer their clients within 48 hours of intake, and any barriers in serving survivors. The next section consisted of questions about care transitions and the main barriers to care coordination between hospitals and CBOs; we asked participants to estimate the proportion of IPV survivors that they serve who come directly from a hospital to their CBO. We also asked for their insights into any differences between IPV survivors that receive care at a CBO following hospital discharge versus those who do not. In the closing section, participants were asked for suggestions to better respond to IPV and if there were any additional topics they would like to discuss. The second author pilot-tested the adapted IDI guide with members of the research team and public health professionals unaffiliated with the study to gather feedback from practice interviews ($n = 8$). Critiques and edits were incorporated into the final guide, including probing techniques to extract additional information from participants and clarifying questions to avoid confusion.

Participants and recruitment

To be eligible for study participation, participants must have worked at a CBO serving IPV survivors for at least 6 months. All recruitment took place over email using an electronic flier containing participant eligibility requirements, study information, and contact information for the study team. Initial recruitment occurred in March 2022, following a quarterly meeting of the Georgia Coalition Against Domestic Violence (GCADV), where the first author presented findings from an earlier study. At this time the first author also described the current study and shared the recruitment flier. The study team followed up by emailing the recruitment flier to those attending the meeting with an invitation to participate in the study. Next, using a publicly available list of agencies serving IPV survivors in Metropolitan Atlanta, the study team sent recruitment emails to the Executive Directors of each agency, asking that they share the study recruitment flyer with their staff. Finally, using snowball sampling methods, we asked each participant to recommend up to three individuals they believed could contribute to the study via email referrals. Those who did not respond were contacted via email a total of four times before study exclusion. Individuals who expressed interest via email were asked to schedule an interview for a day and time that worked for them. Next, they were sent a consent form to review before the interview; the consent form explained the study's purpose in keeping with best practices. They were also sent a Zoom link for the interview and a calendar invite. Verbal consent was obtained before each interview began.

Data collection and management

Data collection occurred from June through December 2022. Following pilot testing and training, two study team members conducted 14 in-depth interviews. After the second author was sufficiently trained, they continued interviewing independently; the third author was also present to take field notes for some interviews ($n = 4$). To ensure that privacy and safety were maintained, the consent form was reviewed prior to the start of each interview. Interviews were conducted and recorded remotely with permission via Zoom, lasting between 20 and 60 min. Following each interview, verbatim transcripts were produced using Happy Scribe (36); the second author performed quality checks of each transcript to ensure accuracy. Names and other identifying information were removed from transcripts.

Data analysis

Data analysis consisted of a thematic analysis using MAXQDA Analytics Pro 2022. Thematic analysis refers to, "the method for recognizing, analyzing, and reporting patterns (themes) within data" (37). These phases involved data familiarization, initial code creation, theme search, theme review, and theme definition and naming (37).

An initial codebook of 16 deductive codes was developed using domains from the IDI guides and IPV literature. Next, the second author read through the dataset multiple times to become familiar with the data and develop memos. Inductive codes were developed as part of the data familiarization and preliminary memoing processes. Inductive codes were further developed based off recurring topics from interviews. Examples of deductive codes included "individual barriers for help-seeking" and "institutional barriers to care coordination," while inductive codes such as "financial ties to abuser" and "lack of flexible funding" were developed based on recurring topics in the interviews.

Transcripts were then coded by a single member of the research team with team discussions about code application, inductive code development and theme development occurring weekly. During the coding process, the research question was kept in mind, focusing on barriers in the transition from hospital to community-based care among IPV survivors. The research team kept detailed memos throughout the coding process to document analytic decisions, potential themes, and reflections on the data. The initial 16 deductive codes were applied to all transcripts; 38 inductive codes were later added and organized in a hierarchical coding scheme and applied as needed to each transcript. This method aligns with Bazeley's (38) approach to organizing code structures based on conceptual similarities, while also ensuring that each concept only appeared in the code structure once. The finalized codebook was then used to recode the first transcript and subsequent 13 transcripts.

Themes were developed based on the frequency and salience of codes across the dataset. Code co-occurrences and relationships between codes were explored to identify overarching patterns and themes. Themes were iteratively reviewed and refined to ensure they captured the most meaningful and coherent patterns in the data, while also considering their relevance to the research question and potential implications for practice and future research in IPV care coordination. The final themes were selected based on their prevalence across the dataset, the depth and richness of the data supporting them, and their ability to provide new insights into the barriers and facilitators of care coordination for IPV survivors transitioning from hospital to community-based services. Descriptive statistics were calculated using Qualtrics and Google Sheets to characterize the sample and provide context for the qualitative findings.

Reflexivity statement

The research team consisted of individuals with expertise in public health, and qualitative research. Three identify as cisgender heterosexual women while the other is a cisgender heterosexual man; two team members identified as having a disability and one team member had lived experience of IPV. Throughout the research process, the team engaged in ongoing reflexivity to consider how their own experiences, assumptions, and biases might influence the data collection, analysis, and interpretation. Regular team meetings provided opportunities for open discussion and critical reflection on the emerging findings and the researchers' positionality. The team also sought feedback from colleagues and stakeholders to challenge their assumptions and ensure the credibility and trustworthiness of the findings.

Results

TABLE 1 Demographic characteristics of community based-organizational staff ($N = 14$).

Demographic	$N = 14$
Age in years	
Average	47.86
SD	9.5
Self-reported gender, n (%)	
Woman	13 (93%)
Man	1 (7%)
Race, n (%)	
Black or African American	7 (50%)
White	4 (28.6)
Other	3 (21.4)
Highest level of education achieved, n (%)	
Bachelor's degree	5 (35.7%)
Master's degree	6 (42.9%)
Doctoral degree	1 (7.1%)
Professional degree (JD, MD)	2 (14.3%)
Years in social service, mean (standard deviation)	
Average	14.5 (11)

Participants ($N = 14$) included 13 women and one man who were staff of CBOs serving IPV survivors in Metropolitan Atlanta (Table 1). Of the 14 participants, 50% ($n = 7$) were Black or African American, 29% ($n = 4$) were White, and 21% ($n = 3$) identified their race as Other. The mean age of participants was 48 years. All participants completed higher education, with 14% ($n = 2$) completing a professional degree (MD, JD, etc.), 35% ($n = 5$) a bachelor's degree, 42% ($n = 6$) a master's, and 7% ($n = 1$) a doctoral degree. Participants saw an average of 16 IPV survivors per day. Participants worked at CBOs in six of the eleven counties that make up Metropolitan Atlanta: Cherokee, Clayton, Cobb, DeKalb, Fulton, and Gwinnett. Participants' professional titles included: executive director, program director, manager, program coordinator, legal advocate; one police officer was also included. Participants had an average of 14.5 years of experience ranging from less than 1 year (0) to 39 years. All but one participant worked directly with IPV survivors; the outlier previously worked directly with survivors and at the time of the interview served in a leadership role at a CBO.

Three inductive themes were developed using the data. Staff of community-based organizations serving IPV survivors perceived that: (1) IPV survivors face individual-, organizational-, and systems-level barriers during help seeking and service provision; (2) Care coordination between hospitals and CBOs is limited due to siloed care provision; and (3) Care coordination can be improved through increased bidirectional efforts.

Theme 1: IPV survivors face individual-, organizational-, and systems-level barriers during help seeking and service provision

CBO staff identified a wide range of barriers that prevent IPV survivors from receiving needed services. These included individual-, organizational- and systems-level factors.

Subtheme 1.1: Individual-level barriers for IPV survivors

Individual factors noted by participants included: emotional ties and financial dependence on abusers as well as a lack of awareness about what constitutes abuse. Participants noted how the complex emotional bonds between survivors and their abusers can make it difficult to seek supportive resources or leave a relationship. These emotional ties are often intertwined with economic dependence. Participants observed survivors' fears about abusers following through on threats resulting in vacillation between survivors' desires for safety and "changes of heart" including recantation and choosing to stay in the relationship. Participants also noted that survivors may also have limited awareness of awareness of available resources—sometimes because of abuser's isolation or coercive control tactics. Participants believed that many survivors, especially those experiencing IPV for the first time, may not recognize the full scope of abusive behaviors resulting in the normalization of abuse. One participant shared:

> Many times my clients will say, 'I thought that was normal' or they will minimize what they've been going through and not realize that is a truly abuse. 'Oh no, it's nothing. It was just a small bruise, he just hit me once'.

Trauma and the psychological toll of abuse were also noted as factors impacting survivors' ability to make decisions, assess relationship risk, or follow through on any plans to leave. The shame of IPV experience, stigma and potential loss of autonomy associated with IPV disclosure were also noted by participants as important individual factors.

Finally, and most relevant to care coordination, participants noted how individual circumstance may affect the ability of survivors to navigate complex health and social support systems. One participant shared:

> It's exhausting to a survivor. And I don't feel like just doling out resources or giving [her], 'here's a bunch of places to go or call.' She's got her kids, she's got to navigate… There's so much going on and I think we must sometimes forget what it must feel like to be in her shoes. And so, I think we need better wraparound services.

The labyrinth of legal, medical, housing, and social services that IPV survivors must navigate to get help can be overwhelming and frustrating, leading some to give up. The sheer volume of steps and hurdles can feel insurmountable for survivors already grappling with trauma and limited resources. One participant captured survivors' frustration:

> And sometimes you have to go through two or three numbers to get to where you need to be. And people get frustrated and give up sometimes.

Subtheme 1.2: Organizational-level barriers for IPV service provision at community-based organizations

Participants identified competitive siloing and resource limitations as major organizational barriers to IPV service provision. Persistent barriers to effective collaboration and coordination included siloed approaches and competition rather than cohesive systems. One participant noted how such competition impedes meeting survivor needs:

> I see a little bit of competition sometimes where that's the feeling that we get, where I don't feel like the victim's needs are really the ultimate priority… And I just feel that agencies should really work better and have better trust between each one another and with the singular goal of just meeting that client's needs in their time of need.

Some participants recommended exploring comprehensive, co-located service models such as Family Justice Centers that provide wraparound services through a centralized process. While recognizing challenges related to confidentiality and logistics, participants felt improved service integration could improve access and reduce burdens on survivors. One participant described:

> Basically, there's this concept where you take every stakeholder that would assist the victim of domestic violence and you put them all in one place. And that makes a lot of sense because when you have too much space between us, things get lost. And we don't get to improve our processes if we never review our processes.

Finally, insufficient and inflexible funding emerged as a common barrier to providing comprehensive services. Participants noted that funding is often restricted and cannot be used for critical expenses such as transportation, childcare, and housing deposits that could significantly aid survivor independence. One advocate stated:

> I think funding is our number one barrier and I would qualify that with saying it's flexible funding because we do have donor funding that is earmarked for specific purposes and it's very, very strict and we cannot use those funds for something that we may consider priority for our clients. We really don't have enough of flexible funding.

Subtheme 3.3: Systems-level barriers to IPV service provision

Two major system-level barriers were noted by participants as negatively affecting IPV service provision: (1) the lack of safe and affordable housing; and (2) health care access and affordability.

First, the lack of safe and affordable housing options for IPV survivors came up universally as a major gap and source of frustration. Both temporary emergency shelter and permanent housing were mentioned. One participant described:

> Right now, the biggest barrier is seeking shelter or finding shelters that have space available. That's the biggest barrier right now. A second barrier is that most of the counties are not accepting new applications for housing vouchers, emergency housing vouchers.

Second, participants identified lack of health insurance coverage and concerns about medical costs as significant barriers that prevent many IPV survivors from seeking or receiving care. A participant explained:

> A lot of our clients do not have access to Medicaid or any kind of care of that nature. And so, to be able to have the financial

> resources to be able to seek some of the care, it can be kind of an impediment.

While some CBOs attempt to assist survivors with medical bills, participants indicated that larger systemic changes are needed to ensure survivors can access essential healthcare without incurring crushing debt or compromising their safety.

Theme 2: Care coordination between hospitals and community-based organizations is limited due to siloed care provision

Subtheme 2.1: CBOs receive few hospital referrals and these survivors have distinct needs

The majority of participants noted that very few of their clients come directly from hospital settings to their organizations. Overall, the percentage of survivors referred directly from hospitals to CBOs was reported to be low. A client specialist shared, *"Personally, since I've been working, since February of this year, I have not had any client that has come directly from an emergency room."* One organization with an informal hospital partnership reported that between 15 and 20% of their clients come via hospital referral; when asked to estimate the proportion of clients that come from hospitals, all other participants reported percentages lower than this figure. One participant shared:

> Well, I think sometimes people are in the moment, they're in a crisis in the moment. And I would say that there's a percentage of our clients that have to go to the hospital in the moment, but once their initial needs are met, then depending on what their situation is, they maybe will return to the abuser… I would say I've had clients definitely that went to the hospital, and I was expecting to see them, somebody in their family might have advocated for them, and I was expecting to see them in my office the next day to try to do the next steps, to try and do a protective order or try and find transitional housing or whatever it is. And then the person sort of just drops off the radar….

When describing the needs of survivors referred following hospital-based care participants described their needs as distinct from other survivors including the need for follow-up medical care, therapeutic treatment (e.g., physical therapy), and supportive services (home health care). Participants noted that few CBO staff have medical training, and that their organizations are not designed to nor do they have the capacity to provide these types of care. However, many participants noted that injuries requiring hospital care act as an alert as to the urgent needs of survivors as described by one participant, *"they are harmed already, so they shoot to the top of our priority list as far as trying to place them in a shelter."*

Subtheme 2.2: CBO and hospital staff cross training is needed

Participants noted that while CBO staff do not have medical training, hospital staff are not well informed about how to manage IPV cases nor do they know of available IPV services. One participant noted that hospital staff often seem unaware of available community resources, suggesting they should consult with CBOs to facilitate appropriate referrals and transitions for survivors upon discharge.

> I don't know that sometimes it seems like there's a disconnect between what the hospitals know is available within the community. So, you would assume that the social workers or nursing staff or other staff members in the hospital would have like our agency has a resource guide and when people call, whatever resources they need, we try to facilitate.

The need for more robust training to help healthcare providers recognize and respond to IPV was a recurring theme. Insufficient training was seen as leading to missed opportunities for intervention and referral, ultimately affecting survivor outcomes. One participant described:

> I guess if you had to think of an overarching barrier, that's probably it, which is that that hasn't been their purview for so long. And from medical perspective that the providers are thinking our job is to treat the acute injury they don't necessarily have in their training, their traditional training, that soft skill of how do we deal with someone who needs support and services beyond that?

Subtheme 2.3: Siloing acts as a barrier to care coordination between hospitals and CBOs

Participants identified numerous barriers hindering smooth coordination and continuity of care for IPV during referral, transitions from hospital to CBO services, and follow up.

Participants described agencies working in silos, with insufficient sharing of survivor information and follow-up after referrals. One participant stated:

> I sometimes feel like we all work in silos, so we might get a call from somebody… She's going to the hospital, let them know about us, and then they reach out to us. And then if they leave the hospital and come to us, it's like that communication now has stopped because, 'Okay, she's out of our care now. Now y'all have her'.

A program coordinator further explained:

> If the referring agency do not have good information on the client and you are not able to client at the point of contact, then that might affect the case management for the client, but it could also affect the outcome of that case management.

One participant identified lack of direct communication and contacts as key barriers:

> The main barriers between hospitals and community-based organizations? Probably correspondence… I think it's hard to get in touch with the right people at the hospitals when you really need them.

Several participants highlighted the absence of "warm handoffs," or direct, coordinated transfers of care from hospital to CBO providers, as a barrier to care coordination.

> Honestly, I think it's a warm hand off. So, like the idea of having an individual who doesn't receive referrals and then who would follow up with the referring agency and then the person who would internally follow up with that client or that client ... that's probably like the biggest barrier is having somebody that's consistent and it comes without being almost without being said.

Another participant noted, *"But it seems like a lot of times the hospitals do not do that extra step of trying to make sure that the person's going from a safe environment to another safe environment or a medical environment or one that will be able to be supportive of their medical needs."*

Theme 3: Care coordination can be improved through increased bidirectional efforts

Participants offered a wide range of suggestions for ways to improve IPV prevention and response. These included: early prevention through school-based healthy relationship education; IPV stigma reduction via community awareness raising; police education on trauma-informed care; and increased support for *pro bono* legal aid. Participants also made recommendations specific to increasing or improving care coordination between hospitals and community-based organizations. These recommendations were largely centered on the use of survivor-centered approaches, improved interagency collaboration, and care coordination resource allocation such as through dedicated staff members whose purpose would be to coordinate care between hospitals and community agencies.

Subtheme 3.1: Care should be survivor-centered and use trauma-informed approaches to minimize re-traumatization during service delivery

Participants consistently emphasized the importance of centering survivor choices and autonomy. Participants described various strategies for reducing the risk of re-traumatization, such as allowing survivors to share their stories on their own terms, coordinating services to avoid repetition, and attending to basic needs before dealing with emotionally taxing matters. A transition coordinator described their approach:

> I think the connection with the advocate can begin with 'this is your space, this is your story, this is your voice.'

Participants stressed the critical importance of respecting survivors' self-determination and not replicating abusive or harmful power dynamics during services delivery.

> There's just so many ways that gets stripped away from a victim… If you lead someone towards an option without understanding the context that they're living in, you can make things worse rather than better.

Participants underscored the necessity for a full continuum of care, delivered in a culturally competent manner especially for survivors of color and immigrants.

Subtheme 3.2: The establishment of formal partnerships and protocols between hospitals and CBOs are necessary for increased collaboration and improved care coordination

Recognizing the need for more integrated, coordinated care, participants advocated for strengthening hospital-CBO partnerships through cross-training, warm handoff protocols, co-location of services, and improved communication channels.

> One thing I'm always attempting to try to figure out is how we can get more integrated training, collaboration, and partnership between hospital entities and domestic violence organizations… So those are the things that are missing in terms of having that flow of information so that they can work together when there's a victim that needs both services.

Another participant described their prior unsuccessful attempts at sharing resources:

> Some of them, they already have like their own brochure with the national hotline or any other hotline that I'm not aware of. And then when I'm telling them this is the Georgia State hotline and if you connect with all the 46 certified shelters so that's why it would be better for the victim to call us directly rather than calling the national on any other number that probably they are not going to be providing. But I think they have their own policies and they don't include our information. Sometimes I want to share with them our posters and the material in English and Spanish and they're like, 'Yeah, no thank you, we already have ours'.

Several participants suggested establishing a "family violence center" that brings together all stakeholders who assist IPV survivors in one place, noting that having too much space between providers leads to things getting lost. Beyond strengthening partnerships with hospitals, participants also called for greater collaboration, resource-sharing, and streamlined processes among CBOs to better serve survivors. Some envisioned a centralized referral and case management system to facilitate warm handoffs and ensure survivors do not fall through the cracks when navigating multiple agencies. Others described the potential benefit of having dedicated IPV advocates staff in hospital settings to better connect survivors to community-based care.

Discussion

Our findings highlight the multi-level barriers IPV survivors face in accessing community-based care following medical care, the limitations of existing hospital-CBO coordination, and opportunities for improvement from the perspectives of CBO staff. Participants identified individual, organizational, and systemic factors that impede IPV survivors' ability to seek help and receive comprehensive services. These insights align with prior research on survivor barriers while uniquely capturing the challenges CBOs navigate in meeting their needs. CBO staff recognized that IPV survivors may minimize their abuse and only seek hospital care when absolutely necessary. This finding is consistent with the robust literature on IPV stigma and disclosure hesitancy (39–41). When survivors are admitted or choose to seek help at a hospital, IPV can be difficult to identify and, in many cases IPV is not disclosed. For survivors that did seek care in hospitals, inconsistent contacts and a lack of bi-directional communications between hospital and CBOs were identified as challenges in supporting survivors' transitions. Hospital staff are often unfamiliar or poorly networked with community-based resources. Yet, EDs have the potential to play an important role in breaking the cycle of violence by facilitating connections to CBOs and ensuring that survivors' medical and social support needs are fully met (42–45). ED-based interventions show promise in responding to IPV (46). Kendall conducted an intervention in an urban Level I trauma center ($n = 360$; mean age 32 years; 97% female, 74% non-white) where 96% of survivors felt increased safety up to 12 weeks after consultation with a CBO advocate and service referral (18). Ideally, once medical needs have been met, IPV survivors would connect with ongoing community social support services (47–49). However, participants mentioned how many IPV survivors were unaware of the available resources even when leaving a hospital; meanwhile, CBOs may passively rely on referrals from hospitals, without actively seeking to connect those released from hospital care into their programming (23, 24, 46). Among our participants most reported that few of the survivors they served came via hospital referrals. Several studies have found that inadequate organizational resources, staff burnout, lack of training, and poor integration with other community services interferes with quality services to IPV survivors (23, 50).

Participants suggested warm handoffs as a way to break silos and ensure IPV survivor connections to community-based care. Warm handoffs have been evaluated as a quality improvement tool for transitioning care albeit not within the field of IPV (51). Warm handoffs can be used to ensure secure and efficient referrals while also maintaining continuity of care thought they are most commonly used in the contexts of mental health and substance use disorder (52); there is scant literature on warm handoffs among IPV survivors (53). What does exist includes notable limitations. For example, Dichter's primary data collection did not include the perspectives of stakeholders beyond survivors (e.g., there was no representation by hospital or CBO staff) and there was no identification of structural factors that would be essential to supporting care transitions (54) necessitating research in this area.

CBO staff expressed a desire to improve care coordination with hospitals to reduce the possibility of survivor retraumatization and to minimize the harmful effects of IPV. They also expressed the importance of keeping the survivor at the center of care. This aligns with Kulkarni's findings on enhancing IPV services including providing empathy, supporting the empowerment of survivors, individualizing care, and maintaining ethical boundaries (23). Participants' emphasis on the importance of trauma-informed, survivor-centered care is consistent with best practices for IPV services. However, their experiences reveal gaps in the implementation of these approaches across systems. Efforts to improve coordination must prioritize survivor autonomy, cultural responsiveness, and minimizing re-traumatization.

Participants also desired a "one-stop shop" where survivors could rest and care for their needs. A few participants mentioned a Family Justice Center (FJC) where survivors could get shelter, therapy, career counseling, conduct a job search, gain transportation to a safe place, get official documents, and help for children and pets. Duncan et al. highlighted the value of FJCs, noting that such centers bring a "multitude of organizations under one roof and eliminates the hurdles so many survivors must jump through" (55). The first FJC began in San Diego and saw a 95% reduction in domestic violence homicides after 15 years (56). The US Congress later recognized the importance of Family Justice Centers in Title 1 of the Violence Against Women Act (VAWA) in 2005 and allocated funding to create more FJCs, which are considered a part of best practice (56). FJCs have been found to increase CBO effectiveness, increase survivor safety and empowerment, reduce survivor fear, and reduce homicides (57–59). FJCs also address the challenges survivors face when travelling to multiple locations to file police reports, receive counseling, and to obtain other services (60). Efforts are underway to establish several FJCs in Georgia modeled after those in Tennessee which houses over a dozen FJCs. Three Georgia locales have begun the intensive planning process, including in the cities of Marietta, Macon, and Waycross, Georgia although there are no current efforts to develop an FJC serving Atlanta (61).

CBO staff reported difficulty in meeting IPV survivors' material needs—including shelter, and financial support—even after connecting with CBOs. IPV survivors who leave abusive relationships often face housing instability and homelessness due to elevated housing costs, economic insecurity, damaged credit, and poor tenant history. In 2003, one study found IPV survivors were four times more likely to experience housing instability when compared to those who did not experience IPV (62). Similarly, a study of 110 survivors receiving CBO services in Georgia found that 38% percent reported homelessness after fleeing abuse, and 25% were forced to leave their homes due to financial problems or partner harassment (63). Such challenges have likely been exacerbated by increasing housing costs and inflation following the COVID-19 pandemic. Notably, participants highlighted survivors' financial needs, both immediate and longer term. In 2005, a national telephone poll found that 64% of IPV survivors reported that their ability to work was affected by violence (64). Physical injuries contribute to absenteeism because of abusers' intrusions at work, harassment, disruption to sleep schedules, and behaviors such as hiding car keys to make job retention challenging for survivors (65). Notably, healthcare costs for those experiencing abuse were 42% higher than for non-abused women (66). Such costs can perpetuate economic instability and dependency on abusers as was mentioned by our participants. The desire to support survivors' financial needs was viewed by participants as in tension with CBO funding structures and mechanisms. This finding aligns with other research which found funding to be a top challenge in the provision of IPV services in North Carolina (24). Structural challenges for meeting IPV survivors' material needs are thus a persistent problem across US settings.

Overall, participants believed that IPV survivor needs were often unmet, and they expressed the desire for additional community-based resources to support survivors short- and long-term needs. Mittal's meta-analysis found that community-based interventions resulted in a decrease of IPV among survivors (67). Likewise, a randomized control study found that survivor-focused outreach can decrease the severity of PTSD, depression, and fear 1 year after the abuse compared to IPV survivors who did not receive the services (68). Moreover, survivors who also were connected with social supports were more likely to leave an abusive relationship underscoring the importance of connection to such services (68). Yet even with several studies noting the benefits of IPV survivor connection to CBO services, there are few documented programs linking IPV survivors from hospitals to CBOs nor have rigorous evaluations been published. Our findings contribute to the limited literature on warm handoffs and care coordination for IPV survivors by highlighting the perspectives of CBO staff and identifying specific barriers and opportunities for improvement in the context of hospital-to-CBO transitions.

Limitations

There are several limitations to this study. For our purposes we considered all organizations serving IPV survivors in the community as CBOs. This included government agencies such as police. This study included one participant who was a police officer. This participant expressed opinion and perceptions which were sometimes substantively different from those of participants working on non-profit organizations. However, we reached thematic saturation. The police participant added richness to the breadth of comments reflected in the themes.

As with all qualitative research, results cannot be generalized to the entire population of IPV survivors. This study applies to Atlanta, Georgia though there may be transferable lessons relevant to other US locales. Findings from this study should be complemented by expanding data collection to incorporate more IPV CBO staff voices from across US.

Conclusion

This study sought to explore, from the perspective of CBO staff, the perceptions of IPV coordinated care between hospitals and CBOs. Participants identified silos and inconsistent communication/relationships between hospital and CBOs as major barriers to care coordination. They also suggested that programs or interventions including warm handoffs may support care connection. However, warm handoffs for IPV have not been well documented or rigorously evaluated, and more research needs to be done in this area. Participants urged the importance of survivor autonomy and the need to reduce retraumatization by coordinating care. They suggested a Family Justice Center as a medium to center survivor needs and reduce administrative burden. Finally, participants identified the material needs of survivors—shelter and cash—as major barriers including the inability of their own organizations to directly provide such resources due to budget constraints.

The consequences of IPV are far-reaching and devastate survivors, their families, and communities. Although Metropolitan Atlanta has a robust networks of CBOs supporting survivors Georgia still ranks 31st nationally for women killed by men (69). In one study 40% of IPV victims killed by their abuser sought help in an ED 2 years before the fatal incident underscoring the importance that interventions based in EDs and hospital settings may have (70). As IPV continues to be a pervasive issue, this analysis suggests that formalizing partnerships between hospital and CBOs, including dedicating staff persons to coordinate care connections via a warm handoff program could improve survivor care connection; likewise, the development of a Family Justice Center would reduce survivor retraumatization. Improving care coordination will require a collaborative effort among policymakers, funders, healthcare institutions, and CBOs to prioritize survivor-centered approaches and invest in effective partnerships. Additional research is needed on such interventions designed to improve care coordination to ensure survivors needs are met.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The requirement of ethical approval was waived by Emory University Institutional Review Board for the studies involving humans because this study was deemed to be exempt due to its nature as public health practice. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because verbal informed consent was procured.

Author contributions

DE: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Supervision, Writing – original draft, Writing – review & editing. JP: Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. KW: Investigation, Project administration, Writing – review & editing. LW: Methodology, Formal analysis, Writing – review & editing.

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Conflict of interest

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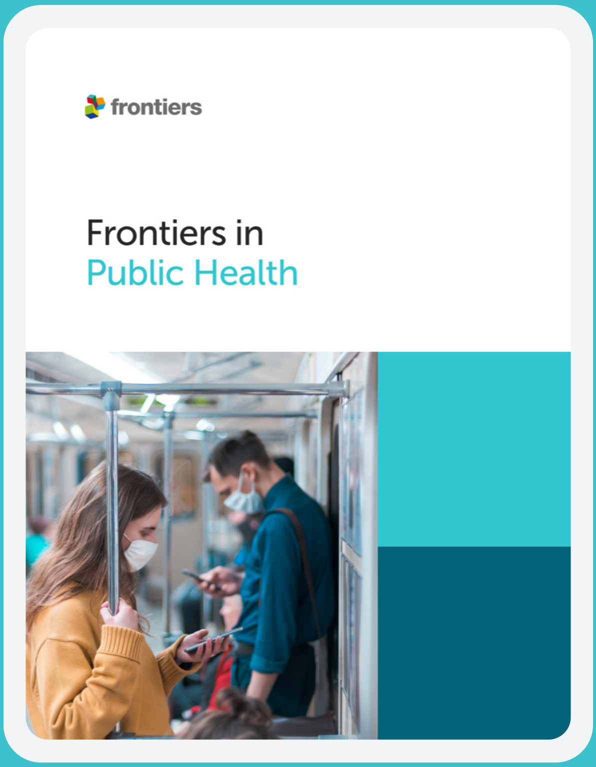

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