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Retained Bullets and Psychological Wellbeing

By

Rikke Møller Nedergaard

Degree to be awarded: MPH

Hubert Department of Global Health

Retained Bullets and Psychological Wellbeing

By

Rikke Møller Nedergaard

MA (Hons) in Social Anthropology

University of St Andrews

2019

Thesis Committee Chair: Monique Hennink, PhD

An abstract of

A thesis submitted to the Faculty of the

Rollins School of Public Health of Emory University

In the partial fulfilment of the requirements for the degree of

Master of Public Health

in Hubert Department of Global Health

2021

Abstract

Retained Bullets and Psychological Wellbeing
By Rikke Møller Nedergaard

Objective: Every year 75,000 people in the United States obtain retained bullets or fragments after firearm injury.[1] There is limited research on the psychological health effects of retained bullets or fragments. In this study, we aim to determine how retained bullets for firearm injury impacts the psychological wellbeing of survivors.
Methods: We conducted qualitative in-depth interviews with 24 survivors who had retained bullets or fragments in their body after firearm violence. These participants were recruited from Grady Memorial Hospital in Atlanta, GA, which specializes in treatment of firearm injuries. We conducted a robust thematic analysis to identify psychological effects on survivors.
Results: Our findings show four elements of psychological wellbeing were influenced by retained bullet fragments, including: 1) Physical wellbeing 2) Emotional wellbeing 3) Social wellbeing 4) Occupational wellbeing. These elements are interconnected and coincide to amplify psychological impact on individuals with retained bullets or fragments.
Conclusions: This study highlights the importance of considering the psychological consequences of retained bullet fragments. Implications for this study include: educating clinicians about psychological impacts of retained bullets or fragments, counseling patients on bullet removal, and considering psychological wellbeing in the decision about whether to remove the retained bullets or fragments at index hospitalization and follow-up appointments.

[1] Author calculations based on data from Smith et al. (2018), CDC (2020) and Nee at al. (2021).

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Acknowledgements

Throughout the work on this thesis, I have received a great deal of support and advice, that I am incredibly grateful for.

I would first like to thank my wonderful thesis chair Dr. Monique Hennink for her unwavering support on this project over the past year and a half. Her insightful feedback and expert knowledge in qualitative advanced my thinking and were invaluable in the process of writing this thesis. She helped keep me on the right track and supported me every step along the way.

I am also so grateful to Dr. Randi Smith who conceptualized this project. She brought me onboard as a Graduate Research Assistant and enabled my participation in this project. Her perspective as an experienced trauma surgeon has been exceedingly helpful throughout the research and writing of this thesis.

Finally, I would like to thank my family and friends for their support and encouragement throughout this process. They helped me through difficult times during the pandemic and I know I would not have been able to complete this project without them.

Table of Contents

Retained Bullets and Psychological Wellbeing

Introduction

Every year 140,000 individuals sustain firearm injuries in the United States and, of these, about 39,000 die (Smith et al., 2018; CDC, 2020). This leaves more than 100,000 survivors of non-fatal firearm-related injury. An estimated 75.5% of these survivors have retained bullet fragments (Nee at al., 2021) in their body, which means that around 75,500 individuals obtain retained bullet fragments every year.

Those most likely to sustain firearm injuries are male (AOR=5.14; Carter et al., 2017a; Eflein, 2019) and African American (AOR=2.75; Carter et al., 2017a; Paris et al. 2002). Further risk factors for firearm injury include growing up in a disadvantaged neighborhood (Carter et al., 2017b) or in single-parent households (OR=3.8; Paris et al. 2002), having no or publicly funded insurance (Carter et al. 2017b), being employed as an adolescent (Schmidt et al., 2019), experiencing childhood trauma (Wamser-Nanney, 2019), carrying, or owning a gun (Schmidt et al., 2019), and using alcohol or drugs (Carter et al., 2017a; Schmidt et al., 2019).

There exist no national standard procedures for when to remove retained bullet fragments, but current practice is to only remove bullet fragments if they are located in areas of the body where they are most likely to cause harm, such as by joints, cerebrospinal fluid, or the eyes (Apte *et al.,* 2019) or if they cause pain or are palpable (Smith et al., 2020). Since follow-up appointments with firearm violence victims are not uniformly conducted (de Araújo et al., 2015), survivors might live with symptoms from retained bullets without seeking medical assistance.

By comparison to other kinds of injury, injury from firearm violence is underfunded and under-researched (Stark & Shah, 2017). There has been an increasing number of studies about lead poisoning from retained bullet fragments or migrating bullets but, thus far, only one epidemiological study has examined how living with retained bullet fragments impacts the mental health of survivors (Smith et al., 2018). This study found a statistically and clinically significant association between retained bullet fragments and depression symptoms (Smith et al., 2018). No studies have examined why this association might exist. There are also

no published qualitative studies on the mental health impacts of retained bullet fragments. Using qualitative research for this topic is especially pertinent because it can help us develop an understanding of how people experience living with retained bullets or fragments. Understanding the emic perspective on this topic is important, as the only existing study shows that people with retained bullets score higher on a standardized depression scale; but it does not tell us why this is the case (Smith et al., 2018). The goal of this study is to understand the survivors' perspective on how living with a retained bullet in their body has impacted their psychological wellbeing. This includes elucidating how the retained bullet fragments impact different aspects of daily life, which contribute to overall psychological wellbeing.

It is crucial to understand how retained bullet fragments might impact the psychological wellbeing of survivors of firearm violence since this can help guide surgeons in their decisions on whether to remove bullets or fragments retained after firearm injury. A recent study which surveyed 472 surgeons found that only 12.9% and 4% considered anxiety and PTSD respectively when determining whether to remove retained bullet fragments (Smith et al. 2020). This supports previous research that mental health is not usually a consideration on removal of bullets or bullet fragments (Apte *et al.,* 2019).

Therefore, the research question for this study is: *How do retained bullets from gunshot injury influence the psychological wellbeing of survivors?*

Literature Review

Gun violence has been shown to be the least researched cause of death relative to mortality rates and the second least funded (Stark & Shah, 2017). As such, what we know about gun violence and its consequences is very limited, and particularly the psychological effects of having a retained bullet from firearm injury.

Retained Bullets and Mental Health

The mental health impacts of retained bullets remain understudied. We only found one published study on this topic from a search across, PubMed, Web of Science, Psych Info, Google Scholar and Pro Quest. This

study by Smith et al (2018) was a prospective cohort study with 139 Black male survivors from firearm injury, which used the PCL-5 scale for PTSD assessment and the QIDS-SR16 scale for depression evaluation. Results found that at 3 months follow-up, patients with retained bullets had comparable PTSD symptoms but significantly higher depression levels than those without retained bullet fragments. This difference remained even when controlling for injury severity, number of wounds, marital status, and education level. The study also found that people with retained bullet fragments were less likely to evaluate their health as "very good" or "excellent". The study did not explore the possible reasons for this association, and there remains a significant gap in published research on this topic.

It has been shown victims with mental illness are more likely to be re-injured (Wann et al., 2006) and that 9% of victims of firearm violence are re-hospitalized from acute stress disorder or PTSD within 6 months of their trauma (Joseph et al., 2019). Victims who were female (OR = 1.79) or younger than 25 years (OR = 4.66) were significantly more likely to develop acute stress disorder or PTSD (Joseph et al., 2019). Another study found that trauma victims with fear of movement and catastrophizing thoughts experience more pain and worse physical health (Archer et al., 2012). Furthermore, people with PTSD symptoms or diagnosis and/or a history of trauma are more likely to perpetrate interpersonal violence (Gillikin et al., 2016). These studies concern trauma or firearm violence in general and do not consider the mental health effects of having retained bullets specifically. However, these findings are interesting in the light of Smith et al. (2018)'s finding that there is a significant association between PTSD and retained bullets. Taken together, this means potential psychological consequences of retained bullets also have a bearing on physical health and inter-personal violence prevention.

Lead Toxicity from Retained Bullets

Bullets are made from many different metals, but lead is used most often (Farrell et al., 1999). When the bullet or fragments are lodged in the human body, they can release lead and other metals that can cause adverse effects for both physical and psychological health (Apte et al., 2019). A significant number of

studies have been conducted on the potential for lead toxicity from retained bullet fragments. These are almost exclusively quantitative studies, such as case studies (Weiss et al., 2017, Nally et al., 2015, La Rosa et al, 2015, DiMaio et al., 1983; Ramji & Laflamme, 2017), case-control studies (de Araújo et al., 2015) and a systematic review (Apte et al., 2019). In this literature, there are 22 symptoms known to be associated with lead exposure, including mental confusion, irritancy, bad mood, and memory loss, along with many physical symptoms such as abdominal pain, headaches, and weakness (de Araújo et al., 2015), which may also affect the psychological wellbeing of the patient.

There have been less than 100 cases of lead poisoning reported in the medical literature (Quail, 2018), but follow-up is not routinely conducted for retained bullets, so it is possible cases may go unnoticed (de Araújo et al., 2015). A cohort study of 451 victims of firearm violence found that lead levels in blood peaked at 3 months after the injury, at which point 38% of subjects had blood lead levels of ≥10 µg/dl (McQuirter et al., 2004). Per the World Health Organization (WHO), there are no safe blood lead levels and even blood lead levels of 5 µg/dL might cause harm (WHO, 2019). Increased blood lead levels are more likely to occur when the bullet is lodged near a joint since the fragments in soft tissue are usually encapsulated (Quail, 2018). However, lead poisoning from bullet fragments in soft tissue has been reported (Weiss et al., 2017). In fact, a recent systematic literature review about lead poisoning from extra-articular retained bullets and concluded that monitoring on lead levels should be conducted at admission, discharge, at monthly intervals until 3 months and then at 1 year after the injury (Nickel et al., 2018).

Migrating Bullets

The human body will try to expel foreign matter, as such, bullets and fragments retained from firearm injury sometimes migrate to a different part of the body (Marantidis & Biggs, 2019). Most studies on migrating bullets are case studies (e.g. Hesami & Johari, 2012; Arslan et al., 2012; Meena et al., 2013; Marantidis & Biggs, 2019). These include cases of bullets migrating within brain tissue (Koçak & Özer, 2004; Arslan et al, 2012), limbs (Meena et al., 2013), and the trunk of the body (Hesami et al., 2012; Marantidis &

Biggs, 2019). Migration can sometimes expel the bullet entirely (Hesami et al. 2012), sometimes make the bullet fragments easier to remove, but it can also induce additional symptoms such as pain (Meena et al., 2013; Marantidis & Biggs, 2019).

Theories on Psychological Wellbeing

In this paper, we primarily use the term "psychological wellbeing", but refer to "mental health" when authors cited use that term. The term "psychological wellbeing" is often used in close association with "mental health" or "quality of life" (Amichai-Hamburger, 2009). It was first conceptualized by the psychologist Carol Ryff, who had noticed that researchers tended to study psychological *dysfunction* far more than positive psychological function (Ryff, 1995). Ryff suggest a model for psychological wellbeing that includes six main elements of positive psychological functioning: 1) *Self-acceptance*, which is defined as having a positive attitude towards oneself. 2) *Positive relations* with other people, defined as relations that are warm, satisfying and trusting. 3) *Autonomy* in being independent, able to control one´s behavior and trusting one´s own judgement. 4) *Environmental mastery*, understood as being capable of carrying out complicated activities in complex surroundings. 5) *Purpose in life* with a sense of direction and goals for the future. 6) *Personal growth* where one continuously learns and develops (Ryff & Keyes, 1995). This six-factor model has been critiqued because four of the elements are highly correlated, specifically personal growth, purpose in life, self-acceptance, and environmental mastery (Springer et al., 2006). Springer, Hauser and Freese argue that these elements are "virtually indistinguishable" (Springer et al., 2006). Nonetheless, Ryff's model has been significant in this discipline because encapsulated the idea that psychological wellbeing is more than the absence of psychiatric illness, and more than mere happiness because people need to feel their lives are meaningful to achieve psychological wellbeing (Ryff, 1986).

Another model for positive psychological wellbeing was developed by Coiffait and Leedham (2016). This model also includes six elements: movement and exercise, pleasurable activity, support for family members and carers, social interaction and positive relationships, control and choice, and sensory stimulation.

However, this model was developed for people with severe and profound intellectual and developmental disabilities (Coiffait & Leedham, 2016). This is likely why it does not have categories for higher function that are included in Ryff´s model (1986).

Neither of these models examines how wellbeing might change after trauma. While Ryff´s model is for people of normal intelligence and function and Coiffait and Leedham´s model is for people with very low intelligence, either model examines psychological wellbeing as an organic concept that might develop naturally over the course of a life. They do not explore or seek to describe what happens to psychological wellbeing when one experiences a traumatic event, which will inevitably impact one´s wellbeing. To understand this better, we will examine literature around recovering from trauma in the next section.

Experiencing and Recovering from Psychological Trauma

The American Psychological Association define trauma as “any disturbing experience that results in significant fear, helplessness, dissociation, confusion, or other disruptive feelings intense enough to have a long-lasting negative effect on a person’s attitudes, behavior, and other aspects of functioning” (American Psychological Association, 2021).

Although researchers might measure trauma using a number of existing scales, it is difficult to determine exactly what situations constitute trauma. Boals (2018) compared “objectively” and “subjectively” traumatic events using six scales: Centrality of Events Scale (CES), the Traumatic Events Questionnaire (TEQ), Perceived Stress Scale (OSS), Quick Inventory of Depressive Symptomatology (QIDS-SR) and the Quality of Life Environment and Satisfaction (Q-LES-Q) scale (Boels, 2018). They found that 73% of events that were experienced as subjectively traumatic also qualified as objectively traumatic, and only 37% of objectively traumatic events were experienced as subjectively traumatic (Boels, 2018). This augments the need to understand the emic perspective on the impact of trauma.

Physical symptoms of psychological trauma might include sleep difficulties, lack of appetite and a decreased immune system (Raghaven & Sandanapitchai, 2020). Trauma is also associated with increased risk of physical disorders such as diabetes, cardiovascular diseases, and cancer (Kendall-Tackett, 2009) and psychological disorders such as depression, anxiety, dissociation, and post-traumatic stress have all been linked to trauma by various studies (Raghaven & Sandanapitchai, 2020; Spauwen et al., 2006; Singer et al., 1995; Zlotnick et al., 1997). Typical post-traumatic symptoms include intrusive thoughts, flashbacks or nightmares, avoidance of places, people or situations that might remind them of the traumatic event, altered cognition or mood, including low mood, increased suspicion, and irritability (American Psychiatric Association, 2021). One study found that the odds of psychological trauma for people with psychotic symptoms is 1.89 times the odds of psychotic symptoms for people without psychological trauma (Spauwen et al., 2006).

Considering the many negative health consequences of trauma, it is important that people who experience trauma recover. There have been many approaches to trauma recovery. Carroll (2013) draws a distinction between problem-focused coping, for issues that one can change, and emotion-focused coping for the issues that one cannot address at a given moment. As an early theorist on the topic, Sigmund Freud argued that people have to work through their trauma (Clewell, 2004). Although parts of his work have since been criticized or reconceptualized, the notion that processing is more productive and avoidance when recovering from trauma has remained (Holahan et al. 2005; Moos et al., 1990; cf. Blalock & Joiner, 2000).

An emotional-focused coping strategy that is commonly used for trauma patients is narrative therapy, where patients create a story around the traumatic event that helps them move on (Madigan, 2011). In this case, “moving on” means that the patient is once again able to have their focus of attention be something other than the traumatic event (Gow & Celinsky, 2012). It has been argued that narrative therapy is especially beneficial for patients who have been in intensive care units (ICUs) since these have often lost time (Williams, 2009). To reconstruct their story, patients often need to know the facts of what happened

to them (Williams, 2009). The therapist and patient then work together to create a narrative where the patient can make sense of the traumatic experience (Madigan, 2011). In a meta-analysis of randomized clinical trials, Wei and Chen found that narrative therapy was moderately effective against post-traumatic disorder (Wei & Chen, 2021).

One last debate on trauma, which remains unresolved, is that researchers disagree about whether you can grow from trauma. Many theorists believe that the trauma will always remain as part of the psyche, and that people do not grow from it, but that people might grow alongside it. On the other hand, other theorists believe people can grow from trauma by developing and learning in ways they would not have been able to without the trauma (Gow & Celinski, 2012).

Student Contributions

Rikke Møller Nedergaard conducted a literature review of previously published research. She cleaned, prepared, and analyzed data for the study. Moreover, she developed the inductive model presented in the results, and wrote the initial drafts of the article and final drafts that incorporated advisor feedback.

Target journal for first submission: American Journal of Public Health

Manuscript

Title: Retained Bullets and Psychological Wellbeing

Authors: Randi Smith, Rikke Nedergaard, and Monique Hennink

Abstract:

Objective: Every year 75,000 people in the United States obtain retained bullets or fragments after firearm injury.[2] There is limited research on the psychological health effects of retained bullets or fragments. In this

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study, we aim to determine how retained bullets for firearm injury impacts the psychological wellbeing of survivors.

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Results: Our findings show four elements of psychological wellbeing were influenced by retained bullet fragments, including: 1) Physical wellbeing 2) Emotional wellbeing 3) Social wellbeing 4) Occupational wellbeing. These elements are interconnected and coincide to amplify psychological impact on individuals with retained bullets or fragments.

Conclusions: This study highlights the importance of considering the psychological consequences of retained bullet fragments. Implications for this study include: educating clinicians about psychological impacts of retained bullets or fragments, counseling patients on bullet removal, and considering psychological wellbeing in the decision about whether to remove the retained bullets or fragments at index hospitalization and follow-up appointments.

Introduction

Every year 140,000 individuals sustain firearm injuries in the United States and, of these, about 39,000 die (Smith et al., 2018; CDC, 2020). This leaves more than 100,000 survivors of non-fatal firearm-related injury. An estimated 75.5% of these survivors have retained bullet fragments (Nee at al., 2021) in their body, which means that around 75,500 individuals obtain retained bullet fragments every year.

Those most likely to sustain firearm injuries are male (AOR=5.14; Carter et al., 2017a; Eflein, 2019) and African American (AOR=2.75; Carter et al., 2017a; Paris et al. 2002). Further risk factors for firearm injury include growing up in a disadvantaged neighborhood (Carter et al., 2017b) or in single-parent households

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There exist no national standard procedures for when to remove retained bullet fragments, but current practice is to only remove bullet fragments if they are located in areas of the body where they are most likely to cause harm, such as by joints, cerebrospinal fluid, or the eyes (Apte *et al.,* 2019) or if they cause pain or are palpable (Smith et al., 2020). Since follow-up appointments with firearm violence victims are not uniformly conducted (de Araújo et al., 2015), survivors might live with symptoms from retained bullets without seeking medical assistance.

By comparison to other kinds of injury, injury from firearm violence is underfunded and under-researched (Stark & Shah, 2017). There has been an increasing number of studies about lead poisoning from retained bullet fragments or migrating bullets but, thus far, only one epidemiological study has examined how living with retained bullet fragments impacts the mental health of survivors (Smith et al., 2018). This study found a statistically and clinically significant association between retained bullet fragments and depression symptoms (Smith et al., 2018). No studies have examined why this association might exist. There are also no published qualitative studies on the mental health impacts of retained bullet fragments. Using qualitative research for this topic is especially pertinent because it can help us develop an understanding of how people experience living with retained bullets or fragments. Understanding the emic perspective on this topic is important, as the only existing study shows that people with retained bullets score higher on a standardized depression scale; but it does not tell us why this is the case (Smith et al., 2018). The goal of this study is to understand the survivors' perspective on how living with a retained bullet in their body has impacted their psychological wellbeing. This includes elucidating how the retained bullet fragments impact different aspects of daily life, which contribute to overall psychological wellbeing.

It is crucial to understand how retained bullet fragments might impact the psychological wellbeing of survivors of firearm violence since this can help guide surgeons in their decisions on whether to remove bullets or fragments retained after firearm injury. A recent study which surveyed 472 surgeons found that only 12.9% and 4% considered anxiety and PTSD respectively when determining whether to remove retained bullet fragments (Smith et al. 2020). This supports previous research that mental health is not usually a consideration on removal of bullets or bullet fragments (Apte *et al.,* 2019).

Therefore, the research question for this study is: *How do retained bullets from gunshot injury influence the psychological wellbeing of survivors?*

Methodology

Study Design

This study employed a cross-sectional study design, using qualitative research methods. Qualitative research is most appropriate for this study because it enables us to explore the lived experience of having retained bullets from firearm injury. Prior quantitative studies have established an association between firearm violence and mental health outcomes, but they cannot explain why these associations exist or describe the life context of individuals living with a retained bullet. We chose in-depth interviews to capture detailed stories and experiences of study participants to understand the "emic perspective" (Headland, Pike, & Harris, 1990). The more confidential setting of in-depth interviews also facilities more personal stories and sensitive emotions around mental health to be discussed.

Study Population

Participants were eligible for the study if they were survivors of firearm violence who have retained bullets or bullet fragments in their bodies. Inclusion criteria were that their retained bullet fragments had to have been confirmed with radiography, the participants had to be above 18 years and able to speak English. We excluded anyone who were imprisoned or pregnant.

The study was conducted at Grady Memorial Hospital in Atlanta, Georgia. Atlanta reports, one of the highest incidences of firearm injuries in the United States (Gun Violence Archive, 2021; Young et al. 2020), and Grady Memorial Hospital specializes in trauma care and treating victims of firearm violence. In 2020, Grady treated 1099 people for firearm injuries, and this number has been increasing steadily at least since 2011.[3] As such, Grady Memorial Hospital was suitable location from which to recruit our target population.

Participant Recruitment

The study's Principal Investigator is a Trauma Surgeon at Grady Memorial Hospital and could assist in identifying eligible patients to recruit to the study. Potential participants were initially identified from medical records and if determined to meet inclusion criteria, they were contacted via telephone by trained research assistants who informed them about the purpose of their study and invited them to participate. Informed consent for participation was also obtained over the telephone as well as in person immediately before the interviews.

We used an inductive process of sampling to determine the appropriate sample size. Recordings were listened to after each interview, and we determined that saturation was reached after a total of 24 interviews. Most of our sample were Black Americans (N = 21) and Male (N = 21), so we specifically aimed to recruit for greater racial and gender diversity. In the end we had recruited 3 female and 2 white study participants.[4] The recruited participants all have retained bullet fragments in their bodies that they have attained within two years of the interview date.

Data Collection

The interviews were conducted by trained qualitative researchers in a meeting room at Grady Memorial Hospital. Interviewers obtained informed consent from participants for the interview and with the permission of the participants, the interviews were recorded. The interview guide included sections on the

[3] This data was provided by Grady Memorial Hospital in personal communication.
[4] For one of the participants, the racial identity was not identified.

initial circumstance of the injury, the information provided by doctors, the impact of the retained bullet fragments on the participant's daily life, feelings towards living with a bullet in their body, whether they would like the retained bullet fragments removed, emotional and psychological effects of the retained bullet fragments, the extent to which they share their feelings about the retained bullet with other people around them, the biggest effect of living with a retained bullet, and what they would like doctors to know about living with a bullet in their body. A full list of questions is included in the Appendix which has the interview guide. The interviews were semi-structured, so we could ensure we would get around key topics while also allowing study participants the opportunity to speak about the things that mattered most to them. Trained research assistants piloted the interview guide and adjusted it accordingly.

Data Analysis

Each interview recording was transcribed verbatim, deidentified, and checked for accuracy. The transcripts were then entered into the textual data management program MAXQDA (Verbi Software, 2020). We conducted a robust thematic analysis (Vaismoradi et al. 2013) to understand the ways in which living with a retained bullet impacted the psychological wellbeing of participants. Data analysis followed the following six steps, which were conducted in a circular way hereby some steps repeated or conducted concurrently: 1) Identifying themes and developing a code book. We systematically read and wrote memos on the transcripts to identify core themes. A codebook of core themes was developed and included inductive themes that emerged from the data as well and deductive themes developed a priori based on the existing literature. 2) Assessing inter-coder reliability, to ensure consistent coding of data between analysts. Two analysts performed an inter-coder reliability exercise using two transcripts. Any coding discrepancies were discussed, and adjustments made to the codebook. A final intercoder reliability exercise let to 97% agreement between coders. 3) Coding data. Using the codebook, we coded the full set of data using MAXQDA, which enabled systematic application of the codes to text. We monitored the quality of the coding on an ongoing basis. 4) Descriptive analysis. We developed thick description of key issues related to the study aims, with a focus on providing depth, breadth, and nuance on the key issues. 5) Comparative

analysis. We conducted structured comparisons of issues by circumstance of injury, location of retained bullet fragments and time passed since injury. 6) Modeling. We developed an inductive model presenting the impacts retained bullets have on psychological wellbeing. We continuously returned to the data throughout this process to validate the analysis and the model.

Ethics Approval

The study received ethical approval from Emory University. The anonymity of participants was ensured by assigning them subject IDs and keeping their names and identifying information in a separate paper file. To ensure confidentiality data were kept in a secured location and only accessible to the study team. With the permission of participants, interviews were recorded. Any identifying information was removed from the transcripts prior to analysis. The recordings and transcripts were stored in an encrypted HIPPA-compliant database and will be deleted upon the completion of the project.

Participants were informed about the purpose of the study and the intended usage of the data before being asked for written consent. They were also told that their participation was voluntary and that they were free to skip questions or stop the interview at any time. Due to the nature of the topic, we deliberately phrased question in a manner that was as sensitive as possible. Study participants were given a resource guide for social services such as mental health care, employment opportunities, substance abuse treatment programs, legal aid, and housing services in Fulton and Dekalb counties. They were also provided with a $40 gift card to reimburse them for their time and travel expenses.

Results

The results show four elements of psychological wellbeing are influenced by having retained bullet fragments after firearm injury. These are survivor's physical wellbeing, emotional wellbeing, social wellbeing, and occupational wellbeing. These elements are all interconnected, and each will be descried in turn below.

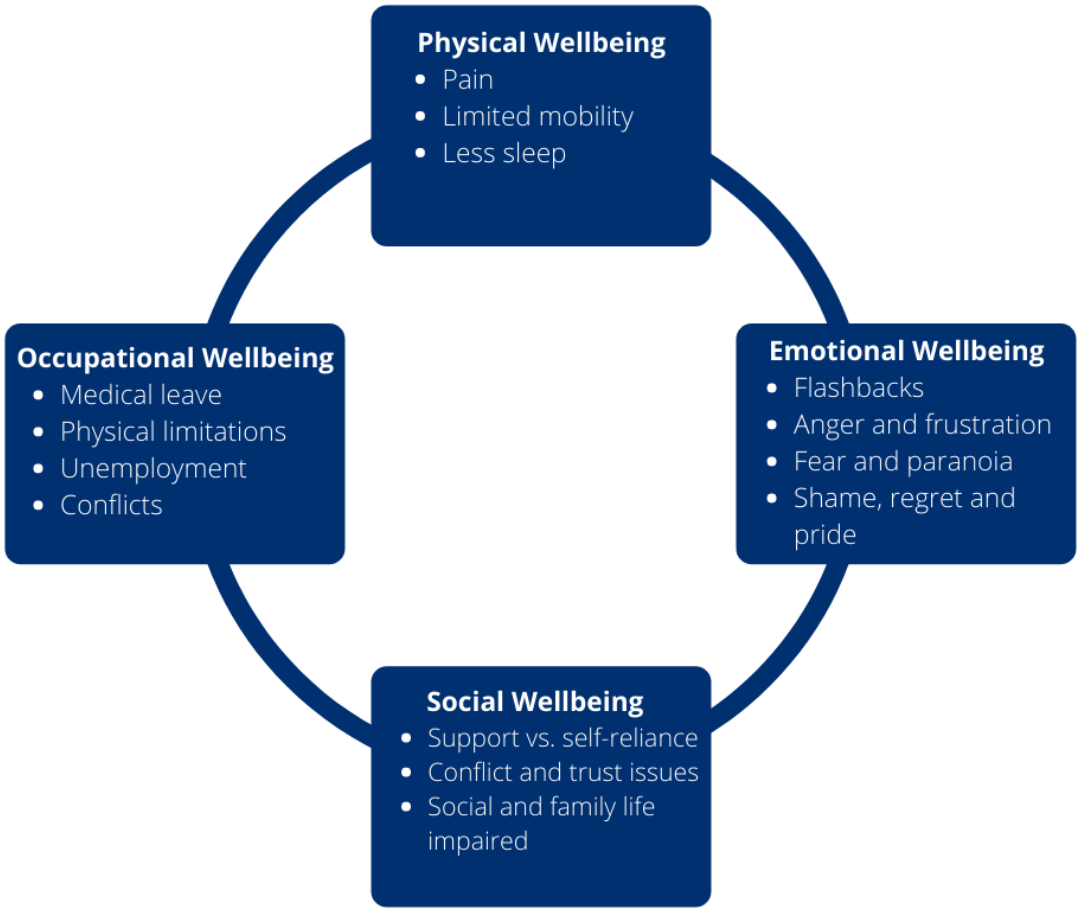

Figure 1: Elements of psychological wellbeing impacted by retained bullet fragments.

Physical Wellbeing

The physical wellbeing of participants was most directly impacted by the retained bullet fragments. When asked what the biggest effect of living with a retained bullet fragment was, half of all participants described the physical effects. Participants described the retained bullet or fragments as a hard lump that agitated them, caused pain, and limited their mobility.

Participants described limited mobility from the retained bullet fragments. They said they could no longer use their bodies the way they used to and therefore were prevented from doing things they wanted to do. During the initial healing period participants could often not walk, or stand, so had difficulty in taking care of themselves. As their injuries healed, they became more self-reliant, but those with bullet fragments in

their upper bodies often still struggled with everyday activities like bathing. Participants with retained bullet fragments in their legs, pelvis, and hips often descried impaired ability to ability to walk, use stairs and run, as their limbs would hurt, get hot or could not support them. While a few participants were unable to feel the injury at all after a period of healing and re-training, most expressed that their difficulties with mobility remained long after the initial injuries had healed.

Pain caused by the retained bullet or fragments was a significant effect in the lives of all participants. They described the pain as “burning”, “sharp or shooting pain” and “irritation or agitation”. Participants typically described feeling pain when they were initially shot and while in the hospital, although some people said they went physically numb so they could not feel anything at all. Throughout the healing process, and sometimes beyond, the pain impacted participant’s sleep. They were unable to sleep, had to adjust their sleeping position or location, or would wake up regularly from pain. In the words of one of the participants who was interviewed 10 months after his injury: “I really don't sleep. If I roll the wrong way or move my arm wrong I'm coming out of my sleep instantly. I'm in pain so I just sit up most of the nights. I don't really sleep that much.” Some participants felt pain at the injury site during or after rain or cold weather. For some people, the pain was constant or came without warning, but it was more common to feel pain when the wounded area was touched or bumped. A few participants felt pain in areas other than the one initially injured. The feeling of pain sometimes varied over time: “Sometimes it feels like it's burning. Sometimes it feels like I'm getting stabbed in my foot. Other times it feels like somebody done took a hammer and hit the heel of my foot.” Participants who had palpable retained bullet fragments associated their pain with the fragments, but others who had internal fragments said they could usually not make a direct association; they were either uncertain about whether the fragments caused pain or were adamant that they did not.

Emotional Wellbeing

All participants experienced effects to their emotional wellbeing, which we define as the participant's feelings and psychiatric symptoms. Although some participants had been diagnosed with PTSD following the firearm injury, many more experienced the psychiatric symptoms and mood changes described below.

Participants described experiencing flashbacks or nightmares after the firearm injury. While awake, participants experienced flashbacks when reminded of the shooting. This was sometimes triggered by simply looking at or touching the location of the retained fragments. At night, participants often struggled to sleep. The pain from the injury would keep them awake and the retained fragments barred them from sleeping in their usual position, which kept them awake. Once asleep, many would experience nightmares or bad dreams in which they recalled the gunshot event or dreamt of being in another shooting. For example: "the other day I had a nightmare; I dreamed that I got shot in the head, type of thing, and I died in the dream". These frequency of flashbacks and nightmares usually lessened after the first few months, especially when participants did not try to suppress the trauma. Participants described using alcohol or marijuana to help them sleep. In these cases, the nightmares usually returned after they stopped using alcohol, which meant they would reoccur long after the initial injury.

Anger and frustration were common emotions resulting from the retained bullet. Participants typically described being more temperamental because of the pain and lack of sleep, which caused arguments with others in their personal and occupational life. Some described anger led them to dent cars or break their phone to release their anger. These mood changes were experienced as a direct consequence of the injury. One participant said: "Pain creates anger". Participants also expressed their frustrations due to the limited mobility the retained bullet caused. For example, they could not fully participate in sports or exercise, which were important parts of their lives prior to the firearm injury. One participant stated that "sports is my life" and another explained: "I used to play basketball, can't do that anymore because I can't run. It's just like basically […] a kid losing something they love […] Basically, when I got shot, some things were

tooken from me that I'll never be able to get back". Many participants said that they felt like a different person after the firearm injury from how they had been beforehand. They described themselves as more angry, agitated, and aggravated, in part these changed emotions resulted from pain and limited mobility, which they felt could be mediated with recovery or potentially with bullet removal.

The retained bullet fragments caused some people to feel fearful or vulnerable. Participants who had not yet recovered from the bullet wound often felt like they could be re-injured more easily. Even after healing, some people would be reminded that they are vulnerable to injury and violence. One male participant commented "Man, I was this big person. Couldn´t nobody tell me nothing [but when I was shot] I couldn't protect myself". Participants described the retained bullet as a reminder of how close they came to death, because they felt that life "flashed before their eyes" during the gunshot event. One participant said it was "humbling" to have lived through it. Even after recovery participants described being vulnerable to illness or death, from lead poisoning, the bullet moving, or the injury not healing properly. They described the retained bullet as a reminder of how easily they could die and the fragility of life.

Hypervigilance and paranoia were frequently described by participants. Some were hypervigilant by being constantly aware of potential dangers around them; they would avoid the place where they were shot or places like it and leave situations that could transpire to violence. One participant described how he now avoided going places where he could not bring his firearm, since he would then better be able to protect himself. Experiencing paranoia over situations they previously would not have worried about was also common. This ranged from being aware of strange cars in their neighborhood to worrying that the headache they had was caused by the retained bullet: "[the bullet] would also make me just kind of paranoid because I felt like it wasn't fully fixed". In general, participants would feel less safe and be more protective of themselves. While most participants were guarded, some would not see people at all because they thought people could be crazy and they never knew who might hurt them. One participant

expressed this sentiment as, “you can´t trust anybody”. This paranoia was pervasive, but fortunately, it appeared to lessen over time.

Shame, regret, and pride were used to describe how participants felt about living with a retained bullet or fragments in their body. Participants felt shame and regret when they were injured doing something they felt they should have avoided, such as intervening in a fight or going out when they should have stayed at home. However, some said they would not change their actions even if they could have avoided getting shot, usually because they were protecting someone they loved. Others felt shameful living with retained bullet fragments. They felt embarrassed and thought people would judge them for having bullet fragments in their bodies, which they believed other people would know about through gossip, or if the bullet fragments or scars were visible. In this way, the retained bullets could induce insecurities: “for a minute there I kind of balance that. […] I kind of lost a little of self-confidence”. Conversely, some participants felt proud about being shot and surviving, and felt it made them stronger. One participant called herself “bad ass” and another said he felt like “superman”. For these participants, the retained bullet was a reminder of their own strength, for example, “if I can get past this, like I said, there's nothing else that I can't overcome”. Yet other participants would insist that they were the same: “I'm still me. I still do me”. People’s different reactions depended on their ways of responding to the trauma they experience, which determined how they were able to move on with their lives.

Social Wellbeing

The participants’ social wellbeing was profoundly impacted by the experience of living with bullet fragments due to the physical and emotional effects these caused.

Many of the participants discussed that they had become much more reliant on family and friends to help them with everyday activities, because the bullet fragments often limited mobility. One participant said that two friends had moved in with him to take care of him and cook for him during recovery. A female participant expressed that her friends had become more protective of her “All my friends still, they're trying

to treat me like – like, if we go out, they be like guarding me". In general, participants were grateful for family members or friends who supported them. The retained bullet fragments reminded participants of the fragility of life, as a result they now take more care to protect the relationships that are important to them, because they realized the value of these relationships. On the other hand, some participants mentioned that they were more self-reliant following their discharge from the hospital. This was not always by choice. Some felt they were on their own (at least some of the time) and that they had no one to rely on, but others chose to be self-reliant, because they did not want other people to pity them, think they were soft, or just because they feel it is their own responsibility. Either way, participants usually described being better able to cope with the effects of the bullet when they had people in their life who could support them practically and emotionally.

A lack of trust in strangers and acquaintances was a common concern. Participants would who had been shot by strangers were more concerned about being out in public, and participants who had been shot by people they knew often said they were more selective with their relations following the shooting. One participant commented: "Sometimes, I can be scared of people sometimes. Or like the guy I seen earlier. Like, man. I think, is he going to kill me again? People, they're serious, what the hell is going on. People are, we cannot trust everybody in this world. You cannot be friends with everybody". Feeling judged for walking around with a bullet in their body was another experienced shared by multiple participants. This was especially an issue for people who had visible retained bullet fragments, or those who experienced that other people gossiped about them. The lack of trust, experiences of being judged and gossiped about often meant that participants chose to engage with a smaller social circle after their trauma.

It was often particularly useful for participants to speak with other people who had experienced similar trauma. None of the participants had been connected with people through the medical system, but a few of the participants had family members or acquaintances who also lived with retained bullet fragments. When they were able to talk with these people, they often worried less about the potential side effects of

living with a bullet, and they felt less alone in their experience. Conversely, participants who did not know anyone who live with retained bullets often felt isolated from people around them and described that they felt no one could relate to their experience. Especially female participants brought up feeling alone in their experience. One of the female participants who brought this up said: “Nobody else got [a retained bullet] but me. Everybody who I know, personally, who either got shot – they don't have a bullet. I'm the only one, like, who got the bullet in their body. I think that is so horrible. I think that's bad. I think – because nobody can relate to it.”

Participants described how having retained bullets impacted their family life. It sometimes caused conflict when the participant felt that their partner could not understand their experience or expected the participant to be able to carry on their lives as they did before they were injured. Participants sometimes felt their family members were less understanding because they could not relate to the experience: “It's […] like you had a picnic and you got that bee, you know what I mean? And it seemed like you the only person in the room its bothering. That's what a bullet in your leg feel like.” Lack of sleep and pain caused irritability that further worsened conflict with family members. Often participants were unable to return to work while recovering, which put a financial strain on the relationship that further exacerbated conflict. Even participants who described their partners as supportive felt that their family life was impacted, because they could not play with their children or be intimate with their partners due to the pain, negative mood, or limited mobility caused by the retained bullet. As people healed or felt less impacted by the retained bullet, the conflicts usually lessened, but rarely disappeared entirely.

Occupational Wellbeing

The professional lives of participants were profoundly impacted by limited mobility, pain, and irritability, which was often experienced to be caused by the retained bullet fragments. All participants were unable to work for a period of time after the firearm injury. Most participants worked in jobs that required physical labor, such as work in kitchens or garages, which meant that limited mobility from the retained bullet

significantly impaired their ability be complete work tasks. Occupational life was tied to both the necessity of making money and to feeling joy and purpose in their lives. For those primarily motivated by the need to make a living, the retained bullet fragments presented a practical obstacle. One participant expressed: “I really want to quit my job now 'cause it hurts. It hurts to do anything. But I can't. I have to keep working.” For some people working causes pain or other physical events, such as a mechanic whose shoulder would regularly dislocate at work. Others continued in their jobs but had limited functionality or needed to be more careful because they could feel the retained bullet fragments. Many participants could not continue in their former line of work because it was too physically demanding, which meant that they were temporarily unemployed while looking for new employment. Similarly, some participants became unemployed but hoped to return after recovering from their injuries. For a few participants, the injury became a motivator to work harder or go back to school because they realized, they wanted more out of life, but some participants lost their professional dreams, such as opening their own car repair shop, after the injury. For these participants, the bullet fragments were either a reminder to do better and push themselves further, or a reminder of the professional limitations they now experienced.

For some participants, the retained bullet fragments impact the social relations they have at work. Irritability was often the cause of these altered relations because participants would be more prone to argue with their boss or colleagues when they were in pain or exhausted from lack of sleep. Paranoia was another factor that impacted relations at work. One private business owner, for example, expressed that he was much pickier about who he chose to work with because he no longer trusted people as easily, after a previous client had shot him. While the physical effects of the bullet lessened over time, there was no indication from our data that professional relations at work improved over time if they had been negatively impacted by the trauma.

Coping Mechanisms

Participants described how they developed mechanisms to cope with the psychological effects of having retained bullet fragments in their body. These coping mechanisms fell into three different categories.

Firstly, they focused on processing the trauma. Participants often used their social networks, such as their partners, families, friends, or religious networks to talk through the events and the ongoing effects on their lives. Some participants described benefitting from therapy, which helped them reframe what happened to them, but many participants described that their social networks were more helpful, because friends and family knew them better. Crucially, a significant proportion of the processing was self-reliant. Participants described engaging in self-talk. They helped themselves through the trauma by making sense of what happened to them and they told themselves that the experience had made them stronger: “I look at it like if you were to give me an almost impossible task, I'm gonna look at it and I'm gonna be, "I can do that." You might be, ‘Why do you have such confidence?’ Because I've been through so much that this is not gonna tear me down. This is not gonna keep me down. This is not gonna do anything to me”.

Secondly, participants would try to distract themselves. This might entail focusing on the good things: “I try not to worry about the negatives too much on me. I can't go in the past and change it. So, I just focus on getting better, exercising and I just focus on all the positive stuff”. They might refocus negative emotions to gratitude for being alive or attempt to distract themselves with activities they enjoy such as singing, going outside, or working on practical projects. Some participants would distract themselves with alcohol: One participant used to drink until she blacked out to keep nightmares away so that she could sleep. Another said he drinks to the point where he pukes up blood, because it helps him deal with physical and mental pain. However, all the participants who relied on alcohol said that it does not help once the intoxication wears off. As such, the substance use is an attempt to nullify or suppress the physical and emotional pain, but it does not help people process the trauma. Marijuana was also used by many participants to lessen their pain or frustration, but none of the participants described adverse effects from this type of substance

use: Instead, it helped them sleep and it helped them calm down. Whichever distraction methods participants relied upon, it seemed to offer them a temporary reprieve from their agony, but it rarely solved the practical problems they experienced.

Thirdly, participants would problem-solve to lessen the practical effects of the bullet on their lives. This primarily involved attempts to get the bullet removed. Having a foreign object in their body was the greatest concern for participants, because they worried what it could do to them in the future. In addition to this, many participants felt that it was "unnatural" to have a bullet in their body. Some could feel the bullet, but others wanted it removed purely for psychological reasons. For example, one participant commented: "It's like a reminder. It's like a trophy. Like somebody got their trophy in me" and another said "I can't live with this in my arm for the rest of my life [...] I'm always gonna think about this." Participants felt having the retained bullet fragments removed would alleviate their psychological burden, they said they would worry less, and that having the bullet removed would bring things back to how they were before.

Discussion

Key Findings

This study found that retained bullet fragments impact four elements of psychological wellbeing (shown in figure 1): physical, emotional, social, and occupational wellbeing. Each of these elements is intertwined with others, in how they influence participants lives. Firstly, retained bullets cause excess pain and limited mobility. Secondly, they impacted the participant's mood by causing frustration, anger, regret, shame, fear, and pride and contribute to psychiatric symptoms such as flashbacks nightmares, paranoia, hypervigilance, and anxiety. Thirdly, social wellbeing was impacted because pain, limited mobility, and emotional and psychiatric symptoms caused by the retained bullets strained participants' ability to maintain social relations. Yet, the retained bullet also prompted some participants to value their close family networks more, especially when these were a source of support during the traumatic aftermath. Fourthly,

participants' occupational life was profoundly impacted because the retained bullet fragments caused pain and limited mobility that kept them from returning to their work and/or serving in the same job functions they had prior to the shooting. On the other hand, the retained bullet fragments served as a reminder that life is fragile and that they need to make the most of it while they have it, which inspired some to go back to school and/or work harder.

These four elements of psychological effects are also interconnected. For example, the physical effects of the bullet (pain, lack of sleep, and limited mobility), impacted participants' emotional wellbeing, social relations, and occupational opportunities. The emotional response to the retained bullets also directly impacted participants' social and occupational relations. Whereas social wellbeing helped determine how quickly people recovered emotionally and physically and when they could return to work. Lastly, occupational wellbeing was important for emotional health and lack of employment negatively impacted social relations.

Participants displayed a remarkable resiliency and were skilled at finding ways to cope. They used their social networks, medical professionals, religious communities, and survivors with similar trauma to process the experience of living with retained bullets fragments. This process usually centered around reframing the experience so they could make their own productive narrative about the retained bullet fragments they had in their body. Self-talk was frequently employed by participants to reinforce their belief in themselves. Participants also tried to distract themselves with activities they enjoyed and things they were grateful for. However, some participants relied on marijuana or alcohol to distract from their trauma, but the latter only seemed to delay the psychiatric symptoms rather than remove them. It is probable that the flashbacks and nightmares only subside once the trauma has been processed, therefore avoidance strategies would not be effective. Action-oriented coping mechanisms included solutions that would solve the problem of the retained bullet in the long term. Participants were exploring options for removal, so that they would no

longer experience symptoms from the retained bullet or have to worry about potential future complications.

Developing a Model for Psychological Wellbeing after Trauma

In current literature there are two models for psychological wellbeing, but neither model considers the impacts of trauma.

Psychological wellbeing was first conceptualized by the psychologist Carol Ryff, who noticed that researchers tended to study psychological *dysfunction* far more than positive psychological function (Ryff, 1995). However, in Ryff's attempt to make up for the over-focus on psychological dysfunction by making a model for psychological wellbeing, she neglected to include psychiatric problems as a well-defined part of the model. Ryff's model also does not include physical elements of wellbeing, although mental and physical health are intrinsically linked (Mcphie, 2019). Physical health is a critical aspect of environmental mastery and autonomy, which are two of the six elements in Ryff's model, but in her descriptions, she does not seem to consider this impact (Ryff, 1995).

Another model for positive psychological wellbeing was developed by Coiffait and Leedham (2016). This model includes physical elements such as sensory *stimulation* and *movement and exercise*, but it was developed for people with severe and profound intellectual and developmental disabilities. As such, it does not include any categories for higher function (Coiffait & Leedham, 2016).

Our study contributes to this literature by developing a model for psychological wellbeing after trauma. While Ryff´s model is for people of normal intelligence and function and Coiffait and Leedham´s model is for people with very low intelligence, either model examines psychological wellbeing as an organic concept that might develop naturally over the course of a life. Neither model explores or seeks to describe what happens to psychological wellbeing when one experiences a traumatic event, which will inevitably impact one's wellbeing. Through our results, we propose a trauma-related psychological wellbeing model with four

main components: physical wellbeing, emotional wellbeing, social wellbeing, and occupational wellbeing, each of which is interconnected and impacted when one experiences trauma.

Significance of Study for Clinical Practice

This study is novel in being the first qualitative study of the psychological consequences of living with retained bullet fragments. It goes beyond the existing literature which only establishes a statistical relationship between retained bullets and depression (Smith et al., 2018), without exploring why this relationship exists. Moreover, understanding the emic perspective from those living with a retained bullet allows us to describe this experience more accurately and differentiate the various elements of psychological wellbeing that are impacted.

With our results we can begin to make recommendations on how surgeons and might handle retained bullet fragments. Currently, mental health is only rarely a concern when surgeons determine whether to remove retained bullets (Smith et al. 2020). Our findings underscore the importance of the mental health of patients as an additional consideration in determining whether bullets and fragments should be removed from the bodies of survivors. Furthermore, our results support the development of other initiatives for survivors of firearm violence. Specifically, participants who knew someone else with retained bullets greatly benefitted from speaking with them about their experiences. This merit the question of whether a peer-sharing process could be formalized to assist victims to process the psychological effects of the retained bullet. Further research may use focus group discussions of survivors with retained bullet fragments to examine whether this helps survivors better process their trauma. In sum, our findings can help create health interventions to support the psychological wellbeing of survivors of firearm violence who have retained bullets or fragments in their body.

Limitations

Despite our efforts to recruit for greater racial and gender diversity, the participants of this study were primarily Black American and male. This presents a limitation to the study; it primarily represents the

perspectives of Black American men. While this demographic is generally reflective of the population treated for firearm injury at Grady Memorial Hospital,[5] future studies should explore how women and people of other racial groups experience living with retained bullets.

Conclusion

This study highlights the importance of considering the psychological consequences of retained bullet fragments. We found that the physical, emotional, social, and occupational wellbeing of survivors is impacted by living with a retained bullet. Our results suggest that trauma surgeons should consider these phycological effects of living with retained bullet fragments when deciding on whether to remove the bullet. Participants in this study had clear psychological impacts from their retained bullet fragments, leading to many of them wanting their retained bullet fragments removed if at all feasible.

Public Health Implications

Every year, approximately 75 000 people in the United States obtain retained bullets or fragments after firearm injury.[6] These retained bullet fragments are rarely removed after initial hospitalization (Smith et al., 2020). Only 12.9% and 4% of surgeons report that they would consider anxiety or PTSD respectively when deciding whether to remove retained bullets or fragments (Smith et al., 2020), although retained bullet fragments have been shown to be significantly correlated with adverse psychological consequences (Smith et al., 2018). This study was the first if its kind in several ways. It is the first study to explore why there is a correlation between psychological wellbeing and retained bullets and the first study to use qualitative research methods to examine this link.

The implications of our findings are that:

[5] Confirmed in personal communication with a representative from Grady Memorial Hospital.
[6] Author calculations based on data from Smith et al. (2018), CDC (2020) and Nee at al. (2021).

- Concern, worry, anxiety, and other psychological ill-effects are common in Individuals with retained bullet fragments after firearm injury. These could be precursors to mental disorders with potential for long-lasting impact on overall health.
- Psychological consequences of retained bullet fragments should be a consideration in clinicians' decisions on whether to remove bullets or fragments from the bodies of survivors of firearm injury.
- If bullets or fragments cannot be removed at the time of the index injury, then it should be discussed at follow-up appointments as routine practice. At this follow-up, psychological wellbeing should be assessed and discussed as a factor for whether the bullet fragments are removed.
- Clinicians should be educated about the ways in which retained bullet fragments can impact psychological wellbeing of survivors so that they are better able to counsel patients and advise on bullet removal.
- Peer support groups for survivors with retained bullet fragments should be piloted to determine whether this is an effective way to support the psychological needs of patients.
- Pain from retained bullet fragments is a notable symptom that clinicians ought to enquire about when following up with patients. Chronic pain has been linked to depression, fatigue, decreased quality of sleep, impaired social functioning, and overall poorer physical and mental health (Ashburn et al., 1999, Ataoğlu et al. 2013).
- Elevated blood lead levels are associated with retained bullet fragments necessitating guidelines for screening and treatment of high levels to prevent lead toxicity (such as plumbism). Lead exposure can have serious health effects including behavioral and neurologic symptoms, and many of the participants were concerned about the possibility for lead poisoning. In line with previous recommendations (Nickel et al., 2018), we suggest that clinicians ought to monitor blood lead levels in patients.

This area of research remains understudied, but with both a quantitative study (Smith et al. 2018) and now a qualitative study supporting the association between mental health and retained bullets, more funding ought to be allocated for interventions or future studies on this topic.

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Appendix

FINAL In-Depth Interview Guide

Retained Bullets & Psychological Wellbeing

Thank you for agreeing to an interview today, we really appreciate your time.

My name is_____. We are conducting research with survivors of gunshot injury who still have a bullet

or bullet fragments in their body after the injury. We want to better understand how this affects people's lives and feel that the best way to do this is to speak directly with people like yourself.

We are most interested to hear about your personal experiences on living with a bullet in your body, so there are no right or wrong answers to the questions, we are most interested in your experiences and opinions. We understand that the gunshot injury may cause some problems for you, but our interest is in how the *bullet in your body* affects you, and our questions will focus on this aspect. Our aim is to use the information from this study to improve medical care for people who have a retained bullet after gunshot injuries.

I will ask you some questions about specific issues but feel free to share other things you feel are important on the different topics. Also, I want to let you know that your participation is completely voluntary. You don't have to answer any question if you prefer not to and you can stop the interview at any time.

We want to accurately capture everything you say so that we have all the information we need to make recommendations from this study. To help us do that, I would like to record our discussion. The reason for recording is so that we don't miss anything you say, and so that the rest of our research team can also hear your experiences and opinions exactly. Everything you share with us today will remain completely confidential and will only be used by our research team to improve medical care. Your name will not be used when we share what we learned in all our interviews, so no one can identify you. **Do I have your permission to record our discussion?**

Our interview will last about one hour. **Do you have any questions before we start?** If you have any questions or need clarifications at any point during the interview, feel free to ask as well.

[ANSWER ANY QUESTIONS AND BEGIN RECORDING IF PERMISSION IS GIVEN]

A. Warm-up Questions

I would like to begin by asking you a little about your gunshot injury.

1. Could you briefly tell me how your gunshot injury happened? (probe: when it happened?)

2. When you were in the hospital for your injury, what did doctors tell you about the bullet or fragments in your body?

   Probes: What was left in your body after the injury?

   How did doctors explain leaving this in your body?

3. Can you feel the bullet/fragments in any way? (probe: where, when, has location changed)

B. Functional Effects of Retained Bullet

I would like to understand how the bullet in your body affects your daily activities.

4. How does having a bullet in your body affect the things you do in your daily life?
   (probe: work duties, home activities, personal/social life – positive & negative effects)

C. Perceptions of Retained Bullet

Next I would like to hear your thoughts about the bullet in your body.

5. How does it feel knowing that you have a bullet in your body after the injury?

    a. How much do you think about the bullet in your body?
    (probe: What do you think about? When? What triggers these thoughts?)

6. How do you feel about having the bullet removed? (probe: why? how often think about this?)

D. Psychological Effects of Retained Bullet

I would now like to ask about your feelings related to the bullet/fragments in your body.

7. In what ways does having a bullet in your body affect your emotional wellbeing – such as your mood, concentration, or memories of the gunshot injury?

    a. How does knowing you have a bullet in your body affect your general mood?
    (probe: describe mood? How do you feel? How does it affect what you do?)

    b. To what extent does the bullet in your body trigger unwanted memories of the gunshot injury? (probe: what happens? how often? How do you feel?)

    c. To what extent do you think the bullet in your body causes nightmares? (probe: how often)

    d. How does having a bullet in your body make you feel about yourself? (e.g. feeling low, self-blame/guilt/shame about incident) (probe: how/why does the bullet cause these feelings?)

8. How openly do you share your feelings about having a bullet in your body with other people?
   (probe: who with (family/clinicians), what share, why share/not share)

E. Closing

We are coming to the end of the interview now, I have two last questions.

9. Of all the things we have discussed, what is the *biggest* effect on your life from living with a bullet in your body?

10. What would you like doctors to know about living with a bullet in your body?

Thank you for participating in this interview, we really appreciate your time and sharing your experience with us.