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# Mass Shootings As the New Normal: An Evaluation of Wikipedia Data and Flashbulb Memories as a Measurement of Public Perception

by

Richard Belz

Bachelor of Science, SUNY Fredonia, 2016

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Submitted to the Graduate Faculty

of the

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This thesis, submitted by Richard Belz in partial fulfillment of the requirements for the degree of Master of Arts from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Richard Belz
October 26, 2020

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## Abstract

**Objectives:** As mass shootings have become more frequent in recent years, one question that arises is whether the public's attention and memory of these mass shootings may be becoming less salient over time. To evaluate changes in the saliency and public interest in these tragedies, this two-part study 1) utilized open access data from Wikipedia and 2) measured the presence of flashbulb memories (FBM) for these events.

**Methods:** For Part I, changes in byte size and edits in 19 mass shooting Wikipedia articles were examined over 12 months to determine public interest in these events. In Part II, 500 participants responded to an online MTurk survey about their FBMs of 22 mass shootings that occurred from 1999 to 2018.

**Results:** Part I results were mixed. Byte size of Wikipedia shooting posts one year after each shooting tended to be larger for more recent shootings. The number of edits showed no significant difference and more recent shootings showed a sharper drop in byte size and number of edits across 12 months. Part II findings indicated that participants reported FBM of these mass shootings. The Columbine Shooting in 1999 was the shooting most frequently identified as an FBM, although the date of the shooting did not appear to be a strong predictor of FBMs. Participants reporting mental illness, knowing someone affected by a mass shooting, and other factors predicted reporting FBMs of shootings. Many participants also reported remembering mass shootings that never occurred.

**Conclusions:** The saliency of mass shootings in the U.S. appears to be influenced by various factors, including individual characteristics and characteristics of the shootings. Whether saliency in mass shootings has waned over time is difficult to conclude based on the mixed results of Study 1 and 2. Potential implications for research and public policy are discussed.

# Mass Shootings As the New Normal: An Evaluation of Wikipedia Data and Flashbulb Memories as a Measurement of Public Perception

Gun violence and misuse is a matter of public health concern in the United States. Mass shootings or mass killings are a particular kind of gun violence, defined by the Federal Bureau of Investigation (FBI) as 3 or more people being killed in a single incident (Blair & Schweit, 2014; Advanced Law Enforcement Rapid Response Training Center & FBI, 2018). More than 330 people have been killed and over 800 have been wounded in mass shooting incidents from 2014 to 2018 in the United States (Follman, Aronsen, & Pan, 2019). Although mass shootings are not the primary source of gun related incidents in the U.S., their frequent occurrence results in continual media coverage, active shooter drills at schools across America, and continuous debates about proposed legislation of having armed guards and teachers at schools and in public places (Haner et al., 2019; Jonson, 2017; Jonson, Moon, & Hendry, 2018; see Lankford, 2016). Therefore, the repercussions of mass shootings in the United States appear to be diverse, enduring, and widespread.

The amount of mass shootings that occur in the U.S. has also been increasing in the last twenty years. Between 1977 to 1997 there were 30 mass shootings in the U.S., and more than 3 times as many in the decade that followed, with 91 mass shootings between 1998 and 2018 (Follman et al., 2019). As mass shootings have become more frequent, a question that arises is whether the public's attention and perception of these mass shootings have changed. More specifically, have mass shootings become less salient to members of the American public? The frequency of these tragic events may result in behavioral habituation, as the response to these events diminishes after repeated stimulation (Rankin et al., 2009). This habituation to mass shootings, resulting in a decrease in the saliency of mass shootings over time, could be an

important barrier to public policies aimed at reducing the frequency of mass shootings and mitigate their impact, particularly if these shootings are seen as unpreventable or as the result of living in American society (see Haner, 2019).

Examining changes in how the public views, consumes, and disseminates information about these shootings online may provide insights into how the saliency of these shootings might be waning in recent years. In the current two-part study, we first examined Wikipedia data to evaluate changes in public interest in mass shootings over time using the edits, byte size, and page views of articles regarding specific mass shootings from 1999 to 2018. In the second part of the study, we surveyed individuals about their flashbulb memories (FBM) of these events. The rationale for this study and accompanying hypotheses are outlined below.

## Open Access Data

Preliminary evidence has shown that the saliency of mass shootings may be waning. Legerski and Nedegaard (2018) used Google Trends data to measure the relative frequency of the term "shooting" searched by individuals within the U.S. during the two-week period following 19 of the largest mass shootings in the U.S. since 2004. They found that spikes in Google searches using the term "shooting" strongly coincided with the dates of the mass shootings that included 8 or more fatalities. They also found a significant relationship between the death toll of these individual shootings and the relative number of shooting-related Google searches. Legerski and Nedegaard (2018) were able to show that significant differences were present in the slope of change in shooting-related Google searches following these shootings, with more recent shootings typically having a steeper decline in slope in shooting-related Googled searches during the two weeks following the shooting, suggesting U.S. media

consumers may be becoming less interested in mass shootings in recent years. One of the aims of the current study was to corroborate these findings by continuing and expanding the use of open access datasets using Wikipedia data.

### *Wikipedia*

Wikipedia is an online, open access database of knowledge and information founded in 2001 that allows users to contribute to various topics from around the world. It is an open educational resource that connects writers and editors to various communities around the world (Di Lauro & Johinke, 2017). Wikipedia articles are free to access with an Internet connection, and users provide citations for their contributions. In relation to memory, Wikipedia can be conceptualized as a worldwide memory location where participants can express and debate differing points of view that leads to the formation and acknowledgement of shared knowledge that reflects collective memory of a society (Pentzold, 2009).

Wikipedia can be a useful data source for studying different aspects of human behavior. The website has been used in behavioral research studies addressing a range of topics, including collective memory of the Vietnam War (Luyt, 2015), group diversity (Ren, Chen, & Riedl, 2016), and collaborative writing (Di Lauro & Johinke, 2017; Lin, Bonk, & Sajjapanroj, 2008). This research can be done by accessing both the content of the article's information, as well as quantitative data made public by the company, including: total number of page views, total byte size of the article, and amount of edits over time. Measures of online information-seeking behavior may have the potential to predict behavior trends and provide important insights into public opinion (Smith & Gustafson, 2017). For example, Wikipedia page views have been used in conjunction with polling data to significantly predict election results up to 28 weeks before

election day, with Wikipedia data significantly adding to the model (Smith & Gustafson, 2017). Therefore, measuring page views, edits, and content of the Wikipedia posts can serve as a valuable research tool for understanding public interest.

For example, consider research by Keegan, Gergle, and Contractor (2011) on patterns of activity on Wikipedia following a 2011 earthquake and tsunami. They utilized 22 articles that were created after the earthquake and tsunami events that included articles about the event itself, nuclear accidents, humanitarian response, event timelines, and a list of damaged cities and towns, which was part of 84 Wikipedia articles that were affected by the incident. They examined the changes in page views, unique editors, and revisions by day for the primary article about the earthquake and tsunami, where the number of editors and revisions tracked each other relatively constantly, and activity by editor involvement and revisions decayed rapidly and stabilized a few weeks after the event. An examination of the changes in revisions and unique editors by day for articles that predate the earthquake and that follow the earthquake revealed a concentration in activity across these articles immediately after the event, where both sets of article categories attracted similar levels of attention four days after the event, but a focus on newer articles (i.e., increased revisions and editor attention) occurred as focus shifted to potential nuclear incidents resulting from the event, which decreased as the nuclear sites stabilized. Overall, a plot of changes in revisions and editors over time revealed a downward trend from the date of the event to the end of the month. Thus, the authors found there was intense interest and attention focused on the topic in the immediate aftermath (e.g., over a thousand unique editors contributing to articles) and a subsequent decline and dispersion of attention and involvement for more newly created relevant articles, which also tapered off over time. A similar analysis on

mass shootings Wikipedia posts may follow a similar trend, suggesting changes in the saliency of these public events.

### *Flashbulb Memories*

While a careful examination of Wikipedia posts can provide one measure of changes in the saliency of mass shootings, another approach might be to evaluate individuals' memories of these tragic events. A vivid memory of a life event, when individuals can recall first learning of that event, is defined as a flashbulb memory (FBM; Luminet & Curci, 2018). Systematic research on FBMs began in the late 1970s with the seminal work by Brown and Kulik (1977), who proposed the criteria that FBM should consist of six components, termed canonical features. These six criteria including being able to report (1) where the individual first learned about the event (the place), (2) ongoing event or activity that was occurring before learning about the event (the ongoing activity), (3) the person who informed the individual of the event (the informant), (4) the affect of other people upon hearing the event (the affect of others), (5) the affect of the individual upon hearing the event (the individual's own affect), and (6) the immediate aftermath of the individual directly after learning about the event (the aftermath).

Brown and Kulik's (1977) seminal work focused on FBMs of the 1963 assassination of President Kennedy, and memory researchers have extended FBM studies to a number of different events. These events have ranged from national tragedies in the U.S. such as September 11 (Curci & Luminet, 2006; Hirst et al., 2015), the Columbia space shuttle disaster (Kershaw et al., 2009), and the Challenger space shuttle disaster (Bohannon, 1988; Neisser & Harsch, 1992). Events outside of the United States have also been evaluated, including the death of French President Mitterrand (Curci et al., 2001), terrorist bombings in Israel (Edery-Halpern & Nachson,

2004), the 1999 Marmara earthquake (Er, 2003), the Paris attacks in 2015 (Gandolphe & El Haj, 2017), the Hillsborough Disaster in England (Wright, 1993), and the German occupation of Denmark during World War II (Berntsen & Rubin, 2006). Collectively, these studies have shown that FBMs share common characteristics among a range of different public events. To our knowledge, however, no studies have been published that have examined FBMs of mass shootings in the U.S. or elsewhere.

## Influences on FBMs

Memory researchers interested in FBMs have frequently attempted to identify factors that might contribute to, and be associated with, FBMs. Understanding the factors that contribute to FBMs can provide insights into understanding the differential impact of these public events on individuals. Many researchers interested in the influences on FBMs have focused on rehearsal, group differences, and cognitive/emotional functioning.

### *Rehearsal*

Rehearsal, especially within the social context, is believed to contribute to the development of FBMs as individuals collectively discuss and engage in meaning making with people within their public sphere in attempt to understand an event (Bohannon, 1988). Thus, increased rehearsal has been associated with FBM formation (Bohannon & Symons, 1992; Davidson & Glisky, 2002; Otani et al., 2005; Tekcan & Peynircioglu, 2002; Tinti et al., 2014).

Rehearsal can be intentionally or unintentionally influenced by media communication, involving acts such as following media proceedings related to a particular event, that can directly influence remembering (Curci et al., 2001; Schaefer et al., 2011). Rehearsal through media

exposure has been shown to be able to increase memory errors and reporting details of memories for events that did not occur, i.e. memories that are false (Crombag et al., 1996), and for reporting false memories for events that did occur, which may vary by social group (Ost et al., 2008). Media exposure can also increase retrieval-induced forgetting within an individual and retrieval-induced forgetting that is socially shared, indicating conversations about a particular event and one's circumstances surrounding that event can alter the memories of both speakers and listeners (Coman et al., 2009). Media exposure can be conceptualized as a component of cognitive and social processes of rehearsal that provide the backdrop for the larger cultural context of FBM (Wang & Aydin, 2018). One of the ways this study examined public perception of mass shootings was by examining FBM in the context of media exposure and rehearsal to better understand the role these factors play in FBM formation and endurance over time.

### *Group Membership*

Variations in individual and group characteristics may also influence the saliency of memories. This might be, in part, due to the different meanings group members associate with events and circumstances they collectively experience. People are more likely to remember things that are viewed as important or meaningful (Symons & Johnson, 1997). What individuals view as important and meaningful is often shaped by the shared experiences and perspectives of their group. The impact of group membership on FBM has been examined in several demographic categories. Brown and Kulik (1977) found substantially more FBMs, along with higher ratings for consequentiality, among African Americans compared to white Americans for news of the assassination of four civil rights political leaders. Yarmey and Bull (1978) found that people from the U.S. tended to have more FBMs about the assassination of President Kennedy

than people from Canada, although this difference was only significant for people in the 18 to 22 age range.

Researchers have observed that age appears to be an important factor in the formation of FBMs. Some evidence suggests that individuals are mostly likely to encode events as FBM if the event occurred when the individual was between 10 and 30 years old (Deane et al., 2016; Pennebaker et al., 1997; Luminet & Curci, 2018). Age, shared experiences, and other generational factors may also produce cohort effects that shape the meaning, and subsequent formation, of FBMs for specific events. A national survey by the Pew Research Center examined age differences in how Americans reflected on the relative importance of recent historic events, including the September 11 attacks, Obama election and Sandy Hook shooting (Deane et al., 2016). Although the September 11 attacks were viewed as the most important historical event across all four generation groups (Millennials, Generation X, Baby Boomers, and the Silent Generation), there were many significant differences. When asked to identify the top ten significant events in recent history, five of the top ten events for Millennial group members included the Sandy Hook and Pulse nightclub shootings, the death of Osama bin Laden, the Boston Marathon bombing, and the Great Recession. None of these 5 events, however, appeared in the top ten list for any of the other generation groups. Therefore, age may be an important consideration when evaluating the saliency of FBMs of mass shootings.

Political party has been shown to be an important factor in influencing biases and how people perceive the world (Ditto et al., 2018), which may influence how people view events. A false memory study by Frenda and colleagues (2013) demonstrated that political views can make people susceptible to false memories. They found liberals were more likely than conservatives to falsely remember former President George W. Bush vacationing during the Hurricane Katrina

catastrophe, and conservatives were more likely to falsely remember seeing former President Barack Obama shaking the hand of former Iranian president Mahmoud Ahmadinejad. Frenda and colleagues (2013) proposed that events are implanted in memory when they align with an individual's preexisting, congruent attitudes and evaluations due to feelings of recognition and familiarity. In this case, this would be based on the degree of fit between an individual's attitudes toward the person involved and attitudes toward the behavior depicted in an event. The impact of political affiliation on FBM has also been studied. Rice, Hamamouche, and Bohannon (2018) examined the impact of race and political preference on FBM for the 2008 election of former President Barack Obama. They found that nonwhite participants recounted their discovery stories regarding the election of the first nonwhite President of the United States three times more often than white participants. Political affiliation played a larger role than race, where liberals exhibited greater recall of the election than moderates or conservatives (Rice et al., 2018). Political affiliations may be important to consider when conducting research on mass shootings because of the potential difference in how members may view these tragic events, as well as because of political differences in gun ownership.

Gun ownership may be another important factor when considering the saliency and memory of mass shootings. Gun owners tend to view mass shootings differently than non-gun owners, being more apt to attribute shootings to the influences of popular culture and poor parenting than individuals who do not own guns (Joslyn & Haider-Markel, 2017). Gun owners may also view mass shootings as threats to gun ownership, which may enhance their saliency. An aim of this study is to identify individual and group characteristics such as gun ownership, age, race, and political beliefs that are salient in the formation of FBM and thus have a potential impact on public perception of mass shootings in the United States.

### *Cognitive Functioning and Mental Illness*

A review by Tat, Gold, & Budson (2018) found that most studies examining FBM characteristics for clinical populations have focused on disorders that focus on cognitive impairment, such as Alzheimer's disease (AD), mild cognitive impairment (MCI), and epilepsy. People with MCI and AD exhibit impairment in the ability to learn new information, where people with MCI are able to form FBM to an extent and people with AD are less likely (Tat et al., 2018). A study by Metternich and colleagues (2013) examined FBM in people with left and right temporal lobe epilepsy and found that they were able to form FBMs but exhibited impairment in the quality of their FBMs (i.e., FBMs were less consistent over time) compared to a healthy older adult control group. Qin and colleagues (2003) examined FBM in people with posttraumatic stress disorder (PTSD) and found that FBMs in people with PTSD were similar for people who also experienced trauma but did not develop PTSD, where both groups were similar on measures of initial autobiographical memory and event memory for factual details of the 9/11 attacks. However, FBMs for people with PTSD become more inaccurate and distorted over time, where significant forgetting was present over the 9 months in event memory for PTSD participants only.

The relationship between other prevalent mental disorders such as depression and anxiety and FBM is less clear, although studies have found a relationship between depression and memory deficits (Asarnow et al., 2014; Burt et al., 1995; Cipolli et al., 1996; Pauls et al., 2015; Semkovska et al., 2019), as well as anxiety and memory deficits (Gulpers et al., 2016; Herrera et al., 2017; Moran, 2016). A meta-analysis conducted by Semkovska and colleagues (2019) found that deficits in selective attention, working memory, and long-term memory can continue even when in remission from a major depressive episode, and can worsen with repeated episodes. In a

review of the literature on anxiety and memory impairment, Moran (2016) identified that self-reported measures of anxiety are reliably related to poorer working memory performance, and that anxiety is related to poorer performance across a wide variety of tasks (e.g. ego-threat, threat-of-shock) whether the anxiety is self-reported or experimentally induced. Klein and Boals (2001) found greater life stress led to poorer working memory performance, where cognitive representations of stressful life events compete with task demands for resources of attention. One of the aims of this study was to explore the possible relationship between mental health and FBM by measuring mental health variables such as depressive symptoms, anxiety symptoms, and experience of potentially traumatic events.

Research has demonstrated a relationship between mental illness and memory for negative life events. A review by Lemogne and colleagues (2006) of three major features of autobiographical memory functioning in depression found an increase in general memory retrieval (overgenerality), a mood-congruent memory effect, and the high occurrence of intrusive memories of stressful events. People with depression tend to recall repeated events (categorical overgeneral memories) rather than single episodes (Lemogne et al., 2006). This phenomenon, termed overgenerality, is more evident with positive events than negative events, is related to the avoidance of intrusive memories, and can persist after remission. When presented with positive and negative cue words and asked to retrieve specific personal events (i.e. the Williams' Autobiographical Memory Test [AMT]), depressed patients (unlike matched controls) are less specific in their memories compared to matched controls. In addition, a study by Romero and colleagues (2014) found people who formerly had depression exhibited greater recall of negative adjectives from a selection of words than people who never had depression. The mood-congruent effect has been identified in depression for autobiographical and non-autobiographical memory,

where people with depression spontaneously recall more negative memories than positive memories (Lemogne et al., 2006). Depression has also been associated with a high occurrence of spontaneous intrusive memories of stressful life events, where intrusions and related avoidance are positively correlated with overgenerality (Lemogne et al., 2006). In addition, the phenomenon of mood dependency effects in memory, where memories that match an individual's mood are more accessible, have been examined in the context of various disorders such as depression (Alexander & Guenther, 1986) and anxiety (Robinson & Rollings, 2011). Based on the research outlined above, people with depressive or anxious symptoms (i.e., in negative mood states) may be more likely to recall negative events, such as memories relating to mass shootings.

Anxiety has also been shown to have an impact on memory for negative life events. Research has shown that people who have anxiety tend to focus more automatically on negative event details, causing them to remember those details better (Hertel & Brozovich, 2010; Ferguson et al., 2007). However, people with anxiety tend to have more difficulty remembering contextual details, perhaps due to a focus on emotional aspects of an event that takes up cognitive resources for attending to nonemotional details of an event (Waring et al., 2010). Thus, people with anxiety may exhibit difficulties forming complete mental representations of events. This study aimed to examine the potential implications of depression and anxiety symptoms, in conjunction with negative life events, on FBM formation for mass shootings, as well as to explore the amount of details remembered about mass shootings (e.g., shooting characteristics, canonical features of FBM) for people with and without symptoms of mental illness.

## Study 1: Wikipedia

Study 1 utilized open access data from Wikipedia to evaluate changes in the saliency and public interest of mass shootings over time. This study aimed to replicate the results of the Google Trends analyses by Legerski and Nedegaard (2018; see below) and to address whether the public's perception of mass shootings and orientation to them have changed over time in the context of open access media.

**Hypothesis 1.** Following the results of Legerski and Nedegaard (2018), we proposed that the amount of casualties would be a robust or stable predictor of public interest across shootings, with the rate of mass shooting casualties being positively correlated with interest indicators across all of the shootings. In other words, the shootings with the most casualties would tend to have the highest relative interest, i.e. Wikipedia articles would have more active public involvement (e.g., more edits, page views, and greater byte size) for events with higher casualties. Thus, Google Trend and Wikipedia data would show similar results when utilized as variables measuring public perception.

**Hypothesis 2.** We hypothesized that the Wikipedia data would show differences in responses to mass shootings over time. More specifically, it was proposed that, in comparison to early shootings, shootings that occurred more recently would have relatively fewer indicators of interest, as well as a sharper decline in interest (as measured by changes in views, edits, and byte size) in the days and months that follow.

## Method

**Measures and Procedure.** Based on an analysis of Google searches that used the term "shooting" after numerous mass shootings in the United States, Legerski and Nedegaard (2018) determined that most mass shootings required a death toll of eight or more to enter widespread national discourse. Using this criteria, we identified 19 total shootings that occurred since Wikipedia's founding in 2001 until 2018. Shootings that occurred before Wikipedia was founded in 2001 were not used in analyses because we were interested in posts written within a year of each shooting. Data from Wikipedia posts on these shootings was collected including the Total Byte Size (TBS), Total Edits (TE), and Total Page Views (TPV). These metrics were identified as potential indicators of change in public interest in these events.

Wikipedia provides data on the TBS of an article (i.e., how large the article is and a measure of how much information has been contributed to and discussed about a topic). TBS was calculated by viewing the article about a particular shooting, selecting "Page Information", then selecting "Revision history statistics". Each change in byte size is recorded and time stamped in Wikipedia, and the total amount of bytes can be computed for any time point or range. TBS was assessed 3 months, 6 months, 9 months, and 12 months after each event.

Wikipedia provides data on the TE of an article (i.e., how many times the article has been revised, which can provide a measure of how much information has been contributed to and discussed about a topic by providing the content of the changes to the article made by the edits). Revision history statistics provided by Wikipedia record each edit with a timestamp, and the total amount of edits can be computed for any time point or range. TE was assessed 3 months, 6 months, 9 months, and 12 months after each event.

Wikipedia provides data on the TPV of an article (i.e., how many times an article has been viewed in a set period). TPV was assessed 3 months, 6 months, 9 months, and 12 months after each event that occurred. Unfortunately, due to an error on the part of Wikipedia, data on TPV before July 1, 2015 is currently unavailable. As a result, TPV data was only available for a subset of the shootings in our sample ($n$ = 6). Due to limited availability of TPV, analyses of TPV were not used in the current study.

## Results

**Hypothesis 1: Relationship between casualties and Wikipedia public interest.** To address the first hypothesis, we conducted analyses to determine whether the amount of casualties were correlated with various indicators of public interest in mass shootings. Analysis of Wikipedia data was performed using SPSS. Descriptive statistics for main variables of interest (e.g., byte size, edits) are presented in Table 1.

Table 1.
*Means and Standard Deviations of Main Variables of Interest*

| | M | SD |
|---|---|---|
| Death Toll | 17.42 | 14.27 |
| Total Byte Size at 3 Months | 57,497.68 | 46,721.01 |
| Total Byte Size at 6 Months | 62,850.37 | 53,957.12 |
| Total Byte Size at 9 Months | 63,013.63 | 51,270.34 |
| Total Byte Size at 12 Months | 66,419.68 | 54,691.69 |
| Total Edits at 3 Months | 2,284.79 | 2,352.73 |
| Total Edits at 6 Months | 2,404.63 | 2,474.84 |
| Total Edits at 9 Months | 2,459.84 | 2,534.73 |
| Total Edits at 12 Months | 2,520.89 | 2,602.65 |
| Total Page Views at 3 Months | 717,104.33 | 734,775.46 |
| Total Page Views at 6 Months | 1,048,815.33 | 1,017,739.13 |
| Total Page Views at 9 Months | 1,326,204.00 | 1,302,558.26 |
| Total Page Views at 12 Months | 1,580,437.67 | 1,582,215.20 |

Correlations were conducted to examine the potential relationships among the amount of casualties and Wikipedia variables of public interest (i.e., edits and byte size). There was a

significant correlation between the death toll of the shootings and many Wikipedia public interest variables (see Table 2). To account for the potential impact of Wikipedia's increased growth and popularity over time, the total number of Wikipedia users was correlated with death toll and Wikipedia public interest variables. No significant correlations were present (see Table 2).

Table 2.
*Correlation of Number of Wikipedia Users, Death toll, and Wikipedia Variables of Public Interest*

| | 1. Number of Wikipedia Users | 2. Death Toll |
|---|---|---|
| 1. Number of Wikipedia Users | - | |
| 2. Death Toll | -0.01 | - |
| 3. Byte Size at 3 Months | -0.123 | 0.52* |
| 4. Byte Size at 6 Months | -0.136 | 0.50* |
| 5. Byte Size at 9 Months | -0.123 | 0.53* |
| 6. Byte Size at 12 Months | -0.13 | 0.53* |
| 7. Edits at 3 Months | 0.141 | 0.66** |
| 8. Edits at 6 Months | 0.137 | 0.66** |
| 9. Edits at 9 Months | 0.137 | 0.65** |
| 10. Edits at 12 Months | 0.137 | 0.65** |
| 11. Slope For Byte Size | 0.124 | -0.51* |
| 12. Slope For Edits | 0.154 | -0.61** |
| 13. Slope For Page Views | -0.114 | 0.3 |

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Additionally, when controlling for the total number of Wikipedia users, the partial correlation of death toll and various public interest variables were still significant, including dependent variables used in Wikipedia analyses (see Table 3). Thus, the amount of people who use Wikipedia to obtain information (e.g., read articles, edit articles, discuss article content and structure) about mass shootings (i.e., public interest in mass shootings) did not appear to be

related to or influenced by the increase in the amount of Wikipedia users over time as the website and concept have become more popular and a more mainstream medium. Because the number of Wikipedia users did not appear to influence any of the variables of interest, Wikipedia users were not controlled for in subsequent analyses.

Table 3.
*Partial Correlation of Death toll and Wikipedia Variables of Public Interest, Controlling for the Number of Wikipedia Users*

| | Death Toll |
|---|---|
| 1. Death Toll | - |
| 2. Byte Size at 3 Months | 0.497* |
| 3. Byte Size at 6 Months | 0.474* |
| 4. Byte Size at 9 Months | 0.509* |
| 5. Byte Size at 12 Months | 0.503* |
| 6. Edits at 3 Months | 0.652** |
| 7. Edits at 6 Months | 0.651** |
| 8. Edits at 9 Months | 0.647** |
| 9. Edits at 12 Months | 0.647** |
| 10. Byte Size Slope at 0 to 3 months | 0.497* |
| 11. Edits Slope at 0 to 3 months | 0.652** |
| 12. Edits Slope at 3 to 6 months | 0.573* |
| 13. Edits Slope at 6 to 9 months | 0.406^ |
| 14. Edits Slope at 9 to 12 months | 0.614** |
| 15. Slope For Byte Size | -0.48* |
| 16. Slope For Edits | -0.592** |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
^ Correlation approached significance ($0.05 < p < 0.10$)

**Hypothesis 2: Public interest over time using Wikipedia.** The second hypothesis addressed differences in responses to mass shootings over time, where more recent shootings were predicted to show a decline in interest in the days and months that follow. Declines in interest were measured two ways: first, by comparing the correlation of the time (i.e., date of the shooting) with the total byte size and edits at 12 months; second, correlations between time and rate of change (i.e., slope) of edits and byte size were calculated. A rate of change was calculated by examining these key indicators at four time points (i.e., 0 to 3 months, 3 to 6 months, 6 to 9 months, and 9 to 12 months from the date of the shooting).

Bivariate correlations were conducted and are presented in Table 4. The correlation between byte size at 12 months and time was significant, $r = .62$, $p = .004$, whereas the

correlation between time and edits at 12 months were *ns*. Therefore, when comparing the 19 mass shooting articles 12 months after each shooting, more recent Wikipedia articles tended to have larger byte sizes, but showed no relative significant difference in edits.

Table 4.
*Correlation Matrix of Amount of Casualties and Wikipedia Variables of Public Interest*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Time | - | | | | | |
| 2. Death Toll | 0.34 | - | | | | |
| 3. Slope For Byte Size | -0.59** | -0.48* | - | | | |
| 4. Slope For Edits | -0.63** | -0.59** | 0.86** | - | | |
| 5. Byte Size at 12 Months | 0.62** | 0.50* | -0.99** | -0.87** | - | |
| 6. Edits at 12 Months | 0.19 | 0.64** | -0.64** | -0.49* | 0.649** | - |

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Thus, a multiple regression was run to predict total byte size 12 months after the shooting using time and death toll as predictors. These variables significantly predicted total byte size at 12 months, $F(2, 19) = 7.41$, $p < .01$, $R^2 = .481$. Time ($p < .05$) significantly added to the prediction, and death toll ($p = .11$) approached significance (see Table 5). These results failed to support hypothesis 2.

Table 5.
*Multiple Regression for Predictors of Total Byte Size at 12 Months*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | -2820233.72 | [-1749976.51, 3890490.93] | | -2.635 | 0.018 |
| Time | 0.0002 | [0.00013, 0.00029] | 0.511 | 2.666 | 0.017 |
| Death Toll | 1245.24 | [509.98, 1980.5] | 0.325 | 1.694 | 0.041 |

Note: $R^2$ adjusted = .416. CI = Confidence Interval.

In terms of the rate of change in these key indicators, a significant negative correlation was present for the slope of byte size and time, $r = -.59$, $p = .007$, such that when comparing Wikipedia articles written over the years about mass shootings, the most recent events tended to

have a much steeper decline in the written content (i.e., total byte size) over the course of a year following the shooting than for articles that were written in the more distant past. A significant negative correlation was present for the slope of byte size and death toll, $r = -.48$, $p = .039$, where shootings with higher death tolls tended to have articles with a much steeper decline in the written content (i.e., total byte size) over the course of a year following the shooting than for articles that were written in the more distant past. Thus, a multiple regression was run to predict the slope of byte size using time and death toll as predictors. These variables significantly predicted the slope of byte size, $F(2, 18) = 6.208$, $p = .01$, $R^2 = .437$. Time added statistically significantly to the prediction ($p < .05$) and death toll approached significance ($p = .139$; see Table 6).

Table 6.
*Multiple Regression Analysis for Slope of Byte Size*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 228582.5 | [133502.56, 323662.42] | | 2.404 | 0.029 |
| Time | 0.000017 | [0.00001, 0.000024] | -0.486 | -2.434 | 0.027 |
| Death Toll | -101.75 | [-167.06, -36.43] | -0.311 | -1.558 | 0.139 |

Note: *R*^2 adjusted = .367. CI = Confidence Interval.

A significant negative correlation was present for the slope of edits and time, $r = -.63$, $p = .004$, such that when comparing Wikipedia articles written over the years about mass shootings, the most recent events tended to have a much steeper decline in the changes made to the written content (i.e., the amount of edits) over the course of a year following the shooting than for articles that were written in the more distant past. A significant negative correlation was present for the slope of edits and death toll, $r = -.59$, $p = .008$, where shootings with higher death tolls tended to have articles with a much steeper decline in changes to the written content (i.e., the

amount of edits) over the course of a year following the shooting than for articles that were written in the more distant past for older shootings. Thus, a multiple regression was run to predict the slope of byte size using time and death toll as predictors. These variables significantly predicted the slope of edits, $F(2, 19) = 9.915$, $p < .01$, $R^2 = .553$. Time ($p < .05$) and death toll ($p < .05$) both significantly added to the prediction (see Table 7).

Table 7.
*Multiple Regression Analysis for Slope of Edits*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 8264.3 | [5226.16, 11302.44] | | 2.72 | 0.015 |
| Time | 0.00000062 | [0.0000004, 0.0000008] | -0.487 | -2.739 | 0.015 |
| Death Toll | -4.92 | [-7.01, -2.84] | -0.419 | -2.358 | 0.031 |

Note: $R^2$ adjusted = .5. CI = Confidence Interval.

## Discussion

**Hypothesis 1: Relationship between casualties and Wikipedia public interest.** We predicted that the amount of casualties would be a robust predictor of public interest across shootings (e.g., the rate of mass shooting casualties would be positively correlated relative to byte size and edits across all of the shootings). As anticipated, there was a significant positive correlation between death toll and Wikipedia public interest variables (i.e., the rate of change of edits and byte size), which were still significant when accounting for the total amount of Wikipedia users at the time of the shooting. Additionally, death toll was a significant predictor of changes in edits and bytes over time. These findings provide support for the first hypothesis, where the shootings with more casualties tended to have higher relative interest (i.e., Wikipedia articles with more active public involvement of edits and greater byte size).

**Hypothesis 2: Public interest over time using Wikipedia.** We predicted that there would be a difference in responses to mass shootings over time, where shootings demonstrating

fewer and a sharper decline in interest over time. When comparing the 19 mass shooting articles one year after each shooting, more recent Wikipedia articles tended to have larger byte sizes, but showed no relative significant difference in edits. These results failed to support hypothesis 2, instead demonstrating that the total byte size tended to increase over time despite the amount of edits not significantly increasing. This may be due to an increase in the death toll of these more recent shootings, as death toll was also associated with an increase in byte size. Death toll approached significance as a predictor of total byte size, suggesting a significant relationship may be made apparent through analyses with more power (e.g., a larger sample size of shootings).

The slopes of changes in byte size and edits during the year following the 19 shootings were negatively correlated with time. This suggests a sharper decline in public interest in more recent shootings. The negative correlation for the slope of byte size and time demonstrated that the more recent shootings tended to have a much steeper decline in the written content (i.e., total byte size) over the course of a year following the shooting than for older shootings. Additionally, the negative correlation for the slope of edits and time demonstrated that the more recent shootings tended to have a much steeper decline in changes to the written content (i.e., total edits) over the course of a year following the shooting than for older shootings.

Multiple regression analyses further supported this trend, where an increase in time was associated with a decrease in byte size and edits (i.e., public interest) over time. In other words, more recent shootings were associated with a steeper decline in interest, providing support for the second hypothesis. Thus, the results of these analyses provide mixed results. Although the byte size of mass shooting Wikipedia articles tended to increase over time, the rate at which the total byte size and amount of edits changed over time tended to decrease, where more recent

shootings displayed a more immediate drop in the frequency of contributions by Wikipedia content creators (e.g., how often edits were made) across the 12 months that followed. This may suggest a more immediate drop in less attention or interest, compared to older shootings. This downward trend of user engagement over time has been found in other studies (e.g., Keegan et. al, 2011), and expands upon previous research by providing a wider time-frame of examining public interest in catastrophic events to reveal trends over a 20-year period compared to a monthly or yearly period.

Several limitations of this study should be noted. The use of 19 mass shooting articles provided a small sample size, which limited the types of analyses available. The inclusion of additional shootings could enable more detailed analyses, such as examining potential differences in public interest for different types of shootings (e.g., school, workplace). Despite the small sample size, however, the results demonstrated several robust findings, suggesting a larger sample size would provide further means for examining future variables and relationships of interest. Wikipedia's lack of page view data prior to 2015 provided another notable limitation, which prevented us from conducting analyses with page views as an indicator. It is our hope that Wikipedia will be able to resolve this issue and allow the public to have access to page view histories prior to 2015. Additionally, Wikipedia data based on byte size and edits reflects Wikipedia content creators, and may not reflect members of the U.S. population as a whole. The company does not provide demographic information of the contributor for each contribution; thus, we are unable to conclude whether the Wikipedia articles were made by individuals living within the United States or elsewhere.

In summary, we found support for hypothesis 1, where an increase in death toll corresponded to an increase in public interest as measured by Wikipedia articles. Results for

hypothesis 2 were mixed, where articles tended to increase in byte size over time, despite a non-significant change in edits, and a steeper decline in the change in byte size and edits (i.e., the slope) over time. Study 1 demonstrates the utility of the use of open access data to examine public interest over time, particularly for potentially traumatic events such as mass shootings. The availability of this data and results of this study should encourage researchers to freely conduct their own studies using this method of examining public interest that may be less influenced by subjective bias and potential issues with retrospective reporting (e.g., recency effect, changes in memory for an event each time it is recalled), as biases of individual memory (e.g., primacy effect, recency effect) may be better controlled for through Wikipedia's timestamped information databases (see General Discussion).

## Study 2: Flashbulb Memories

Using data collected in an online survey, Study 2 measured the presence of flashbulb memories (FBM) for mass shootings to evaluate changes in the saliency and public interest of these events over time. This study aimed to evaluate the prevalence in which individuals have FBMs of mass shooting events and to identify factors (e.g., time, group status) that may influence the saliency and vividness of mass shootings. To our knowledge, this was the first study to examine the prevalence of FBMs of mass shootings. Additionally, fictional shootings were included as a control variable, and analyses were conducted to examine factors that predict the reported recollection of these false shootings. As a continuation of Study I, we were interested in identifying whether more recent shootings were less salient to participants, as well as other factors that influenced the saliency of mass shootings. Additionally, Study 2 was done in part to address a few limitations of Study 1 by examining responses to mass shootings among a wider audience than Wikipedia content creators, allowing us to better control for differences in

demographic variables among our participants. We hoped our findings would better illuminate how the public views these shootings, and that our research might have implications for policy advocates seeking to understand factors that might influence public perception and attention to these tragic events.

**Hypothesis 1.** Based on our literature review, we hypothesized that mass shootings could be encoded, recalled, and measured using a flashbulb memory framework, and that these memories would have a moderately high prevalence among our participants. Following the standard used in FBM research (Brown & Kulik, 1997; Mahmood et al., 2004), the presence of an FBM for an event was defined as participants being able to identify at least one canonical feature (i.e., an attribute of the reception context), as established by Brown and Kulik (1977), of at least one mass shooting.

**Hypothesis 2.** We hypothesized that FBM would be associated with various characteristics of the shooting event. Based on the finding in Study 1, we predicted that shootings with higher death tolls would more commonly be identified as FBMs and that participants would be more apt to identify memories of shootings in the distant past as FBMs. We also predicted that shootings involving young individuals, either as the victim or perpetrator of the shooting, would be more salient, and thus be more frequently identified as FBM by participants.

**Hypothesis 3.** We hypothesized that FBMs would be associated with various participant characteristics, including mental health and group membership (e.g., gun ownership, political affiliation). Based on previous research (see Lemogne et al., 2006; Alexander & Guenther, 1986; Robinson & Rollings, 2011; Waldfogel, 1948), we predicted that people with depressive

symptoms, anxious symptoms, and/or more reported negative life events would exhibit greater recall of mass shootings, and thus recall more canonical features of FBM and have more FBM for mass shooting events. Additional participant characteristics (e.g., gun ownership, political affiliation, age) were explored. As part of this set of analyses, we also explored participant factors that predicted the reported recollection of memories of shootings that did not occur.

## Method

**Participants**. A total of 500 participants (52.4% female, 46.2% male, 1.4% other designation) were recruited between February 12, 2020 and March 23, 2020 through Mechanical Turk (MTurk), a crowdsourcing website operated by Amazon that allows people to request certain tasks to be completed that the performers of the tasks are compensated for. Participants received 50 cents each for completing an online questionnaire. The questionnaire was administered through Qualtrics, a software program that functions as an online survey tool for building and administering surveys. The questionnaire contained three items (i.e., "I have never fallen asleep", "I am 150 years old", "I have been to every country in the world in the past week") to serve as validity checks to identify participants who may need to be dropped from analysis due to inattentive and/or invalid responding. No participants failed these validity checks and we elected to retain all participant responses.

Participants were required to be at least 18 years old to participate in the study, which is the minimum age required to perform work on MTurk. Since the study examined the public's perception of certain phenomena and focused on perception within the U.S., only participants living in the United States were allowed to participate in the study. Participants ranged in age from 18 to 74 years old ($M$ = 38.5, $SD$ = 13.1). Seventy-seven percent of participants self-

identified as white, 10% identified as Black, 4.8% identified as Asian, and 7.2% identified as another race. Eleven percent of the sample were of Hispanic, Latino, or Spanish origin. Twenty-one percent of participants were located in the Northeast, 37% were in the Midwest, 18% were in the South, and 20% were in the West. Twenty-nine percent of participants were gun owners, 77% reported belonging to a religion, and 20% endorsed the presence of mental illness. Fifty-five percent of participants reported an annual income above $50,000 and 43% reported an annual income below $50,000. Fifty-five percent of the sample had children, 26% had friends or family who identified as LGBT, 12% endorsed the presence of epilepsy, and 27% endorsed a family history of Alzheimer's Disease. Fourteen percent of the sample reported knowing someone who was affected by a mass shooting (i.e., themselves or a loved one).

**Measures and Procedure.** Measurement tools were collected in two blocks. Block A included surveys of their memories of actual and factitious mass shootings. Block B included measures of participant demographics, emotional adjustment, life events, and attributions of blame towards mass shootings. These blocks of assessment measures were administered in random order, resulting in 55.6% of participants administered Block A materials before Block B.

In Block A, participants completed a scale developed for this study, termed the Flashbulb Memories of Mass Shootings Scale (FBMOMSS), based on the work of Gandolphe and El Haj (2017), Hirst et al. (2015), and Mahmood et al. (2004). The FBMOMSS consisted of seven sections, presented to the participant as Part A through Part G (see Appendix A). The first component of the questionnaire is the Mass Shooting Screener section (Part A). A list of 28 mass shootings was presented, including real and fictitious events. Twenty-two real shootings were selected following recommendations by Lankford (2016) and Legerski and Nedegaard (2018), including the deadliest shooting in the last 25 years. Six fictitious shootings were devised using

an online random location generator (Random Lists, 2013), and were created to provide a measure of control for accuracy in event recognition and to provide a measure of participants' abilities to accurately identify shootings. Participants were asked to identify the shooting(s) they remember. For each shooting they endorsed remembering (that actually occurred), participants were asked a series of 13 follow-up questions relating to FBM and questions about the characteristics of the shooter and the event. These questions included six questions corresponding to the canonical categories of FBM, questions that correspond to components of FBM (e.g., rehearsal), as well as questions asking about the race of the shooter and if the shooting occurred close to where the participants live. We recorded the fictitious shootings participants reported remembering, but, unlike with the shootings that did occur, we did not ask subsequent follow up questions related to the fictitious shootings. This was done to streamline the data collection process in an effort to minimize testing fatigue. After completing the FBMOMSS, participants were asked to answer a question regarding past involvement in mass shootings (i.e., "Have you ever known anyone who has ever been affected by a mass shooting").

During Block B, participants were asked to complete the demographics section and to provide their age, race, U.S. state of residence, gender, gun ownership status, belief in background checks, political ideology, history of a psychiatric or mental condition, political affiliation, sexual preference, and amount of children. Screener questions regarding memory impairment (e.g., history of Alzheimer's Disease and other memory deficits, history of epilepsy) were also included.

After finishing the demographic items, participants completed a short battery of clinical inventories. Participants completed the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), 10-item Perceived Stress Scale (PSS-10; Cohen, Kamarck, &

Mermelstein, 1983), and the Quick Inventory of Depressive Symptomatology, Self-Report (QIDS-SR16; Rush et al., 2003). Participants also completed two sets of questions related to media consumption and political engagement (see Appendix A). Three questions about frequency of media usage related to political information were adapted from Pontes, Henn, Griffiths, and Pontes (2017). A measure of political engagement was adapted from the Online Political Engagement Scale (OPEnS; Pontes et al., 2017).

***Penn State Worry Questionnaire (PSWQ).*** The PSWQ is a reliable and valid self-report measure of trait-like pathological worry (Stober & Bittencourt, 1998). The PSWQ consists of 16 items that assess the excessiveness, duration and uncontrollability of worry and associated stress. Cronbach's alphas have been shown to range between .86 and .95 in clinical and nonclinical samples, with an average value of .90. Cronbach's alpha for the current study was acceptable at .93.

***10-item Perceived Stress Scale (PSS-10).*** The PSS-10 assesses the degree to which situations in life are perceived as stressful (Cohen et al., 1983; Cohen & Williamson, 1988). The items were designed to measure how unpredictable, uncontrollable, and overwhelming respondents viewed their lives. Participants respond on a 5-point scale ranging from 0 (never) to 4 (very often), and four items are reverse-scored. The responses to the 10 items are totaled to create a psychological stress score, where higher scores indicate greater psychological stress. Internal reliability, i.e. Cronbach’s alpha, has been shown to be .84, .85, and .86 for the validation samples (Cohen et al., 1983). Cronbach's alpha for the current study was acceptable at .88.

***Quick Inventory of Depressive Symptomatology, Self-Report (QIDS-SR16).*** The QIDS-SR16 is a 16-item self-report measure of depressive symptom severity derived from the 30-item Inventory of Depressive Symptomatology (IDS; Rush, Gullion, Basco, Jarrett, & Trivedi, 1996). The QIDS-SR16 has nine symptom domains, which consist of sad mood, concentration, self-criticism, suicidal ideation, general interest, energy/fatigue, sleep disturbance, appetite/weight, and psychomotor agitation/retardation (Rush et al., 2003). Each symptom item is scored on a scale of 0 to 3, with higher scores representing greater symptom severity. A systematic review and meta-analysis by Reilly, MacGillivray, Reid and Cameron (2015) demonstrated that Cronbach's alpha ranged from .69 to .89 across 37 studies. Cronbach's alpha for the current study was .74, which indicated an adequate level of internal consistency.

***Online Political Engagement Scale (OPEnS).*** The modified version of OPEnS (Pontes et al., 2017) used in the present study, termed OPEnS-United States Adapted (OPEnS-USA), is an 8-item measure of political engagement. This scale assesses how frequently participants visit several categories of websites (e.g., websites of political parties, news organization websites) and rate each item on a 4-point scale, where 3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited. An additional item was added to assess whether participants had voted in a recent election. A total score is obtained by adding the scores for the first seven questions, where higher scores represent higher levels of online political engagement. Participants can be dichotomously compared by being classified as politically- engaged (i.e., if the total score is $\geq 1$) or non-online politically-engaged (i.e., if the score is 0 for every question). The OPEnS has demonstrated criterion-related validity as evidenced by significant positive associations with frequency of media usage, where Pearson's r ranged from .53 to .77 and were significant at the

0.01 level or better. In addition, the estimated coefficient for Cronbach's alpha has shown to be .81 (Pontes et al., 2017). Cronbach's alpha for the current study was acceptable at .84.

***Debriefing Procedure.*** Following administrations of the measures outlined above, participants were presented with debriefing information. This information included a complete list of the dates of the shootings and list of the six shootings that were fictionalized for the purposes of the study. Participants were also given a list of resources (e.g., websites and hotline numbers) to contact if they experienced any emotional duress as a result of the study.

## Results

To assess order or priming effects of block administration on dependent variables of interest, we conducted preliminary analyses to test whether the order of the administration was systematically associated with differences in scores on various measures. A comparison of mean differences in variables between the two test order administration groups failed to show a consistent pattern indicative of order effects (see Table 8). Due to these results, all participants were collapsed into one group for analyses.

Table 8.
*Independent t-test Comparing the Order of Blocks on FBM*

| | Block A Administered First | | Block B Administered First | | |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t-value |
| Total FBMs | 3.25 | 3.62 | 2.9 | 3.7 | 1.06 |

**Hypothesis 1: Flashbulb memory framework for mass shootings.** To test the first hypothesis in Study 2, we examined whether mass shootings could readily be identified utilizing a commonly used framework for identifying FBM. According to participant responses, nearly 66% percent of participants were able to identify at least one canonical feature for at least one mass

shooting. Twenty-seven percent of participants were also able to identify all six categories for one or more mass shootings. The percentage of participants with FBMs (i.e., one or more categories per shooting) for one or more shootings are presented in Table 7. More than half of participants (52.6%) had an FBM for at least two shootings, and more than a third of participants (34%) had FBMs for at least four mass shootings (see Table 9).

Table 9.
*Cumulative Percentage of Participants with One or More FBMs of Mass Shootings*

| Amount of Shootings | Cumulative Percentage of Participants with FBM |
|---|---|
| At Least One Shooting | 65.6% |
| At Least Two Shootings | 52.6% |
| At Least Three Shootings | 41.6% |
| At Least Four Shootings | 34.0% |
| At Least Five Shootings | 28.4% |
| At Least Six Shootings | 22.4% |
| At Least Seven Shootings | 17.4% |
| At Least Eight Shootings | 14.0% |
| At Least Nine Shootings | 10.2% |
| At Least Ten Shootings | 8.8% |
| At Least Eleven Shootings | 6.4% |
| At Least Twelve Shootings | 3.4% |

Note: 34.4% of participants did not report any FBM for any shootings

Table 10 provides the percentages of participants that identified each mass shooting as an FBM and provides a measure of the most commonly recalled shootings. Values in parentheses indicate the percentage of participants who reported all six categories for each shooting. These percentages are also separated by age cohort groups.

Table 10.
*Amount of Participants with FBM Per Shooting*

| Shooting | Date | All Generations | Baby Boomer | Gen X | Millennial | Gen Z |
|---|---|---|---|---|---|---|
| Santa Fe HS in Santa Fe, TX | 5/18/2018 | 11.2% (1.6%) | 3% (0%) | 7.9% (1.6%) | 13.7% (1.6%) | 15.2% (3%) |
| Marjory Stoneman Douglas HS in Parkland FL | 2/14/2018 | 20.4% (5.2%) | 27.3% (7.6%) | 20.6% (5.6%) | 19.9% (4.3%) | 12.1% (6.1%) |
| Las Vegas Strip in NV | 10/1/2017 | 30.2% (7.8%) | 42.4% (15.2%) | 25.4% (7.9%) | 28.9% (6.6%) | 33.3% (6.1%) |
| Pulse Nightculb in Orlando, FL | 6/12/2016 | 28.8% (7%) | 28.8% (9.1%) | 27.8% (4.8%) | 29.3% (7.8%) | 30.3% (6.1%) |
| Inland Region Center in San Bernadino, CA | 12/2/2015 | 12.6% (2.2%) | 10.6% (1.5%) | 11.1% (2.4%) | 13.7% (2%) | 12.1% (6.1%) |
| Umpqua Community College in Roseburg, OR | 10/1/2015 | 6.6% (1.6%) | 3% (0%) | 3.2% (0.8%) | 8.6% (2%) | 12.1% (6.1%) |
| African Methodist Church in Charleston, SC | 6/17/2015 | 15.4% (3.6%) | 24.2% (6.1%) | 15.1% (3.2%) | 12.9% (3.1%) | 6.1% (6.1%) |
| Washington Navy Yard in Washington, D.C. | 9/16/2013 | 8.2% (1.8%) | 9.1% (3%) | 2.4% (1.6%) | 10.5% (1.2%) | 9.1% (3%) |
| Sandy Hook Elementary in Newtown, CT | 12/14/2012 | 30.6% (10%) | 33.3% (13.6%) | 27.8% (13.5%) | 30.5% (7.8%) | 42.4% (9.1%) |
| Film Theater in Aurora, CO | 7/20/2012 | 20.4% (4.4%) | 31.8% (7.6%) | 15.9% (4%) | 18.8% (3.5%) | 21.2% (6.1%) |
| Salon Meritage in Seal Beach, CA | 10/12/2011 | 5% (1%) | 4.5% (1.5%) | 1.6% (0%) | 6.3% (0.8%) | 6.1% (6.1%) |
| Hartford Distributors in Manchester, CT | 8/3/2010 | 6.2% (1.4%) | 1.5% (0%) | 2.4% (0%) | 8.6% (2%) | 6.1% (6.1%) |
| Fort Hood, TX | 11/5/2009 | 13.8% (2.8%) | 19.7% (6.1%) | 13.5% (3.2%) | 12.1% (1.6%) | 15.2% (6.1%) |
| American Civic Association in Binghampton, NY | 4/3/2009 | 9% (1.4%) | 1.5% (0%) | 4.8% (0%) | 13.3% (2%) | 12.1% (6.1%) |
| McLendon Family in Geneva County, AL | 3/10/2009 | 6.4% (0.6%) | 6.1% (1.5%) | 3.2% (0%) | 8.2% (0.8%) | 3% (0%) |
| Westroads Mall shooting in Omaha, NE | 12/5/2007 | 6.8% (1.6%) | 3% (0%) | 2.4% (0.8%) | 9.8% (1.6%) | 12.1% (9.1%) |
| Virginia Tech in Blacksbury, VA | 4/16/2007 | 17.8% (3.2%) | 16.7% (3%) | 21.4% (4%) | 16.4% (2.7%) | 15.2% (6.1%) |
| Goleta Postal Office in Goleta, CA | 1/30/2006 | 7% (1.4%) | 1.5% (0%) | 5.6% (1.6%) | 9% (1.6%) | 9.1% (3%) |
| Red Lake HS in Red Lake, MN | 3/21/2005 | 6.8% (1%) | 3% (0%) | 2.4% (0%) | 9.8% (1.2%) | 9.1% (6.1%) |
| Wedgwood Baptist Church in Fort Worth, TX | 9/15/1999 | 8.6% (1%) | 7.6% (1.5%) | 4% (0.8%) | 10.5% (0%) | 12.1% (6.1%) |
| Atlanta Day Trading in Atlanta, GA | 7/29/1999 | 5.4% (1%) | 3% (0%) | 4.8% (1.6%) | 6.3% (0.8%) | 6.1% (3%) |
| Columbine High School in Littleton, CO | 4/20/1999 | 32.2% (7.6%) | 47% (13.6%) | 32.5% (7.9%) | 28.9% (6.3%) | 24.2% (6.1%) |

All Generations includes the Silent Generation (ages 75 to 92, n=2)
Baby Boomer - ages 56 to 74 (n=66)
Gen X - ages 40 to 55 (n=126)
Millennial - ages 24 to 39 (n=256)
Gen Z - below age 24 (n=33)

Value to the left is percentage of participants with one or more FBM categories
Value to the right is percentage of participants with all six FBM categories

The shootings associated with FBMs were relatively stable across the generational groups. The top three mass shootings recalled for the Baby Boomer generation were Columbine (first), Las Vegas (second), and Sandy Hook (third), compared to Columbine (first), Pulse and Sandy Hook (second, tied), and Vegas (third) for Generation X. Millennials most frequently identified Sandy Hook (first), Pulse (second), and Vegas and Columbine (third, tied) for the Millennial generation, whereas Generation Z participants most commonly recalled Sandy Hook (first), Las Vegas (second), and Pulse (third).

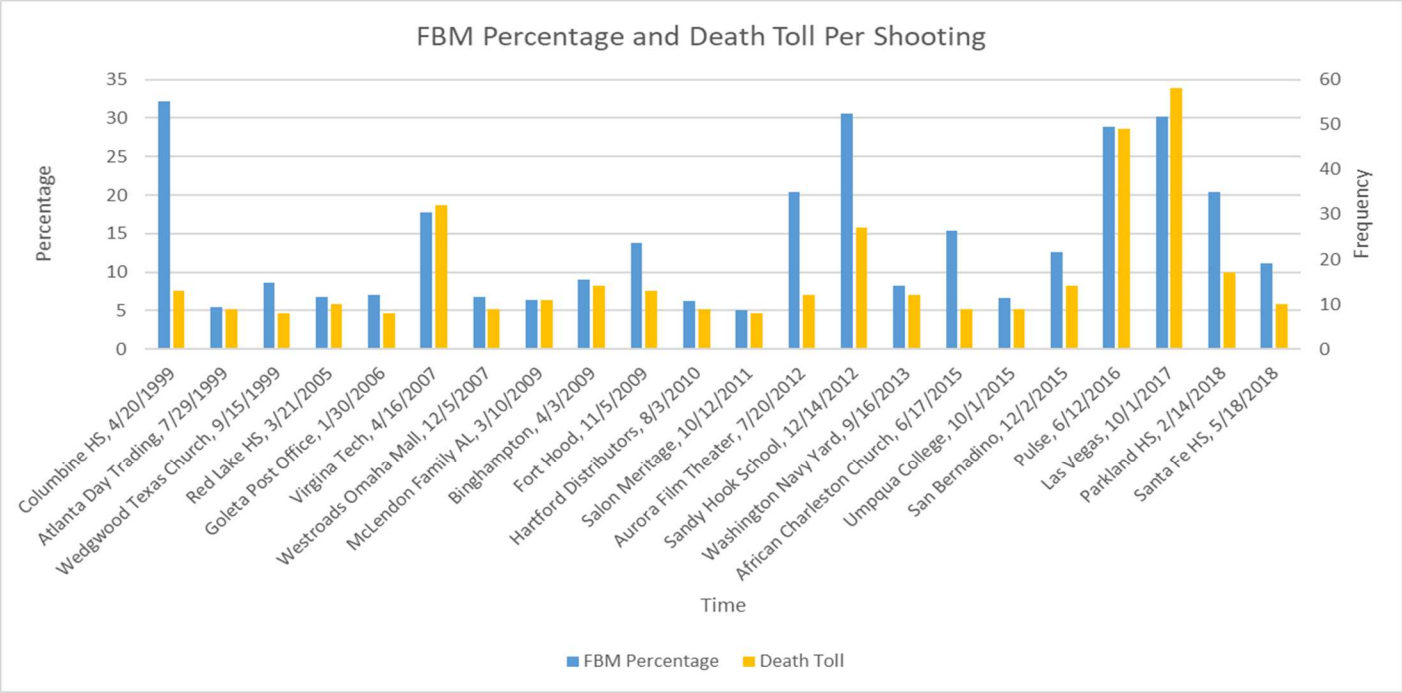
For each shooting, partial correlation coefficients were calculated to evaluate whether the time since the shooting occurred was significantly correlated to the number of participants who described at least one categorical feature for the shooting (i.e., had an FBM), while controlling

for the number of individuals killed in the shooting, for each generation. The partial correlations between time and the number of participant FBMs for each shooting was nonsignificant for every age group. Fisher's r to z transformations (see Mendoza, 1993) were used to compare these correlations across members of the different generational cohorts (i.e., Baby Boomers to Generation Z), and no differences in the correlations were found. Therefore, in subsequent analyses, analyses were done with all participants and not separated by age cohorts. Table 10 shows the percentage of FBMs across the groups in the *All Generations* column. From these results, you can see that the most common shooting identified as an FBM across all groups was the 1999 shooting at Columbine Highschool in Littleton, CO, with the Sandy Hook and Pulse Night Club shootings identified as the second and third most common FBM, respectively. When considering all 6 canonical features, the shooting at Sandy Hook Elementary was the most common, although only 10% of the sample met this conservative FBM criteria for the shooting.

Figure 1 provides a visual representation of the frequency of FBM and death toll per shooting. Although high death toll frequency appears to coincide with the frequency of FBM mass shootings, often there were many notable exceptions. The mass shooting at Columbine High School in 1999 had the greatest amount of participants with an FBM, despite occurring more than twenty years ago and having a lower death toll than more recent shootings such as Sandy Hook, Parkland, and Las Vegas, as well as having a similar death toll to several other shootings that had a lesser rate of FBM (see Figure 1). Further, Figure 1 demonstrates about a third of participants identified the Columbine shooting as an FBM. Note that many of the mass shootings, such as the American Civic Association in Binghamton in 2009 and the Inland Region Center in San Bernardino that have occurred in more recent years, which had similar death tolls to Columbine, had substantially fewer participants who reported FBMs of these events. The

twenty-two shootings included in this study represent the deadliest shootings out of the more than 90 that have occurred from 1999 to 2018 (Follman et al., 2019). However, for many shootings, the percentage of participants with an FBM was considerably low, such as under 6% for the Salon Meritage in 2011.

Figure 1




It appears that some of the six different canonical features of FBMs were more common than others. Mean differences in these features were analyzed to determine which of these features were the most commonly endorsed. Mean values are presented in Table 11.

Table 11.
*Means and Standard Deviations for FBM Categories*

| Amount of FBM by Category | Mean | SD |
|---|---|---|
| Do you remember where you were when you first learned about the event? (Place) | 2.41 | 3.29 |
| Do you remember the ongoing event or activity that was occurring before learning about the event? (Ongoing Activity) | 2.14 | 3.16 |
| Do you remember how you were informed of the event? (Informant) | 2.74 | 3.39 |
| Do you remember what happened right after you heard about the event? (Aftermath) | 1.89 | 3.09 |
| Do you remember how you felt when you first heard about the event? (Own Affect) | 2.66 | 3.36 |
| Do you remember how other people felt when they heard about the event? (Affect of Others) | 1.27 | 2.27 |
| Total Amount of FBM | 3.09 | 3.65 |

A repeated measures ANOVA with a Greenhouse-Geisser correction was used to compare these means. The ANOVA results determined that there were significant differences in the means for the six FBM categories, $F(2.275, 1135.274) = 86.21$, $p < .0001$ (see Table 12). Post hoc tests using Fisher's LSD demonstrated the Place category ($M = 2.41$, $SD = 3.29$) was significantly higher ($p < .05$) than the Ongoing Activity, Aftermath, and Affect of Others categories, such that the Place category was significantly more common for FBMs than the Ongoing Activity, Aftermath, and Affect of Others categories. The Ongoing Activity category ($M = 2.14$, $SD = 3.16$) was significantly higher ($p < .05$) than the Aftermath category. The Informant category ($M = 2.74$, $SD = 3.39$) was significantly higher ($p < .05$) than all five other categories. The Aftermath category ($M = 1.89$, $SD = 3.09$) was significantly higher ($p < .05$) than the Affect of Others category. The Own Affect category ($M = 2.66$, SD =3.36) was significantly higher ($p < .05$) than the Place, Activity, Aftermath, and Affect of Others categories. The Affect of Others category ($M = 1.27$, $SD = 2.27$) was significantly lower than all other categories. In

summary, it appears that participants most commonly reported remembering being informed of the mass shooting, and were least likely to recall how others around them felt when they learned of the event.

Table 12.
*Repeated Measures ANOVA for FBM Categories*

| Predictor | Sphericity Correction | SS | df | MS | F | p-value | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| Category | Greenhouse-Geisser | 751.372 | 2.275 | 330.259 | 86.206 | 0.001 | 0.147 |
| Error(Category) | Greenhouse-Geisser | 4349.295 | 1135.274 | 3.831 | | | |

Note: SS is Sum of Squares. MS is Mean Square.

**Hypothesis 2: Relationship between shooting characteristics and FBM.** To address the second hypothesis of Study 2, we examined the impact of shooting characteristics (e.g., setting, death toll, time, characteristics of the shooter) on FBM. Exploratory analyses were conducted in order to determine which variables were most salient in forming an FBM and influencing public opinion on mass shootings. Questionnaire data was entered and analyzed using SPSS.

An initial exploratory analysis was conducted with the FBM data by examining bivariate correlations among the potential variables (see Table 13). Significant correlations were then utilized as predictors in subsequent multiple regression models. Death toll was significantly positively correlated with the total amount of participants with FBM, $r = .818$, $p < .01$, such that shootings with higher death tolls tended to have a greater amount of people with FBM. Death toll was significantly positively correlated with shooter age, $r = .397$, $p < .05$, such that higher death toll was associated with increased age of the shooter. This could potentially be influenced by the deadliest shooting in this sample, occurring in Las Vegas in 2017, having the highest shooter age. In contrast, there was a significant negative correlation between shooter age and whether the shooting was a school shooting or not, $r = -0.562$, $p < .01$, such that school shootings tended to be committed by shooters who were younger in age than non-school shooters. There was also a

significant negative correlation between whether the shooter legally obtained guns used in the shooting and whether the shooting was a school shooting or not, $r = -0.482$, $p < .05$, such that school shootings tended to be committed by shooters who did not legally obtain guns.

A partial correlation of whether the shooter legally obtained guns used in the shooting and whether the shooting was a school shooting or not was conducted controlling for shooter age, and the correlation was not significant, $r = -0.268$, $p =$ ns. This suggests shooter age may be a factor influencing this relationship (e.g., younger shooters tend to perpetrate school shootings, who may be below the legal age of purchasing guns). The shooter being white or not was significantly negatively correlated with whether the shooter lived or died, $r = -0.418$, $p < .05$, such that shooters who were white tended to live after the shooting (e.g., did not commit suicide, were not lethally subdued by law enforcement) compared to shooters who were not white.

Of note and contrary to our hypotheses, time was not significant with any variables of interest, with the exception of the total amount of participants with FBM, $r = .482$, $p < .05$. Thus, more recent shootings tended to have more participants with FBM, which was inconsistent with our hypotheses.

Table 13.
Correlation Matrix of Relevant Shooting Variables and Total FBMs Per Shooting

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Time | - | | | | | | | | | |
| 2. Death Toll | 0.343^ | - | | | | | | | | |
| 3. School Shooting | 0.104 | 0.004 | - | | | | | | | |
| 4. Shooter Age | 0.021 | 0.397* | -0.562 | - | | | | | | |
| 5. Male Shooter | 0.112 | 0.159 | 0.233 | -0.0178 | - | | | | | |
| 6. White Shooter | 0.179 | -0.04 | -0.036 | -0.008 | 0.018 | - | | | | |
| 7. Shooter Had Prior Signs of Mental | -0.178 | -0.012 | 0.218 | 0.042 | 0.136 | 0.263 | - | | | |
| 8. Shooter Obtained Guns Legally | 0.153 | 0.127 | -0.482* | 0.522* | -0.177 | -0.231 | -0.073 | - | | |
| 9. Shooter Died | -0.338^ | 0.29 | -0.026 | 0.167 | -0.233 | -0.418* | 0.026 | -0.073 | - | |
| 10. Total Participants with FBM | 0.482* | 0.818** | 0.139 | 0.09 | 0.166 | 0.187 | 0.056 | 0.00 | -0.042 | - |

* Correlation is significant at the .05 level (1-tailed).
** Correlation is significant at the .01 level (1-tailed).
^ Correlation approached significance ($.05 < p < .01$).
Scoring for dichotomous variables (i.e. 3, 5, 6, 7, 8, 9) was 1=Yes, 0=No

***Multiple Regression: Mass Shooting Characteristics influencing FBMs.*** After identifying relevant predictors and accounting for parsimony, in the context of the current

literature and the present study, multiple regression was used to predict the amount of people who had FBMs using time, death toll and the shooter's age as predictors. These variables significantly predicted the amount of people who had an FBM, $F(3, 18) = 16.559$, $p < .001$, $R^2_{adjusted} = .772$ (see Table 14). Death toll added statistically significantly to the prediction ($p < .01$). Time did not significantly add to the prediction ($p = .166$) and shooter age approached significance ($p = .085$). Thus, time was not a significant predictor of FBM, despite the significant correlation of time and FBM described earlier (see Table 13).

Table 14.
*Multiple Regression for Predictors of FBMs*

| Predictor | *B* | *B* 95% *CI* | Beta | *t*-value | *p*-value |
|---|---|---|---|---|---|
| (Constant) | -806.19 | [-218.57, -1393.81] | | -1.372 | 0.19 |
| Time | $6.33x10^{-8}$ | [$1.99x10^{-8}$, $10.67x10^{-8}$] | 0.195 | 1.458 | 0.166 |
| Death Toll | 2.57 | [2.13, 3.01] | 0.852 | 5.853 | 0.001 |
| Shooter Age | -0.9 | [-1.39, -0.41] | -0.252 | -1.844 | 0.085 |

Note: $R^2$ adjusted = .772. CI = Confidence Interval.

**Hypothesis 3: Relationship between participant characteristics and FBM for mass shooting events.** To address the third hypothesis of Study 2, we examined the impact of participant characteristics (e.g., mental health, negative life events, gun ownership) on FBM. Exploratory analyses were conducted in order to determine which variables were most salient in forming an FBM and influencing public opinion on mass shootings. Questionnaire data was entered and analyzed using SPSS. Descriptive statistics for relevant variables, such as mental illness measures (e.g., PSS), are presented in Table 15.

Table 15.
*Means and Standard Deviations for Participant Variables of Interest*

| | Mean | SD |
|---|---|---|
| PSS | 16.23 | 7.8 |
| PSWQ | 47.63 | 15.2 |
| QIDS | 7.44 | 4.98 |
| OPEnS | 7.11 | 4.85 |
| Frequency of Internet usage* | 2.07 | 1.12 |
| Political Ideology** | 5.33 | 2.79 |

*Daily use of the Internet for news or programs about politics and current affairs
**Higher values reflect more conservative ideology

***Multiple Regression: Participant characteristics influencing total amount of FBMs.*** To examine the total amount of FBMs, bivariate correlations were examined among the potential variables. After identifying relevant predictors and accounting for parsimony in the context of the current literature and the present study, a series of multiple regression analyses were used to predict the total amount of FBMs identified by each participant. Predictors selected for these analyses were placed in four categories: the Mental Illness category (i.e., the presence of a mental condition, PSS score, PSWQ score, QIDS score), the Demographic Information category (i.e., know someone affected by a mass shooting, gun ownership, political ideology, age, sexuality, have LGBT friends or family, have children), the Neurological category (i.e., history of Alzheimer's Disease, history of epilepsy), and the Internet Engagement category (i.e., frequency of Internet use for news or programs about politics and current affairs, frequency of Internet use to get or exchange information about mass shootings, use of the Internet to get news or information about a recent mass shooting, OPEnS score).

Correlations for the first set of analyses, the Mental Illness category, are provided in Table 16. There was a significant positive correlation between the presence of a mental condition and total FBM, $r = .134$, $p < .01$, such that the presence of a mental condition was associated

with increased FBM. There was a significant positive correlation between PSS scores and total FBM, $r = .142$, $p < .01$, such that increased PSS scores, measuring participants' feelings of stress, were associated with increased FBM. There was a significant positive correlation between QIDS scores and total FBM, $r = .115$, $p < .05$, such that increased QIDS scores, measuring depression symptoms, were associated with increased FBM. Correlates with Total False Memories, shown in the tables below, will be addressed in subsequent analyses.

Table 16.
*Correlation Matrix of Mental Illness Variables and Total FBMs*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Presence of a Mental Condition | - | | | | | |
| 2. PSS Score | 0.219** | - | | | | |
| 3. PSWQ Score | 0.305** | 0.666** | - | | | |
| 4. QIDS Score | 0.152** | .623** | 0.468** | - | | |
| 5. Total FBM | 0.134** | .142** | .077^ | 0.115* | - | |
| 6. Total False Memories | -0.065 | .29** | 0.135** | 0.295** | 0.311** | - |

* Correlation is significant at the .05 level (2-tailed).
** Correlation is significant at the .01 level (2-tailed).
^ Correlation approached significance (.05 < p < .10).
Scoring for the dichotomous variable (i.e. item 1) was 1=Yes, 0=No

Thus, multiple regression was used to predict the total amount of FBMs using the presence of a mental condition, PSS score, and QIDS score as predictors. These variables significantly predicted the total amount of FBMs, $F(3, 442) = 4.294$, $p < .01$, $R^2_{\text{adjusted}} = .022$. The reported presence of a psychiatric or mental condition was significantly associated with more shooting-related FBMs ($p < .05$; see Table 17). PSS scores and QIDS scores were not significantly associated with FBM ($p$ = ns), when controlling for reported psychiatric or mental condition.

Table 17.
*Multiple Regression for Predictors of FBMs from Mental Illness Variables*

| Predictor | *B* | *B* 95% *CI* | Beta | *t*-value | *p*-value |
|---|---|---|---|---|---|
| (Constant) | 2.06 | [1.67, 2.45] | | 5.306 | 0.001 |
| Presence of Mental Illness | 0.992 | [0.57, 1.41] | 0.113 | 2.356 | 0.019 |
| PSS Score | 0.034 | [0.01, 0.06] | 0.073 | 1.207 | 0.228 |
| QIDS Score | 0.028 | [-0.02, 0.07] | 0.038 | 0.642 | 0.521 |

Note: $R^2$ adjusted = .022. CI = Confidence Interval.

Correlations for the second set of analyses, the Demographic Information category, are provided in Table 18. There was a significant positive correlation between knowing someone affected by a mass shooting and total FBM, $r = .168$, $p < .01$, such that knowing someone affected by a mass shooting was associated with increased FBM. There was a significant positive correlation between gun ownership and total FBM, $r = .178$, $p < .01$, such that owning a gun was associated with increased FBM. There was a significant positive correlation between sexuality and total FBM, $r = .198$, $p < .01$, such that greater attraction to the same sex was associated with increased FBM. There was a significant positive correlation between having LGBT friends or family and total FBM, $r = .115$, $p < .05$, such that having LGBT friends or family was associated with increased FBM compared to not having LGBT friends or family. There was a significant positive correlation between having any children and total FBM, $r = .141$, $p < .01$, such that having any children was associated with increased FBM compared to not having any children.

Table 18.
*Correlation Matrix of Demographic Variables and Total FBMs*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Known Anyone Affected by a Mass Shooting | - | | | | | | | | |
| 2. Age | -0.022 | - | | | | | | | |
| 3. Gun Ownership | 0.016 | -0.083^ | - | | | | | | |
| 4. Political Ideology | -0.045 | -0.003 | 0.36** | - | | | | | |
| 5. Sexuality | 0.083^ | -0.208** | 0.221** | 0.162** | - | | | | |
| 6. Have LGBT Friends or Family | 0.203** | -0.003 | -0.007 | -0.183** | -0.001 | - | | | |
| 7. Have Any Children | -0.014 | 0.271** | 0.156** | 0.132** | -0.127** | -0.012 | - | | |
| 8. Total FBM | 0.168** | -0.065 | 0.178** | -0.082^ | 0.198** | 0.115* | 0.141** | - | |
| 9. Total False Memories | 0.039 | -0.131** | 0.317** | 0.314** | 0.47** | -0.10* | 0.176** | 0.311** | - |

* Correlation is significant at the .05 level (1-tailed).
** Correlation is significant at the .01 level (1-tailed).
^ Correlation approached significance (.05 < *p* < .01).
Scoring for dichotomous variables (i.e. 1, 3, 6, 7) was 1=Yes, 0=No
Note: For political ideology, higher values indicate more conservative ideology.
Note: For sexuality, higher values indicate greater attraction to the same sex.

Multiple regression was used to predict the total amount of FBMs using knowing someone affected by a mass shooting, gun ownership, sexuality, having LGBT friends or family, and having any children as predictors. These variables significantly predicted the total amount of FBMs, $F(5, 470) = 8.799$, $p < .001$, $R^2_{\text{adjusted}} = .076$. Knowing someone affected by a mass shooting, the tendency to be attracted to the same sex, and having children were significantly associated with more shooting-related FBMs ($p < .01$), as well as gun ownership ($p < .05$; see Table 19). Having friends or family who are LGBT approached significance ($p = 0.068$).

Table 19.
*Multiple Regression for Predictors of FBMS from Demographic Variables*

| Predictor | *B* | *B* 95% *CI* | Beta | *t*-value | *p*-value |
|---|---|---|---|---|---|
| (Constant) | 1.252 | [0.92, 1.59] | | 3.75 | 0.001 |
| Know Someone Affected by a Mass Shooting | 1.475 | [1, 1.95] | 0.14 | 3.124 | 0.002 |
| Gun Ownership | 0.822 | [0.46, 1.18] | 0.105 | 2.291 | 0.022 |
| Sexuality | 0.276 | [0.19, 0.36] | 0.152 | 3.327 | 0.001 |
| Have LGBT Friends or Family | 0.669 | [0.3, 1.04] | 0.082 | 1.831 | 0.068 |
| Have Any Children | 0.887 | [.56, 1.21] | 0.124 | 2.737 | 0.006 |

Note: $R^2$ adjusted = .076. CI = Confidence Interval.

Correlations for the third set of analyses, the Neurological category, are provided in Table 20. There was a significant positive correlation between having a family history of

Alzheimer's Disease and total FBM, $r = .278$, $p < .01$, such that having a family history of Alzheimer's Disease was associated with increased FBM. There was a significant positive correlation between having epilepsy and total FBM, $r = .278$, $p < .01$, such that having epilepsy was associated with increased FBM.

Table 20.
*Correlation Matrix of Neurological Variables and Total FBMs*

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Family History of Alzheimer's Disease | - | | | |
| 2. History of Epilepsy | 0.426** | - | | |
| 3. Total FBM | 0.278** | 0.388** | - | |
| 4. Total False Memories | 0.292** | 0.563** | 0.311** | - |

* Correlation is significant at the .05 level (2-tailed).
** Correlation is significant at the .01 level (2-tailed).
^ Correlation approached significance (.05 < p < .10).
Scoring for the dichotomous variables (i.e. 1, 2) was 1=Yes, 0=No

Multiple regression was conducted with the total amount of FBMs using family history of Alzheimer's Disease and history of epilepsy as predictors. These variables significantly predicted the total amount of FBMs, $F(2, 488) = 49.593$, $p < .001$, $R^2_{\text{adjusted}} = .166$. Having a family history of Alzheimer's Disease and history of epilepsy were significantly associated with more shooting-related FBMs ($p < .01$; see Table 21).

Table 21.
*Multiple Regression for Predictors of FMBs from Neurological Variables*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 2.357 | [2.18, 2.53] | | 13.289 | 0.0001 |
| Family History of Alzheimer's Disease | 1.031 | [0.66, 1.41] | 0.125 | 2.744 | 0.006 |
| History of Epilepsy | 3.783 | [3.28, 4.29] | 0.342 | 7.491 | 0.0001 |

Note: $R^2$ adjusted = .166. CI = Confidence Interval.

Correlations for the fourth set of analyses, the Internet Engagement category, are provided in Table 22. There was a significant positive correlation between the frequency of Internet use for news or programs about politics and current affairs and total FBM, $r = .194$, $p <$

.01, such that a greater frequency of Internet use for news or programs about politics and current affairs was associated with increased FBM. There was a significant positive correlation between the frequency of Internet use to get or exchange information about mass shootings and total FBM, $r = .218$, $p < .01$, such that a greater frequency of Internet use to get or exchange information about mass shootings was associated with increased FBM. There was a significant positive correlation between the using the Internet to get news or information about a recent mass shooting and total FBM, $r = .092$, $p < .05$, such that a using the Internet to get news or information about a recent mass shooting was associated with increased FBM. There was a significant positive correlation between OPEnS scores and total FBM, $r = .123$, $p < .01$, such that higher OPEnS scores, reflecting more frequent online engagement in politics, was associated with increased FBM.

Table 22.
*Correlation Matrix of Internet Engagement Variables and Total FBMs*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Frequency of Internet use for news or programs about politics and current affairs | - | | | | | |
| 2. Frequency of Internet use to get or exchange information about mass shootings | 0.387** | - | | | | |
| 3. Used the Internet to get news or information about a recent mass shooting | 0.15** | 0.314** | - | | | |
| 4. OPEnS score | 0.352** | 0.292** | 0.25** | - | | |
| 5. Total FBM | 0.194** | 0.218** | 0.092* | 0.123** | - | |
| 6. Total False Memories | 0.189** | 0.355** | 0.213** | 0.13** | 0.311** | - |

* Correlation is significant at the .05 level (2-tailed).
** Correlation is significant at the .01 level (2-tailed).
Scoring for the dichotomous variable (i.e., 3) was 1=Yes, 0=No

Multiple regression was used to predict the total amount of FBMs using the frequency of Internet use for news or programs about politics and current affairs, frequency of Internet use to get or exchange information about mass shootings, use of the Internet to get news or information about a recent mass shooting, and OPEnS score as predictors. These variables significantly

predicted the total amount of FBMs, $F(4, 467) = 7.322$, $p < .001$, $R^2_{\text{adjusted}} = .051$. Frequency of Internet use for news or programs about politics and current affairs and frequency of Internet use to get or exchange information about mass shootings were significantly associated with more shooting-related FBMs ($p < .05$; see Table 23). The use of the Internet to get news or information about a recent mass shooting and OPEnS scores were not significantly associated with total FBM ($p$ = ns).

Table 23
*Multiple Regression for Predictors of FBMs from Internet Engagement Variables*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 1.365 | [0.98, 1.75] | | 3.571 | 0.001 |
| Frequency of Internet use for news or programs about politics and current affairs | 0.413 | [0.29, 0.54] | 0.126 | 2.481 | 0.013 |
| Frequency of Internet use to get or exchange information about mass shootings | 0.581 | [0.38, 0.79] | 0.146 | 2.842 | 0.005 |
| Used the Internet to get news or information about a recent mass shooting | 0.066 | [0.05, 0.08] | 0.016 | 0.341 | 0.733 |
| OPEnS score | 0.019 | [-0.01, 0.04] | 0.025 | 0.514 | 0.608 |

Note: $R^2$ adjusted = .051. CI = Confidence Interval.

***Fictitious Shootings.*** Because our design included fabricated shootings, supplemental analyses were used to evaluate participant characteristics that predicted the identification of one or more fictitious shootings ($M = 0.97$, $SD = 1.71$). The number of participants who identified one or more false shootings is portrayed in Table 24. Only 34% of participants identified one or more false shootings.

These fictitious shootings were presented imbedded in the list of actual shootings. In an effort to reduce the demands on participants, no follow up questions related to the six characteristics of FBM were solicited for these fictitious shootings. Nevertheless, we were interested in how reporting a recollection of recalling these fictitious shootings might be associated with the various participant characteristics and measures used in the study.

Table 24.
*Cumulative Percentage of Participants with One or More False Shootings*

| Amount of False Shootings | Cumulative Percentage of Participants with False Shootings |
|---|---|
| At Least One Shooting | 34% |
| At Least Two Shootings | 22.2% |
| At Least Three Shootings | 16.2% |
| At Least Four Shootings | 12.8% |
| At Least Five Shootings | 6.8% |
| At Least Six Shootings | 5% |

Note: 66% of participants did not report any false shootings

To examine the total amount of false shootings participants identified, bivariate correlations were examined among the potential variables. After identifying relevant predictors and accounting for parsimony in the context of the current literature and the present study, multiple regression was used to predict the total amount of false memories. Predictors selected for these analyses were placed in the four categories used in the analyses above: the Mental Illness category, the Demographic Information category, the Neurological category, and the Internet Engagement category. Correlations for the first set of analyses, the Mental Illness category, are provided in Table 16. There was a significant positive correlation between PSS scores and total false memories, $r = .29$, $p < .01$, such that increased PSS scores, measuring stress, were associated with increased false memories. There was a significant positive correlation between PSWQ and total false memories, $r = .135$, $p < .01$, such that increased PSWQ scores, measuring participant worries, were associated with increased false memories. There was a significant positive correlation between QIDS scores and total FBM, $r = .295$, $p < .01$, such that increased QIDS scores, measuring depression, were associated with increased false memories.

Multiple regression was used to predict the total amount of false memories using PSS score, PSWQ score, and QIDS score as predictors (see Table 25). These variables significantly

predicted the total amount of false memories, $F(3, 423) = 15.497$, $p < .01$, $R^2_{adjusted} = .093$. PSS and QIDS scores were significantly associated with more shooting-related FBMs ($p < .01$), such that individuals who reported more stress and depression symptoms, tended to reported recalling more false shootings. PSWQ scores approached significance ($p = .079$).

Table 25.
*Multiple Regression for Predictors of Recall of False Shootings from Mental Illness Variables*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 0.216 | [-0.26, 0.46] | | 0.893 | 0.372 |
| PSS Score | 0.042 | [0.03, 0.06] | 0.209 | 2.934 | 0.004 |
| PSWQ Score | -0.011 | [-0.12, -0.01] | -0.109 | -1.762 | 0.079 |
| QIDS Score | 0.066 | [0.05, 0.09] | 0.201 | 3.35 | 0.001 |

Note: $R^2$ adjusted = .093. CI = Confidence Interval.

Correlations for the second set of analyses, the Demographic Information category, are provided in Table 18. There was a significant positive correlation between age and total false memories, $r = -0.131$, $p < .01$, such that decreased age (i.e., being younger) was associated with increased false memories. There was a significant positive correlation between gun ownership and total false memories, $r = .317$, $p < .01$, such that owning a gun was associated with increased false memories. There was a significant positive correlation between political ideology and total false memories, $r = .314$, $p < .01$, such that greater conservative ideology was associated with increased false memories. There was a significant positive correlation between sexuality and total FBM, $r = .47$, $p < .01$, such that greater attraction to the same sex was associated with increased false memories. There was a significant positive correlation between having LGBT friends or family and total false memories, $r = -0.10$, $p < .05$, such that having LGBT friends or family was associated with having less false memories compared to not having LGBT friends or family. There was a significant positive correlation between having any children and total false

memories, $r = .176$, $p < .01$, such that having any children was associated with increased false memories compared to not having any children.

Multiple regression was used to predict the total amount of false memories using age, gun ownership, political ideology, sexuality, having LGBT friends or family, and having any children as predictors (see Table 26). These variables significantly predicted the total number of false shootings recognized by participants, $F(6, 459) = 37.95$, $p < .001$, $R^2_{\text{adjusted}} = .323$. All variables were significant ($p < .05$). According to these results, individuals who were older and had LGBT family members or friends were less likely to endorse recall of shootings that never occurred.

Table 26.
*Multiple Regression for Predictors of Recall of False Shootings from Demographic Variables*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | -0.345 | [-0.60, -0.09] | | -1.336 | 0.182 |
| Age | -0.012 | [-0.02, -0.01] | -0.091 | -2.248 | 0.025 |
| Gun Ownership | 0.535 | [0.38, 0.69] | 0.146 | 3.455 | 0.001 |
| Political Ideology | 0.089 | [0.06, 0.11] | 0.148 | 3.551 | 0.001 |
| Sexuality | 0.34 | [0.31, 0.37] | 0.404 | 9.984 | 0.001 |
| Have LGBT Friends or Family | -0.326 | [-0.48, -0.177] | -0.085 | -2.195 | 0.029 |
| Have Any Children | 0.684 | [0.55, 0.82] | 0.203 | 4.97 | 0.001 |

Note: $R^2$ adjusted = .323. CI = Confidence Interval.

Correlations for the third set of analyses, the Neurological category, are provided in Table 20. There was a significant positive correlation between having a family history of Alzheimer's Disease and total FBM, $r = .292$, $p < .01$, such that having a family history of Alzheimer's Disease was associated with increased false memories. There was a significant positive correlation between having epilepsy and total FBM, $r = .563$, $p < .01$, such that having epilepsy was associated with increased false memories.

Multiple regression was used to predict the total amount of false memories using family history of Alzheimer's Disease and history of epilepsy as predictors (see Table 27). These variables significantly predicted the total amount of false memories, $F(2, 488) = 111.526$, $p <$

.001, $R^2_{adjusted}$ = .311. Having a history of epilepsy was significantly associated with more false memories ($p < .01$), and having a family history of Alzheimer's Disease approached significance ($p = .075$).

Table 27.
*Multiple Regression for Predictors of Recall of False Shootings from Potential Neurological Variables*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 0.528 | [0.45, 0.60] | | 7.142 | 0.001 |
| Family History of Alzheimer's Disease | 0.28 | [0.12, 0.44] | 0.074 | 1.787 | 0.075 |
| History of Epilepsy | 2.666 | [2.46, 2.88] | 0.524 | 12.652 | 0.001 |

Note: $R^2$ adjusted = .311. CI = Confidence Interval.

Correlations for the fourth set of analyses, the Internet Engagement category, are provided in Table 22. There was a significant positive correlation between the frequency of Internet use for news or programs about politics and current affairs and total false memories, $r$ = .189, $p < .01$, such that a greater frequency of Internet use for news or programs about politics and current affairs was associated with increased false memories. There was a significant positive correlation between the frequency of Internet use to get or exchange information about mass shootings and total false memories, $r$ = .355, $p < .01$, such that a greater frequency of Internet use to get or exchange information about mass shootings was associated with increased false memories. There was a significant positive correlation between the using the Internet to get news or information about a recent mass shooting and total false memories, $r$ = .213, $p < .01$, such that a using the Internet to get news or information about a recent mass shooting was associated with increased false memories. There was a significant positive correlation between OPEnS scores and total false memories, $r$ = .13, $p < .01$, such that higher OPEnS scores, reflecting more frequent online engagement in politics, was associated with increased false memories.

Multiple regression was used to predict the total amount of false memories using the frequency of Internet use for news or programs about politics and current affairs, frequency of Internet use to get or exchange information about mass shootings, use of the Internet to get news or information about a recent mass shooting, and OPEnS score as predictors. These variables significantly predicted the total amount of false memories, $F(4, 467) = 20.148$, $p < .001$, $R^2_{adjusted} = .14$. The frequency of Internet use to get or exchange information about mass shootings and use of the Internet to get news or information about a recent mass shooting were significantly associated with more false memories ($p < .05$). Frequency of Internet use for news or programs about politics and current affairs approached significance ($p = 0.064$). OPEnS scores were not significantly associated with total false memories ($p$ = ns; see Table 28). In summary, individuals who reported high frequency of Internet usage to gain and exchange information about shootings and politics, were more likely to endorse recall of shootings that never occurred.

Table 28.
*Multiple Regression for Predictors of Recall of False Shootings from Internet Engagement Variables*

| Predictor | B | B 95% CI | Beta | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | -0.073 | [-0.24, 0.10] | | -0.428 | 0.669 |
| Frequency of Internet use for news or programs about politics and current affairs | 0.138 | [0.06, 0.21] | 0.09 | 1.858 | 0.064 |
| Frequency of Internet use to get or exchange information about mass shootings | 0.546 | [0.46, 0.64] | 0.292 | 5.981 | 0.001 |
| Used the Internet to get news or information about a recent mass shooting | 0.222 | [0.14, 0.31] | 0.117 | 2.553 | 0.011 |
| OPEnS score | -0.008 | [-0.03, 0.01] | -0.022 | -0.462 | 0.644 |

Note: $R^2$ adjusted = .14. CI = Confidence Interval.

## Discussion

**Hypothesis 1: Flashbulb memory framework for mass shootings.** It was predicted that mass shootings were able to be encoded and measured as flashbulb memories (FBMs). Nearly sixty-six percent of participants were able to identify at least one categorical feature for at least one

mass shooting, which was comparable to other studies (Mahmood et al., 2004; Er, 2003) and provided support for the first hypothesis. More than half of participants (52.6%) had an FBM for at least two shootings, and more than a third of participants (34%) had FBMs for at least four mass shootings. This is comparable to a study by Edery-Halpern and Nachson (2004), where FBM was examined for five terror attacks in Israel over a three-year period (i.e., 1995 to 1997) by 131 participants living in Israel in 1998. Although the exact amount of participants with FBM for each event was not provided, they found the strongest FBMs (i.e., those with the greatest amount of detail) were associated with several features (e.g., how distinctive the event was, the emotional intensity of the event; see hypothesis 2 which addresses event characteristics). The results of this study were also similar to a study by Er (2003), in which more than 58% of participants had an FBM for an earthquake that occurred 6 to 9 months prior. Together these studies show that mass atrocities like terror attacks and mass shootings can have a long lasting and meaningful impact on the public (Hirst et al., 2015; Er, 2003; Hornstein et al., 2003; Curci et al., 2001).

By focusing on mass shootings, the current study shows that FBMs can be identified for multiple events that occurred across time and in disparate locations. To date, most FBM studies have focused on single events (e.g., the death of Princess Diana in 1997), a few isolated events (e.g., terror attacks in Israel), or events that were limited to smaller geographic regions (e.g., Israel, Edery-Halpern & Nachson, 2004; France, Curci et al., 2001; Italy, Lanciano et al., 2013). More than 32% of participants had an FBM for the Columbine mass shooting, for example, which occurred more than 20 years ago in April 1999, thus supporting research that FBMs can persist for many years after an event (Hirst et al., 2015; Colegrove, 1899). Our findings also showed that FBM can be experienced by individuals not directly impacted by the event.

Research of FBMs for a devastating earthquake in the Marmara region of Turkey and the September 11 terrorist attacks showed that even individuals not directly affected by these disasters developed FBMs of them (Er, 2003; Hirst et al., 2015). The lasting influence of these events that shape their encoding and recall as FBM may be due to the emotional, social, and political means associated with these events.

**Hypothesis 2: Relationship between shooting characteristics and FBM.** It was predicted that various shooting characteristics would impact the presence of FBM. As expected, death toll was a significant predictor of the total amount of FBMs per shooting, with shootings with higher death tolls tending to be more frequently identified as FBMs. This supports earlier research that has noted the impact of death toll on salience of individual events and events over time (see Edery-Halpern & Nachson, 2004), and aligns with the support that was found for the first hypothesis in Study 1 and Study 2.

Our results indicated that time was not a significant predictor of FBMs. Thus, the date the shooting occurred was not significantly associated with the amount of FBMs each shooting had over time, despite time being significantly positively correlated with the total amount of participants with FBM. This finding was inconsistent with our hypotheses, and suggests characteristics of memory and influences on memory may play a role in examining FBM in terms of public interest (see General Discussion).

Shooter age and death toll were the only shooting-specific significant predictors of any FBM. Shooter age was nearly a significant predictor for the amount of people who had an FBM, where participants were more apt to identify mass shootings as FBM when the perpetrator of the shooting was younger. This may be due to 50% of the top five most common FBMs being for school shootings, which tend to have lower ages relative to other mass shooters.

**Hypothesis 3: Relationship between participant characteristics and FBM for mass shooting events.** It was predicted that shooting and participant characteristics would impact the presence of FBM. Several variables representing individual characteristics were significant predictors of FBM. Knowing someone affected by a mass shooting, frequency of Internet use to get or exchange information about mass shootings or news, having epilepsy, having a family history of Alzheimer's Disease, being a parent, having friends or family who identify as LGBT, gun ownership, and the presence of mental illness predicted the total amount of FBM. Of note, other variables (e.g., race, gender) did not significantly predict the presence of FBM. This discussion will focus on significant predictors of FBM.

Knowing someone affected by a mass shooting significantly predicted the presence of FBM. This aligns with similar research that has shown the impact of personal significance on FBM (see Talarico & Rubin, 2018), and supports previous research demonstrating that individual ratings of personal importance are positively correlated with FBM formation (Bohannon & Symons, 1992; Mahmood et al., 2004; Conway et al., 1994). Additionally, knowing someone involved in a mass shooting demonstrates the principle of consequentiality in FBM, where group membership has been shown to predict the presence and strength of FBM (see Curci et al., 2015). Knowing someone involved in a mass shooting incident increases risk to the person in the situation, the emotion of the person being told, and the implications of the social network of those related to or in the lives of the one who was at risk. This could strengthen the importance of the event knowing a loved one was at risk, increasing the negative emotion surrounding the event and contributing to the formation of FBM (Gandolphe & El-Haj, 2017; Mahmood et al., 2004). Future studies should address further distinctions of personal significance on different

levels of FBM, as well as differences among cultures, as these appear to be under-reported or under-investigated in the present literature.

The amount of time spent using the Internet to get or exchange information about mass shootings daily, as well as the use of the internet to get news or information about a recent mass shooting, were components of an adapted measure of online political engagement by Pontes and colleagues (2017). Increased amount of time was associated with greater total FBMs for mass shootings, suggesting individuals who frequent internet sites for information about mass shootings are more prone to knowing about mass shootings as they occur or being more knowledgeable or interested in the political ramifications of these shootings. Ironically, individuals who frequently obtained information from the Internet were also the most likely to endorse have memories of shootings that never occurred.

Having epilepsy and having a family history of Alzheimer's Disease (AD) were significant predictors of FBM, where having epilepsy and having a family history of AD increased the total amount of FBMs. These findings appear to contradict evidence suggesting that these neurological problems and risk factors can cause disruptions in memory functioning (Reed et al., 2020; Leal et al., 2019). These results are difficult to explain. Metternich and colleagues (2013) found people with epilepsy were able to form FBMs, but that those with epilepsy exhibited less consistency in FBM across a two-month interval. Thus, it may be that neurological issues such as epilepsy are more likely to influence the quality of FBM compared to quantity. Relatedly, research has shown memory decline in a sample of participants with epilepsy of varying severity to be only 30 percent (Lv et al., 2014), suggesting a more complex relationship between neurological issues and FBM. Research examining the presence of FBM and epilepsy across longer periods of time are limited. As an example, Spanhel and colleagues

(2018) examined FBM and the impact of the amygdala, a brain structure that can be adversely impacted by epilepsy (see Metternich et al., 2020). They found that participants with epilepsy who had amygdalar damage had lower recall of FBM across an interval of at least 8 weeks compared to those with an intact amygdala, suggesting that amygdala damage negatively impacts FBM retrieval. Amygdala damage can be common in people with epilepsy (Aroniadou-Anderjaska et al., 2008), making future studies that address epilepsy of differing severity using neurological imaging techniques important in understanding FBM. With regards to AD, it may also be that participants' history of AD may not be a factor in disrupting the recall of FBMs, as AD tends to occur after the age of 65 and be diagnosed at age 80.

Being a parent, or having at least one child, significantly predicted FBM. Being a parent was shown to increase the amount of FBMs, which may be explained in terms of personal significance or group membership. In other words, parents may be more likely to have FBM for shootings involving children of any age or who are similar in age to their own children. Although whether the shooting was located at a school or not was not a significant predictor of FBM, it is possible that the sample size (i.e., the amount of shootings examined) did not allow for the presence of true differences between these categories to be made apparent. Although 50% of the top five most common FBMs were for school shootings, only 38% of parents had at least one FBM, and 56% of the sample were parents. Silva and Capellan (2018b) identified a disproportionate amount of news coverage of school shootings, which may increase the propensity of FBM for parents. Future studies with a larger sample size could further elucidate this relationship between FBM and parenting.

Having friends or family who identify as LGBT was associated with an increased total amount of FBMs. People in the LGBT community are more likely to be targeted for their

sexuality and tend to experience greater rates of victimization than heterosexual individuals (Katz-Wise & Hyde, 2012; see Burks et al., 2015). People in the LGBT community may be more likely to be aware of sudden, violent crime occurring, as is the nature of mass shootings, and may be more likely to inform their friends and family of the event. In this regard, LGBT members may be more likely to act as an informant of FBM, where recognizing the source of the information is one category of FBM. Additionally, individuals who have LGBT friends or family may be more wary of mass shootings in the news after the Pulse shooting in 2016 that targeted a predominantly gay nightclub. Even individuals who are not at increased risk for hate crimes may be more attentive to the possibility of a friend or loved one being affected by a mass shooting, reinforcing the ability of personal significance in the saliency of mass shootings and formation and retention of FBM.

Gun ownership was a significant predictor of FBM, where gun owners were associated with having more FBMs. This suggests that gun ownership provides a measure of group membership in predicting FBM for mass shootings. Gun owners may feel threatened about changes to gun laws and restrictions on firearms after a mass shooting, as Porfiri and colleagues (2019) have shown gun purchases increase after mass shootings, where the highest number of federal weapons background checks for gun acquisition from 1999 to 2017 was recorded in December 2012. December 2012, the authors note, followed the Sandy Hook Elementary School shooting that occurred in the second week of that December, and in the period from 1999 to 2017 news coverage was most concentrated in January 2013, in the aftermath of the Sandy Hook shooting.

It was also predicted that people with depressive symptoms, anxious symptoms, and/or more reported negative life events would exhibit greater recall of mass shootings, and thus recall

more canonical features of FBM and have more FBM for mass shooting events. Specific scales assessing these features (i.e., PSS, PSWQ, QIDS) were not found to significantly contribute to models predicting FBM. However, the presence of a psychiatric or mental condition was a significant predictor of FBM. Additionally, stress scores (i.e., the PSS) and depression scores (i.e., the QIDS) were significant predictors of identifying false shootings, which is examined in more detail below.

The presence of mental illness was associated with an increased amount of total FBMs. The present study contributes to an FBM literature that is lacking in examining the nature of mental disorders such as depression and anxiety on FBM (see Tat et al., 2018). Although participants did not specify the nature of their mental illness or comorbidities, the results still provide important information, as individuals were more than twice as likely to have an FBM if they endorsed the presence of a mental condition. This suggests individuals who reported the presence of mental illness can view negative events such as mass shootings as more salient, and thus be more likely to mentally express this by having FBM for mass shootings.

Taken together, these results demonstrate there is not a single factor, but rather are varying combinations of factors, such as recency of the mass shooting, death toll, and the personal or societal impact of the shooting that assist in determining the cause of and retention of FBMs, and thus, by extension, the public's interest in mass shootings over time.

**Examination of Fictitious Shootings**

Memories for false events have been studied extensively over the years, including in the context of suggested events (Loftus & Palmer, 1974; Sondhi & Gupta, 2007) and FBM (Budson et al., 2007; Greenberg, 2004; Hyman, 1999; Neisser & Harsch, 1992). In the present study, having epilepsy, decreasing age, gun ownership, political ideology (i.e., being more

conservative), sexuality (i.e., being more attracted to the same sex), not having LGBT friends or family, having any children, increased frequency of Internet use to get or exchange information about mass shootings, using the Internet to get news or information about a recent mass shooting, increasing PSS (i.e., psychological stress) scores, and increasing QIDS (i.e., depression) scores were associated with increased false memories. This aligns with previous work that found memory for false events could be predicted by group membership and ideology differences. For example, Frenda and colleagues (2013) found liberal individuals were more likely than conservative individuals to falsely remember former President George W. Bush on vacation during the Hurricane Katrina catastrophe, and conservative individuals were more likely to falsely remember seeing former President Barack Obama shaking the hand of former Iranian president Mahmoud Ahmadinejad. Further, Rice and colleagues (2018) found that nonwhite participants recounted their FBM regarding the election of the first nonwhite President of the U.S. three times more often than white participants, and political affiliation played a larger role than race, where liberals exhibited greater recall than moderates or conservatives. Additionally, research has demonstrated a relationship between psychological stress, depression, and false memory, where individuals under stress or with depressive symptoms can have higher false recognition of stimuli (Yiping et al., 2018; Pardilla-Delgado et al., 2016). The present study demonstrates this effect for mass shooting events, where individuals with higher stress scores and depression scores were more likely to identify false mass shootings.

Of note, epilepsy predicted FBM for real shootings as well as memories for false events. Declarative memory, the memory of facts and events, can be impaired for individuals with epilepsy. Impaired declarative memory is a characteristic component of temporal lobe epilepsy (TLE), which accounts for about 70 percent of epilepsy types (Arzimanoglou et al., 2005).

Episodic memory, the acquisition of time and context dependent information (e.g., components of FBM) are particularly affected by TLE. Epilepsy has been shown to decrease recognition for word-based stimuli (Seidenberg et al., 1993). Additionally, epilepsy has been shown to encourage false memories through experiential phenomena termed dreamy states or psychical seizures (Penfield & Perot, 1963; Gloor, 1990), where false traumatic autobiographical events have been perceived as truthful and severe enough to lead to a PTSD diagnosis (Cohen et al., 2010). Thus, individuals with epilepsy may be more likely to identify false mass shootings, believing these potentially traumatic events did occur, due to impairment in recalling mass shootings they may recognize that did occur, where memory of FBM categories for real shootings are mismatched to false shootings that share the same semantic structure (i.e., shooting location and date). Since the impact of epilepsy on memory can vary by type of epilepsy and treatment effects over time (e.g., higher false alarm scores in males; Hudry et al., 2003), future studies can attend to these differences in more detail as they relate to FBM.

**Limitations**

Several limitations of this study should be noted. The cross-sectional nature of this study, as well as its use of surveys, can be seen as a limitation where biases may be present in reporting (e.g., influences on recall; see General Discussion). However, in addition to obtaining robust findings, cohort effects were not noted, the sample obtained contained participants throughout the U.S., and a longitudinal study of this nature (i.e., examination of a twenty-year time period) would entail a much larger commitment of time and resources. Relatedly, most FBM studies rely on retrospective reporting, where ongoing memory studies that account for, incorporate, or adjust for future events such as mass shootings before they occur are rare (see Stephenson et al., 2009).

Similar to limitations discussed in Study 1, a greater selection of shootings over a longer time period could be helpful in examining more nuanced characteristics of shootings and FBM over time. Sample sizes utilizing a larger amount of shootings could increase power in analyses relying on robust sample sizes, such as examining characteristics of shootings (e.g., shooting location, mental health of the shooter) that potentially predict FBM and public interest.

Since the amount of FBMs for mass shootings in this sample of deadliest shootings was low for many of the events, future studies could examine aspects of why FBMs may be low for many of the deadliest shootings in the U.S. and be compared to less deadly shootings. This study focused on the most salient shootings out of more than 90 shootings during this time period (Follman et al., 2019). Thus, if this analysis was continued with a larger sample size that included less deadly shootings, significant trends may emerge.

Alternatively, future studies could focus on a few select shootings over a certain timeframe or with certain characteristics (e.g., similar targets of shooters) to obtain larger sample sizes for people aware of these shootings who may have memories of them. Alternative assessment methods (e.g., interviews) could also be used. These methods could enable addressing more in depth or nuanced questions without placing a large burden of time or resources on participants and encourage detailed relevant reporting.

Although the presence of mental illness significantly predicted FBM, specific measures of mental illness and distress (i.e., stress on the PSS, worry symptoms on the PSWQ, depression symptoms on the QIDS-SR16) did not significantly predict the presence of FBM for real shootings. Future studies may focus more on mental health and FBM in the form of alternative data collection (e.g., interviews) or increased survey participants to potentially increase sample sizes in different groups (e.g., those who have mental illness and FBM, those who do not have

mental illness and did not have FBM for certain shootings or any shootings) to further elucidate the relationship of mental health and FBM, including the relationship of stress (e.g., PSS scores) on memory for real versus fictitious shootings.

## General Discussion

This study was designed to address whether the public's perception of mass shootings and orientation to them have changed over time, to evaluate whether mass shooting events can be identified as FBM, to identify factors (e.g., time, group status) that may influence the saliency of mass shootings, and to assist in understanding public views of these shootings that may encourage public policy and preventive measures. In order to address whether the public's perception of mass shootings and orientation to them have changed over time, this two-part study utilized Wikipedia data (i.e., byte size, edits, and page views of articles) for 19 of the deadliest mass shootings from 2001 to 2018 (Part One) and FBM for 22 of the deadliest mass shootings from 1999 to 2018 (Part Two).

### Wikipedia and FBM as Measures of Public Interest

It is important to note the relationship of open access data from Wikipedia and FBM on measurement of public interest. Wikipedia data provides a means of examining public interest over time, as measured by components of Wikipedia articles and the articles themselves, while FBM provides a means of examining public interest over time by examining the presence, absence, and strength of memories for how individuals have heard about a particular event.

As a means of measuring public attention to mass shootings, analyzing Wikipedia posts and FBMs have their own advantages and limitations. According to Pentzold (2009), Wikipedia can be conceptualized as a worldwide memory location where individuals are able to express and debate differing points of view that lead to the formation and acknowledgement of shared

knowledge that comprises collective memory. With a group of interconnected participants, Wikipedia appears to be less prone to rates of forgetting compared to FBM. Wikipedia accounts of events on subjects like mass shootings can be examined and easily measured, providing a real-time indicator of the public's attention to these atrocities, although this approach to research has limitations. In contrast, FBM can provide a more intimate view of individuals' relationships to these public events, as individuals' shared group experience (e.g., "I was there" or "I was there too"; see Lanciano et al., 2013), or their experience of how the events impacted members of their group (see Talarico & Rubin, 2018). Thus, FBM exists on an individual, autobiographical level that is subject to memory processes (e.g., interference, recency effect, loss of brain function through aging).

The overarching aim of these two studies was to determine whether there is evidence that suggests the mass shootings in the United States of America have become the "new normal". In other words, have shootings in the country become less salient than they once were. Research from our two studies were mixed. Some evidence suggests that these shootings have become less salient. Changes in the byte size and edits of Wikipedia articles tended to decrease over time, such that interest in contributing to articles about these shootings tended to decline more rapidly over time. Thus, more recent shootings displayed a more immediate drop in article engagement (i.e. contributions from Wikipedia editors), suggesting less attention or interest being present for newer shootings compared to older shootings. Additionally, various factors predicted the amount of FBM, demonstrating that saliency of mass shootings can vary for different groups of people (e.g., those who own guns, those who are parents) over time. It can be argued that various individual and event characteristics influence how mass shootings are perceived, discussed (e.g.

through Wikipedia), and remembered (e.g. FBM), making an overall degree of saliency less realistic than a more nuanced approach.

In contrast, we found that the total byte size of Wikipedia articles about these shootings tended to increase over time, although the amount of edits did not significantly change, where more recent Wikipedia articles tended to have larger byte sizes. This may be due to an increase in the death toll of these more recent shootings, as death toll was also associated with an increase in byte size. Additionally, Study 2 found more recent shootings were associated with more participants with FBM, although time did not significantly predict FBM. This could also be related to the sample size and selection of the shootings described earlier, as well as death toll (e.g., higher death toll was associated with greater FBM and death toll tended to increase over time) and influences on memory (e.g., recency effect).

Among some interesting findings, we found that a variety of factors may influence the saliency of these shootings, such as shooting characteristics (e.g., death toll) and individual characteristics (e.g., mental illness, internet engagement). Print, online, and broadcast media may also influence FBM and Wikipedia data over time. For example, it appears media coverage that focuses on certain kinds of shootings such as school shootings, despite being a minority of mass shootings, can have an impact on FBM. Half of the six mass shootings with the highest amount of FBM were located at schools, despite being only 14% of mass shootings from 1982 to 2018 (see Follman et al., 2019). It is very likely that school shootings that involve children and adolescents appear to be the most emotionally impactful, as well as have the most media coverage, and thus most apt to result in FBMs (see Schildkraut et al., 2017; Silva & Capellan, 2018a, 2018b). Sensitivity to the loss of children in these events might be particularly salient to parents, who tended to have a greater amount of FBM compared to non-parents.

Although not a central focus of our study, we did find that a third of participants mistakenly identified shootings that never occurred. It appears there are many factors that influence the presence of these false memories, and interestingly many of these predictive factors overlapped with predicting FBM for real shootings. For example, greater frequency of Internet use for news or programs about politics and current affairs, as well as greater frequency of Internet use to get or exchange information about mass shootings, were associated with increased FBM for both real shootings and identifying shootings that did not occur. It might be that individuals who consume more mass media are passionate about mass shootings, which influences how readily they identify with these events, real or not. The presence of these false memories highlights some of the difficulties in measuring FBM, which rely on retrospective reporting and can be false. Recording and authenticating FBM may provide some logistical challenges, but the current study does provide a novel approach for assessing the validating of individual memories for events. Future FBM research may benefit from further focusing on factors that contribute to inaccurate memories of events.

**Public Policy and Preventative Measures**

The present study may be used to inform policy advocates regarding public opinion on mass shootings in terms of media consumption of these events (i.e., Wikipedia) and how these events are remembered (i.e., FBM). Haner and colleagues (2019) note that preventing mass shootings may involve implementing and enforcing strategies that differ from preventing other shooting types, but that policies aimed at one type of gun violence may have a diffusion of benefits in reducing other outcomes (e.g., suicides and firearm accidents). For example, Barry and colleagues (2015) note that large majorities of gun owners and non-gun owners strongly support measures to strengthen gun laws in the U.S., where 85 percent of gun owners and 82

percent of non-gun owners support background checks for any individual in any location seeking to buy a gun. Gun regulation research has found support for this bi-partisan view, as background checks have been shown to make it more difficult for offenders to obtain guns (Vittes et al., 2013).

This two-part study, to our knowledge, is the first to examine the saliency of mass shootings over time through the use of Wikipedia articles and FBM. More research is needed to identify factors that influence the saliency and meaningfulness of mass shootings, as well as how false shootings and false memories can impact this saliency. Various means of facilitating future research have been proposed (e.g., including larger sample sizes, running more nuanced analyses with greater power), which could help further elucidate the saliency of mass shootings.

With regards to the saliency of mass shootings, understanding and enhancing factors that contribute to the saliency of mass shootings may be helpful in developing public policies aimed at decreasing the frequency of mass shootings. Greater public awareness of mass shootings, both school shootings and the smaller work-place shootings that receive less media attention, may be needed to address this public health issue (Silva & Capellan, 2018a; see Muschert & Carr, 2006). Increasing awareness of mass shootings may promote policy change similar to how increased awareness assisted in promoting changes in the treatment of people with disabilities (Happer & Philo, 2013), changes regarding civil rights (Winter & Eyal, 1981), and changes in sentiment towards the Vietnam War (Mandelbaum, 1982). Thus, for individuals who are interested in making policy changes related to mass shootings and decreasing their occurrence through legislative means, it would be important to recognize factors that may increase the saliency of these events.

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# Appendix A

MTurk Survey

Part A

Thank you for volunteering to participate in this study. Your answers to the following questions will be greatly appreciated and will be used to help understand memory processing. No directly identifiable or personal information, such as your name or address, will be obtained or used in this survey. Please answer honestly and accurately to ensure you are paid at the end of this survey.

Below is a list of mass shootings. Some of the mass shootings in this list occurred, while other fictional shootings have been created for the purposes of this study. If a shooting is known by more than one name, both are included. We are attempting to identify 1) Which mass shootings participants are aware of, and 2) Which mass shootings participants can remember the first instance they learned that the shooting occurred.

Please review the list below. Select Yes in Column 1 if you recognize the shooting. Select Yes in Column 2 if you selected Yes in Column 1 for a given shooting AND if you have a memory of the first instance you learned the shooting occurred. If you do not recognize a shooting, then the column can be left blank.

Las Vegas Shooting (a.k.a. Las Vegas Strip Shooting) in Las Vegas, Nevada

Pulse Nightclub (a.k.a. Orlando Nightclub Shooting) in Orlando, Florida

Virginia Tech in Blacksburg, Virginia

Sandy Hook Elementary School in Newtown, Connecticut

Marjory Stoneman Douglas High School (a.k.a. Parkland Shooting) in Parkland, Florida

Inland Region Center (a.k.a. San Bernardino Attack) in San Bernardino, California

American Civic Association (a.k.a. Binghamton Shootings) in Binghamton, New York

Fort Hood (a.k.a. First Fort Hood Shooting) in Fort Hood, Texas

Washington Navy Yard in Washington, D.C.

Film Theater (a.k.a. Aurora Shooting) in Aurora, Colorado

Santa Fe High School in Santa Fe, Texas

McLendon Family (a.k.a. Geneva County Shooting) in Geneva County, Alabama

Red Lake High School in Red Lake, Minnesota

Umpqua Community College in Roseburg, Oregon

African Methodist Church (a.k.a. Charleston Church Shooting) in Charleston, South Carolina

Hartford Distributors in Manchester, Connecticut

Westroads Mall in Omaha, Nebraska

Salon Meritage (a.k.a. Seal Beach Shooting) in Seal Beach, California

Goleta Postal Office in Goleta, California

Wedgwood Baptist Church in Fort Worth, Texas

Atlanta Day Trading in Atlanta, Georgia

Columbine High School massacre Littleton, Colorado

Riverside Polytechnic High School in Riverside, California

Allen Edmonds Shoe Factory in Meridian, Indiana

Laredo Dollar Tree in Laredo, Texas

Wave Nightclub (a.k.a. Wave Shooting) in Norfolk, Virginia

Emporia State University in Emporia, Kansas

Dewitt Mall in Ithaca, New York

Tonawanda Elementary School (a.k.a Elm Grove Shooting) in Elm Grove, Wisconsin

Jenkinson's Boardwalk Amusement Park in Point Pleasant Beach, New Jersey

St. Paul's Lutheran Church (a.k.a. Statesboro Church Shooting) in Statesboro, Georgia

Boyd Hill Recreation Center in Rock Hill, South Carolina

Fort Polk in Vernon Parish, Louisiana

Part B: FBM Questions

Please answer the following questions about the [name of shooting].

1) Please describe in at least one sentence how you first became aware of this mass shooting.

Please finish your response to this question before proceeding to the next page.

2) Do you remember what time it was when you first became aware of this mass shooting?

How confident is your recollection?

1----------2----------3----------4----------5

(not confident at all) (extremely confident)

3) Do you remember how you first learned about this mass shooting (what was the source of the information)?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

4) Do you remember where you were?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

5) Do you remember what you were doing?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

6) Do you remember who else was there?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

7) Do you remember how you felt when you first became aware of this mass shooting?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

8) Do you remember who the first person was with whom you communicated about the shooting, and how did he/she feel about it?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

9) Do you remember what were you doing immediately before you became aware of the shooting?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

10) Do you remember what you did immediately after you became aware of the shooting?

How confident is your recollection?

(not at all) 1----------2----------3----------4----------5 (extremely)

11) In the two weeks following the shooting, how closely did you follow the media coverage?

(very little) 1----------2----------3----------4----------5 (very much)

12) In the two weeks following the shooting, how much did you talk about the shooting with others in person or online?

(very little) 1----------2----------3----------4----------5 (very much)

13) When you think about the time you heard about this mass shooting, to what extent do you re-experience the original visual scene (or the original sounds, touches, smells, etc. that were present when you heard about this event)?

(no image at all) 1----------2----------3----------4----------5 (as vivid as normal vision)

Part C: Accuracy Questions (Event Memory)

Please answer the following questions regarding the [shooting].

14) What was the race of the shooter? If you can identify the ethnicity of the shooter (e.g. Hispanic, non-Hispanic) please do so as well.

15) What was the age of the shooter? An age range (ex. 8 to 12 years, young, middle-aged) or single number can be entered.

16) How did the shooter obtain the gun(s) that were used in the shooting?

Legally; Illegally; Some were obtained legally and some were obtained illegally; I'm not sure; I don't remember

17) Did the shooter have any known history of mental illness before the shooting?

Yes. But I don't remember specifics

Yes. If you can, describe the condition(s) you remember (PTSD, depression, the mother

had anxiety, etc.)

No

I don't know

18) Can you recall if the shooter informed anyone of his or her plans to carry out a mass shooting or if he or she wrote a manifesto?

Yes, the shooter informed at least one other person (face to face or online)

Yes, the shooter wrote a manifesto before committing the act

Yes, the shooter did both

No

I don't know

19) If you know what type of weapon was used, please describe it. If you do not, please write "IDK".

20) If you can remember what year this shooting occurred, please write it. If you can remember the date more specifically (month and year, or day month and year) please write that.

21) Did this shooting occur within 10 miles from your home?

Yes, No

Part D: General Questions

1) Do you believe mass shootings have become more frequent in recent years?

(not really) 1----------2----------3----------4----------5 (definitely)

2) If you believe mass shootings have become more frequent in recent years, do you think they will continue to be more common in the future?

(not really) 1----------2----------3----------4----------5 (definitely)

3) How much blame for mass shootings would you place on the availability of guns?

(no blame) 1----------2----------3----------4----------5 (a lot of blame)

4) How much blame for mass shootings would you place on the influence of violence in popular culture such as movies, television, and the internet?

(no blame) 1----------2----------3----------4----------5 (a lot of blame)

5) How much blame for mass shootings would you place on the way parents raise their children?

(no blame) 1----------2----------3----------4----------5 (a lot of blame)

6) How much blame for mass shootings would you place on the shooter(s)?

(no blame) 1----------2----------3----------4----------5 (a lot of blame)

7) Have you ever known anyone who has ever been affected by a mass shooting (e.g., was a victim who was killed or injured, knew someone who was killed or injured, attended an event or location before or after the event took place)? If yes, please identify the shooting and describe who the person was in relation to you and how he or she was involved.

8) How likely do you think you might personally observe a mass shooting in your lifetime?

Not at all likely 1----------2----------3----------4----------5 Extremely likely

9) How likely do you think you will be in a situation where you may need a gun to protect you or those around you?

Not at all likely 1----------2----------3----------4----------5 Extremely likely

10) If you know the names of the shooters of any of the shootings, please list the name and corresponding shooting. If you know one of the names of the shooters but not the shooting, please still write the name or names.

Part E: Demographic Questions

What is your age?

What is your race?

Are you of Hispanic, Latino, or Spanish origin?

Yes No

If yes, please write which (Mexican, PR, Cuban, Colombian, etc.) ____

Which U.S. state do you live in?

What is your gender? Male Female Other identification ____

Do you currently own a gun? Yes No

Do you support the use of background checks before obtaining a gun? Yes No

Do you believe background checks reduce crime, including the occurrence of mass shootings?

Yes No

Where does your political ideology tend to fall? Please indicate your response by marking the appropriate point on the scale provided.

Left Center Right

Liberal ------ Moderate ----- Republican

1 5 10

What is your religious affiliation, if any?

Roman Catholic Protestant (Lutheran, etc.) Orthodox Judaism Mormonism/Latter Day Saints Islam Buddhist Hindu Atheist Agnostic Other ___

Have you ever been diagnosed with a psychiatric or mental condition, such as depression, anxiety, a traumatic brain injury? Yes No

If yes, what was the diagnosis or diagnoses? _____

What is your political affiliation, if any? (In other words, which party are you registered with, and/or that you most identify with?)

Republican, Democrat, Independent, Libertarian, Green Party, None, Other ____

Who do you identify as being attracted to?

0----1-----2-----3-----4----5----6

Exclusively Bisexual Exclusively

heterosexual homosexual

Do you identify as being asexual? Y/N

Would you consider any of your parents, friends or other family members (such as siblings, aunts, uncles) to be gay, lesbian, bisexual, transgender, or asexual?

Yes No

If yes, please write which family member(s) and their identity ____

What is your estimated annual household income? $ _____

Do you have a family history of Alzheimer's Disease? Yes No

Have you ever been diagnosed with any kind of memory problem?

Yes what was it/what were they?_____ No

Do you have epilepsy? Yes No

Have you ever had a seizure? Yes No

Do you have any children?

Yes No

If yes, how many?

Please list how many children you have in each category, along with their gender, below.

If you have no children in a particular category, that category can be left blank.

Newborn or Toddler (0 to 3 years old)

Pre-K (4 years old)

Kindergarten (5 years old)

Elementary School (5-11 years old)

Middle School (10 to 14 years old)

High School (13 to 18 years old)

College (Bachelor's) (17 and above)

Advanced Education (Master's, J.D., PhD, Ed.D, etc.) (20 and above)

Part F: Clinical Inventories

The Penn State Worry Questionnaire (PSWQ)

Available at https://outcometracker.org/library/PSWQ.pdf

The Inventory of Depressive Symptoms and the Quick Inventory of Depressive Symptoms

Available at https://ebbp.org/resources/IDS-SR%20English.pdf

Perceived Stress Scale

Available at
http://www.healthmeasures.net/administrator/components/com_instruments/uploads/TOOLBOX%20Bank%20FF%20v2.0%20-%20Perceived%20Stress%2018%20plus_1-24-2017.pdf

Part G: Media Consumption and Political Engagement

1) How much time a day do you spend using the Internet for news or programs about politics and current affairs?

none, less than ½ hour, ½ hour to 1 hour, 1 to 2 hours, more than 2 hours

2) How much do you use the Internet to get or exchange information about mass shootings?

a great deal, a fair amount, not very much, not at all

3) Did you make use of the Internet to get news or information about a recent mass shooting?

many times, several times, once or twice, no

During the 2016 presidential election campaign did you visit any of the following websites, and if so, how frequently?

4) official national or local websites of the political parties

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

5) candidates' websites (local, regional, and/or national candidates)

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

6) political blogs

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

7) social networking groups (e.g. Facebook) organized around a political issue

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

8) online video channels (e.g. YouTube) to view official or unofficial videos about election issues, party leaders or local candidates

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

9) Twitter sites of parties, leaders, or candidates

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

10) news organization websites (CNN, Fox News, MSNBC, BBC America, etc.)

3 = Many times, 2 = Several times, 1 = Once or twice, and 0 = Never visited

11) Did you vote for any candidate in the most recent presidential election (e.g. Democrat, Republican, or third party)?

Yes No