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Objective: The study of physical injury from terrorist explosives is an increasing international area of research. However, there are few data sets to characterize the scope of injury and death from these devices. Therefore, one option is to begin evaluating statistics reported by a nontraditional public health data source, the U.S. Federal Bureau of Investigation (FBI) Bomb Data Center. Methods: We reviewed data reported by the FBI Bomb Data Center for the years 1988–1997 and analyzed the number of bomb-related deaths and injuries and incidence of bombings. Results: The FBI reported 17,579 bombings, 427 related deaths, and 4,063 injuries in the United States between 1988 and 1997. The benefits of this data are reporting of information not normally found in public health data, including type of explosive device and explosive composition. The primary limitations include lack of case comparison and unknown methods of data reporting and data collection. Conclusion: To completely study physical injury from explosive devices requires a systematic and comprehensive data set. The FBI data provides an interesting statistical resource to assess the scope of injury from bombs in the United States, but at the current time cannot be used for extensive epidemiological analysis.

Introduction

Investigation of injuries from specifically terrorist and criminal explosive devices is a growing area of international study. But its study is limited due to few national and international sources of medical data to analyze. Therefore, it is critical to explore nontraditional public health data sources to better characterize statistics on morbidity and mortality. For this reason, we investigated the limitations and benefits of using federal law enforcement data that reports frequency of bombing events, in addition to death and injury statistics.

The importance of these data are its nontraditional use in the public health arena. Public health traditionally uses data such as International Classification of Diseases, Morbidity and Mortality and national health registries to abstract data. Many medical and public health audiences may be unaware that injury and death statistics are even reported by the Federal Bureau of Investigation (FBI). Therefore, we present a descriptive analysis of this secondarily collected data and provide the reader an overview of its reported death and injury numbers.

The current study aims to report and analyze data on the types and numbers of bombing events in the United States, related injuries, and deaths between 1988 and 1997, reported by the U.S. FBI Bomb Data Center (BDC). We will discuss the usefulness of these data and identify limitations that will thwart rigorous and more extensive epidemiological analysis.

Methods

We secondarily reported FBI BDC data by examining reports of data for the years 1988 through 1997, identifying trends in annual total bombings (actual and attempted), bombing types (explosive or incendiary), and data for bomb-related injuries and deaths.

Data for the years 1988–1997 were reported solely in the 1997 FBI BDC Bulletin. The FBI defines a “bomb” as “the illegal possession or use of explosive material with criminal purpose, implying their use to destroy property or cause injury.” The FBI defined “actual bombings” as the “illegal detonation or ignition of an explosive or incendiary device,” including premature detonation or ignition of a device while it is being prepared, transported, or placed. Analysis also included the number of attempted bombings which was defined as “an unsuccessful attempt to illegally detonate or ignite an explosive or incendiary device” resulting from the malfunction or disarmament of the device before it explodes or detonates.

Results

During 1988–1997, the FBI received reports of 17,579 actual bombings (Table I). The annual number of bombings ranged from 749 to 2,493 incidents during this time. The number of actual bombings more than doubled over the 10-year period, from 749 to 1,590 incidents (Table I and Fig. 1). The maximum number of incidents peaked at 2,493 bombings in 1992, before a 3-year decline of incidents starting in 1995. Among the 17,579 bombings during this time, approximately 78% were caused by explosive devices and 22% from incendiary devices (Table I and Fig. 1). The FBI BDC defined “explosive bombing” as the “detonation of a device (an improvised explosive device[IED]) constructed with high or low order explosive material” such as dynamite; black, smokeless, and pyrotechnic material; or flash powder. The FBI defined “incendiary bombing” as pertaining to devices constructed of flammable materials creating a burning, nondetonating effect, and not consisting of high-explosive or low-explosive material. These are called improvised incendiary devices and sometimes consist of materials like gasoline and are commonly referred to as “fire bombs.”

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The percentage of explosive bombings peaked in 1995 (79.4%) and comprised an annual range of total bombings between 76.0% and 79.4% from 1988 to 1997. Incendiary bombings peaked early in the study, in 1989, and comprised 24.1% of bombings that year. Incendiary bombings ranged between 20.8% and 24.1% during the 10-year study period. In addition, the FBI BDC reported 5,129 attempted bombings between 1988 and 1997. More than one-half of these attempts occurred during the final 4 years between 1994 and 1997 (2,627, 51.2%). There were more attempted bombings using incendiary devices than among actual bombings, approximately 27% incendiary and 73% explosive.

The FBI reported 427 deaths between 1988 and 1997 (Table II and Fig. 2). The greatest number of FBI reported deaths occurred in 1995, where 167 (86.5%) fatalities from the Oklahoma City bombing contributed to the 193 count. The least number of deaths were reported in 1989, with 11 cases. The FBI also reported 4,063 bomb-related injuries between 1988 and 1997. There were 9.5 times more injuries than reported deaths. The most injuries were reported in 1993, possibly including the 1,042 injuries from the World Trade Center bombing. The second highest number of injuries occurred in 1995, also possibly capturing the 592 injured casualties from the Oklahoma City bombing. The least injuries occurred in 1988, and injuries ranged between 3.9 and 27 times greater than deaths during the 10-year period (Fig. 2).

**Discussion**

The FBI BDC provided information not normally available in public health data. Two types of information were data about the type of explosive material and motivations of the bomber. Information solely from 1997 provided some general insights that can be applied for the years 1988 through 1997. The FBI data showed that 78% of the bombings were explosive and 22% incendiary. Some readers might expect that explosive bombings would cause more deaths than injuries. However, our analyses revealed that there were overall, 9.5 times more injuries than death. By only examining the available 1997 FBI data, it suggests that the majority of the explosive bombings consisted of less powerful low-explosive devices composed of crudely built containers versus those made from much more powerful and...
lethal high explosives. If explosive bombings in the FBI data consisted of mainly low-explosive material, then this may explain why more injuries than deaths were identified.

Among 4,335 explosive devices reported to the FBI in 1997, black or smokeless powder was used in 44% (1,919) of improvised explosive devices, 24% (1,027) contained chemical or improvised mixtures, and 19% (823) contained pyrotechnic material. Similar trends were found when Karmy-Jones et al. reported FBI data for the 10-year period from 1980 to 1990. During this time, the authors reported 12,216 bombing incidents. Based on the 1990 data, they inferred that the majority of devices (53%) consisted of pipe bombs containing black powder and smokeless powder.

This is important because it can allow researchers to correlate distinct injury patterns and casualty outcomes that are consistent with specific types of explosions: low-explosive and high-explosive bombings. Low explosives can cause more injuries than death, consisting of penetrating wounds due to shrapnel, broken glass, and debris secondary to the device, as well as burns. For example, a bombing in the Soho District of England in April 1999 involved a criminal explosion of fireworks flash powder placed in a device concealed within a duffle bag, killing three people, causing below-the-knee amputations, and severely burning others. The explosion of a Molotov cocktail, an incendiary type of bomb, reported by Benmeir et al. and the explosion of a device with an incendiary ammonium nitrate substance reported by Gomez Morell et al. and Jimenez-Hernandez et al. also document extensive cases of burns. Additionally, Karmy-Jones et al. described injuries sustained by two patients who had attempted to construct an explosive device consisting of black powder in the privacy of a home garage. Among their injuries were a closed head injury, facial lacerations, orbital lacerations, and complex hand lacerations. These casualty statistics contrast sharply with the World Trade Center Bombing (United States) in 1993, Oklahoma City (United States) in 1995, Beirut Marine Barracks (Lebanon) in 1983, and the U.S. Embassy bombings in Kenya and Tanzania in 1988, in addition to the Bali bombings in 2002, Riyadh and Moscow bombings in 2003, and the Madrid train bombings in 2004 that all used large amounts of high explosives. These bombings caused a high number of immediate deaths, critical injuries, and more complex and severe multidimensional patterns of physical injury.

### Table II

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Annual Deaths</th>
<th>Total Annual Injuries</th>
<th>Ratio of Injury to Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>12</td>
<td>145</td>
<td>12 (10.28)</td>
</tr>
<tr>
<td>1989</td>
<td>12</td>
<td>202</td>
<td>16 (16.18)</td>
</tr>
<tr>
<td>1990</td>
<td>22</td>
<td>222</td>
<td>22 (22.22)</td>
</tr>
<tr>
<td>1991</td>
<td>23</td>
<td>230</td>
<td>12 (12.12)</td>
</tr>
<tr>
<td>1992</td>
<td>26</td>
<td>349</td>
<td>13 (13.13)</td>
</tr>
<tr>
<td>1993</td>
<td>49</td>
<td>1,323</td>
<td>27 (27.27)</td>
</tr>
<tr>
<td>1994</td>
<td>63</td>
<td>3,221</td>
<td>17 (17.17)</td>
</tr>
<tr>
<td>1995</td>
<td>71</td>
<td>10,463</td>
<td>36 (36.36)</td>
</tr>
<tr>
<td>1996</td>
<td>28</td>
<td>18,041</td>
<td>16 (16.16)</td>
</tr>
<tr>
<td>1997</td>
<td>25</td>
<td>87,553</td>
<td>24 (24.24)</td>
</tr>
</tbody>
</table>

Fig. 2. Distribution of FBI reported deaths and injuries in the United States from 1988 to 1997.
**Limitations**

Although the FBI data were very helpful in many respects, there still exist some limitations that constrain the ability to continue more accurate and comprehensive assessment of the bombing problem as it relates to injuries. The FBI BDC uses a passive system to collect information about bombing incidents within the United States and its territories, which can include U.S embassies. Data collected may include reports of actual bombings, attempted bombings, hoax devices, recoveries of nonexploded devices, illegally possessed explosive materials and their precursor chemical materials, and military ordnance devices.

This information is voluntarily reported by federal, state, and local law enforcement agencies, including more than 600 bomb squads, the Postal Inspection Service, Military Explosive Ordnance Disposal units, and the Bureau of Alcohol, Tobacco, and Firearms. As a result, the FBI data are possibly more incomplete than some data sources like the National Vital Statistics System due to limitations of voluntary reporting habits and varying investigative resources. However, it is important to consider that data codes are often very limited in definition and sometimes ambiguous, thus making it difficult to characterize what truly caused the injury.

The U.S Department of Justice acknowledges that statistics reflect only incidents reported to federal databases and are not completely representative of the scope of bombings and injury in the United States. It would be of great benefit to learn the methods by which injuries are actually reported to the bomb data center, including data fields and instruments used to report injuries, timeliness of reporting, and any areas of incomplete or unknown reporting. Also, as is the case with many databases, FBI data were often incomplete and many unknowns were encountered. For example, although the FBI reported 16 perpetrators affiliated with terrorist motivations in 1997, motivations of more than one-half of the population were still unknown. Although we were able to infer a trend in explosive versus incendiary bombings during the 10-year period, the FBI data were aggregated and did not provide information on a case-by-case basis. In other words, the data were not presented in such a way that one could identify specific injuries to specific people or types of devices.

To conduct a more extensive epidemiological analysis, data such as demographics of those injured (age, sex, location, or area of country), medical treatment, and types of injuries would be needed. This ideal data set would merge the capabilities of medical and public health information with law enforcement records. This type of registry system would provide data on the characteristics of the bombing event (bomb characteristics, scene setting, environmental and building traits), demographics of victims, injury types and severity, medical treatment, and outcome. It would be helpful to make a direct correlation between different bombing events and resulting injuries so that risk factors can be identified to mitigate injury.

**Conclusions**

Characterizing trends in morbidity and mortality from explosive devices require systematic study and complete data sets. For instance, the Israeli Trauma Registry provides one source of systematized and sorted data on explosion trauma from terrorism. So far, this study provided an opportunity to investigate a nontraditional public health data source. The FBI data provided a unique source of health data, revealing interesting statistics such as the incidence of 17,579 bombing events in the United States within a 10-year period, 78% of which were explosive and 22% incendiary bombings, 427 reported deaths, and 4,063 reported injuries during 1988–1997. Although there are several limitations using the FBI data source as a complete and true epidemiological tool, there are some benefits.

Although there are several limitations using the FBI data source as a complete and true epidemiological tool, there are some benefits. This study should encourage researchers to explore nontraditional public health data sources. Because the study of explosive injuries encompasses many fields (e.g., law enforcement, medicine, public health, engineering), researchers should anticipate a multidisciplinary approach to develop a systematic and standard method of documenting morbidity and mortality from explosions. Interested researchers should anticipate exploring more data sets, where they can weigh the benefits and limitations of each set of data, with the intent of developing a systematic and standard method of documenting injury from explosive devices.

**References**


