well as the plethora of factors that might influence outcomes in patients with complex conditions like heart failure. However, traditional biological factors fail to explain substantial variability in health outcomes in patients with cardiovascular disease.\textsuperscript{1,2} Emerging evidence, including our study, suggests that considering social factors like health literacy will enhance the ability to identify patients at high risk for adverse outcomes.

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**RESEARCH LETTER**

**Stray Bullet Shootings in the United States**

To the Editor: Stray bullet shootings create fear and insecurity in affected communities\textsuperscript{1-3}; entire populations have been advised to remain indoors at times of high risk.\textsuperscript{4} No nationwide information on these shootings is available.

**Methods.** We defined a stray bullet as having escaped the sociogeographic space or perimeter customarily set by the circumstances surrounding the firing of the gun from which it came, and cases as shootings events that involved at least 1 stray bullet injury to a person: a gunshot wound or injury by secondary mechanism. Cases could arise from violence, shooting sports, celebratory gunfire,\textsuperscript{5} or other activity. We included bystander shootings arising from violence if the bystander had no active role and was not targeted intentionally, shootings in which persons were injured by shooters targeting structures, and shootings from unintentional gunfire when the shooter and the person shot were not the same person. We excluded shootings in which persons were targeted at random but shot intentionally.

Between March 1, 2008, and February 28, 2009, we conducted real-time surveillance using Google and Yahoo! news alert services, searching on stray bullet, and the news archives of GunPolicy.org. One year later, we searched for follow-up reports. We did not retrieve articles when payment or a subscription was required (<5%) or, in secondary searches, articles that had not been archived (~2%).

Proportions were calculated based on all cases identified. To detect reporting bias, we compared case-fatality ratios for persons injured by stray bullets in cases arising from violence with those for persons injured by nonstray bullets in those same cases and for firearm-related assaults in the United States in 2007,\textsuperscript{7} and we determined whether outcome severity and characteristics of persons injured were associated with the number of articles retrieved, using the Wilcoxon rank sum test with a 2-tailed *P* < .05 representing statistical significance. Data were analyzed using SAS version 9.1.3 for Windows (SAS Institute, Cary, North Carolina) and VassarStats (Vassar College, Poughkeepsie, New York). The University of California, Davis, institutional review board exempted this project from review.

**Results.** We reviewed 1996 nonduplicate reports on 501 shooting events; 284 (56.7%) events met case criteria (FIGURE). Of these, 168 (59.2%) were incidental to violence (TABLE). Seven cases (2.5%) resulted from an unintended firing of a gun.

Altogether, 317 persons received stray bullet injuries; 142 (44.8%) were female, and 176 (55.5%) were outside the age range 15 to 34 years (Table). Most individuals (258, 81.4%) were unaware of the events leading to the gunfire that caused their injuries. Many (129, 40.7%) were at home; most of these persons (88, 68.2%) were indoors. Sixty-five persons (20.5%) died, 18 (27.7%) of them at the shooting site and 55 (84.6%) on the day they were shot. Fourteen persons received nonfatal injuries by secondary mechanisms. The case-fatality ratio for stray bullet injuries did not differ from that for non–stray bullet injuries (20.8%; 11/53; difference, 0.3%; 95% confidence interval, −9.7% to 13.6%) or firearm-related assault nationwide (20.6%; 12 632/61 308; difference, 0.1%; 95% confidence interval, −5.7% to 4.2%).

Cases involving stray bullet fatalities yielded more reports than others (median, 8; interquartile range [IQR], 4-11, and 2; IQR, 1-4, respectively; *P* < .001). There was no difference by sex (median, 3; IQR, 2-6, for females and 3; IQR, 2-6, for males).

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Figure. Flow Diagram for Case Identification

1. 501 Shooting events assessed for eligibility
2. 491 Identified by automated news service reports
3. 486 Google.com or Yahoo.com
4. 5 GunPolicy.org
5. 10 Identified by review of retrieved news articles

106 Excluded
- 106 No injury to humans
- 58 Near miss
- 48 Struck animal or object
- 29 Injury but not from stray bullet
- 18 Outside time period

284 Events met case criteria and included in analysis (317 individuals)

Flow Diagram for Case Identification
Table. Circumstances of Stray Bullet Shootings and Demographics of Persons Killed or Injured

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumstance</td>
<td></td>
</tr>
<tr>
<td>Incidental to violence</td>
<td>168 (59.2)</td>
</tr>
<tr>
<td>Hunting, other sports</td>
<td>21 (7.4)</td>
</tr>
<tr>
<td>Celebratory</td>
<td>13 (4.8)</td>
</tr>
<tr>
<td>Maintenance, handling</td>
<td>8 (2.8)</td>
</tr>
<tr>
<td>Other</td>
<td>9 (3.2)</td>
</tr>
<tr>
<td>Unknown</td>
<td>65 (22.9)</td>
</tr>
<tr>
<td>Demographics</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>159 (50.2)</td>
</tr>
<tr>
<td>Female</td>
<td>142 (44.8)</td>
</tr>
<tr>
<td>Unknown</td>
<td>16 (5.1)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>27 (8.5)</td>
</tr>
<tr>
<td>5-14</td>
<td>72 (22.7)</td>
</tr>
<tr>
<td>15-24</td>
<td>53 (16.7)</td>
</tr>
<tr>
<td>25-34</td>
<td>32 (10.1)</td>
</tr>
<tr>
<td>35-44</td>
<td>23 (7.3)</td>
</tr>
<tr>
<td>45-64</td>
<td>19 (6.0)</td>
</tr>
<tr>
<td>55-64</td>
<td>18 (5.7)</td>
</tr>
<tr>
<td>≥65</td>
<td>17 (5.4)</td>
</tr>
<tr>
<td>Unknown</td>
<td>56 (17.7)</td>
</tr>
</tbody>
</table>

1-6, for males; P=.47) or age within or outside the range 15 to 34 years (median, 3; IQR, 2-6, and 3; IQR, 2-8, respectively; P=.32).

Comments. Most stray bullet shootings arise from violence, but they frequently affect females, children, and older adults. Those who are shot have little or no warning; opportunities for prevention once shooting starts are limited.

Several limitations deserve mention. Any definition of “stray bullet” contains an element of subjectivity. Underreporting by news media and failure of automated retrieval services to capture reports may have led to underascertainment and bias in our data. We do not report rates; the very similar case-fatality ratios suggest that reporting was not biased by severity. Missing information was common.

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Author Contributions: Dr Wintemute had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Wintemute, Claire, McHenry, Wright.
Acquisition of data: Wintemute, Claire, McHenry, Wright.
Analysis and interpretation of data: Wintemute, Wright.
Drafting of the manuscript: Wintemute, McHenry.
Critical revision of the manuscript for important intellectual content: Wintemute, Claire, Wright.

Statistical analysis: Wintemute.

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