WHAT DO WE KNOW?

Vision 20/20 Model Performance in Community Risk Reduction

February 2020 | Marty Ahrens | Fire Analysis Research Manager
Overview

• Fire department responses
• Home structure fires
• Other types of FD calls
  – Brush, grass and forest fires
  – Carbon monoxide incidents
  – Vacant building fires
• Leading causes of fatal and non-fatal injuries
• RE-AIM evaluation framework

Presentation at nfpa.org/CRR
Local FD responses (in millions): 2018

- Medical aid, 23.6, 64%
- Fire, 1.3, 4%
- False alarm, 2.9, 8%
- Mutual aid, 1.5, 4%
- HazMat, 0.4, 1%
- Other hazard, 0.7, 2%
- All other, 6.3, 17%

From NFPA’s *Fire Loss in the United States during 2018*, by Ben Evarts
**Assist invalid calls**

- Fire departments respond to more assist invalid calls than structure fires in recent years
  - *What do we know about these situations?*
  - *Is there a prevention opportunity?*

Source: National estimates based on NFIRS and NFPA's fire experience survey
Reported fires in 2018 by major property class or incident type

**Fires**
- Highway vehicle, 14%
- Other, 7%
- Grass, brush or forest, 20%
- Outside with value, 5%
- Outside rubbish, 13%
- 1- or 2-family, 21%
- Apt, 7%
- Other resid, 2%
- Non-residential structure, 8%

**Civilian Deaths**
- Highway vehicle, 14%
- Other vehicle, 2%
- Outside with value, 5%
- Outside rubbish, 13%
- 1- or 2-family, 65%
- Apt, 10%
- Other resid, 3%
- Non-residential structure, 2%
- Other vehicle, 2%
- All other, 5%
Home structure fires
Home structure fires in 2013-2017

- Average of 354,400 reported fires per year in 2013-2017
  - Average of 2,620 civilian deaths and 11,220 civilian injuries annually
  - 69% of home fires in 1- or 2-family homes caused
    - 85% of home fire deaths
    - 65% of injuries
  - 52% of deaths were caused by the 19% of fires from 11 pm to 7 am
  - In 2011-2015, 32% of fatalities were sleeping
Calculating estimates

• Ratio from NFPA fire experience survey/NFIRS compensates for fires reported to FDS but not NFIRS

• Non-confined and confined fires analyzed separately for each causal data element
  – Unknowns typically allocated

• Leading causes pulled from multiple data elements
  – Scenario descriptions
  – Double counting occurs

• USFA uses cause hierarchy
Leading causes of home structure fires: 2013–2017

**A. Fires**
- Cooking: 49%
- Heating eq: 14%
- Electrical dist and lighting: 10%
- Intentional: 8%
- Smoking materials: 5%

**B. Deaths**
- Cooking: 22%
- Heating eq: 21%
- Electrical dist and lighting: 19%
- Smoking materials: 14%
- Intentional: 14%

**C. Injuries**
- Cooking: 45%
- Heating eq: 12%
- Electrical dist and lighting: 10%
- Smoking materials: 10%
- Intentional: 7%
- Candles: 6%
Home fire death and injury rate per 1000 reported fires, by cause: 2013–2017

A. Death rates

- Smoking materials: 33.5
- Electrical dist and lighting: 14.4
- Intentional: 13.4
- Heating eq: 9.9
- Cooking: 3.2

B. Injury rates

- Candles: 91.3
- Playing with heat source: 79.9
- Smoking materials: 63.7
- Electrical dist and lighting: 32.2
- Cooking: 29.0
- Intentional: 28.0
- Heating eq: 27.5
Leading causes of fires in 1- or 2-family vs apt fires: 2013–2017

A. Fires

- Cooking: 38% (1- or 2-Fam), 72% (Apartment)
- Heating eq: 18% (1- or 2-Fam), 7% (Apartment)
- Electrical dist and lighting: 13% (1- or 2-Fam), 3% (Apartment)
- Intentional: 9% (1- or 2-Fam), 5% (Apartment)
- Clothes dryer or washer: 5% (1- or 2-Fam), 2% (Apartment)
- Smoking materials: 4% (1- or 2-Fam), 6% (Apartment)

B. Deaths

- Cooking: 22% (1- or 2-Fam), 39% (Apartment)
- Heating eq: 8% (1- or 2-Fam), 14% (Apartment)
- Electrical dist and lighting: 21% (1- or 2-Fam), 13% (Apartment)
- Smoking materials: 20% (1- or 2-Fam), 30% (Apartment)
- Cooking: 19% (1- or 2-Fam), 14% (Apartment)
- Intentional: 15% (1- or 2-Fam), 14% (Apartment)

C. Injuries

- Cooking: 39% (1- or 2-Fam), 55% (Apartment)
- Heating eq: 14% (1- or 2-Fam), 10% (Apartment)
- Electrical dist and lighting: 12% (1- or 2-Fam), 7% (Apartment)
- Smoking materials: 9% (1- or 2-Fam), 10% (Apartment)
- Intentional: 7% (1- or 2-Fam), 7% (Apartment)
- Candles: 7% (1- or 2-Fam), 6% (Apartment)
Leading areas of origin in home structure fires: 2013–2017

A. Fires

- Kitchen or cooking area: 44%
- Bedroom: 6%
- Confined chimney or flue fire: 5%
- Unclassified outside area: 4%
- Living room: 4%

B. Deaths

- Living room: 25%
- Bedroom: 23%
- Kitchen or cooking area: 17%
- Unclassified function area: 9%

C. Injuries

- Kitchen or cooking area: 39%
- Bedroom: 20%
- Living room: 10%
- Unclassified function area: 4%
Leading causes of living room and bedroom fires: 2013–2017

A. Living room

- Heating eq: 27%
- Electrical dist and lighting: 24%
- Intentional: 14%
- Candles: 10%
- Smoking materials: 10%
- Fan or air conditioner: 4%
- Playing with heat source: 2%

B. Bedroom

- Electrical dist and lighting: 32%
- Intentional: 14%
- Candles: 13%
- Smoking materials: 12%
- Heating eq: 11%
- Playing with heat source: 4%
- Fan or air conditioner: 6%
Deaths rates from reported fires starting with
- upholstered furniture
- mattresses or bedding
are more than twice as high in current period.
Fatal injuries can occur at the very beginning of fire

- One in five victims had a physical disability
- Older adults may not be able to move as quickly
  - Clothing ignitions

Harder to save those who are intimate with ignition
Home fire deaths by age: 2013-2017

- 0-4: 150
- 5-9: 110
- 10-14: 60
- 15-24: 110
- 25-34: 190
- 35-44: 210
- 45-54: 370
- 55-64: 520
- 65-74: 430
- 75-84: 300
- 85+: 160

Home fire injuries by age: 2013-2017

- 0-4: 420
- 5-9: 300
- 10-14: 330
- 15-24: 1,430
- 25-34: 1,870
- 35-44: 1,680
- 45-54: 1,760
- 55-64: 1,650
- 65-74: 1,000
- 75-84: 500
- 85+: 280
Home fire deaths by age group and fire cause
2011-2015 annual averages

- Smoking materials
- Cooking
- Heating
- Electrical distribution or lighting
- Intentional
- Candle
- Playing with heat source

<table>
<thead>
<tr>
<th>Age Group</th>
<th>&lt;5</th>
<th>5-9</th>
<th>10-14</th>
<th>15-19</th>
<th>20-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65-74</th>
<th>75-84</th>
<th>85+</th>
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<tbody>
<tr>
<td>Smoking</td>
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</tr>
</tbody>
</table>
Home fire injuries by age group and fire cause
2011-2015 annual averages

- Smoking materials
- Cooking
- Heating
- Electrical dist or lighting
- Intentional
- Candle
- Playing

< 5 5-9 10-14 15-19 20-24 25-34 35-44 45-54 55-64 65-74 75-84 85+
Smoke alarms in home fires: 2013–2017

A. Fires

- Fire too small to operate: 14%
- Operated: 54%
- Did not operate: 7%
- No smoke alarm: 26%

B. Deaths

- Fire too small to operate: 1%
- Operated: 42%
- Did not operate: 17%
- No smoke alarm: 40%
When present in 2012-2016, home smoke alarms operated in 88% of large enough fires

- 71% of the deaths and 88% of injuries

**Effectiveness of Operating Smoke Alarms**

<table>
<thead>
<tr>
<th>Fires</th>
<th>Deaths</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupants responded</td>
<td>Occupants responded</td>
<td>Occupants responded</td>
</tr>
<tr>
<td>81%</td>
<td>66%</td>
<td>86%</td>
</tr>
<tr>
<td>No occupants</td>
<td>No occupants</td>
<td>No occupants</td>
</tr>
<tr>
<td>11%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>Occupants didn't respond</td>
<td>Occupants didn't respond</td>
<td>Occupants didn't respond</td>
</tr>
<tr>
<td>5%</td>
<td>24%</td>
<td>7%</td>
</tr>
<tr>
<td>Failed to alert occupants</td>
<td>Failed to alert occupants</td>
<td>Failed to alert occupants</td>
</tr>
<tr>
<td>2%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Fire death rate per 1,000 reported home structure fires by presence of smoke alarms and AES: 2012–2016

- No alarm or AES: 11.0
- Battery alarm but no AES: 8.5
- Any alarm but no AES: 6.4
- Hardwired alarm but no AES: 4.1
- Any smoke alarm and any AES: 1.3
- Hardwired smoke alarm and sprinkler: 1.1
When present in 2012-2016, home fire sprinklers

- Operated in 94% of large enough fires
  - Were effective 97% of incidents operating
  - Operated effectively in 92% of the fires
- Only 1 sprinkler operated 89% of the time
  - 5 or fewer in 99%
- Sprinklers were present in only 7% of home fires
CPSC’s survey of unreported fires in 2004-2005

- 97% of home fires were handled without the fire department
- Older adults less likely to have fires
- Smoke alarms were more likely to have operated and alerted when on every floor, interconnected
- Reported and unreported fires both fell from earlier survey

Other types of FD calls
Brush, grass and forest fires
Carbon monoxide
Vacant building fires
Brush, grass and forest fires

- Local FDs responded to average of 306,000 such fires per year in 2011-2015
  - 23% of fires
  - 60% burned less than 1 acre
    - 10 acres were consumed in 5%
    - More than 9,000 buildings per year were involved
- Vegetation was first ignited in 6,200 home structure fires per year
Local fire department responses to brush, grass, or forest fires by major cause: 2011-2015

- Intentional: 19%
- Outside or open fire for waste disposal: 14%
- Smoking materials: 10%
- Electrical power or utility line: 10%
- Garden tools or agricultural equipment: 5%
- Lightning: 4%
- Playing with heat source: 4%
- Agriculture or land management burns: 4%
- Fireworks: 4%
- Rekindle: 4%
Carbon monoxide

- Average of 380 unintentional deaths per year in 2013-2017
  - Excludes fire deaths
  - Obtained from [https://wonder.cdc.gov/mcd.html](https://wonder.cdc.gov/mcd.html)
    - Multiple cause of death - ICD-10 Codes: T58 (Toxic effect of carbon monoxide)
    - Underlying cause of death - ICD-10 Codes: X47 (Accidental poisoning by and exposure to other gases and vapors)

- FD responses in 2016:
  - 79,600 CO incidents (Some may be false)
  - 91,400 CO alarm malfunctions, 68,000 unintentional false alarms
Vacant building fires: 2011-2015

- Average of 30,200 structure fires per year caused
  - 60 civilian deaths, 160 civilian injuries, 3,310 firefighter injuries and $710 million in property damage annually
  - 6% of reported structure fires, but 13% of FF structure fire injuries
  - Total of 20 FF fatalities in 2007-2016 in 17 fires at properties that were vacant, or under demolition or renovation

- Half were intentional
  - 61% of unsecured vs. 35% of secured

- More likely to spread beyond structure
  - 12% of unsecured and 9% of secured spread beyond
Leading causes of fatal and non-fatal injuries of all types
Leading causes of unintentional injury deaths in 2017 among those 65 or older

Source: CDC’s WISQARS: Leading Causes of Death Report for Unintentional Injuries
Leading causes of unintentional injury deaths in 2017 among those under 15

Source: CDC’s WISQARS: Leading Causes of Death Report for Unintentional Injuries
Leading causes of unintentional injury deaths in 2017 among those 15-64

<table>
<thead>
<tr>
<th>Cause</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poisoning</td>
<td>5.0</td>
<td>16.5</td>
<td>15.0</td>
<td>4.7</td>
<td>0.6</td>
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<tr>
<td>MV traffic</td>
<td>6.76</td>
<td>5.25</td>
<td>5.56</td>
<td>1.2</td>
<td>0.5</td>
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<tr>
<td>Fall</td>
<td>0.20</td>
<td>0.40</td>
<td>0.51</td>
<td>2.8</td>
<td>0.10</td>
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<tr>
<td>Suffocation</td>
<td>0.10</td>
<td>0.20</td>
<td>0.40</td>
<td>0.8</td>
<td>0.10</td>
</tr>
<tr>
<td>Fire/burn</td>
<td>0.10</td>
<td>0.20</td>
<td>0.30</td>
<td>0.6</td>
<td>0.50</td>
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<tr>
<td>Drowning</td>
<td>0.50</td>
<td>0.40</td>
<td>0.50</td>
<td>0.50</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Source: CDC’s WISQARS: Leading Causes of Death Report for Unintentional Injuries
### Unintentional fall injuries seen at EDs in 2017 by age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>In Thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>819</td>
</tr>
<tr>
<td>5-9</td>
<td>530</td>
</tr>
<tr>
<td>10-14</td>
<td>451</td>
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<tr>
<td>15-24</td>
<td>671</td>
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<tr>
<td>25-34</td>
<td>647</td>
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<tr>
<td>35-44</td>
<td>624</td>
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<tr>
<td>45-54</td>
<td>829</td>
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<tr>
<td>55-64</td>
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<td>65-74</td>
<td>1,000</td>
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<tr>
<td>75-84</td>
<td>1,004</td>
</tr>
<tr>
<td>85+</td>
<td>967</td>
</tr>
</tbody>
</table>

8.6 million unintentional fall injuries seen at EDs in 2017

- Leading cause of non-fatal unintentional injuries in children under 10 and people 25 or older
- 2nd leading cause in people 10-24

Source: CDC’s WISQARS
Unintentional struck by/against injuries seen at EDs in 2017 by age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>In Thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>278</td>
</tr>
<tr>
<td>5-9</td>
<td>324</td>
</tr>
<tr>
<td>10-14</td>
<td>451</td>
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<tr>
<td>15-24</td>
<td>755</td>
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<td>25-34</td>
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<td>35-44</td>
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<tr>
<td>45-54</td>
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<td>55-64</td>
<td>278</td>
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<tr>
<td>65-74</td>
<td>160</td>
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<tr>
<td>75-84</td>
<td>92</td>
</tr>
<tr>
<td>85+</td>
<td>61</td>
</tr>
</tbody>
</table>

3.7 million unintentional struck by/against injuries

- Leading cause of unintentional injuries in 15-24 age groups
  - 2nd leading cause overall, under 10, and 85+
  - Ranked 3rd among 25-44 and 55-64
- Sports, cell phone use, etc.
Unintentional fire or burn injuries seen at EDs in 2017 by age

- Almost 400,000 fire or burn injuries
- **Ranked 7th** for infants, **8th** for 1-4
  - Not in top 10 for other age groups
  - Children are frequent victims of scalds and contact burns
- Many burns were workplace injuries
Get more injury data

  - More causes available
  - Fatal injury data (death certificates) is available at state level
    - Will only show results with at least 10
    - Can use multiple years
  - Non-fatal injuries are national estimates only of ED visits
    - From CPSC’s National Electronic Surveillance System (NEISS)
- See [cpsc.gov/Research--Statistics/NEISS-Injury-Data](https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data) for product-related injuries
RE-AIM evaluation framework
RE-AIM evaluation framework

1999 *American Journal of Public Health* article by Glasgow, Vogt and Bowles

- **REACH**
  - Percent, representativeness of participating

- **EFFICACY**
  - Effectiveness, positive and negative outcomes, indirect benefits, opportunity cost

- **ADOPTION**
  - Proportion, representativeness of organizations adopting program

- **IMPLEMENTATION**
  - Were program, protocols followed by individuals and organizations?

- **MAINTENANCE**
  - Institutionalization and long-term behavior change
References to 2-RE-AIM articles

• “Evaluating the Public Health Impact of Health Promotion Interventions: The RE-AIM Framework”
  – ~3400 citations
  – https://ajph.aphapublications.org/doi/pdfplus/10.2105/AJPH.89.9.1322

• “Using The RE-AIM Framework to Evaluate A Community-Based Smoke Alarm Installation Program”
  – Stephens-Stidman, McCoy, Roper, Campa, Barnard, and Istre
In conclusion...
Fire service is already involved in many risk areas

• Most involved with fire
  – Messaging often can include burns
  – Home fires cause more deaths and injuries than other fires

• Falls, crashes, and other situations cause more deaths and injuries than fires

• What do you already know about your community?
  – Are you collecting usable data?
NFPA reports, custom analyses and methods

- *Fire Loss in the United States during 2018, pub 2019*
- *Home Structure Fires - 2019*
- *Home Fire Victims by Age and Gender - 2018*
- *Brush, Grass and Forest Fires – 2017*
- *Smoke Alarms in US Home Fire - 2019*
- *US Fire Death Rates by State* & tool to compare rates, demographics
- *Fires by Occupancy or Property Type tool*
- “Carbon Monoxide Incidents” - 2019
- “Fires in Vacant Buildings” – 2018
- “How the NFPA National Estimates Are Calculated for Home Structure Fires”
- “NFPA’s Methodology and Definitions Used in ‘Leading Causes of Structure Fires’ Tables”
Compare fire deaths by state tool

• Up to 5 states or all US at a time
  – Uses death certificate data from National Center for Health Statistics accessed through CDC’s WISQARS

• Average fire and fire death rates by year
  – Mostly 5-year averages back to 1981-1985

• Demographic and risk factors
  – Race and ethnicity
  – Poverty
  – Adult smokers
  – People with a disability
## Number of Fires Reported to Local Fire Departments in the United States by Property Use: 2013-2017 Annual Averages

<table>
<thead>
<tr>
<th>Major Property Class (click here to expand)</th>
<th>Fires</th>
<th>Civilian deaths</th>
<th>Civilian injuries</th>
<th>Property loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Assembly</td>
<td>15,636</td>
<td>13</td>
<td>184</td>
<td>$342,620,307</td>
</tr>
<tr>
<td>2 - Educational</td>
<td>4,859</td>
<td>1</td>
<td>56</td>
<td>$57,357,147</td>
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<tr>
<td>3 - Health Care, Detention &amp; Correction</td>
<td>6,682</td>
<td>4</td>
<td>169</td>
<td>$60,239,417</td>
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<tr>
<td>4 - Residential</td>
<td>382,397</td>
<td>2,739</td>
<td>11,672</td>
<td>$7,298,475,292</td>
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<tr>
<td>5 - Mercantile or Business</td>
<td>18,582</td>
<td>15</td>
<td>308</td>
<td>$852,387,668</td>
</tr>
</tbody>
</table>

Select a Type of Fire
- Outside or Unclassified Fire
- Structure Fire
- Vehicle Fire
Other resources

- scholar.google.com/
- usfa.kohalibrary.com/app/search
- saferproducts.gov/
- nfpa.org/CRR

- And most importantly,
EACH OTHER!!
Thank you!