

Effectiveness of Individual Intervention Types

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U.S. Department of Transportation
Federal Motor Carrier Safety Administration



Topics To Be Discussed:

- Carrier Intervention Effectiveness Model (CIEM)
- Safety benefits derived from individual intervention types
- Intervention Cost Survey
- Estimates of safety effectiveness / cost effectiveness for various intervention types
- Other measures of effectiveness (other than CIEM)
- Future Research

Primary FMCSA Tool for Measuring Effectiveness

- Carrier Intervention Effectiveness Model (CIEM)
 - Previously known as Compliance Review Effectiveness Model (CREM)

The CIEM Algorithm

- Measures overall change in crash rate in treatment group, after carriers receive investigations or warning letters.
- Uses this crash rate change to estimate the number of “crashes prevented” in the fiscal year, due to these interventions.

Data Evaluated by CIEM

- **Pre-intervention period:**

- *Treatment group's combined Crash Rate (crashes per PU) during the 1-year period immediately prior to their interventions.*

- **Post-intervention period:**

- *Treatment group's combined Crash Rate during the 1-year period immediately following their interventions.*

Three-Step CIEM Estimation Process

1. Calculate change in treatment group's overall Crash Rate, from the pre- to the post-intervention period.
2. *Adjustment Step:* Subtract-out any change in Crash Rate exhibited by carriers **not** receiving interventions during same time period (comparison group).
3. Estimate the number of crashes prevented, based on treatment group's adjusted Crash Rate change.

Adjusted Crash Rate Change

$$= (\text{Cr. Rate}_{\text{post}} - \text{Cr. Rate}_{\text{pre}})_{\text{trmt}} - (\text{Cr. Rate}_{\text{post}} - \text{Cr. Rate}_{\text{pre}})_{\text{contrl}}$$

i.e., How Much of the Treatment Group Crash Rate Change Can We Attribute to the Interventions?

Treatment and Comparison Group Crash Rate Reductions for FY16

| Carrier Size Group | FY 2016 Treatment Group | FY 2016 Comparison Group |
|--------------------|-------------------------|--------------------------|
| 1 (1–5 PUs) | 46.4% | -1.2% |
| 2 (6–20 PUs) | 33.0% | -1.6% |
| 3 (21–100 PUs) | 20.0% | 0.8% |
| 4 (100+ PUs) | 0.9% | -0.3% |

Net Percent Reductions in Crash Rates 1 Year After a Carrier Received an Intervention

| Carrier Size Group | FY 2014 | FY 2015 | FY 2016 |
|------------------------|---------|---------|---------|
| 1 (1–5 power units) | 47.0% | 53.4% | 47.7% |
| 2 (6–20 power units) | 35.5% | 37.2% | 34.5% |
| 3 (21–100 power units) | 20.9% | 22.4% | 19.2% |
| 4 (100+ power units) | 0.2%* | 1.2%* | 1.1%* |

FY15 to FY16 CIEM-Estimated Benefits from Interventions*

| Fiscal Year | Number of Interventions | Crashes Prevented | Injuries Prevented | Lives Saved |
|-------------|-------------------------|-------------------|--------------------|-------------|
| 2015 | 34,695 | 7,136 | 3,965 | 212 |
| 2016 | 44,359 | 7,405 | 4,079 | 214 |

**Based on all carrier reviews and warning letters combined.*

GAO Recommendation 17-49 (October 27, 2016)

1. Identify methods to evaluate the effectiveness of **individual** intervention types.
2. Update agency **cost estimates** for conducting individual intervention types.
3. Establish performance measures to regularly monitor **effectiveness** and **efficiency** of interventions (based on items #1 and #2).

Caveats for Implementing GAO Recommendations

- FMCSA can estimate the effectiveness of individual interventions types, in terms of *safety benefits achieved*, **but**,
- FMCSA cannot measure the **relative** effectiveness of one intervention type **versus** another.

Requirements for Comparing Relative Effectiveness of Individual Intervention Types

- 1. Would need experimental design.**
- 2. Intervention types would need to be randomly assigned to carriers.**
- 3. Safety profile of carriers would need to be similar for the various intervention types.**

FMCSA's Intervention Process:

- Specific intervention types are **not** randomly assigned to carriers targeted for intervention.
- Typical safety profile of carriers receiving one type of intervention may differ from safety profile of carriers receiving another type of intervention.
- Therefore, FMCSA cannot compare the ***relative*** effectiveness of each intervention type.

Recommendation #1: Estimating Benefits from Individual Intervention Types

- First implemented for **FY16 CIEM** results.
- Intervention type defined by *first intervention* received by carrier during the fiscal year (2 percent of carriers received multiple interventions in 2016).
- Carriers receiving multiple interventions in same year were *not excluded* (*don't want to throw out carriers who respond poorly to interventions*).

Percent Net Crash Rate Reductions, by Intervention Type, FY16 Interventions

| Carrier Size | Onsite Focused | Onsite Comprehensive | Other Non-Ratable Reviews | Warning Letter |
|------------------|----------------|----------------------|---------------------------|----------------|
| (1–5 PUs) | 34.9% | 51.7% | 18.0%* | 50.1% |
| (6–20 PUs) | 25.1% | 30.2% | 14.7%* | 41.4% |
| (21–100 PUs) | 17.4% | 17.6% | -1.5%* | 21.7% |
| (≥100 PUs) | -0.1%* | 3.4%* | -2.4%* | 2%* |
| *not significant | | | | |

FY16 CIEM-Estimated Benefits, By Individual Intervention Types

| First Investigation/ Intervention Type | All Carriers Receiving Interventions: Number of Carriers | Crashes Prevented | Injuries Prevented | Lives Saved |
|--|--|----------------------|-----------------------|----------------|
| Onsite Focused | 6,549 | 1,193 | 657 | 35 |
| Onsite Comprehensive | 5,469 | 902 | 497 | 26 |
| Other Non-ratable Review | 506 | 0 | 0 | 0 |
| Warning Letter | 30,377 | 5,385 | 2,966 | 156 |

GAO Item #2: What Does It Cost to Conduct Various Types of Interventions?

FMCSA Response:

Conducted Investigation Cost Survey, 2018

Cost Information Collected from Safety Investigators:

- Labor costs for preparing for the investigation
- Travel costs (including any vehicle costs and labor costs incurred while en route)
- Labor costs related to conducting investigation, and labor costs related to documenting and uploading findings to the agency's Motor Carrier Management Information System (MCMIS)

Number of Usable Investigations Available for Cost Analysis, by Investigation Type

| Investigation Type | Frequency | Percent |
|----------------------|-----------|---------|
| Offsite | 36 | 2.74 |
| Onsite Comprehensive | 410 | 31.18 |
| Onsite Focused | 869 | 66.08 |
| Total | 1,315 | 100.00 |

Average and Median Costs Associated with Intervention Types

| Investigation Type | Cases | Average Cost | Median Cost |
|--------------------|-------|--------------|-------------|
| Offsite | 36 | \$1,145.29 | \$1,018.55 |
| Comprehensive | 410 | \$2,540.24 | \$2,231.28 |
| Onsite Focused | 869 | \$2,032.50 | \$1,817.75 |

Efficiency Measure for Investigations

- **Definition Used:**

Safety Benefits Accrued per Dollar Spent

Estimated Cost Efficiency for Intervention Types

| Investigation Type | Carriers Receiving Intervention | Dollars Spent per Crash Prevented | Dollars Spent per Injury Prevented | Dollars Spent per Life Saved |
|--------------------|---------------------------------|-----------------------------------|------------------------------------|------------------------------|
| Offsite | 122 | N/A | N/A | N/A |
| Comprehensive | 5,470 | \$13,703 | \$24,857 | \$479,142 |
| Onsite Focused | 6,548 | \$10,325 | \$18,745 | \$357,698 |

Other Measures of Intervention Effectiveness (2011-2012 data)

| Investigation | | BASICS on Alert at Time of Investigation | | Any BASIC Regardless of Alert Status | |
|---------------|--------|--|--|--|--|
| Type | Number | % Carriers w. 1+ BASICS on Alert after 12 months | % Carriers w. 1+ BASICS on Alert after 24 months | % Carriers w. 1+ BASICS on Alert after 12 months | % Carriers w. 1+ BASICS on Alert after 24 months |
| Focused | 12,762 | 66 | 39 | 77 | 48 |
| Comprehensive | 8,169 | 75 | 46 | 86 | 54 |

Future Research

- Determine effect of increasing length of Pre- and Post-intervention time periods in CIEM (currently length is one year)
- Track crash rates over time for carriers receiving interventions, to measure both recidivism and “regression to the mean.”

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