



CENTER *for* ADVANCED
PUBLIC SAFETY

CONSIDERATIONS FOR OPTIMAL TRAFFIC SAFETY ALLOCATION

Special Presentation for the TRCC

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For more information on safety countermeasures see:

<http://www.safehomealabama.gov/safety-topics/>

THE UNIVERSITY OF
ALABAMA

OPTIMAL TRAFFIC SAFETY ALLOCATIONS

- Reality of Countermeasure (CM) Constraints:
 - ✓ Budgets are fixed
 - ✓ Objective: maximum fatality/injury reduction
- Major Considerations in CM Selection
 - ✓ What is the potential fatality reduction?
 - ✓ How much can the CM reasonably reduce?
 - ✓ How much will Countermeasure cost?
- Unspoken Downside of any Safety CM
 - ✓ Could these funds be better spent elsewhere?

THE STARTING POINT

- Determine Fatality Reduction Potential

- Truism:

It is impossible to reduce more fatalities than occur within the crash category.

Reference Following as "Table 1"

Fatalities/Crashes by Type

Sources: ADECA HSP Table 1; CARE 2016 Data



Yellow = Predominantly Risk Taking

Crash Type	Fatalities	Crashes
1. Restraint Not Used	464	10,586
2. Impaired Driving (DUI-Alcohol-Drugs)	232	5,927
3. Speeding	207	3,782
4. Obstacle Removal	169	6,274
5. Pedestrian, Bicycle, School Bus	124	1,666
6. Pedestrian	120	817
7. Mature - Age > 64 (15+ years)	115	14,134
8. License Status Deficiency	115	6,810

Fatalities/Crashes by Type

Crash Type	Fatalities	Crashes
9. Motorcycle	108	1,685
10. Youth – Age 16-20	106	23,731
11. Distracted Driving	92	17,943
12. Truck (other than pickup) Caused	56	5,149
13. Utility Pole	46	2,522
14. Fail to Conform; Stop or Yield Sign	32	7,574
15. Vehicle Defects – All	21	3,883

Fatalities/Crashes by Type

Crash Type	Fatalities	Crashes
16. Construction Zone	18	2,934
17. Vision Obscured by Environment	14	1,577
18. Fail to Conform to Signal	10	4,667
19. Child Restraint Deficient	5	2,838
20. Railroad Trains	5	64
21. Bicycle	4	476
Summary:		
68% Risktaking; 2016 data		

MAJOR CONSIDERATIONS

- These are *Current Status Statistics*
 - ✓ We already implement many effective countermeasures
 - ✓ The most effective – via our state safety experts/SHSP
 - ✓ Downside possibilities for new programs:
 - Definitely reduce funding to current programs (truism)
 - Might be no better than existing
- New is Not Necessarily Better
 - ✓ But something is ...
 - ✓ *We can always do better* (new or existing CMs)
 - ✓ Culture: Continuous Improvement Forever

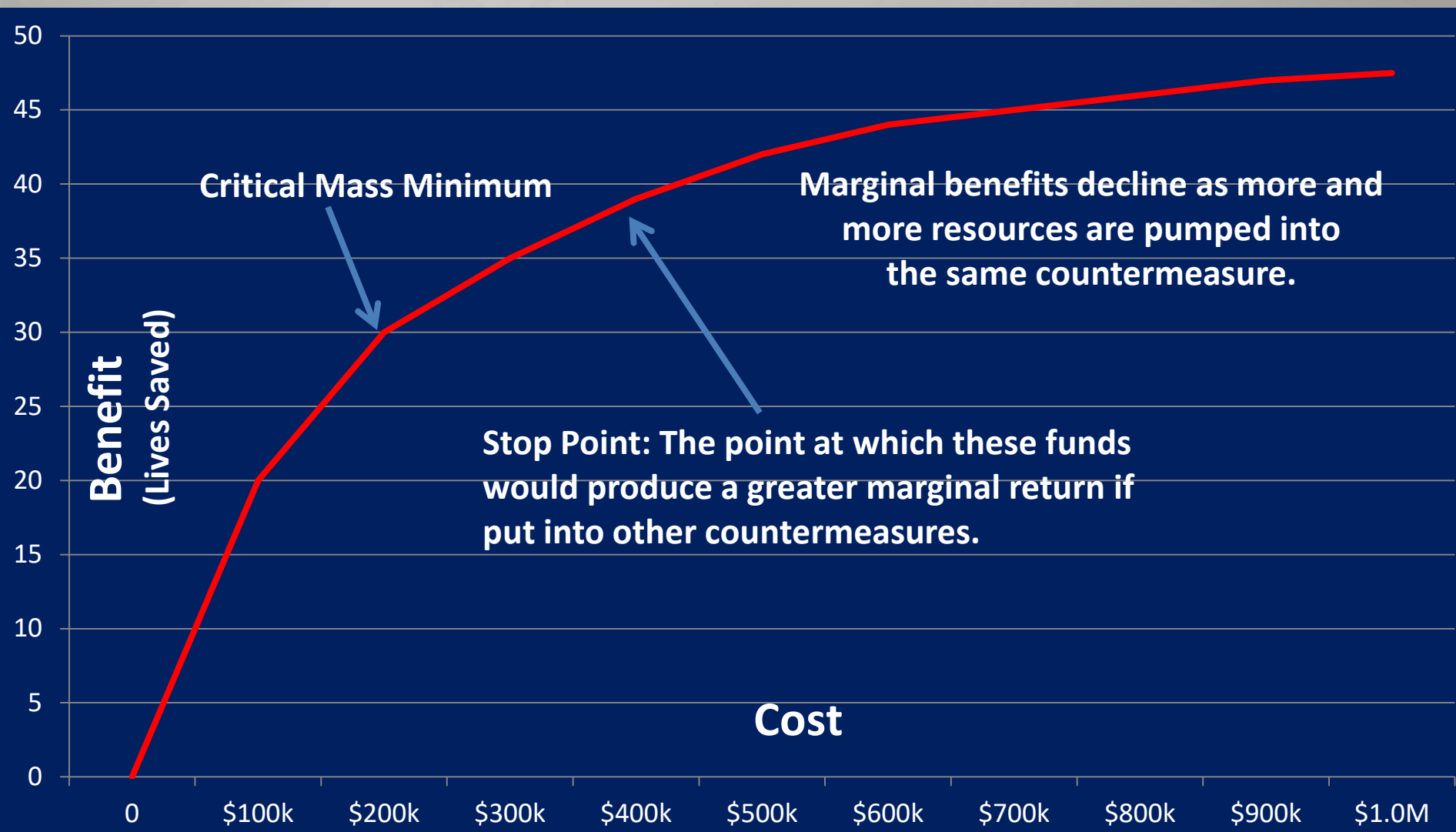
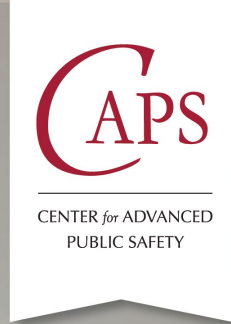
DIMINISHING RETURNS CONCEPT



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- Adding More and More Funding to the same CM ...
 - ✓ Generally produces more benefits, BUT
 - ✓ At some point the “marginal benefit” declines
 - Marginal benefit – benefit obtained from last \$ invested
 - Proof – ultimately there will be no more fatalities to reduce
- Every CM has a Diminishing Returns Curve
- It is not Essential that We Create it Perfectly
- More Important that we Understand Concept

DIMINISHING RETURN CURVE EXAMPLE



Critical Mass Minimum

Marginal benefits decline as more and more resources are pumped into the same countermeasure.

Stop Point: The point at which these funds would produce a greater marginal return if put into other countermeasures.

**Benefit
(Lives Saved)**

Cost

LOGICAL APPROACH: THINGS TO AVOID



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- The “Silver Bullet” Answer
- Solutions at the Extremes (all or nothing)
 - ✓ “All virtue is at the mean between extremes” -- Aristotle
- “If it only saves one life it will all be worth it”
 - ✓ It may be OK to say it; but it is wrong to believe it
 - ✓ Competing alternatives for resources may save more
- Taking Credit for Recent Fatality Reductions
 - ✓ Did we take any of the blame when they increased?
 - ✓ Taking undue credit can validate a weak program
 - ✓ Especially if we actually believe it

NEEDED: A SYSTEMATIC APPROACH

- Things to Recognize
 - ✓ We can do better!!!!
 - ✓ We need to entertain all new ideas
 - ✓ We need to re-evaluate current countermeasures
 - ✓ Optimization cannot be obtained by:
 - Considering just one countermeasure in a vacuum
 - Refusing to see countermeasures' downsides
- This Requires Considering all Alternative Tradeoffs
 - ... that are within our purview of control

PROPOSED STEPS IN A SYSTEMATIC APPROACH

1. Research and Brainstorming
 - A. No bad ideas or criticism ... think outside the box
 - B. "Infeasible" suggestions may get others outside the box
 - C. BOTH new programs AND new approaches to existing
2. Document the Reasonable New Ideas
3. Evaluate for Feasibility (High Level Analysis)
4. Prioritize the Remaining Feasible Alternatives
5. Cost-Benefit Analysis to find Stop-Points

PROPOSED APPROACH TO IMPLEMENTATION



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- Research Your Specialty Area
 - ✓ Data for Alabama – let us help with CARE (brown@cs.ua.edu)
 - ✓ Start web search with <http://www.SafeHomeAlabama.gov/>
 - What is the current practice in AL?
 - What are they doing in other states?
 - ✓ Follow up by contacting practitioners
- Formulate Alternative Countermeasures
 - ✓ Including the current countermeasures
- Optimize Countermeasures for the Next Time Cycle
- Improve Countermeasure Implementation
 - ✓ Who, what, where, when, and why
 - ✓ Where, how old, and other demographics

SOME EXAMPLES OF CARE ASSISTANCE



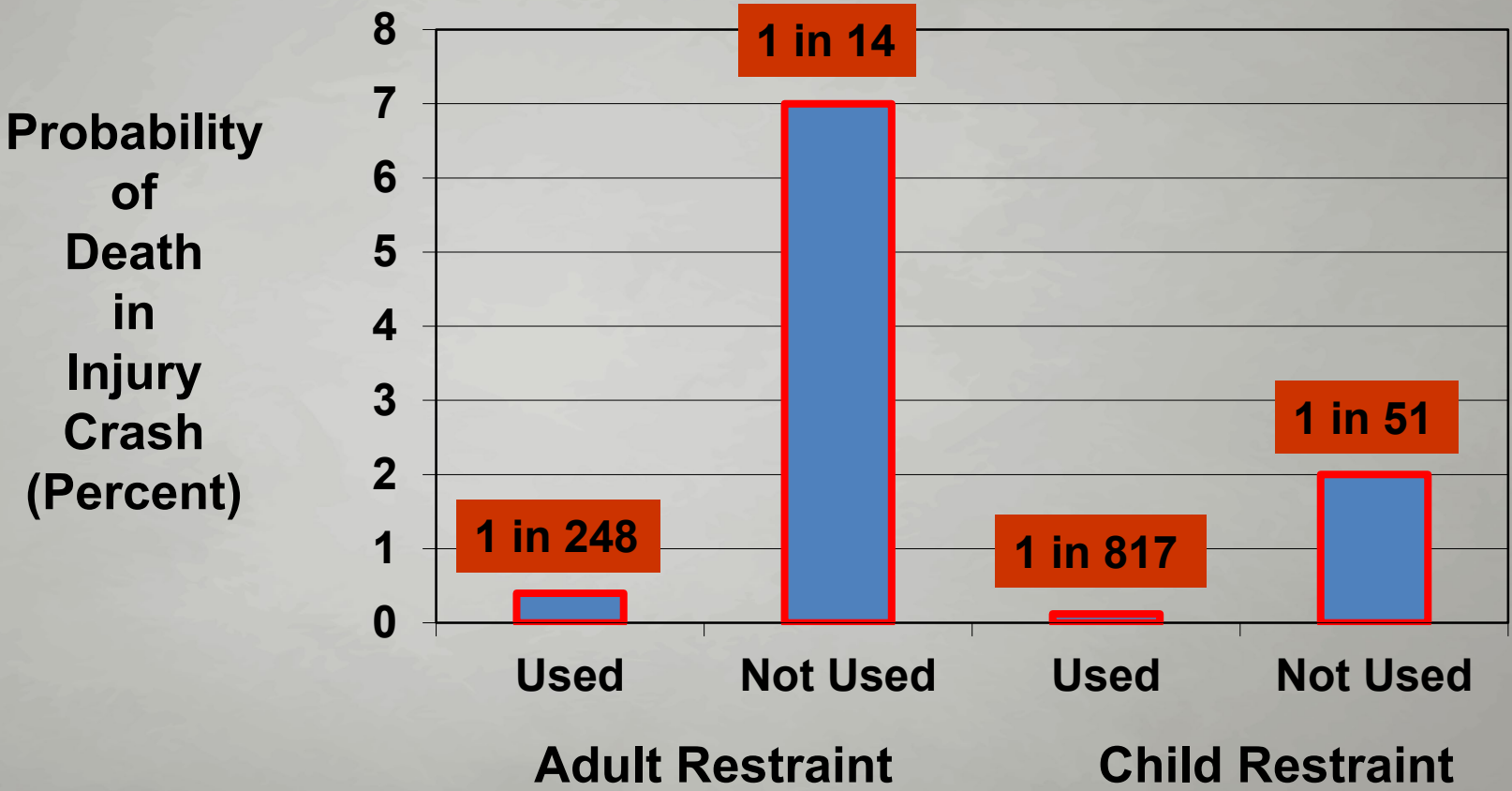
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From Table 1:

- #1 Restraint Use
- #2 Speed Reduction
- #3 DUI
- #4 Youth Risk Taking
- Toward Zero Deaths (TZD)
 - ✓ How can we get there?
 - ✓ What roles can we play?

Restraint Effect on Death in Injury Crashes

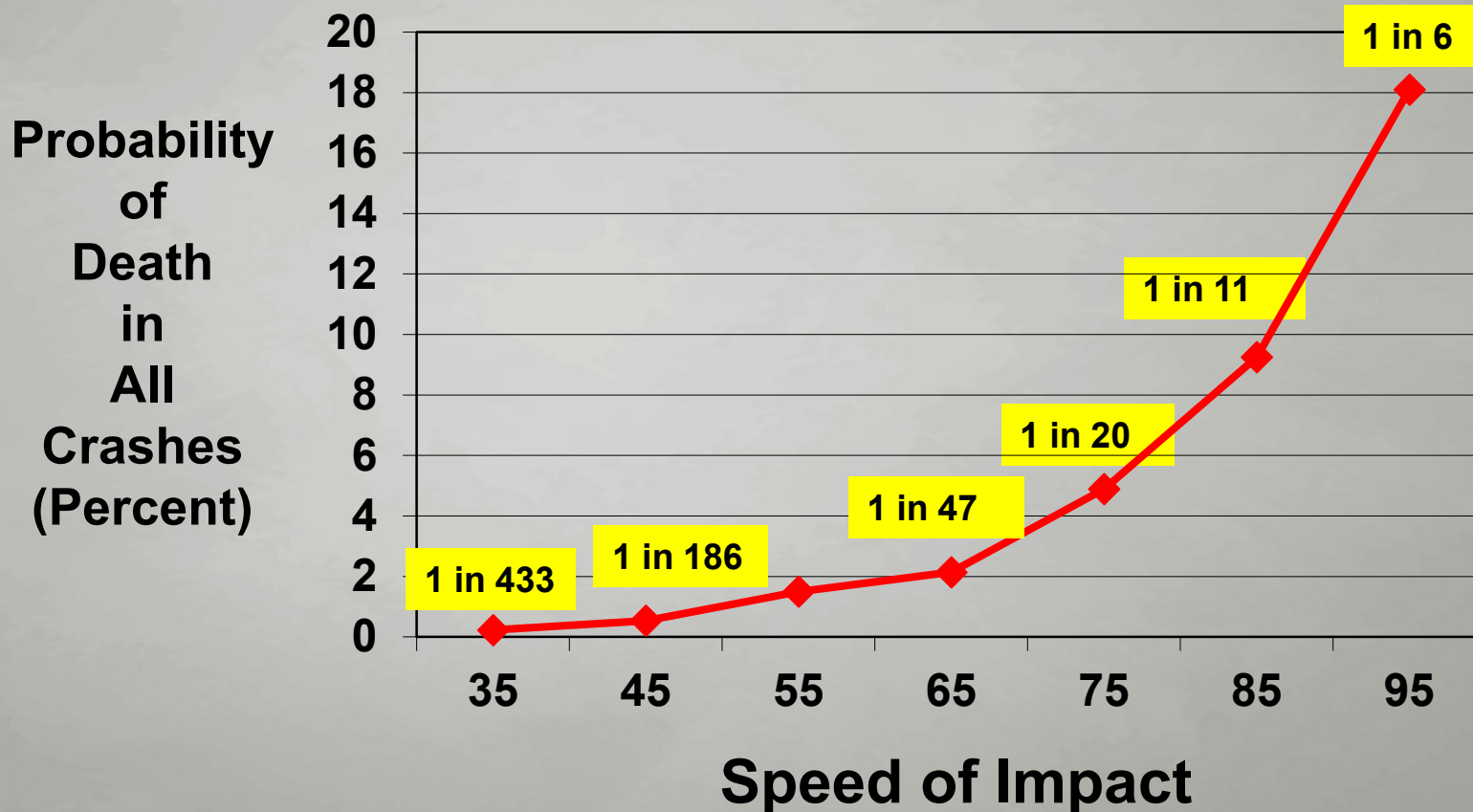
Increased chances for both adult and child: probability of being killed while unrestrained is about 16.7 times restrained



Alabama 2012-2016 Crash Data

Chance of Fatal Crash by Speed

Doubles for Every 10 MPH Increase



Speed vs. Non-Speed by Age

2012-2016 Alabama Integrated Crash Data

C107: CU Driver Raw Age

1 in 4
Age 16-20
crashes
Involved
speed

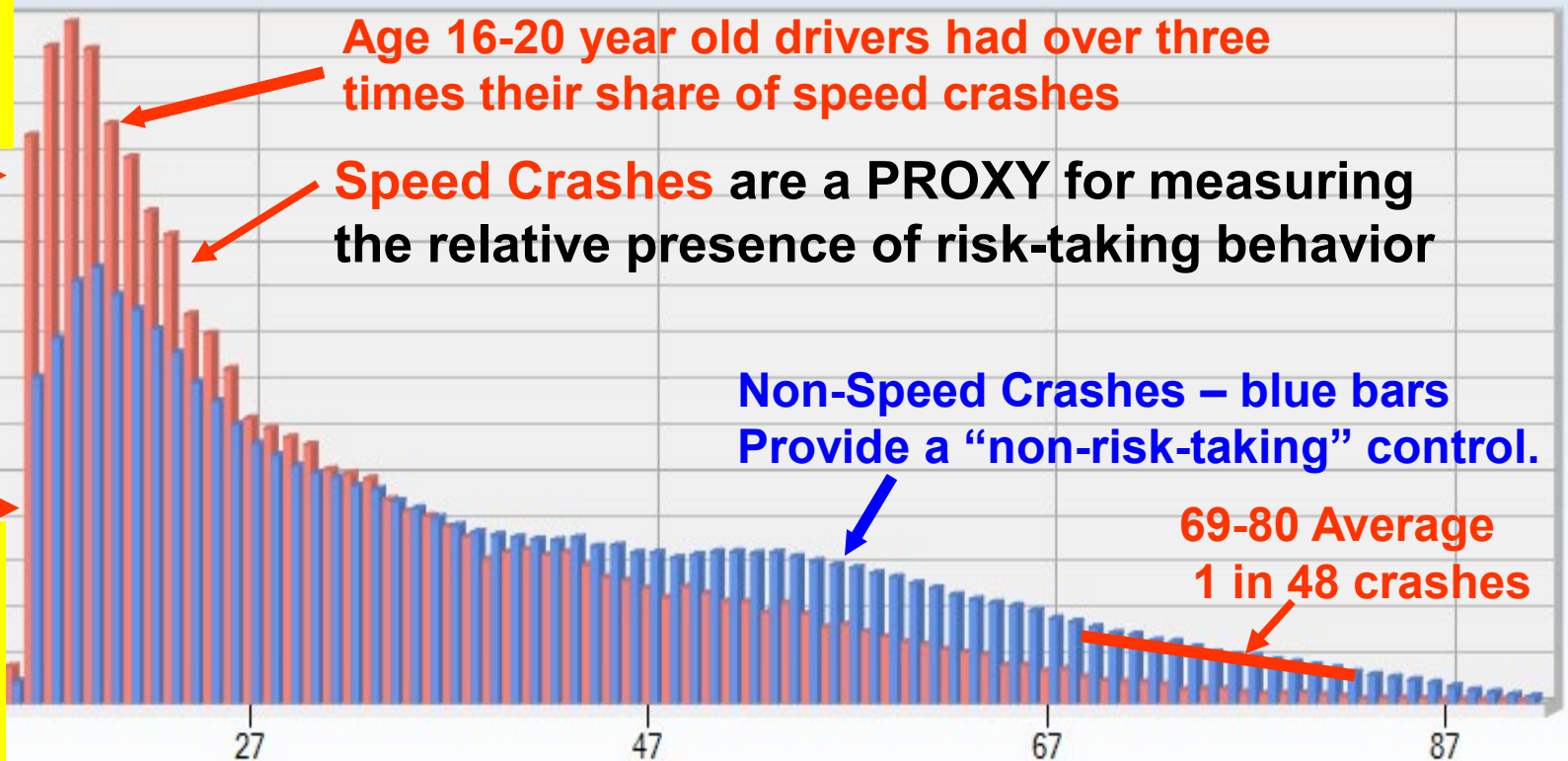
Age 16-20 year old drivers had over three times their share of speed crashes

Speed Crashes are a PROXY for measuring the relative presence of risk-taking behavior

Non-Speed Crashes – blue bars
Provide a “non-risk-taking” control.

Average
of all
Ages
1 in 60

69-80 Average
1 in 48 crashes



C107: CU Driver Raw Age

YOUNG DRIVER COUNTERMEASURES



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- **Focus Group Data on Youth Perceptions**
 - Denied they drove recklessly, but laughed at it (observed result)
 - The cops are doing it (speeding and not restrained)
 - I got a warning! (something to brag about)
- **Teen Misperceptions – Their Own Invulnerability**
 - The only real problem is DUI (drugs and/or alcohol)
 - Being risky is cool (cultural norm) – movies and TV
- **Essential: Youth Culture Change**
 - Must start with the media (it worked for smoking)
 - Peer-level motivation (making it un-cool) – long term
 - Stronger Graduated Drivers License (GDL) Law
 - Imaging the possibilities (before driving)

V023: Raw Age Driver C

#3 DUI – PAST 1993-2002

V023: Raw Age Driver C

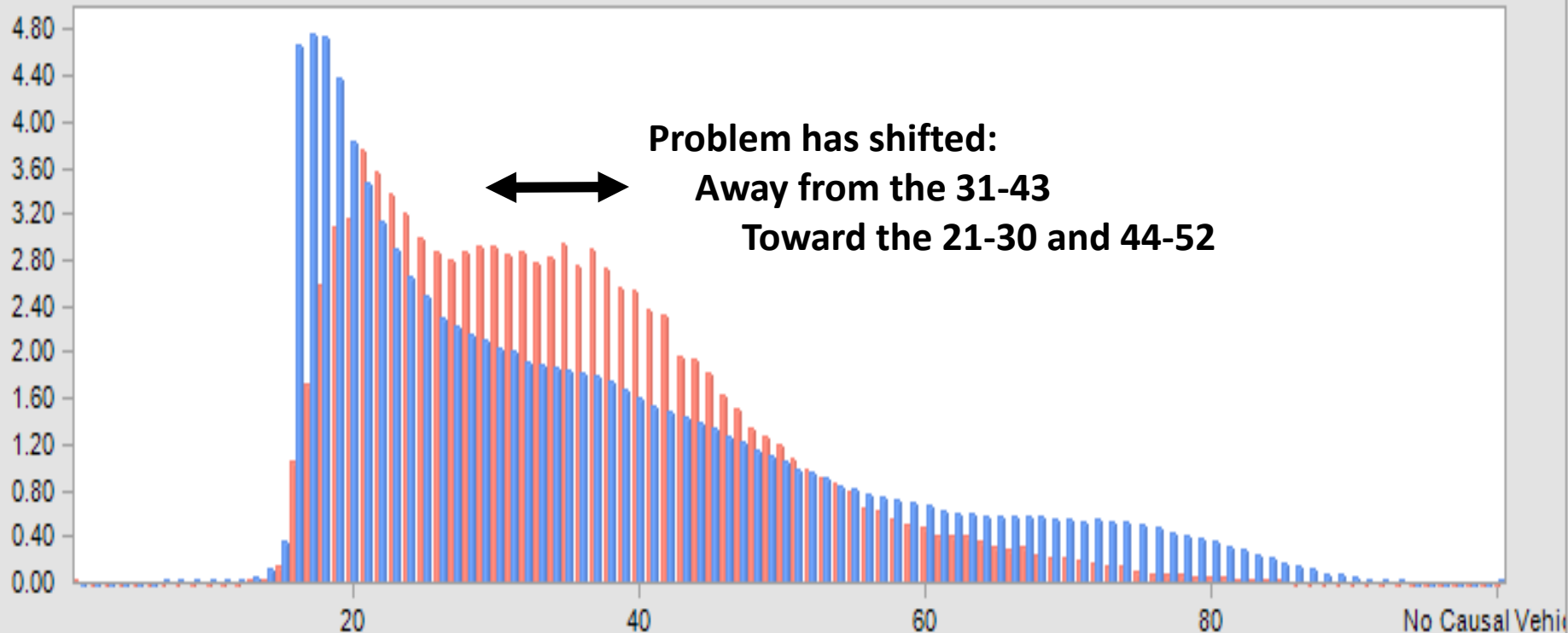
	Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
	21	3135	3.763	41442	3.462	1.087*	250.562
	22	2961	3.554	37543	3.136	1.133*	347.940
	23	2818	3.382	34556	2.887	1.172*	412.840
	24	2661	3.194	31787	2.656	1.203*	448.568
	25	2497	2.997	28720	2.404	1.207*	427.720

**1993-2002
Data**

Sort by Sum of Max Gain



IMPACT Results - 1993-2002 Alabama Crash-Road Data - Alcohol Related vs. Not Alcohol Related
V023: Raw Age Driver C



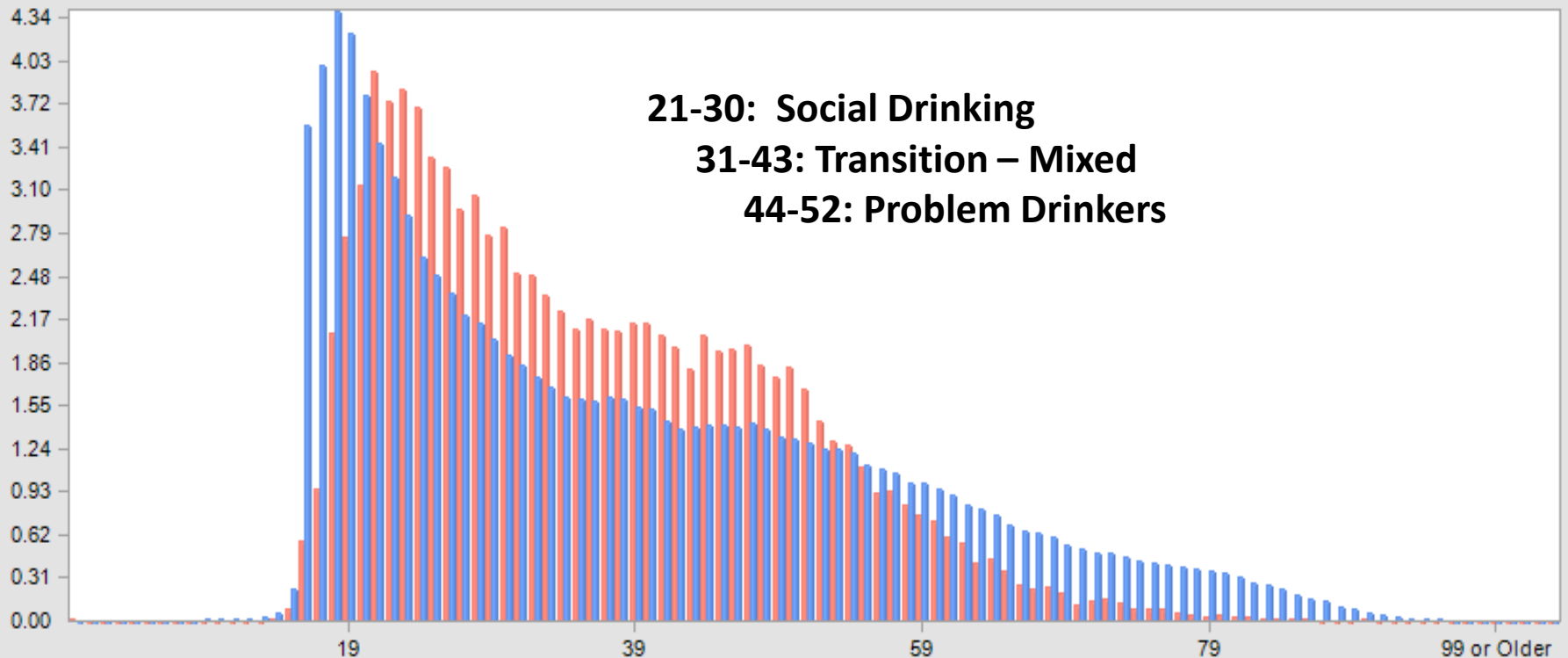
	Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
21		1492	3.948	21769	3.435	1.149*	193.911
22		1415	3.744	20276	3.199	1.170*	205.938
23		1445	3.824	18458	2.912	1.313*	344.346
24		1395	3.691	16550	2.611	1.414*	408.120
25		1263	3.342	15798	2.493	1.341*	320.962
26		1235	3.268	14912	2.353	1.389*	345.795
27		1121	2.966	13972	2.205	1.345*	287.847
28		1158	3.064	13538	2.136	1.434*	350.727
29		1051	2.781	12820	2.023	1.375*	286.541
30		1069	2.829	12118	1.912	1.479*	346.401

**2007-2012
Data**

Sort by Sum of Max Gain



IMPACT Results - 2007-2012 Alabama Integrated Crash Data - DUI (Alcohol or Drugs) And Not Age Causal GE 99 vs. DUI (Alcohol or Drugs) NOT C107: CU Driver Raw Age



Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
28	834	2.74	12702	2.16	1.269*	176.591
29	866	2.84	12092	2.05	1.384*	240.162
30	878	2.88	11700	1.99	1.450*	272.451
31	885	2.91	11392	1.94	1.501*	295.391
32	826	2.71	10996	1.87	1.451*	256.887
33	808	2.65	10803	1.84	1.445*	248.876
34	742	2.44	10194	1.73	1.406*	214.396

2012-2016 Data

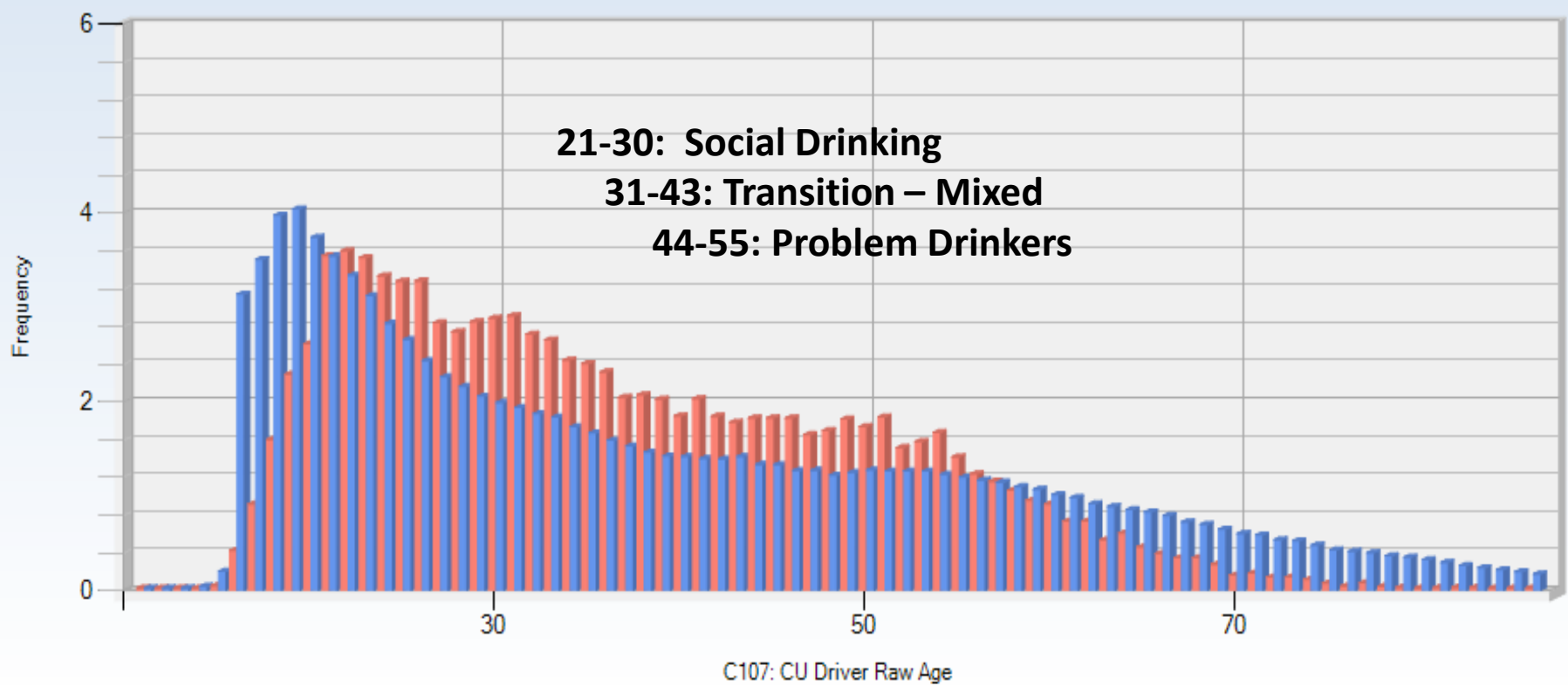
Sort by Sum of Max Gain

Display Filter Name

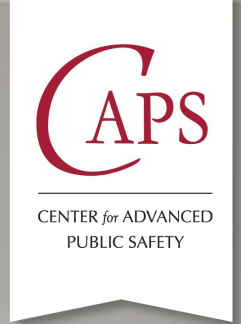


2012-2016 Alabama Integrated Crash Data

C107: CU Driver Raw Age



ULTIMATE TZD

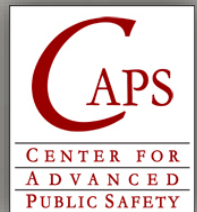


See the SafeHomeAlabama Autonomous Vehicle Page:

<http://www.safehomealabama.gov/SafetyTopics/VehicleSpecific/AutonomousVehicle.aspx>

Over 100 links from which to start your research

To Generate Public Acceptance of these Technologies



Ultimate Advance TZD Toward Zero Deaths



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See the SafeHomeAlabama Autonomous Vehicle Page:

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Our Role in Automated Vehicles

- **Start Research with Over 100 Links on SHA**
- **Generate Public Acceptance of these Technologies**
- **Recognize the Major Issues**
 - **Liability and other litigation problems**
 - **General cultural acceptance of driverless vehicles**
 - **Vulnerabilities of malicious hacking**

**THANK YOU!
ANY QUESTIONS?**



Questions???



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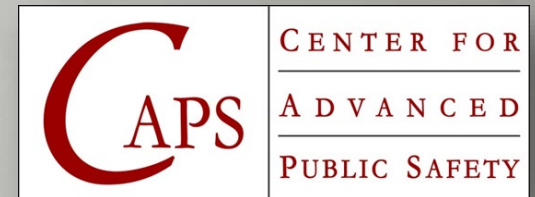
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