Enforcement of speeding and impaired driving: The most effective methods and cost-effective intensity levels

Professor Max Cameron
Monash Injury Research Institute

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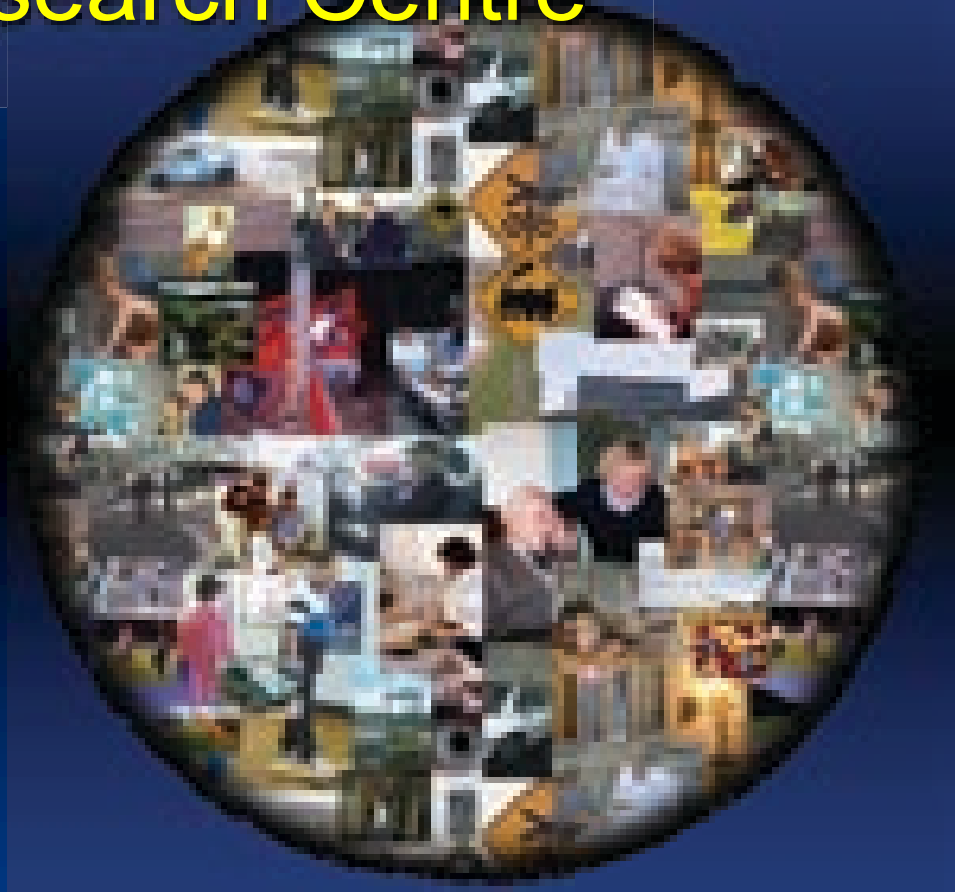
- Whole of University
- Largely self-funding
- Now part of the Monash Injury Research Institute that spans all forms of injury e.g.
  - road safety
  - occupational safety
  - domestic safety
  - suicide
  - children / old people
  - sporting / recreational



Research on enforcement and legislation

Over 20 years of empirical research on traffic enforcement in Victoria (and other jurisdictions) - not just theoretical advice based on psychological principles

Relationship between Victoria Police and MUARC has led to highly effective evidence-based enforcement

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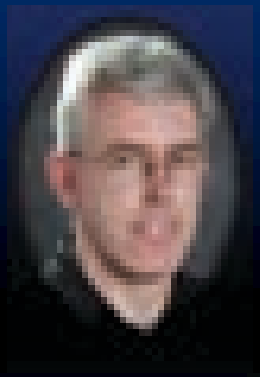
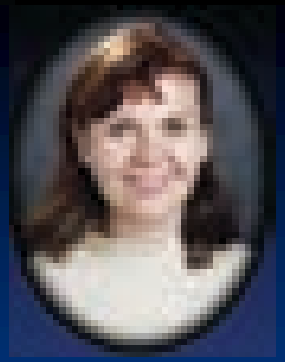
The research team

Max Cameron

Stuart Newstead



Kathy Diamantopoulou



Amanda Delaney

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SPEED ENFORCEMENT

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Various objectives and modes of speed camera systems

- Objectives
  - local effects, or general effect over road system
  - specific deterrence (deter re-offending by speeders), or general deterrence (deter potential speeders)
- Operational modes
  - fixed or mobile cameras
  - overt or covert operations
  - signs indicating camera sites or zones (where a mobile camera may be present)
  - measure spot-speed or average speed over a section

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Diversity of speed camera operations

	OVERT	COVERT
Fixed installations, usually signed (fixed cameras)	New South Wales Great Britain	
Known fixed sites - "black spots" (mobile cameras)	New South Wales Western Australia South Australia	
Fixed sites, randomly allocated cameras (mobile cameras)	Queensland	
Signed speed camera zones (mobile cameras sometimes)	New Zealand	New Zealand hidden camera trial (1998-2000)
Unsigned sites or zones (mobile cameras)		Victoria (also some unsigned fixed cameras since 2000)

Visibility Rules for UK speed cameras

- Fixed camera housings should be conspicuous yellow
  - and should not be hidden behind trees or road signs
- Mobile camera units
  - clearly marked vehicles
  - operators should wear fluorescent clothing
- Warning signs must be placed in advance of camera sites
  - only where cameras are operating regularly

Queensland speed camera unit

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Victorian speed camera program from 1990

54 Slant Radar Speed Cameras:

- Operated 4,000 hours per month (from 1992 to July 2001, then further increased)
- 2 million vehicles checked per month
- Average 40,000 speeding tickets per month
- Multi-million dollar publicity with theme:

"Don't fool yourself - Speed Kills"

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Unique characteristics of the Victorian speed camera program

- Aimed to reduce speeding everywhere at all times
- Not an “accident black spot” treatment
- Relatively covert operations
- Many different locations used (4,500 in total)
- Relatively large number of cameras
- Back-office able to process large number of offences (no constraint on camera use)

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Victorian mobile speed camera (up to 2001/02)

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Victorian car-mounted speed camera

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Effects on crashes

	OVERT OPERATIONS		COVERT OPERATIONS		
Type of site: **Effects On crashes:**	**Fixed installations, known fixed sites, signed sites/zones**	**Fixed sites, randomly allocated operations**	**Signed sites or zones**	**Unsigned sites or zones**	**Unsigned sites, "flashless" cameras, low enforce tolerance**
Jurisdictions operating automatic cameras in this way	Great Britain New Zealand New S. Wales W. Australia S. Australia	Queensland (4000 hours per month)	New Zealand **(hidden camera trial)**	Victoria to 2000/2001 (4000 hours per month)	Victoria 2001/2002 onwards **(50% incr. in hours)**
Fatal crashes	(fixed cameras) -28% (mobile cameras)	Added general effect: - 9%			
Serious casualty crashes	Local effect [NZ]: - 23% (mobile cameras). General effect: - 13%				
Casualty crashes		Local effect: - 35%. General effect: - 26%	Added general effect: - 11%	General effect: -21% (- 32% in Melbourne)	Added general effect: - 3.25% (due to incr. hours)

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Effects on crash injury severity

	OVERT OPERATIONS		COVERT OPERATIONS		
Type of site: / Effects On crashes:	**Fixed installations, known fixed sites, signed sites/zones**	**Fixed sites, randomly allocated operations**	**Signed sites or zones**	**Unsigned sites or zones**	**Unsigned sites, "flashless" cameras, low enforce tolerance**
Jurisdictions operating automatic cameras in this way	Great Britain New Zealand New S. Wales W. Australia S. Australia	Queensland (4000 hours per month)	New Zealand **(hidden camera trial)**	Victoria to 2000/2001 (4000 hours per month)	Victoria 2001/2002 onwards **(50% incr. in hours)**
Casualties per casualty crash			Added general effect: - 9%		
Serious casualties per crash				General effect: - 21% (Melbourne)	
Fatalities per crash					Added general effect: - 51% (due to incr. hours)

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Conclusions about speed camera effects on road trauma

- Overt operations have strong local effects
  - Especially fixed speed cameras
- Overt mobile cameras can have general effects across the road system
  - Especially if operations are randomly scheduled in time and space
- Hiding the cameras adds to the general effect
- Covert mobile cameras reduce crash injury severity (especially fatal outcome) as well as a general effect on crashes

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Relationship between enforcement levels and crash outcomes

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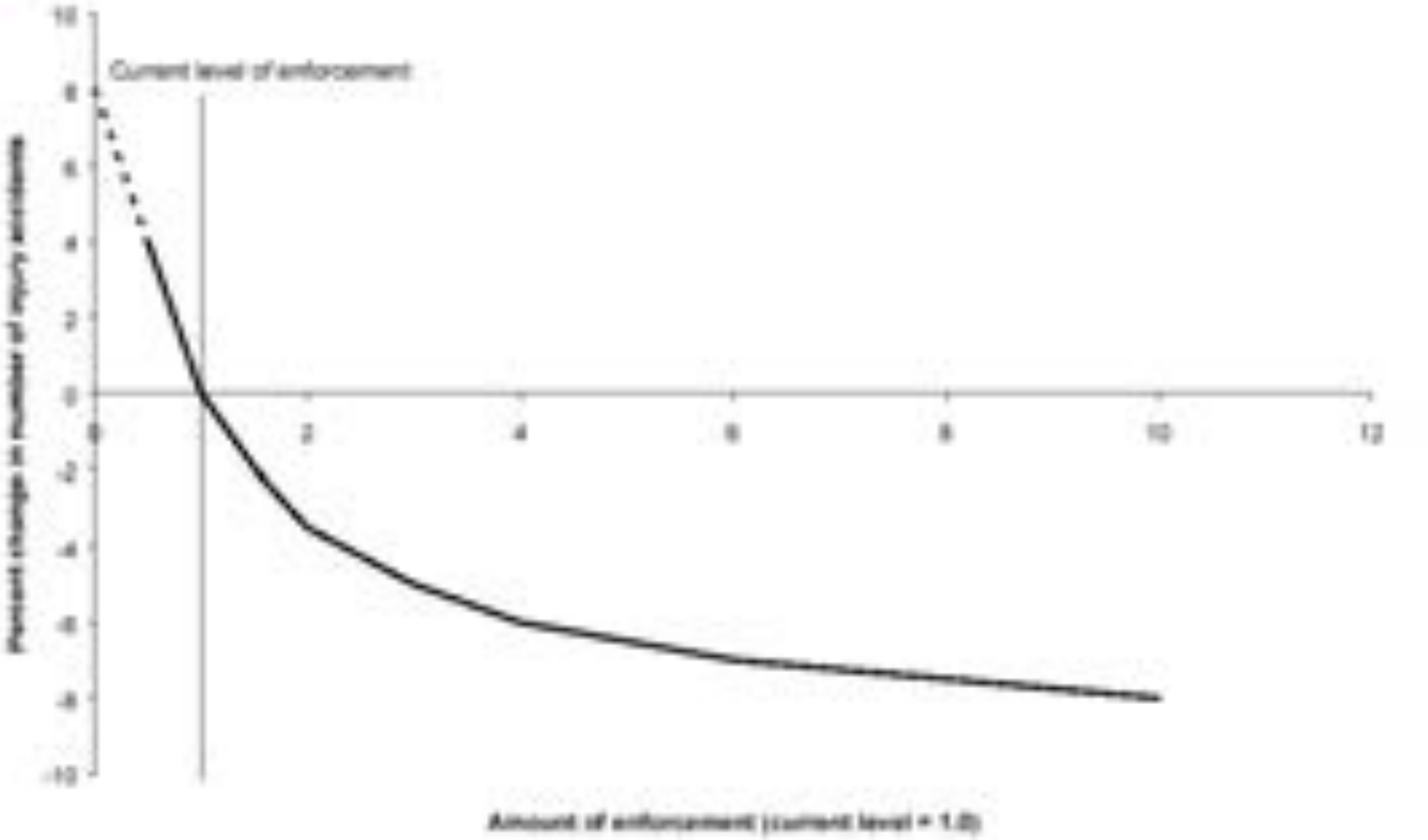
Change in crashes v. level of enforcement (from Elvik)



Deterrence achieved by Victorian mobile speed camera program

- The principal mechanism is the actual detection of speeding drivers and the subsequent issuing of penalties (i.e. specific deterrence)
- Supporting mechanisms are provided by :
  - publicity emphasising the risks of speeding and detection by a speed camera
  - perhaps actual camera operations (though covert)
- (i.e. general deterrence)

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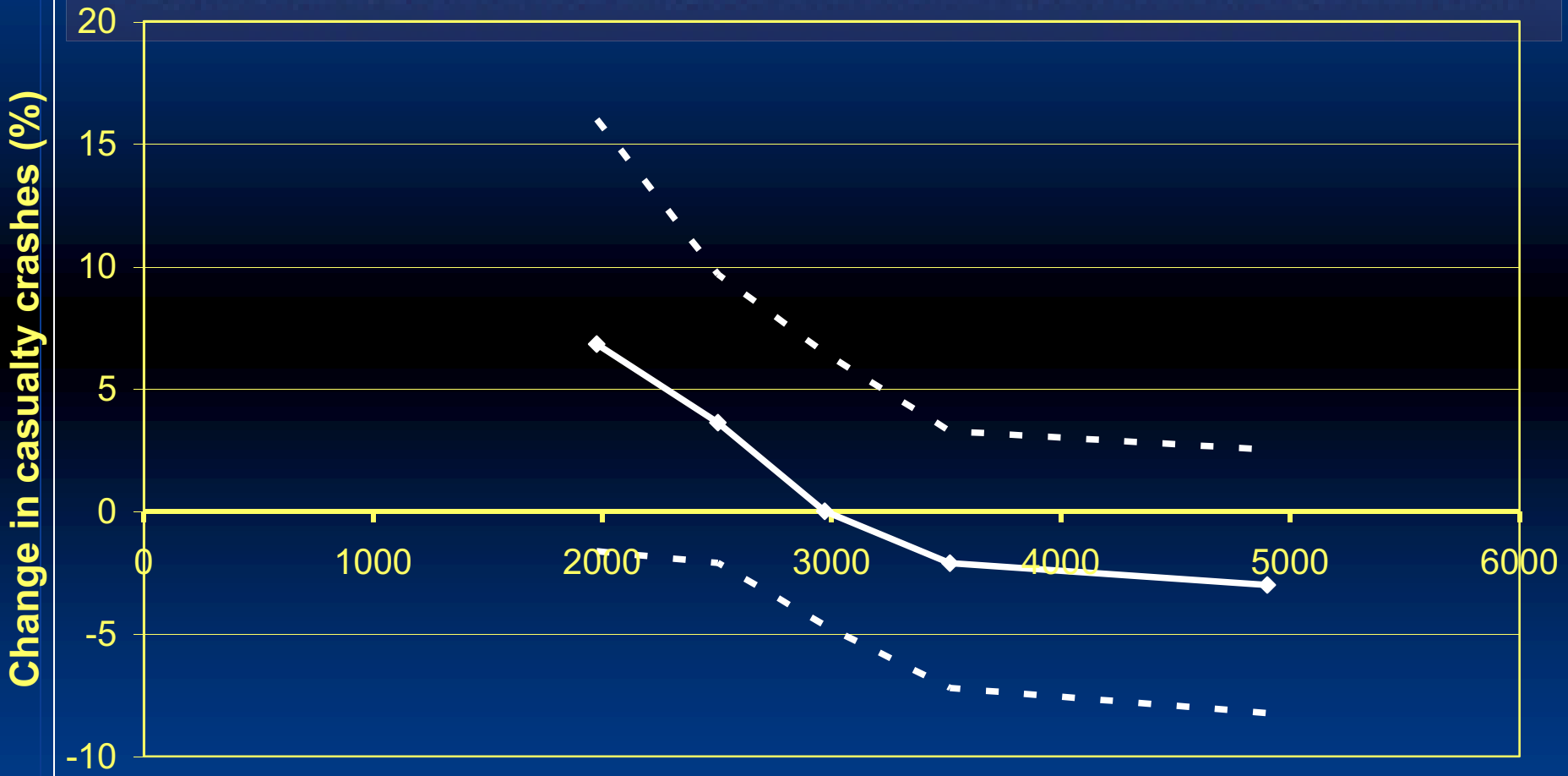
Change in casualty crashes versus speeding tickets detected in previous month



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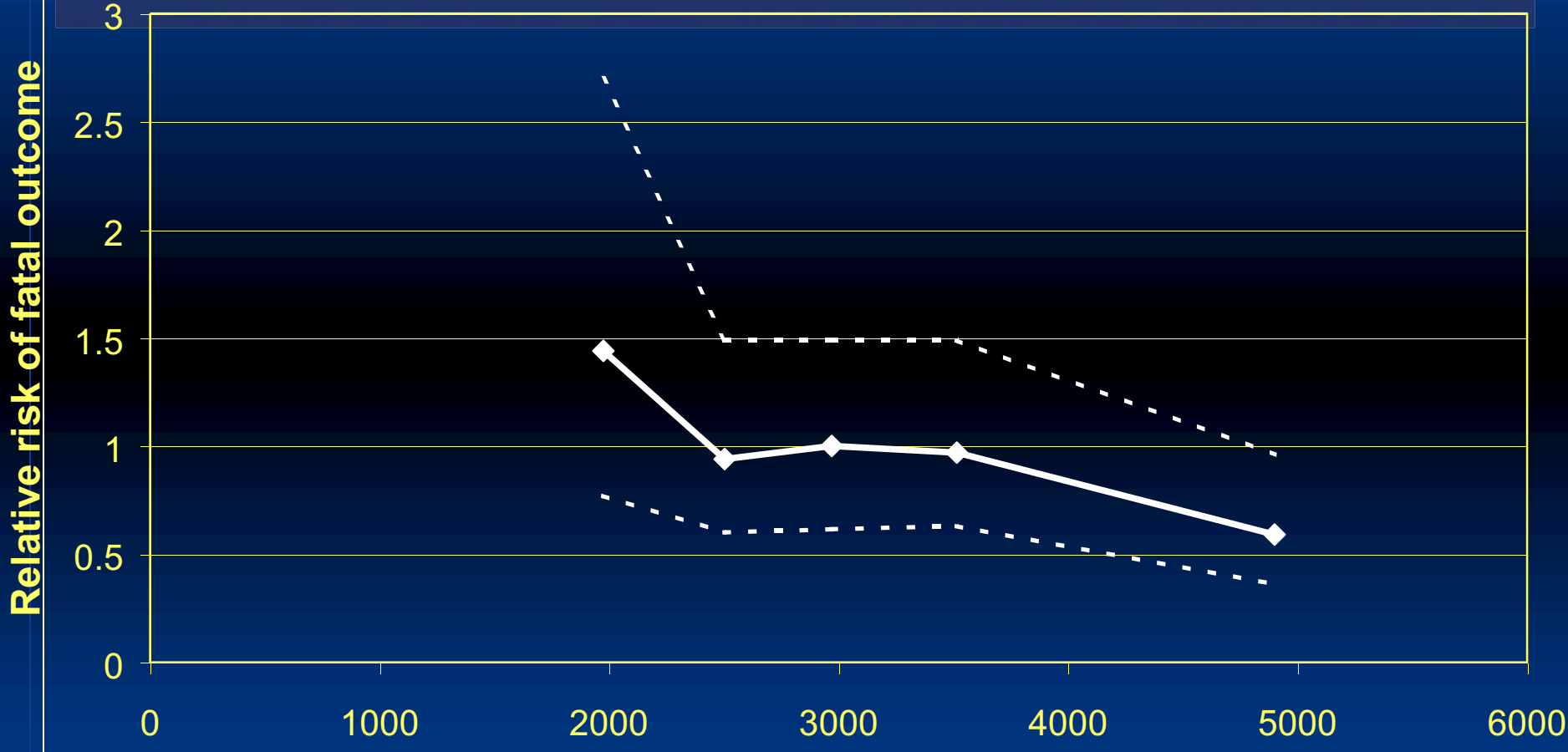
Relative risk of fatal crash outcome vs. speeding tickets detected in previous month



Covert mobile speed cameras on urban arterial roads

Speed camera hours per month	Speeding tickets issued per month	Marginal BCR for next increase in hours	Program BCR (above base level)	Casualty crash reduction	Fatal crash reduction	Fine revenue per month ($'000)	Program cost per month ($'000)
3000	**30000**	22.7	0.0	0.0%	0.0%	*3000*	221.1
4000	**40000**	14.3	4.4	3.2%	24.2%	*4000*	289.9
5000	**50000**	10.0	5.9	5.5%	38.9%	*5000*	358.8
6000	**60000**	7.6	6.3	7.4%	48.7%	*6000*	427.6
7000	**70000**	6.0	6.4	9.0%	55.8%	*7000*	496.4
8000	**80000**	4.9	6.3	10.4%	61.1%	*8000*	565.2
9000	**90000**	**4.1**	**6.1**	**11.5%**	**65.3%**	***9000***	**634.1**
10000	**100000**	3.5	5.9	12.6%	68.6%	*10000*	702.9

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Queensland speed camera program

- Overt operations from marked vehicles
- Signage advising camera presence
- Sites chosen based only on crash criteria
  - At least 80% of casualty crash locations are within 2 km of camera sites
- Random allocation (by Queensland Transport) of camera shifts to sites and time blocks
  - Very limited opportunities for Police to depart from the random assignment
- General effect from aggregated local effects

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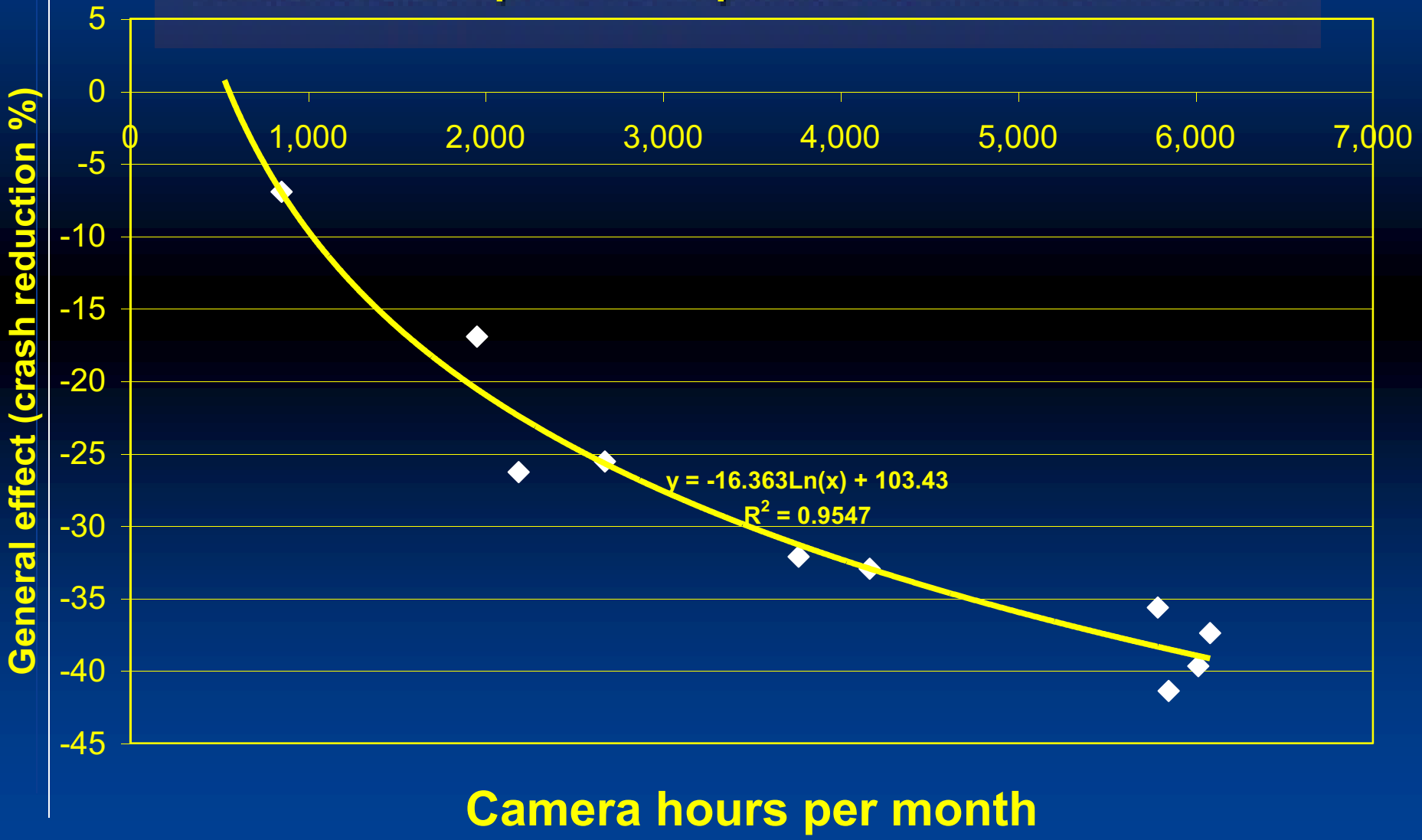
General effect on casualty crashes: Fitted relationship with speed camera hours



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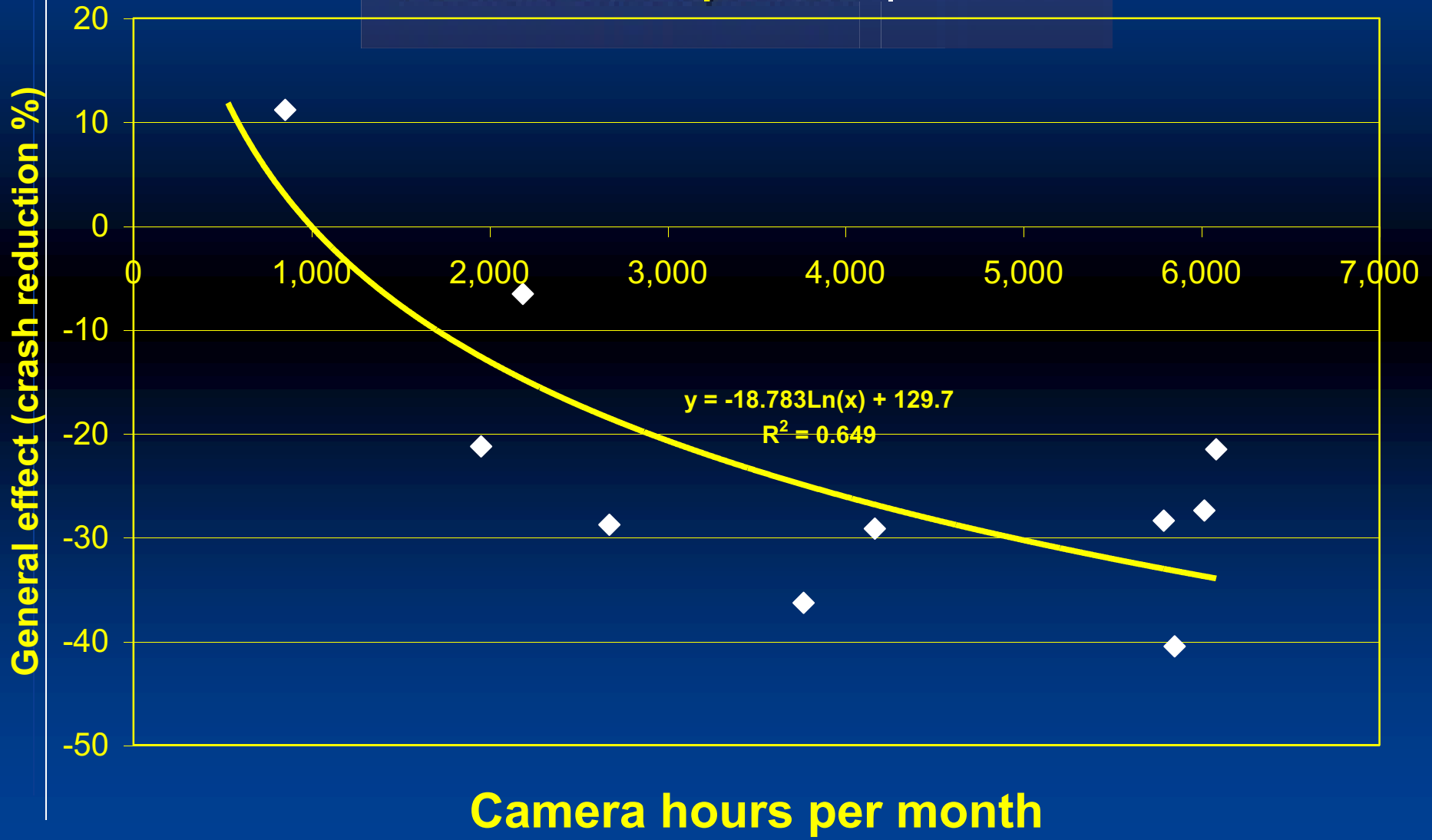
General effect on fatal crashes: Fitted relationship 1997-2006



Overt mobile speed cameras with random scheduling on urban arterial roads

Speed camera hours per month	Speeding tickets issued per month (short-term)	Marginal BCR for next increase in hours	Program BCR (above base level)	Casualty crash reduction	Fine revenue per month ($'000)	Program cost per month ($'000)
3000	30,000	21.9	0.0	0.0%	*3000*	221.1
4000	33,020	16.6	4.5	7.1%	*3302*	289.0
5000	34,500	13.3	6.5	12.7%	*3450*	356.7
6000	34,760	11.1	7.4	17.2%	*3476*	424.2
7000	34,010	9.6	7.8	21.0%	*3401*	491.5
8000	32,390	8.4	8.0	24.3%	*3238*	558.8
9000	30,000	7.5	8.0	27.3%	*3000*	625.9
10000	26,940	6.8	7.9	29.9%	*2694*	693.0

Elvik et al (2012) economic analysis of manual speed enforcement

Increase in the amount of enforcement	Speed enforcement		
	Percentage reduction of fatalities	Total benefit-cost ratio	Marginal benefit-cost ratio
Increase by 50%	4.4	8.00	8.00
Double current level	6.5	5.84	3.69
Three times current level	8.6	3.84	1.85
Three and a half times current level	9.1	3.28	1.03
Four times current level	9.6	2.87	0.92
Four and a half times current level	9.9	2.55	0.72
Five times current level	10.1	2.28	0.51
Six times current level	10.6	1.91	0.41
Ten times current level	11.4	1.14	0.18

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DRINK-DRIVING ENFORCEMENT

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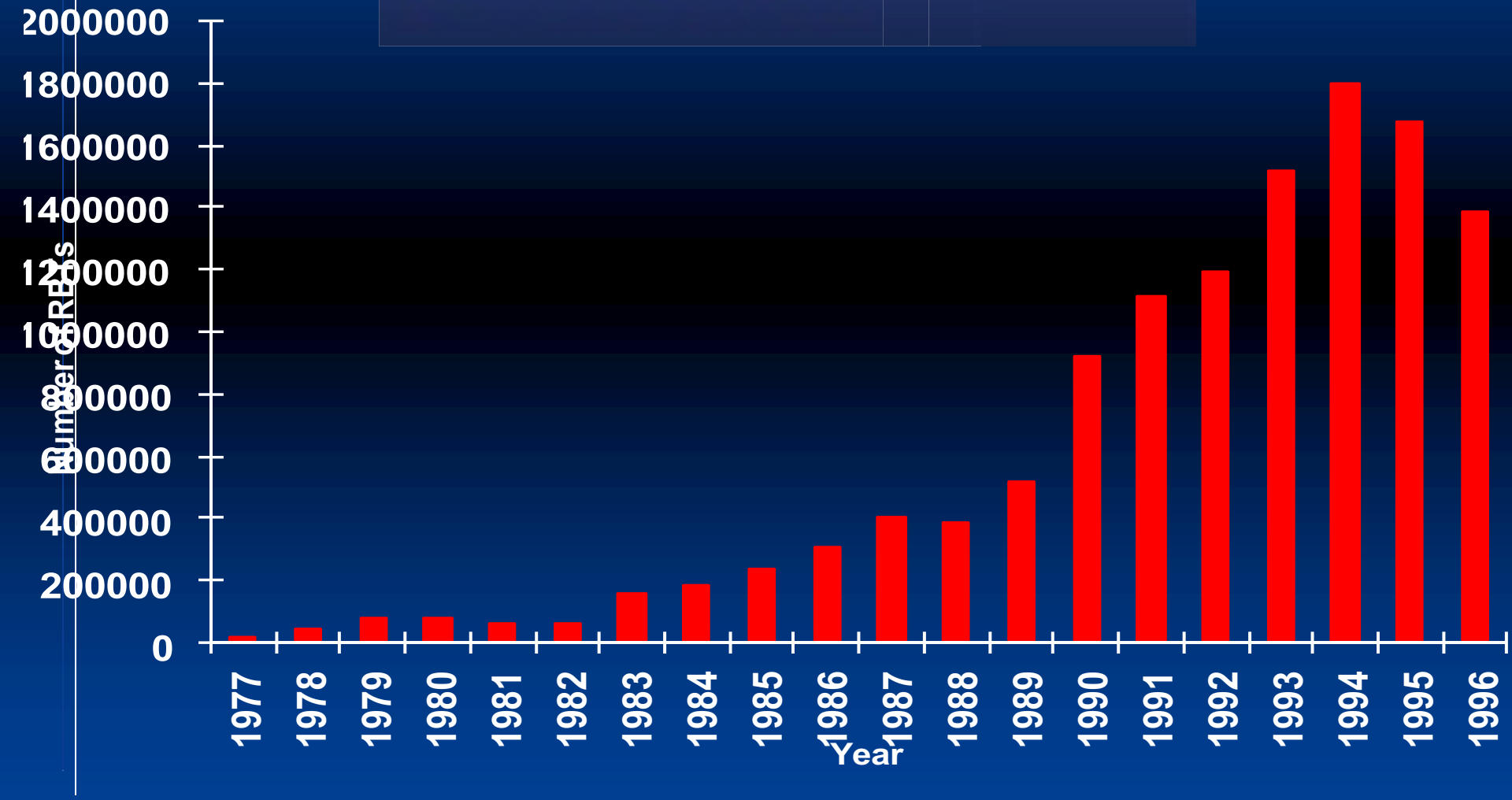
Annual Number of Random Breath Tests Victoria, 1977 - 1996



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Random Breath Testing in Melbourne
Effects on serious casualty crashes at night

Year	Weeks of intense testing	RBT operation hrs/week	Intensity of operations (hrs/100sq km/wk)	Crash reductions in area influenced	Supporting publicity
1978	7	100	22.8	-23%	Yes
Early 1979	4	93	21.2	-21%	Yes
Late 1979	8	74	16.9	-25%	Yes

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New bus-based operations for Random Breath Testing, 1990

- Car based operations supplemented by 13, highly visible, bus-based RBT stations
- “If you drink then drive, you’re a bloody idiot” campaign launch
- Rapid rise in the number of drivers tested:
  - 500,000 in 1989, 1.1 million in 1991

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Targeted alcohol screening testing

- Car-based testing of intercepted suspect drivers and/or at targeted locations and times
- Less effective on crashes than RBT
  - 6% reduction in casualty crashes
  - Compared with 10% reduction from RBT (and 17% reduction in fatal crashes – more alcohol involved)
- Role of targeted testing in apprehending those drink-drivers with very elevated BAC (> 0.15 g/100ml)
  - These “problem” drink-drivers now probably represent the greatest proportion, especially in rural areas

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Best practice in drink-driving enforcement

- RBT in urban areas should be conducted for at least 20 hours per 100 square kilometres per week.
- Scheduling of RBT in urban areas should make use of the residual effect of at least two weeks and not necessarily return to the same testing area within two weeks.

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Best practice in drink-driving enforcement (cont.)

- RBT operations should be very overt, including high visibility and testing a substantial proportion of passing motorists.
- However, maximising the number of tests should not be at the expense of covering broad urban areas and achieving the minimum testing hours per unit area.

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Best practice in drink-driving enforcement (cont.)

- Car-based RBT should be used in urban areas in conjunction with RBT buses in order to provide a broader coverage of the urban road system for a greater number of hours per week and hence achieve a general deterrence effect.
- Car-based RBT should also be conducted on sub-arterial roads and residential streets where it is perceived that RBT buses are not operated.

Best practice in drink-driving enforcement (cont.)

- Car-based RBT should be preferred in rural areas, covering both minor and major roads.
- If RBT buses are operated in rural areas, they should not operate alone and should undertake RBT in conjunction with car-based RBT on alternative roads.

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Best practice in drink-driving enforcement (cont.)

- Targeted alcohol screening testing should principally aim to apprehend drink-drivers with very elevated BACs and should not be seen as a substitute for RBT in contributing to the total number of preliminary breath tests conducted.

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Relationship between enforcement levels and crash outcomes

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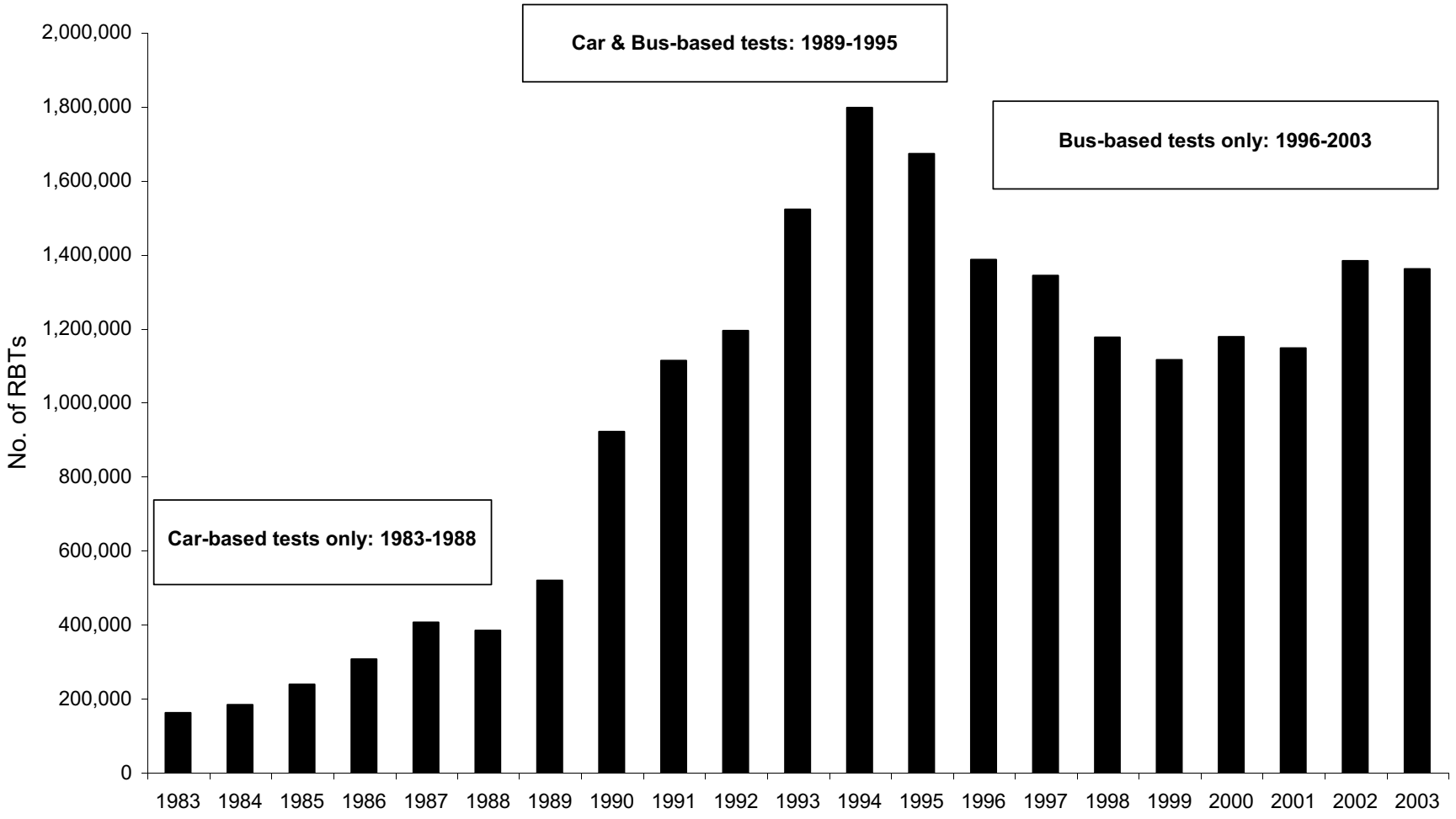
Annual RBTs: Victoria 1983-2003



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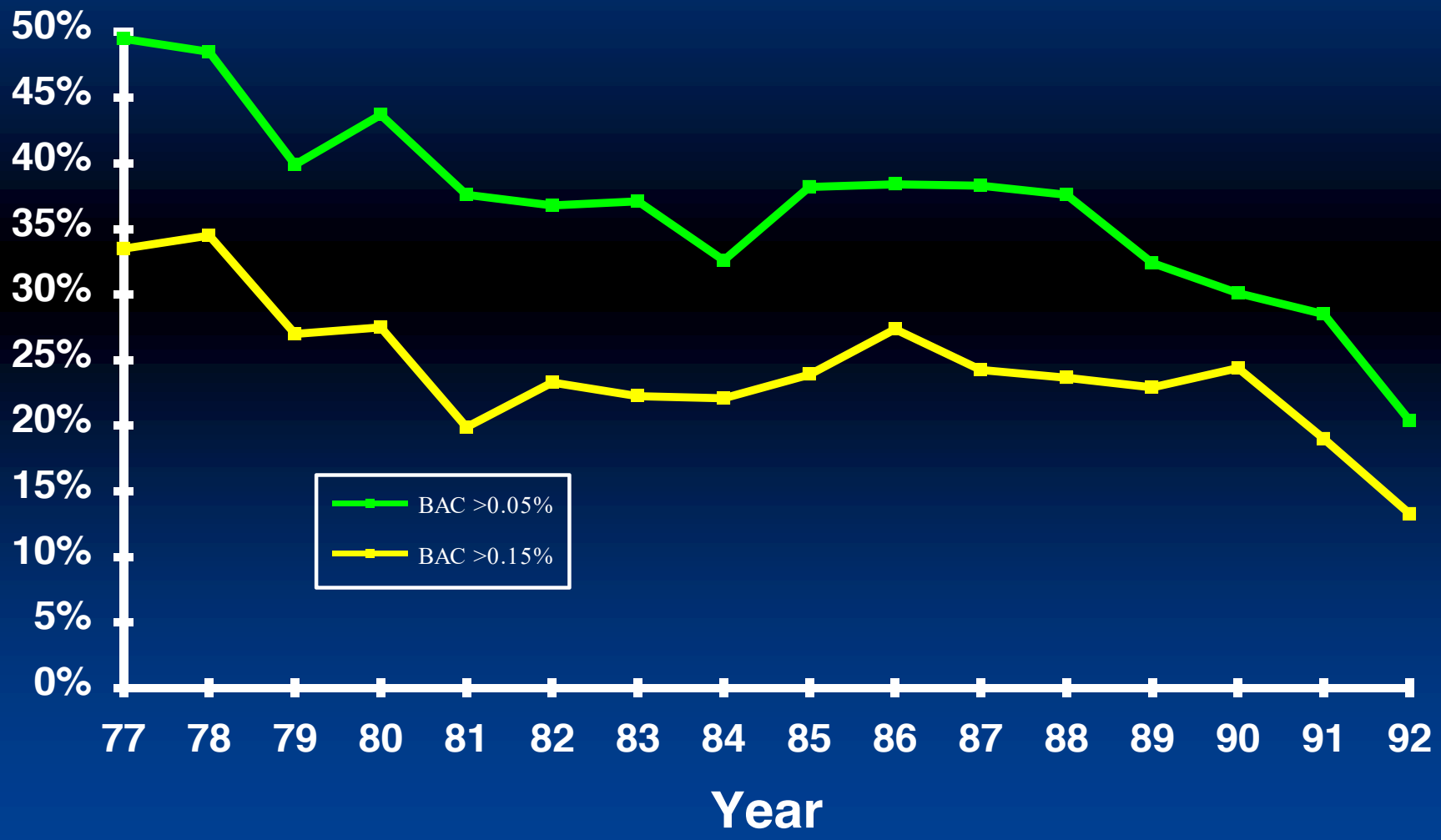
Proportions of drivers and riders killed with BACs above 0.05% and 0.15%, Victoria



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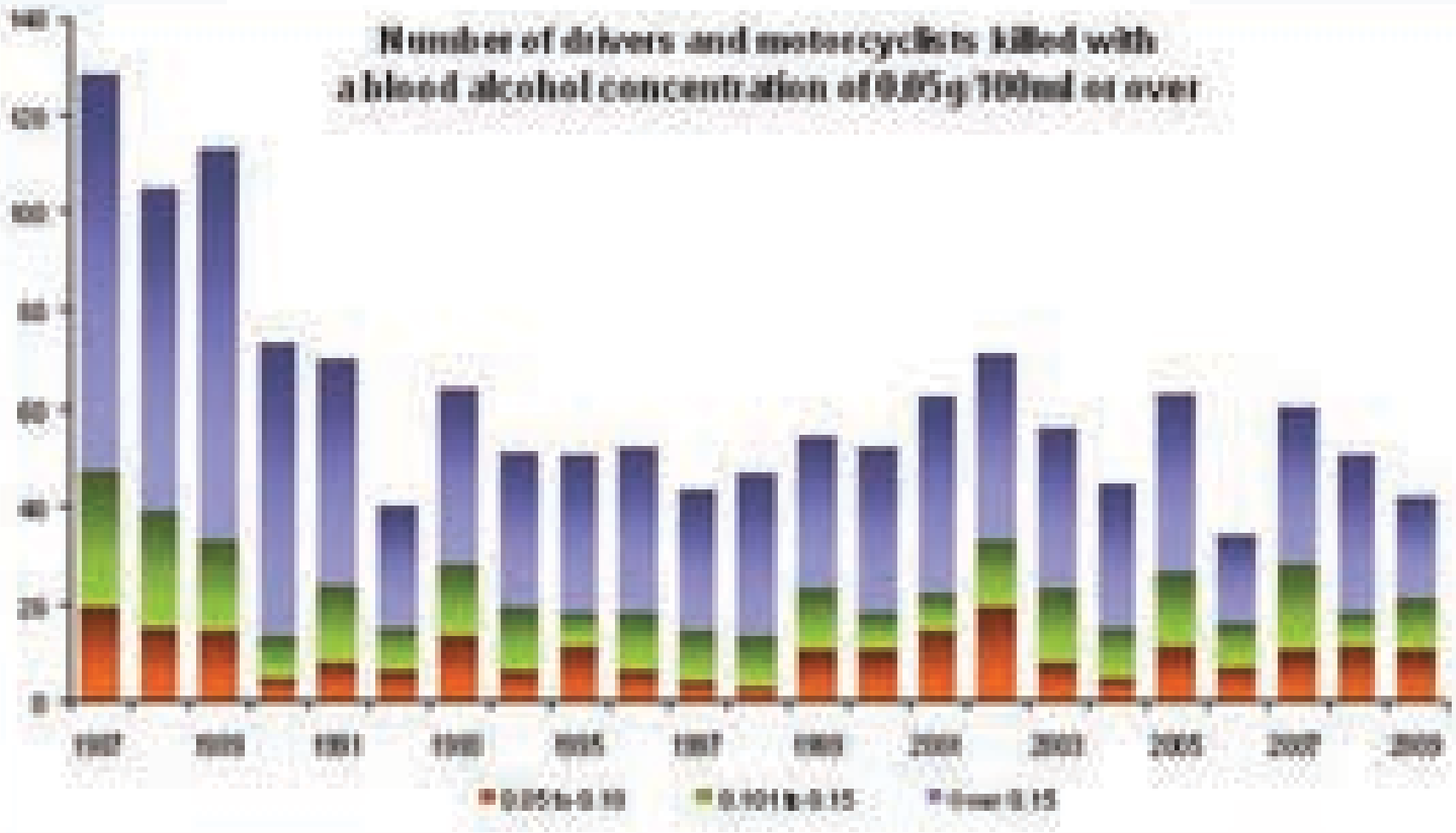
Victorian drivers and riders killed with BAC at or above 0.05%



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Residual drink driving problem

- 2/3 of killed drink drivers have BAC above 0.15%
- Those drivers that can be deterred are deterred
- A residual of those drivers less likely to be deterred are left
  - Likely to be repeat drink drivers who are unreceptive to the threat of detection and application of traditional legal sanctions (fines and licence withdrawal)
  - Treatment of underlying alcohol-related problems is required

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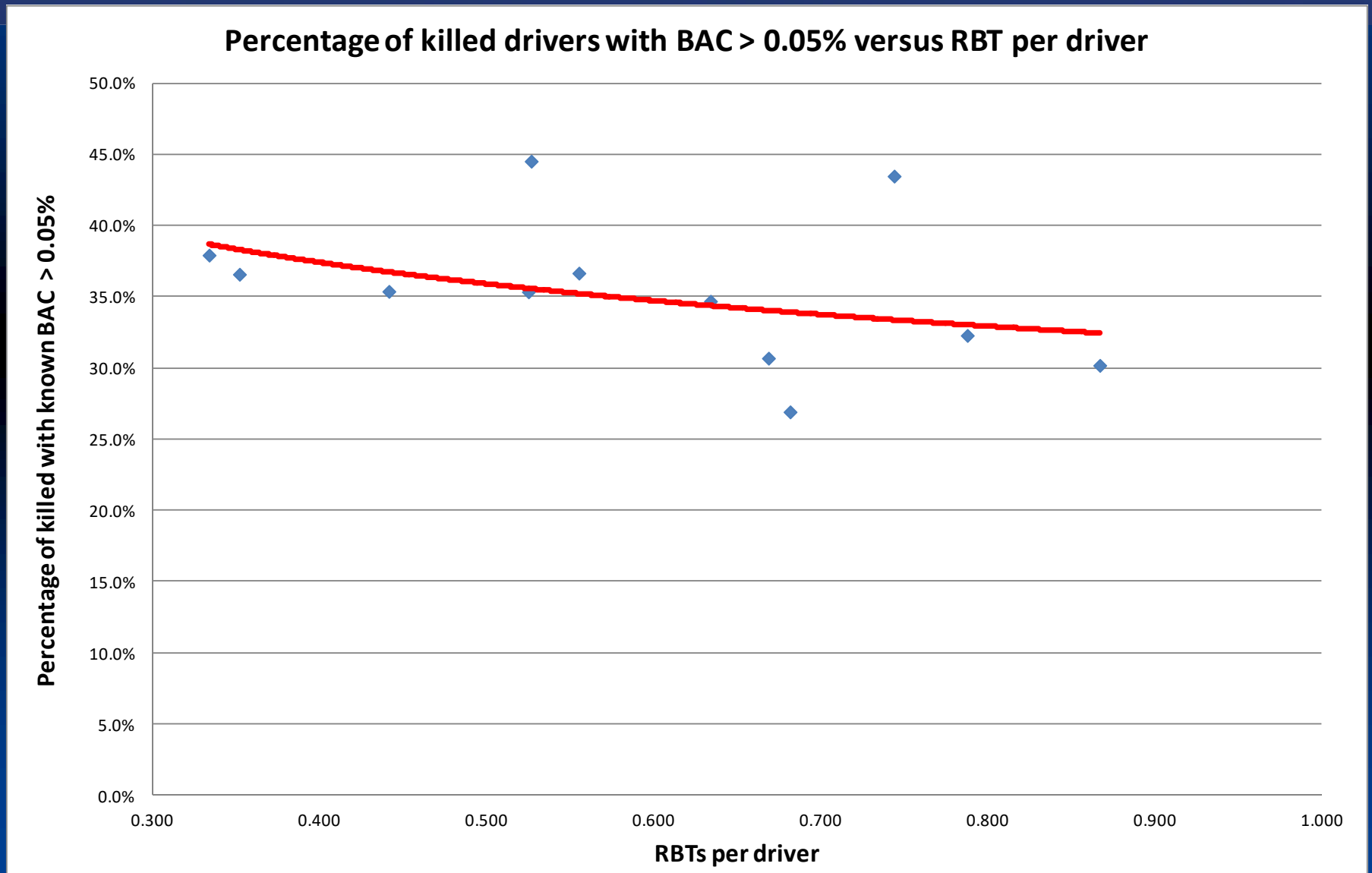
Drivers killed with BAC above 0.05% v. RBTs



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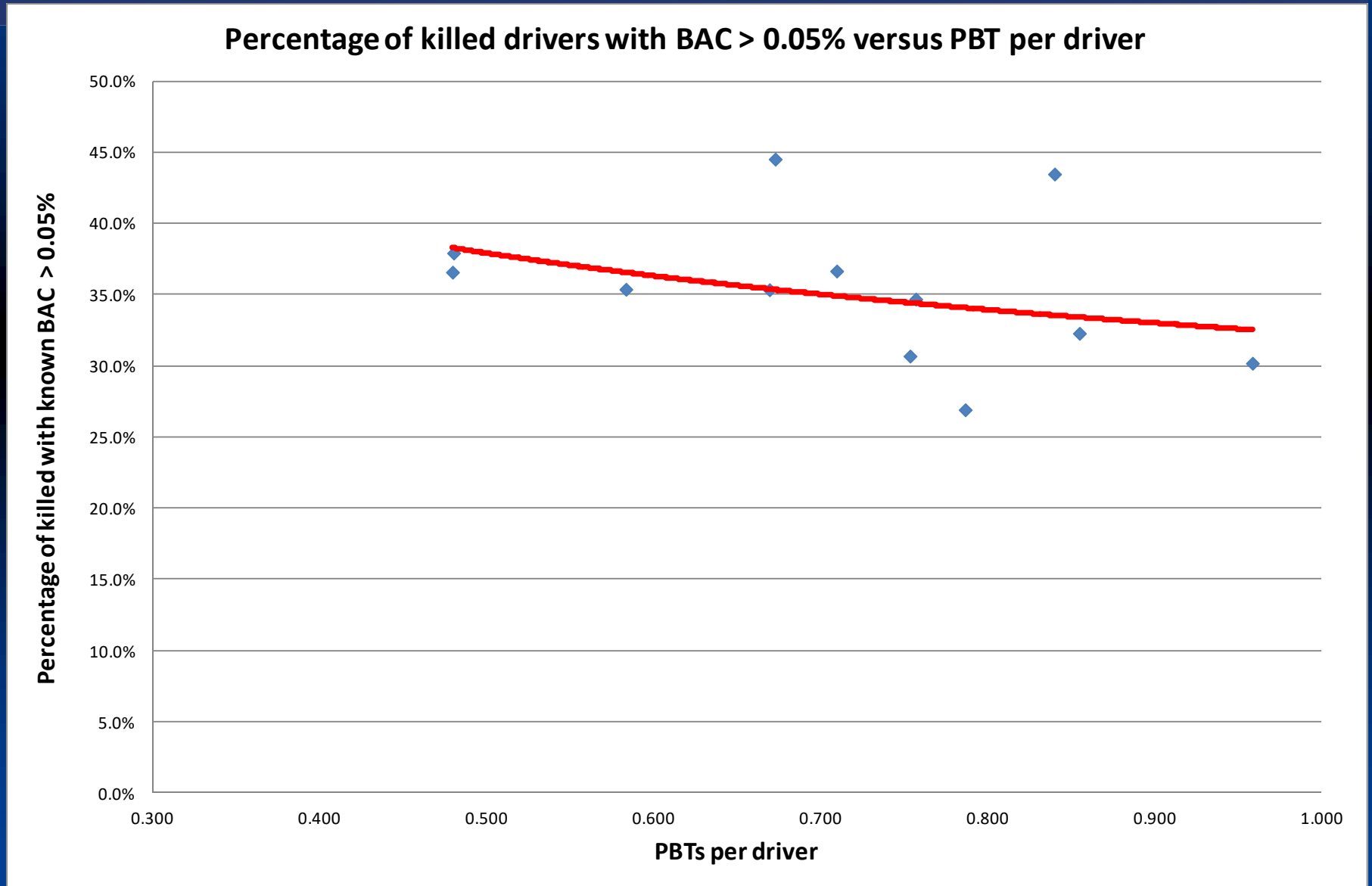
Drivers killed with BAC above 0.05% v. PBTs



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Economic analysis of increased Preliminary Breath Tests (90% RBT) per licensed driver

Preliminary breath tests (PBTs) per annum	PBTs per licensed driver	Estimated proportion of driver fatalities with BAC > 0.05%	Percentage of total driver fatalities saved	Social cost of fatal crashes saved p.a.($ m)	Cost of additional PBTs p.a.($ m)	Expanded program BCR (above 2011 level)	Marginal BCR
Base level	**0.485**	**0.382**	0.0%	0	-	NA	NA
Double	0.996	0.322	8.8%	84.3	14.8	5.69	5.47
Three times	1.494	0.293	12.6%	120.7	27.1	4.45	2.05
Four times	1.991	0.274	14.9%	142.9	40.5	3.53	1.36

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Elvik et al (2012) economic analysis of drink-driving enforcement

Increase in the amount of enforcement	Enforcement of drinking and driving		
	Percentage reduction of fatalities	Total benefit-cost ratio	Marginal benefit-cost ratio
Increase by 50%	3.3	12.87	12.87
Double current level	4.8	9.40	5.94
Three times current level	6.3	6.19	2.97
Three and a half times current level	6.7	5.28	1.65
Four times current level	7.0	4.62	1.32
Four and a half times current level	7.3	4.10	0.99
Five times current level	7.4	3.67	0.82
Six times current level	7.8	3.07	0.66
Ten times current level	8.3	1.83	0.29

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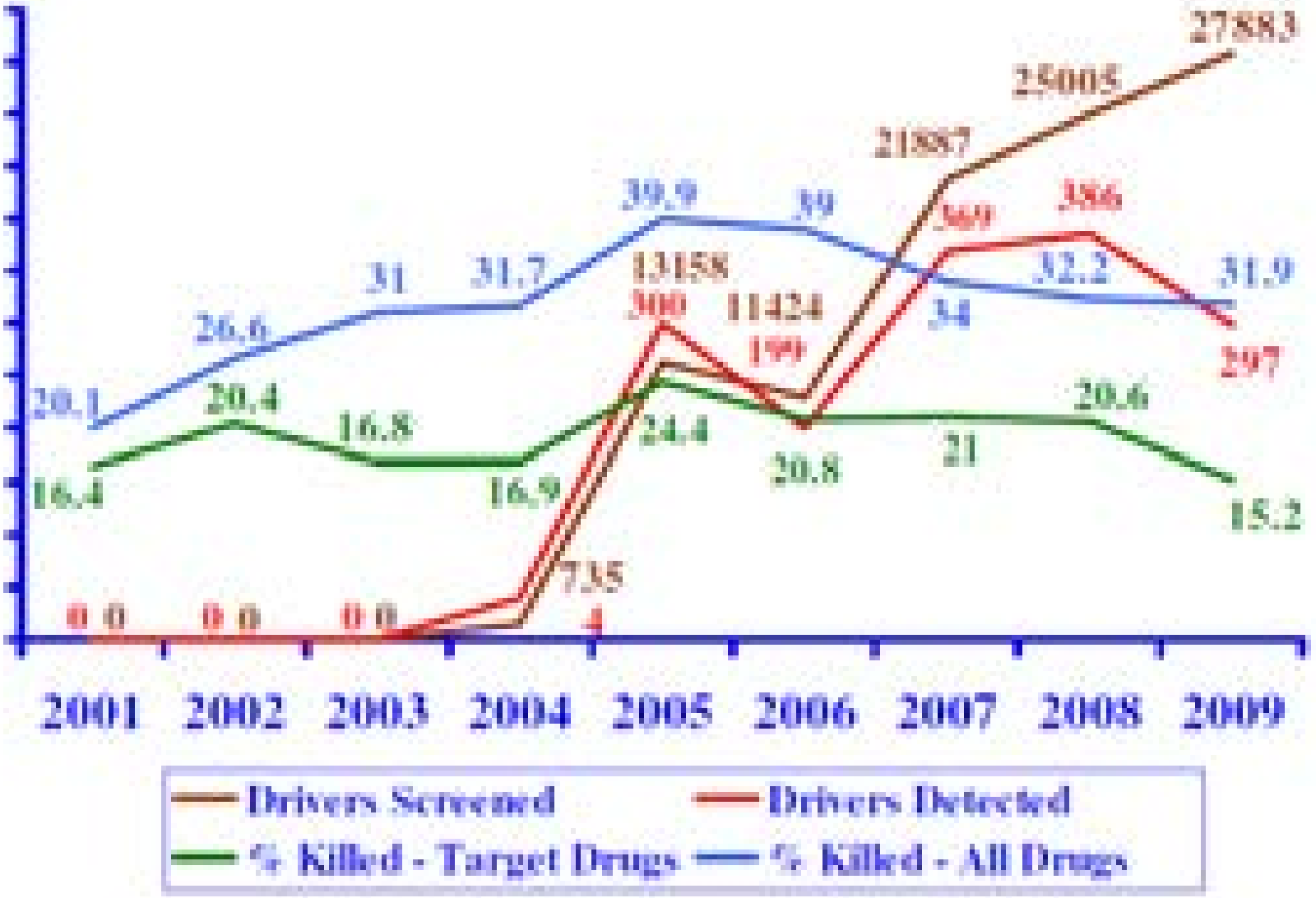
DRUG-DRIVING ENFORCEMENT

Random Drug Testing, Victoria



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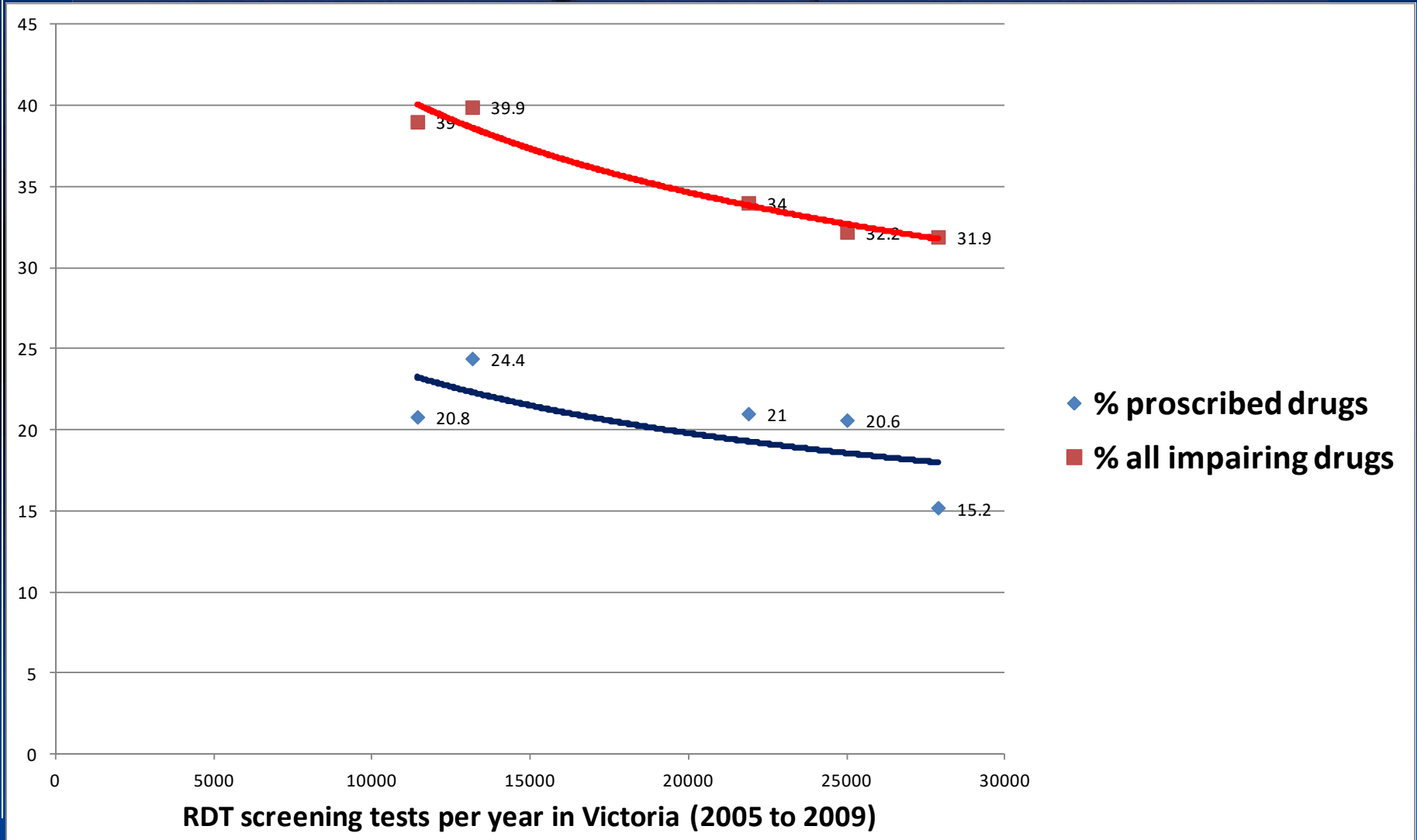
Percent drivers killed with drugs v. Random Drug Tests p.a. in Victoria



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Economic analysis of increased Random Drug Tests per licensed driver

Random Drug Tests (RDTs) per annum	RDTs per licensed driver (%)	Estimated proportion of driver fatalities with impairing drug(s)	Percentage of total driver fatalities saved	Social cost of fatal crashes saved p.a.($ m)	Cost of additional RDTs p.a. ($ m)	Expanded program BCR (above 2008-11 level)	Marginal BCR
8,700	0.54%	**0.480**	0.0%	0	-	NA	NA
20,000	1.24%	0.386	15.2%	149.2	1.62	91.97	49.28
40,000	2.49%	0.322	23.2%	227.1	4.49	50.61	16.53
80,000	4.98%	0.269	28.8%	281.8	10.22	27.58	5.88
120,000	7.47%	0.242	31.3%	306.6	15.95	19.22	3.27
160,000	9.96%	0.225	32.9%	321.7	21.68	14.84	2.17

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THANK YOU

Any questions?