

Cost Effectiveness of Injury Control in Low Income Countries

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December 11, 2007



Objective

- Find out how cost-effective it would be to intervene to control injuries in low income countries
 - Rationale for doing this
 - Methods to do this
- What was learned



Disease Control Priorities Project 2

- Chapters paired leading epidemiologists with health economists
 - General outline of a chapter
 - 1) This is how big the problems is
 - 2) This is a list of interventions with evidence on effectiveness
 - 3) This is the cost and cost per DALY of the intervention
 - Detailed methods relegated to working papers



Each chapter was a desk study

- Authors had no budget to do research, but they had travel funds to collaborate
- For no money, authors had to answer:
 - Burden?
 - What works?
 - What is cost?
- Mainstay of DCP2 is systematic (and unsystematic) review
 - Literature on burden, what works, what is cost?

1) Burden of Disease

Method: Consult Global Burden of Disease Documents

Disease or Injury	Number of Deaths
1. Ischemic heart disease	• 7,033,331
2. Cerebrovascular disease	• 5,344,039
3. Lower respiratory infections	• 3,857,580
4. COPD	• 2,621,448
5. HIV/AIDS	• 2,570,823
6. Diarrheal diseases	• 2,019,585
7. TB	• 1,596,055
8. Childhood diseases	• 1,391,677
9. Low birth weight	• 1,343,581
10. Road traffic injuries	• 1,203,356

2) What works?

- Literature in injury control interventions in low and middle income countries is slim
- Systematic review limited to low and middle income country intervention evaluations
 - Speed bumps Afukaar, F. K. (2003).
 - Bicycle helmets Li and Baker (1997)
 - Motorcycle helmets Tsauo (1999)
 - Traffic enforcement (Poli de Figuereido, 2001)
 - Childproof kerosene storage containers (Krug, 1994)



3) What does it cost?

- Synthetic models based on estimates of resources and local prices

Editors' Workplan: Ask for the world settle for a whole lot less

- Common Problem: No Cost Effectiveness Studies in Literature
- Standard building blocks for synthetic cost models

	A	B	C	D	E	F
1	Days in a work year	250	8.81			
2	World Bank region	Level		Best	Low	High
3						
4	East Asia and Pacific	Level 1 Jobs	EAP1	\$6.87	\$4.49	\$9.82
5	East Asia and Pacific	Level 2 Jobs	EAP2	\$8.81	\$5.93	\$12.31
6	East Asia and Pacific	Level 3 Jobs	EAP3	\$12.70	\$8.48	\$18.03
7	East Asia and Pacific	Level 4 Jobs	EAP4	\$21.39	\$14.22	\$30.33
8	East Asia and Pacific	Level 5 Jobs	EAP5	\$33.78	\$20.94	\$49.45
9						
10	Europe and Central Asia	Level 1 Jobs	ECA1	\$8.31	\$5.83	\$10.92
11	Europe and Central Asia	Level 2 Jobs	ECA2	\$10.65	\$7.69	\$13.81
12	Europe and Central Asia	Level 3 Jobs	ECA3	\$15.36	\$10.96	\$19.84
13	Europe and Central Asia	Level 4 Jobs	ECA4	\$25.87	\$18.59	\$33.77
14	Europe and Central Asia	Level 5 Jobs	ECA5	\$40.85	\$27.65	\$57.36
15						
16	Latin America and Caribbean	Level 1 Jobs	LAC1	\$16.34	\$7.39	\$19.26
17	Latin America and Caribbean	Level 2 Jobs	LAC2	\$20.94	\$9.69	\$24.08
18	Latin America and Caribbean	Level 3 Jobs	LAC3	\$30.20	\$13.94	\$35.27
19	Latin America and Caribbean	Level 4 Jobs	LAC4	\$50.84	\$23.11	\$59.08
20	Latin America and Caribbean	Level 5 Jobs	LAC5	\$80.29	\$34.51	\$99.40

Detailed Example: Traffic Enforcement

- Why?
- Traffic crashes are the leading contributor to total injuries
- Enforcement addresses leading cause of crashes
 - Driver factors responsible for 70-80% of crashes in crash scene studies
- For enforcement, DCP2 Chapter addressed
 - “How effective?”
 - “What cost?”



How effective is traffic enforcement

- Enforcement studies from high income countries judged inappropriate for extrapolation
 - Examples
 - Speed and red light cameras
 - Safety belt promotion and enforcement
 - Alcohol control



Evidence on Enforcement Effectiveness in Middle Income Countries

- Poli de Figueroido, Brazil 1997: Three pronged approach succeeded
 - Legislation to impose stiffer penalties,
 - Media coverage of the new regime
 - Better enforcement
- Yielded 25% reduction in fatalities

What would traffic enforcement cost?

- Building a cost model
 - Traffic cop to vehicle ratios vary around the world:
 - US (Michigan State) 1 cop per 7000 vehicles
 - India (Urban Hyderabad) 1 cop per 1000 vehicles
 - Citation rates vary around the world
 - US (Michigan) 1 citation per 3 vehicles
 - India (Hyderabad) 8 citations per 10 vehicles



Cost model for Sub Saharan Africa

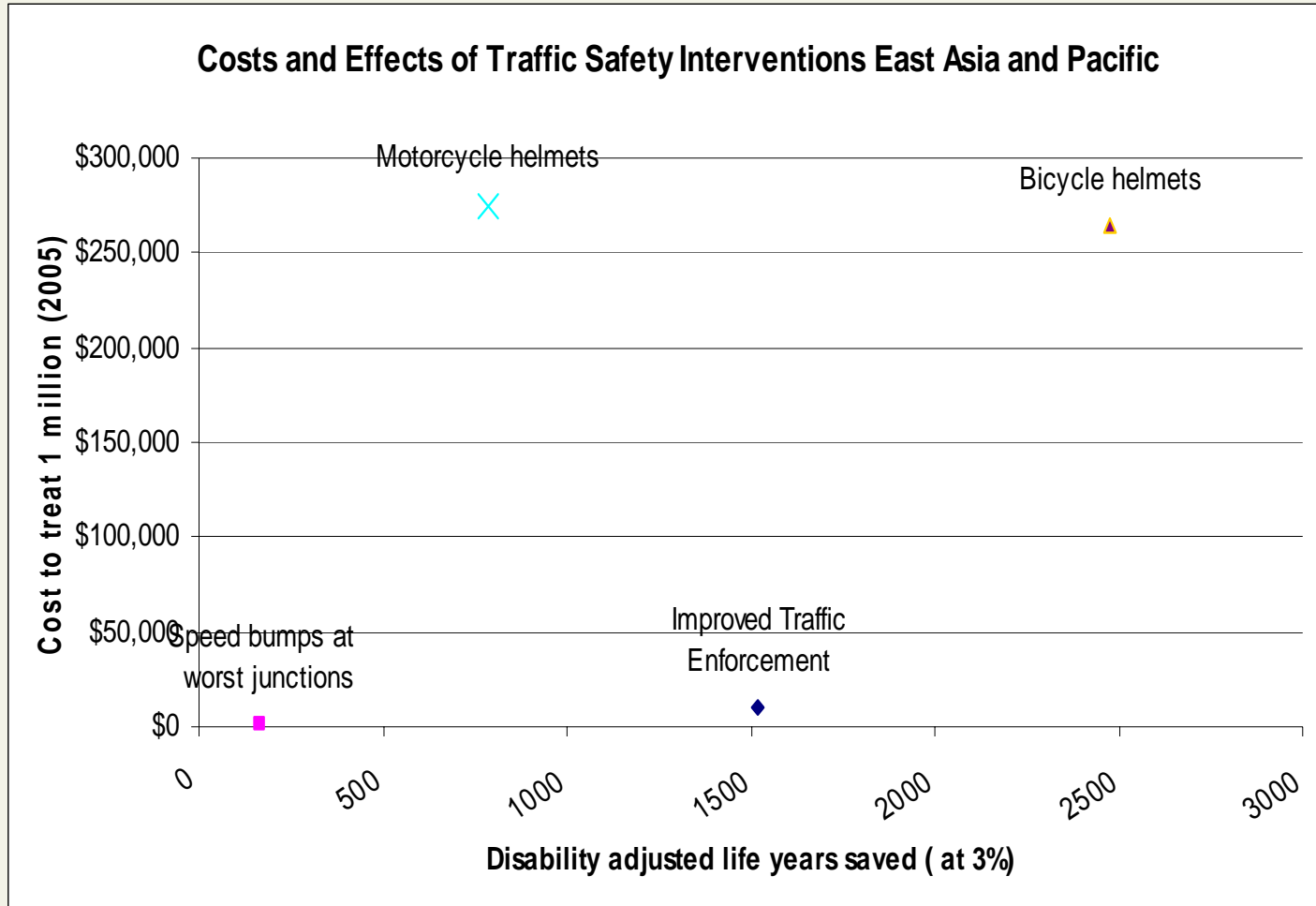
- Sub Saharan Africa averages 24,000 vehicles per million people (41 people per vehicle)
 - Daily pay for African Police officer set at \$15.00
 - Assume 1 cop per 1000 vehicles
 - Assume baseline of 1 citation per 6 vehicles
- Would cost \$22,118 (2004) at SSA salaries, fuel and vehicle costs to double traffic police force to the point where it can ticket 1 in 3 vehicles for safety violations



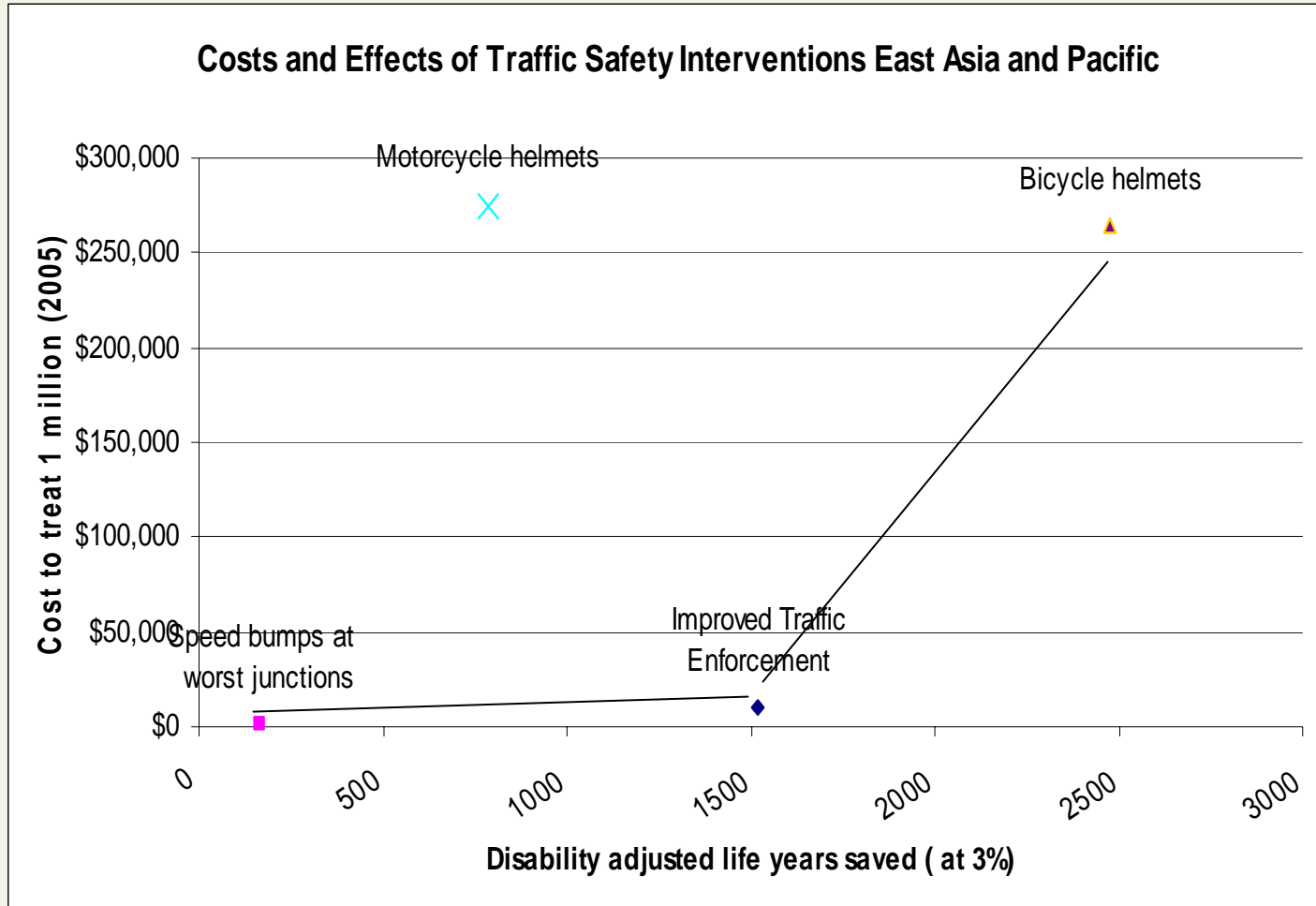
How many lives saved

- Brazilian experience in enforcement modeled as a doubling of the force
 - Accompanied by tougher laws and media
- A Sub Saharan African country improving enforcement in a population of 1 million could prevent 71 deaths per year
- In Sub-Saharan Africa
 - Cost effectiveness of \$313 per death averted, \$11 per DALY averted
- In East Asia and Pacific
 - Cost effectiveness of \$221 per death averted, \$7 per DALY averted

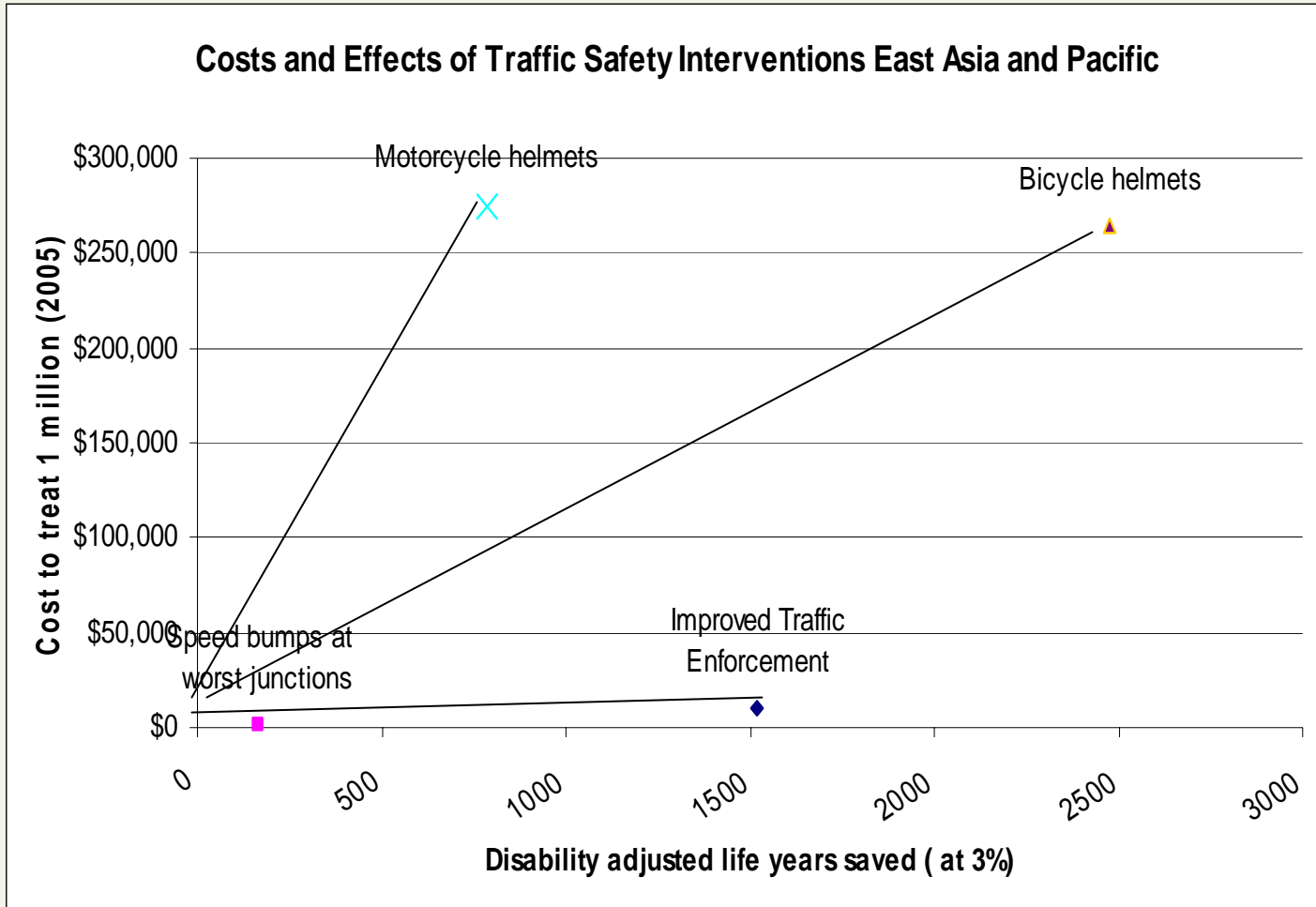
Cost and Effects Space



Expansion Path



Generalized CEA



Other Effective Interventions Exist

Intervention	Cost per DALY Averted	
	Sub Saharan Africa (DALY)	East Asia and Pacific (DALY)
Speed bumps at top 25%ile dangerous junctions	\$2	\$4
Improved enforcement	\$11	\$7
Bicycle Helmet Promotion		\$107
Motorcycle Helmet Promotion		\$351

By comparison: treating AIDS patients in Africa with simplest regimen of highly active therapy costs \$635 per DALY averted.

Model: Extrapolating Results to World

Improved enforcement (Doubling Police Presence on Highways combined with Media Campaign)	Cost per Death Averted
Lower and Middle Income Country Average	\$1924
East Asia and Pacific	\$221
Eastern Europe and Central Asia	\$4,027
Latin America	\$5,171
Middle East and North Africa	\$1,657
South Asia	\$157
Sub Saharan Africa	\$313

Validation

- 1) Systematic review of literature on *cost-effectiveness* of interventions in low income countries
- 2) Review literature of effectiveness and extrapolate costs based on a model
- 3) Assess cost-effectiveness by observing programs in the field



Validating Models with Data

A Case Study of Enforcement in Uganda

- No direct observations of costs and effects of traffic enforcement in low income countries
- Need to collect field data
- In Uganda, 19,528 crashes and 2034 deaths in 2005
- What Uganda started in 2004
 - Updated its traffic code
 - Launched a traffic patrol unit
 - 4 vehicles and 20 officers
 - On the major trunk roads in Central Uganda.

Traffic Enforcement in Uganda 2006



Police Patrol



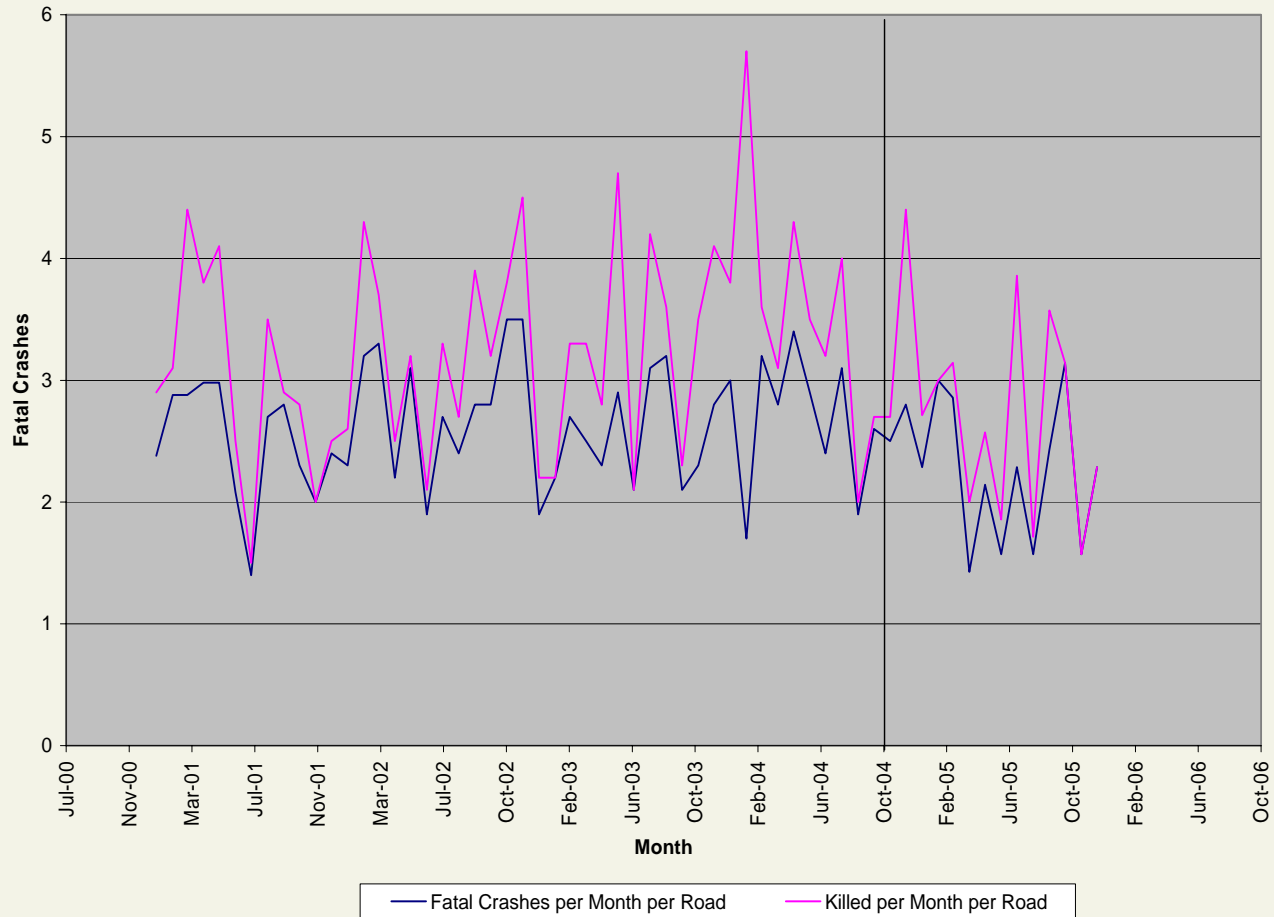
Police officer using available instruments to patrol violations



Methods

- Conducted a review and interview of key informants at 12 police stations patrolled along the highways of the country.
- Monthly data on traffic accidents and fatalities along with traffic citations was recorded on four major roads
- Time series analysis methods (ARIMA) used to assess whether fatalities per road were lower after intervention
- Calculated costs and potential revenue from citations in order to determine potential cost offsets.

Time Series Data on Crashes





Results

- Number killed per month is 16% lower ($p < 0.05$) in post intervention phase
- Annual cost of traffic patrols amounts to \$71,000.
- Annual number of citations equal up to a value of \$327,311.
 - From government perspective can save 46 lives per year and collect \$100,000s at the same time



Comparing model to data

- Simulation Model predicted enforcement would cost \$313 per death averted
- Field data showed: cost \$1555 per death averted saved to invest in traffic safety
- Simulation model was too optimistic
- So collecting real field data was worthwhile



Discussion

- How does \$1555 to save a life in Africa stack up?
 - Most motorists whose lives are saved would live at least another 20-30 years
- Traffic enforcement costs \$50-\$70 per life year saved
 - Comparison: Antiretroviral treatments for AIDS cost \$600 per life year saved
- Why no PEPFAR for traffic deaths?



Summary

- When compared to many other interventions in public safety and health improved enforcement is one of the cheapest ways to save life.
- Unsolved Mystery:
 - Why are so many traffic enforcement units underfunded?