

Statistical methods for critical events and accidents

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How can information from near-crashes be used to prevent real crashes?

1

Do near-crashes resemble real crashes? Are more extreme near-crashes more like real crashes?

2

Is it possible to find driver behavior or traffic situations which is different in near-crashes than in normal driving? Are these differences even more extreme in real crashes?

Statistical methods

1

Regression: Is relative risk the same for crashes and for near-crashes?

Extreme Value Statistics (EVS): Can the distribution of near-crashes predict the frequency of real crashes?

Extreme value statistics models behavior in extreme situations. It is a well developed area of statistics which includes all the standard statistical tools: suitable distributions (the Extreme Value distributions), estimation methods, model checking tools, multivariate and regression tools, user friendly (free) software

Crash proximity measures:

TTEC = Time To edge Crossing

Gap = time between first car leaves conflict area and second car enters conflict area

TTC = Time To Collision

etc

UMTRI (Gordon et al) “do near-crashes give similar risk estimates as crashes?”

Seemingly Unrelated Regression → *yes to question 1 (?)*

EVS: TTEC → road departure → road way departure crash

2.3 mile segment of US-23 with 117 traversals by 43 different drivers in instrumented cars.

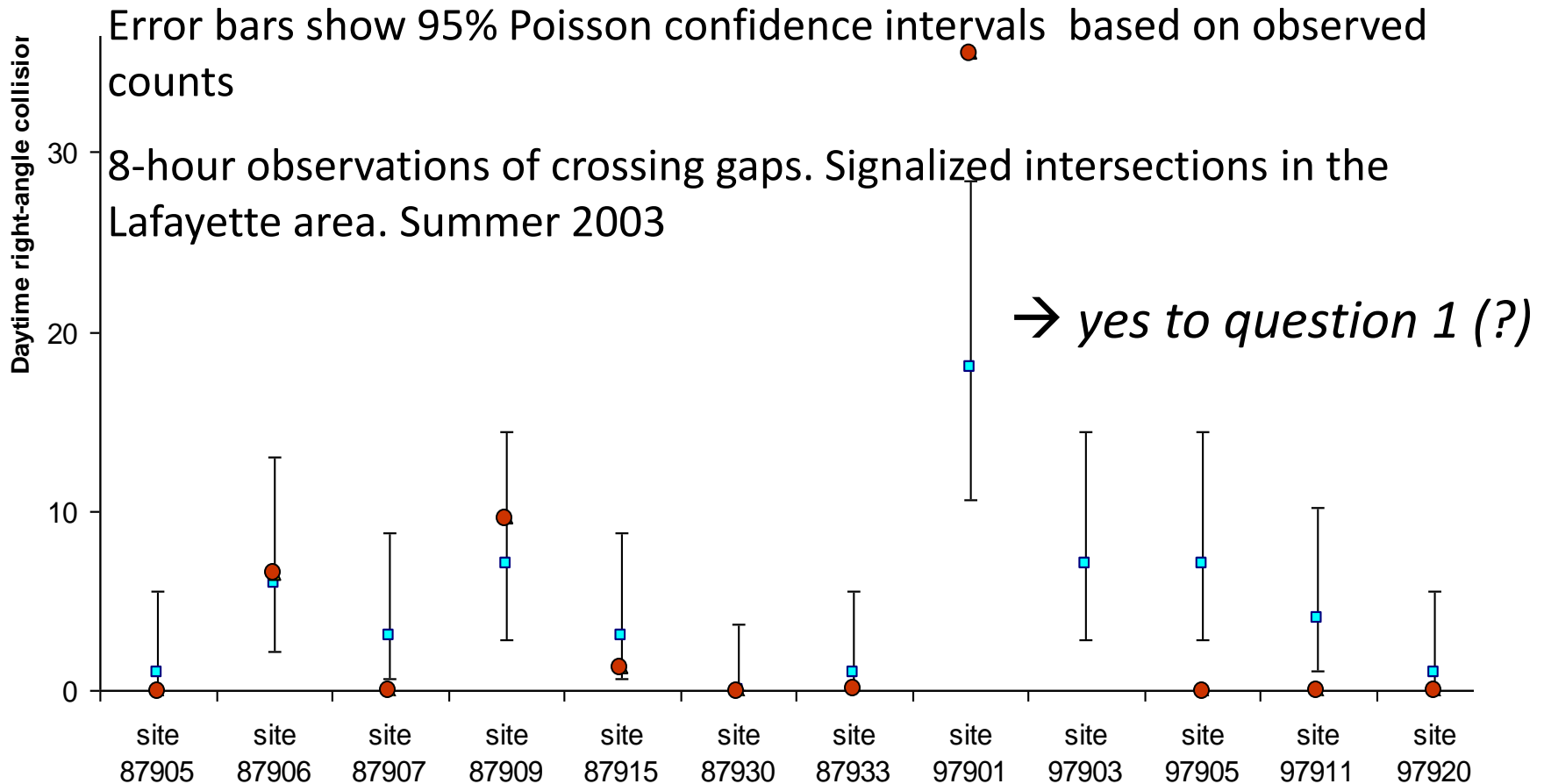
EV distribution fit to minimum TTEC values for the 117 traversals → predicts 12 road departures/year

On the average there were 1.8 road way departure crashes/year

→ *yes to question 1 (?)*

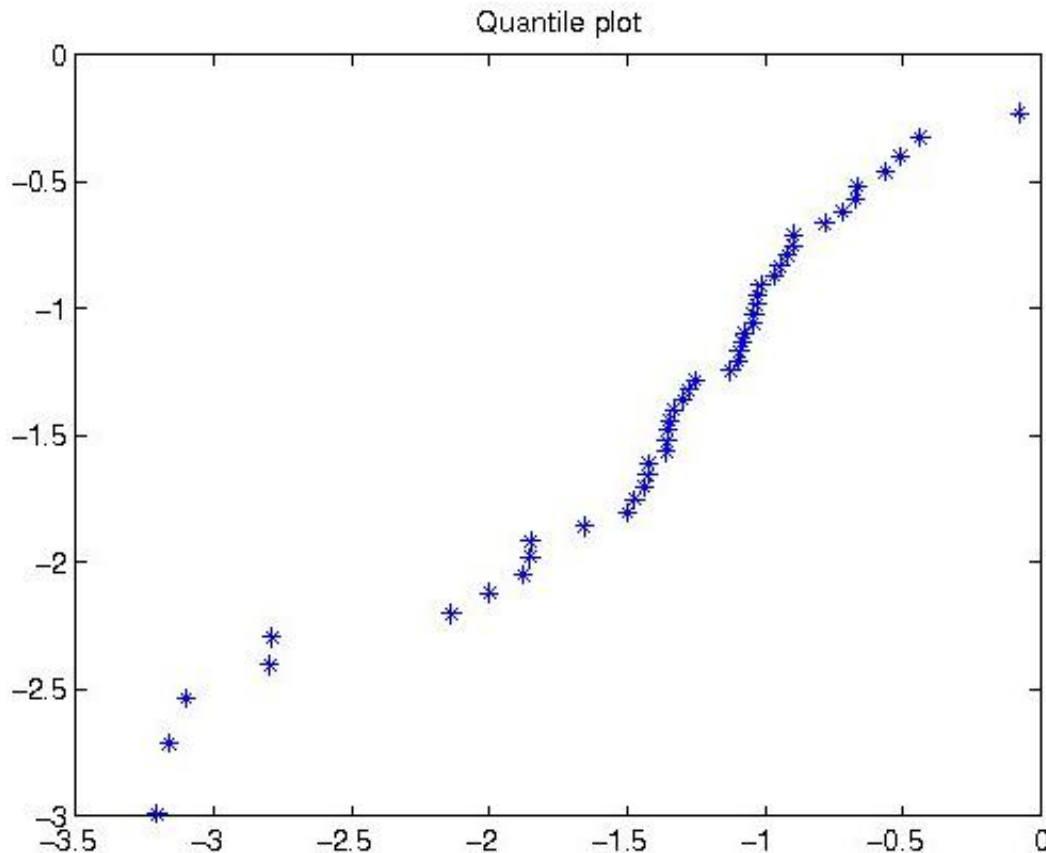
Slide from presentation by P. Tarko, Purdue university: "Risk evaluation for intersections"

- *four year actual counts of daytime rightangle collisions*
- *EVS estimate of crash frequency from gap measurements*



We (J. Jonasson, R. Jörnsten, O. Nerman) “do near-crashes give similar risk estimates as crashes?”

100-car data, risk of rear-ending, TTC

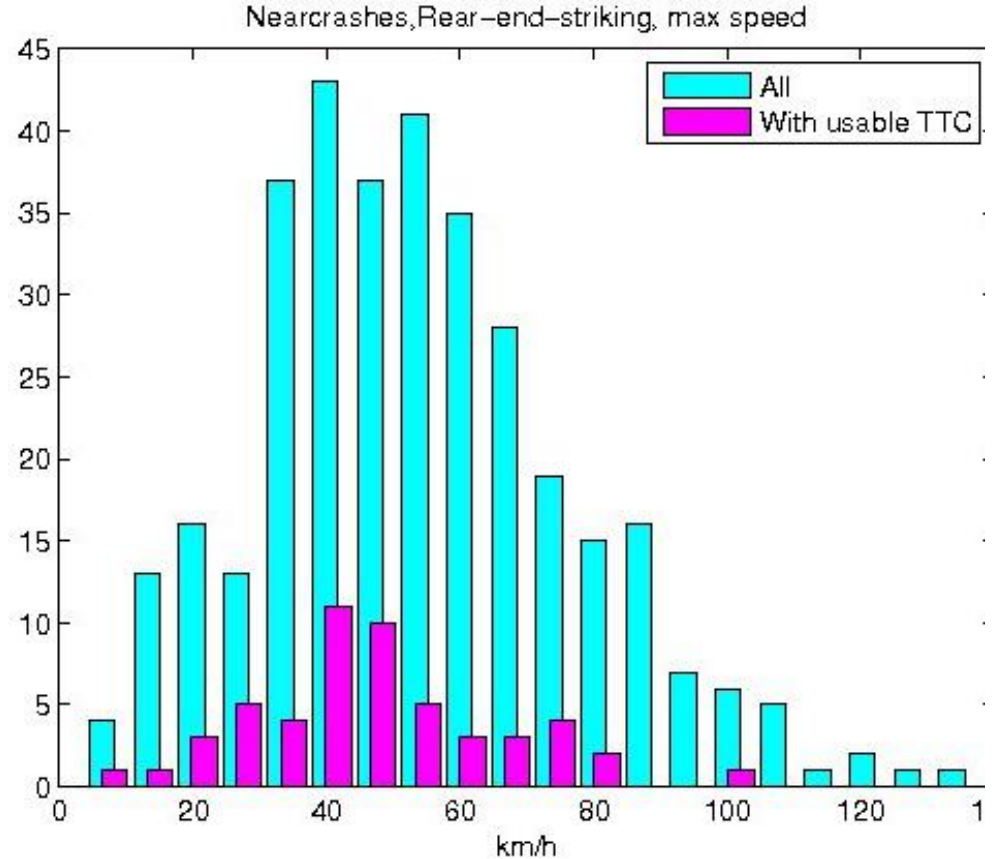
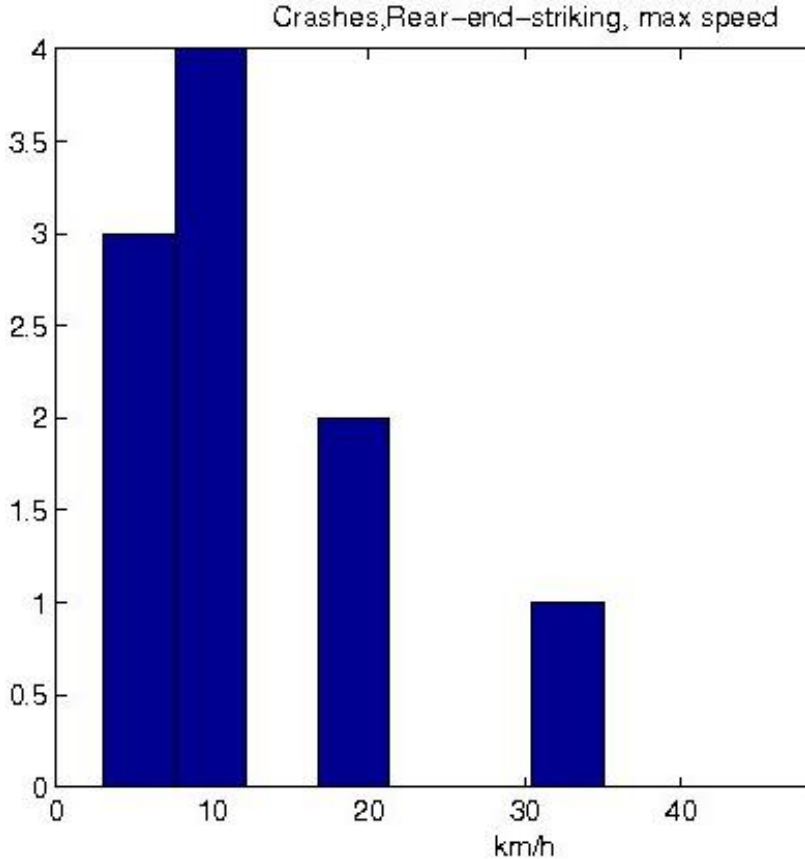


EVS estimate of expected number of crashes ≈ 0.5

Observed number of crashes = 10

Didn't work?

An explanation



All real rear-ending crashes were in start-stop traffic but the near-crashes with usable TTC were in higher speed situations

So maybe still: → *yes to question 1 (?)*

The next steps: question 2

- Use near-crashes for investigation of to what extent attention measures and other driving and traffic characteristics influence crash risk
- Develop statistical predictors of crash risk
- Investigate the relation of risk estimates obtained in different in naturalistic driving studies (Semifot, 100-car, SHRP 2, ...)
- Study the normal driving – near-crash/crash relation in naturalistic driving experiments

More and better data crucial, new statistical methods must be developed

M. Barnes*, A. Blankespoor, D. Blower, T. Gordon, P. Green, L. Kostyniuk, D. LeBlanc, S. Bogard., B. R. Cannon, and S.B. McLaughlin (2010). Development of Analysis Methods Using Recent Data: A Multivariate Analysis of Crash and Naturalistic Event Data in Relation to Highway Factors Using the GIS Framework. *Final Report **SHRP S01**, University of Michigan Transportation Research Institute*

A. P. Tarko, P. Songchitruksa (2006). ESTIMATING FREQUENCY OF CRASHES AS EXTREME TRAFFIC EVENTS. *Report, Purdue University*