Investigation of the influence of the median to the relative risk of interurban road segments

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Background

- Regression assumptions are often violated in practice
- Most common violation in road safety data related to error-structure distribution
- Poisson assumption commonly assumed
  - Fixed dispersion parameter (=1, i.e. mean=variance)
- Generalized linear models allow relaxation of this restriction
  - Dispersion parameter != 1 (quasi-Poisson)
  - Other distributions of the exponential family (e.g. negative binomial)

Data and methodology

- Data about straight and flat segments from the national highway network (PATHE)

- Accidents occurred between 1996 and 1999

- Generalized linear model

Final model specification

- Dependent variable: relative risk
- Independent variables
  - Median (0/1 binary variable, 1=with median)
  - Rain/dry (0/1 binary variable, 1=rain)
  - Lighting conditions (0/1 binary variable, 1=low lighting conditions)
  - Traffic flow (veh/day)

$$g(\mu_i) = \text{intercept} * 1 + b_{med} * median_i + b_{dark} * dark_i + b_{rain} * rain_i + b_{flow} * flow_i$$

Estimation results
Poisson

Poisson			
	Estimated Coefficient	Standard error	z-value
Intercept	0.19471	0.23342	0.834
No median	1.76023	0.15267	11.529
Dark	-0.5383	0.08612	-6.251
Wet pavement	-1.2185	0.10776	-11.308
Traffic flow	0.16353	0.03395	4.817
Null deviance	554.51 (83 degrees of freedom)		
Residual deviance	186.41 (79 degrees of freedom)		
AIC	475.75		

Estimation results quasi-Poisson

Quasi-Poisson			
	Estimated coefficient	Standard error	z-value
Intercept	0.223	0.322	0.692
No median	1.712	0.183	9.316
Dark	-0.478	0.129	-3.706
Wet pavement	-1.186	0.144	-8.201
Traffic flow	0.159	0.0520	3.058
Null deviance	243.37 (83 degrees of freedom)		
Residual deviance	78.93 (79 degrees of freedom)		
AIC	235.71		

Estimation results
Negative binomial

Negative binomial			
	Estimated coefficient	Standard error	z-value
Intercept	0.225	0.338	0.668
No median	1.705	0.190	8.969
Dark	-0.471	0.136	-3.456
Wet pavement	-1.182	0.151	-7.791
Traffic flow	0.158	0.0550	2.884
Null deviance	235.109 (83 degrees of freedom)		
Residual deviance	73.408 (79 degrees of freedom)		
AIC	422.97		

Impact of median in accident rate

Accidents (dry weather, daylight)
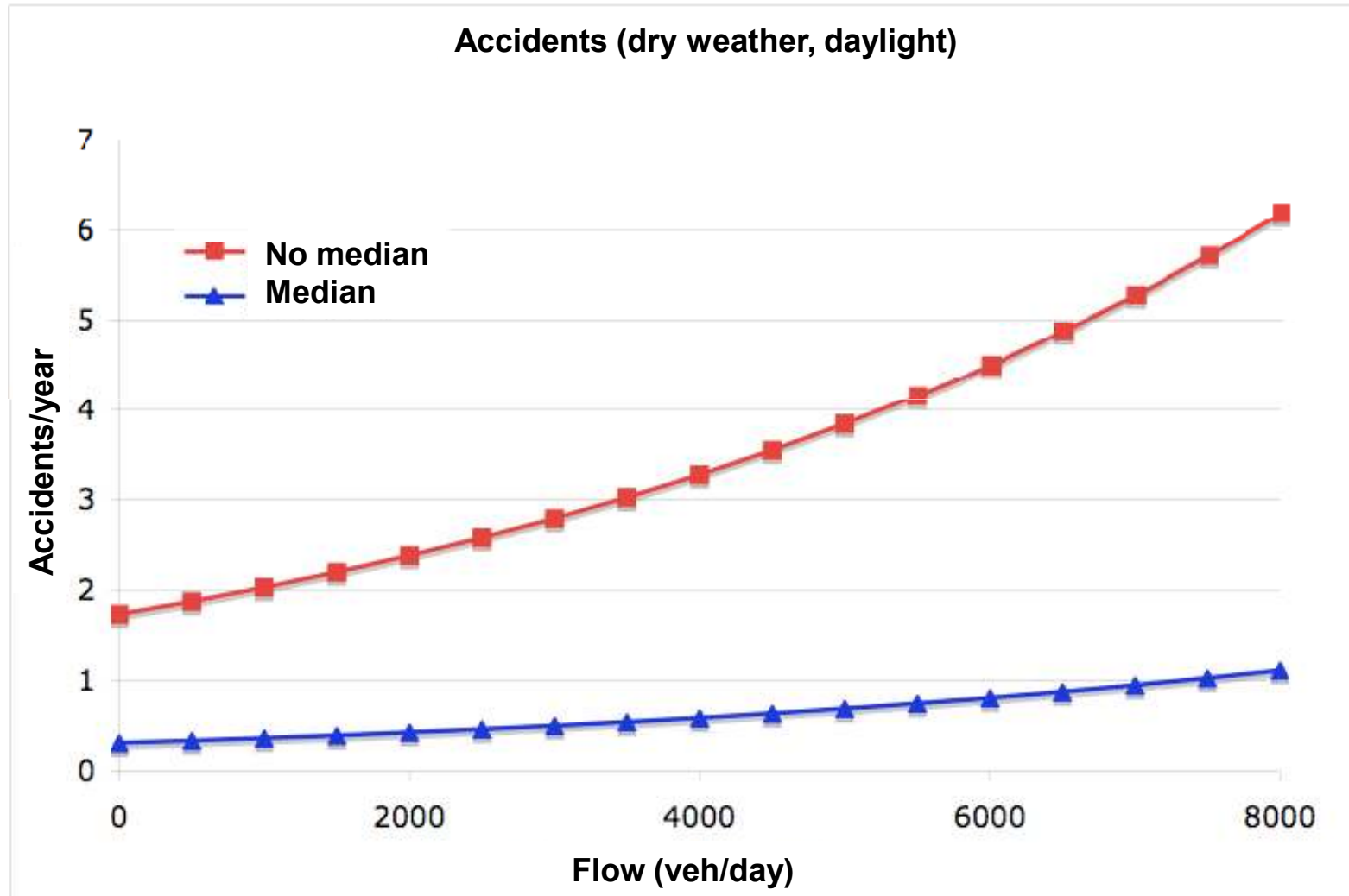
Conclusions

- Use of generalized linear models
- Insight that can be used to reduce accident frequency and severity
  - Non-linear increase of risk with the increase of AADT
  - Increase is higher in the absence of median
- Correlation of weather and lighting conditions with accidents
- Impact of road characteristics?
  - Lane width, curvature, upstream/downstream segments, type of cross-section, shoulder

Expected impacts

- Prioritization of road infrastructure improvements
- Targeted enforcement campaigns