Analysis of Driver Behavioral Adaptation to the Lateral Drift Warning System

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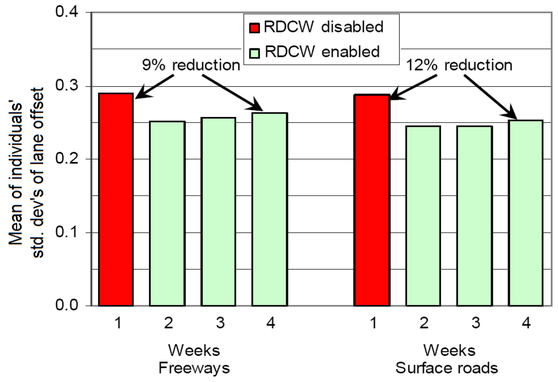
1) Introduction/Objectives

- Behavioral adaptation - changes in driving behavior over time as drivers adjust to presence of technologies
- Adaptation relies on human predisposition. Drivers perceive risk differently depending on personality.
- Assessing adaptation while using ITS safety devices - important role in determining benefit from device implementation

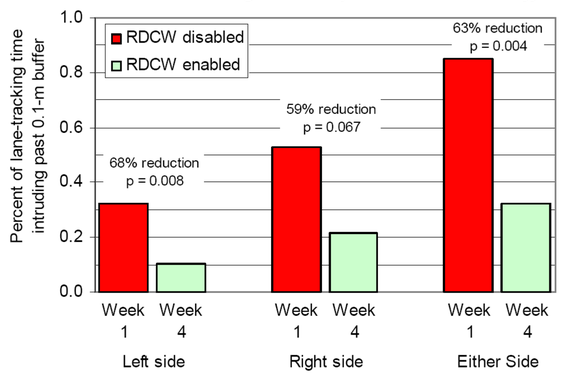
2) Data and Methodology

- Univ. of MI Transportation Research Institute (UMTRI) Roadway Departure Crash Warning – Field Operational Test
- Lateral drift warnings: visual, audible, tactile – vehicle exceeded thresholds of lateral distance from lane centerlines
- 71 drivers from Ann Arbor, MI, area - each participated for 4 weeks
- Week 1: pseudo-alerts – system recorded alert instances but did not warn driver
- UMTRI Technical Report (*Ref. 1*) shows changes in driving behavior over time – lateral vehicle positioning

Mean of Standard Deviation of Lane Offset (meters)

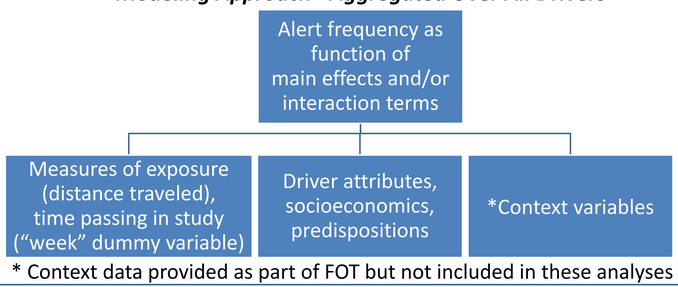


Percent Lane-Tracking Time Beyond 0.1-Meter Buffer

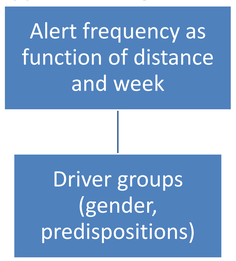


- Model Type – Random Effects Negative Binomial (RENB), grouped by driver

Modeling Approach - Aggregated Over All Drivers



Modeling Approach – Segmented Into Groups



* Context data provided as part of FOT but not included in these analyses

Descriptive Statistics and Categorization of Driver Attributes

Factor	*Mean*	*Categories*
Gender (binary; 1 = male)	0.49	Male, Female
Smoker (binary; 1=yes)	0.83	Yes, No
Years with driver's license (min. = 2.5, max = 54)	28.19	0-21; 22-37; 38+

Segmentation of Predispositions

Variable	*Definition*	*Response Type (# of questions)*	*Segmentation – Mean*
Sensation-Seeking Desires	Need for excitement	Binary (40)	High, Low; score = 14
Risk Perception	Risk associated with driving	7-pt Likert Scale (30)	High, Low; score = 84.79
Locus of Control	What controls outcomes in life	Binary (13)	Internal, External; score = 3.82

Ref. 1: Leblanc, D., J. Sayer, C. Winkler, R. Ervin, S. Bogard, J. Devonshire, M. Mefford, M. Hagan, Z. Bareket, R. Goodsell, and T. Gordon. Road Departure Crash Warning System Field Operational Test: Methodology and Results. The University of Michigan Transportation Research Institute: Ann Arbor, MI, 2006

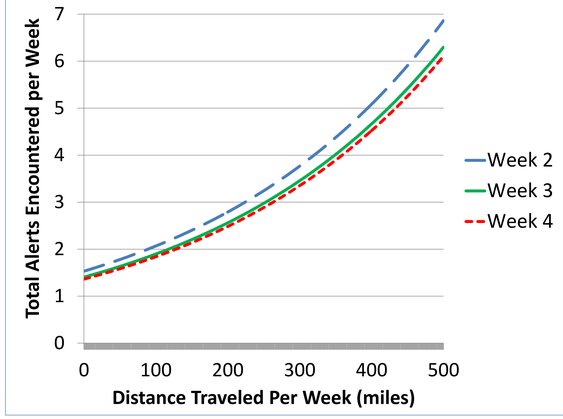
3) Aggregate Analysis

RENB – All Drivers

Variable	*Coef.*	$e^{coef.}$
Weekly distance (miles)	0.003	1.003
Week 2	-0.270	0.763
Week 3	-0.356	0.700
Week 4	-0.387	0.679
Constant	0.696	2.006

- Alert freq. decreased with each passing week, offset by travel dist.
- Relationship between exposure and alert freq. - not linear
- Interactions: gender, smoker, yrs. with license - inconclusive

Weekly Counts of Alerts by Distance – All Drivers

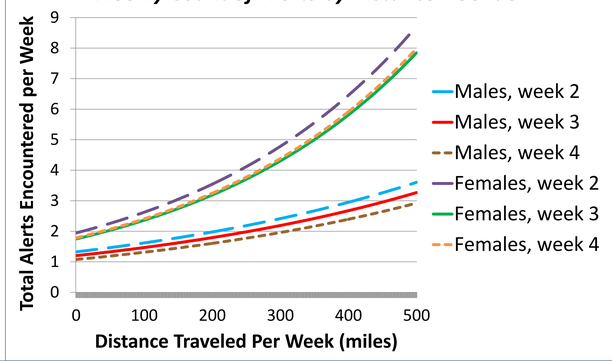


4) Segmentation

Driver Attributes

- Gender - males had more consistent & noticeable decreases in alert frequency over time

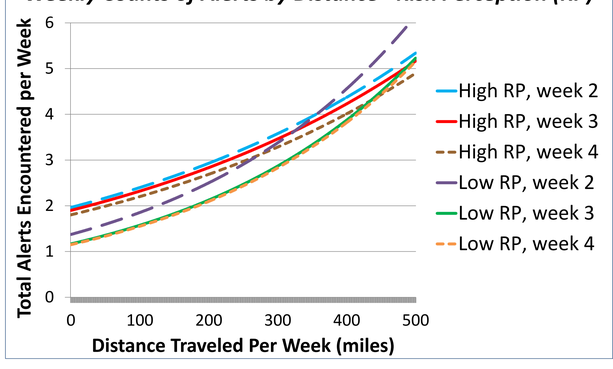
Weekly Count of Alerts by Distance - Gender



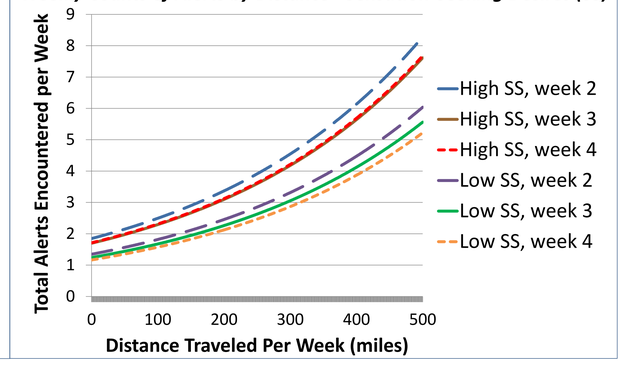
Predispositions

- Higher risk perception levels - more substantial decreases
- Higher sensation-seeking desires - less substantial decreases
- Locus of control – no definable differences

Weekly Counts of Alerts by Distance - Risk Perception (RP)



Weekly Counts of Alerts by Distance - Sensation-Seeking Desires (SS)



5) Conclusions

- Drivers in study decreased alert frequency over time. Various characteristics can influence adaptation.
- Exposure significantly positively correlates with alert likelihood
- Small sample size - limits of reasonability for parameter significance and number of parameters evaluated
- Effects of some predictors may be influenced by technological skill levels (not measured) – biased estimates

Note: Research conducted from 2008 to 2009 during graduate program in Civil Engineering