ABSTRACT
A Right-hook (RH) crash is a bicycle-motor vehicle crash between a right-turning motor vehicle and a simultaneously through-moving bicycle at an intersection. At a signalized intersection, RH crashes can occur at the onset of the green indication or during the latter period of the green.

RIGHT-HOOK CRASH CAUSALITY AT SIGNALIZED INTERSECTIONS
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EXPERIMENTAL METHODS
STATIC ONLINE SURVEY:
- To determine predictive driver and bicyclist behavior at signalized intersections
- To improve driving simulator scenarios
DRIVING SIMULATOR EXPERIMENTS:
- To determine driver related crash causality
- To evaluate the effectiveness of alternative intersection mitigation strategies

EXPERIMENT 1: DETERMINE INTERSECTION USER BEHAVIOR
- Static Online survey developed with Qualtrics
- Targeted population - a minimum of 100 licensed drivers and 100 bicyclists between the ages of 18 to 75 years
- The survey results will be used to identify independent variables to be tested in the follow-up driving simulator experiments
SURVEY QUESTIONS:
The survey includes demographic questions, and questions on the travel behavior and perceptions of safety of driver and bicyclist at intersections.
EXAMPLE QUESTION:
Suppose you detect a bicyclist in the passenger side mirror just before turning right during a green light at an intersection as shown in the figure. What would you do in such condition (check one)?

EXPERIMENT 2: ANALYZE MOTORISTS’ VISUAL SEARCH PATTERN
RESEARCH OBJECTIVE:
Investigate motorists' visual attention to determine if motorists fail to notice bicyclists due to misallocation of attention - potentially contribute to RH crashes at signalized intersections.
VARIABLES MEASURED:
Independent Variable:
- Volume of opposing traffic
- Bicyclists’ speed
- Green indication stage
Dependent Variable:
- Fixation duration
- Scanpath

EXPERIMENT 3: ASSESS MOTORISTS’ CRASH AVOIDANCE BEHAVIOR
RESEARCH OBJECTIVE:
Assess motorists’ crash avoidance behavior to confirm the influence of opposing traffic volume, bicyclist speed and volume on RH crash occurrence.
VARIABLES MEASURED:
Independent Variable:
- Volume of opposing traffic
- Bicyclists’ speed
- Volume of adjacent bicyclists
Dependent Variable:
- Fixation duration
- % of crashes avoided

EXPERIMENT 4: ASSESS MOTORISTS’ SITUATIONAL AWARENESS (SA)
RESEARCH OBJECTIVE:
Assess motorists’ SA of the driving environment to determine if motorists’ SA contributes to RH crashes at signalized intersections.
VARIABLES MEASURED:
Independent Variable:
- Volume of adjacent bicyclists
- Volume of adjacent traffic
Dependent Variable:
- Measure of SA

Oregon crash data:
- In 2007-2011, 18% (507) of the total bicycle-motor vehicle crashes in OR were RH crashes (Kittleson and Associates, Inc.)
- In Portland Metro, 47% of the total bicycle-motor vehicle crashes at signalized intersections were RH crashes from 2007-2011 (Kittleson and Associates, Inc.)

Despite the severity and increased frequency of RH crashes, RH crash causality has yet to be established in the literature, a critical step toward the design of effective countermeasures.

RESEARCH OBJECTIVE
Leveraging the Oregon State University (OSU) high fidelity Driving Simulator and Mobile eye tracking technology, this research aims to:
- Determine driver related RH crash causality
- Identify effective countermeasures to reduce RH crash frequency and severity

EXPECTED FINAL OUTCOME
Improve the overall safety of multimodal signalized intersection users by:
- A better understanding of driver related RH crash causality
- Identifying potential crash mitigation strategies to implement at intersections