Health Belief Model constructs as helmet use predictors: A pilot study, Michigan, 2015

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APHA 2017 Poster Session Handout

ACNOWLEDGEMENTS

INTRODUCTION

Overview of Problem
This study identified motorcyclist's perceptions of helmet use in Michigan using the Health Belief Model (HBM). Motorcycles account for less than 1% of vehicle-miles traveled per year yet 14% of road traffic fatalities (1). Motorcycle helmets can reduce risk of death (2) and traumatic brain injuries (3).
Risks and rights of motorcyclists are brought to the public through policy changes that dictate helmet use. Only 19 states and the District of Columbia require all motorcyclists to wear helmets, and 28 states have partial laws, which typically only apply to licensed riders under 21 years (CDC, 2012; NHTSA, 2009).

Michigan Policy
Michigan reduced its policy to a partial helmet law in 2012 (4), so that individuals who meet provisions, including passing a safety course or having two years of experience, obtaining an insurance premium, and being over 21 years old may ride without a helmet (5). While those who do not meet the provisions are still required to wear a helmet, the policy can be difficult to enforce (6). This is first Michigan-specific study that considers the beliefs and behaviors of living motorcyclists, rather than utilizing observations, or hospital/crash scene data since policy change.

Objective: understand reasons behind helmet use in a partial helmet law state to improve individual and public health initiatives.
Contribute to the growing body of research of motorcyclists' safety choices and perceptions.
Use research to impact policy, decrease fatality rates, and decrease costs of medical treatments and property damage.

Theory
HBM constructs are intended to identify perceptions and largely have been used in health education for changing individual health-directed behaviors. In the case of motorcycle helmet use, the helmet is a tool that has demonstrated effectiveness for injury risk prevention.

Null Hypothesis:
The decision to wear a motorcycle helmet will not be influenced by HBM constructs.
Alternative Hypotheses: Two alternative hypotheses were tested by examining HBM construct perceived expectations as two separate components (benefits and barriers).

1) individuals with greater perceived benefits of wearing motorcycle helmets and greater perceived threat (susceptibility and severity) of injury will be more likely to always wear motorcycle helmets.

2) Individuals with greater perceived barriers of wearing motorcycle helmets and lower perceived threat (susceptibility and severity) of injury will be less likely to always wear motorcycle helmets.

Exploratory constructs of motorcycling behavior
We predicted that social and individual motorcycling safety behaviors, such as wearing other protective gear, group affiliations, and voluntary training, would correlate positively with always helmet use.

METHODS
The study used a correlational cross sectional design and convenience sampling and was carried out in August through December of 2015.

Instrument:
The six-page survey was hosted on Surveymonkey.com, and contained an informed consent page, a self-reported motorcycle behavior questionnaire, a HBM instrument, demographic questions and a conclusion/contact page with a link to a gas-card drawing.
The HBM instrument was adapted from the Bicycle Helmet Attitudes scale (BHAS) (8). With permission from the authors, these HBM statements were modified to reflect motorcycle helmet use, including changing wording and eliminating repetitive, difficult or irrelevant items (15 items). The BHAS was tested for validity through Verimax rotations and reliability using Chronbach's alpha (over .80).

Recruitment:
In general, recruitment populations were mostly male, but ranged in socio-economic backgrounds. Eligible participants lived in Michigan and were 18 years or older. Survey responses were removed if they didn't meet eligibility or did not complete the entire survey. In-person recruitment occurred at a metro-Detroit motorcycle night (two recruitment dates), as well as a rural parts-swap event. Approximately 300 individuals attending the events were recruited and were provided a survey invitation card.
Social media populations had a wider range of demographics. Between the two social media pages, there were over 2000 subscribers, and a digital recruitment message was posted twice on each page. Individuals were unrestricted from sharing the survey with friends and family. Therefore an unknown additional group of potential participants were invited outside of the main recruitment methods.
Due to the nature of the present study, the exact rate of participation cannot be determined, but the participation was lower than predicted based on the amount of individuals reached. A power analysis determined 73 minimum participants and was conducted based on rates of helmet use from a 2013 Michigan event observation study (9).

The proposal was submitted and exempt from the Eastern Michigan University Human Subjects Review Committee and Institutional Review Board.

Statistical methods:
 Participant data used with The Statistical Package for the Social Science version 20 for Windows (SPSS) for analysis. Participant data was separated by self-reported helmet use – always and not always.

Testing:
Correlational Analysis: demographic information and other injury risk behaviors
Frequency Analysis: self-reported behaviors and demographic data
Chronbach's alpha test: Inter-item reliably for each construct (> .60 accepted)
Kruskal Wallis analysis: Null hypothesis testing - differences between helmet groups
Spearman's Rho: Alternative hypotheses- examined relationships of tested constructs

RESULTS

Overview: A total of 94 online survey responses were collected. One non-resident and two respondents who answered yes to previously completing the survey were excluded from the analysis. Incomplete survey responses excluded 15 other cases. Incomplete cases were defined as those who began the survey but skipped at least one page and/or section of the survey.
In total, there were 76 usable responses. All participants were at least 18 years old and consented to participate in the study.
Demographics: Most respondents were male, over 40 years old (mean=47.2 years, SD = 13.78), and rode recreationally. Nearly half of the sample had experienced a crash before. **Three quarters of the sample reported wearing helmets every time they ride (n=57)**. The characteristics were similar to other motorcycle helmet studies that utilized self-reported behavior and perception questionnaires (10,11).

Validity: As these item categories were adapted from a previous study (8) a Chronbach's Alpha test was run for the subcategories to test inter-item reliability. All but social cues surpassed the .60 alpha acceptability level.

Null hypothesis: We rejected the null hypothesis; there were significant differences in perceptions of four out of five HBM constructs between helmet use groups (Table 2). The testing revealed significant differences ($\alpha = .05$) in construct and sub-construct scores for always helmeted and not-always helmeted groups.

Alternative hypotheses: We failed to reject the two alternative hypotheses.
Testing the first alternative hypothesis found a very weak positive correlation between the constructs for always helmeted respondents (Spearman's rho = 0.019), while not-always helmeted respondents had a weak negative correlation (rho = -0.136). Both groups' construct relationships were insignificant at an alpha of 0.05 (always helmeted: *p*=.891, not always helmeted: *p*=.579).
Testing the second alternative hypothesis found a somewhat moderate positive correlation between the constructs for always helmeted respondents (rho = 0.351), while not-always helmeted respondents had a weak negative correlation (rho = -0.208). The always helmeted correlation between perceived threat and perceived barriers is significant at an alpha of 0.05 (*p*=0.007), but the not-always helmeted correlation was not significant (*p*=.392).

Exploratory constructs: Significant positive correlations with helmet use included helmet use as a passenger (r=.822, *p*=.001), protective gear while riding (r=.509, *p*=.001) and seatbelt use in other vehicles (r=.353, *p*=.002).
Experience level was significantly negatively correlated with helmet use (r= -.234, *p*=.042).

Always helmet use was not significantly correlated with training, Michigan motorcycle license endorsement, organization affiliations, or any life experience (Table 1).

DISCUSSION

This pilot study found significant differences in perceptions of HBM constructs and self-reported risk behaviors between the helmet use groups. Greater research and advocacy is needed as we navigate the public health consequences of a nation with lenient helmet laws.

Alternative Hypotheses & The Health Belief Model: The weak and unexpected relationships were largely due to the fact that the differences in 'perceived severity' between groups were not statistically significant, a major component of both alternative hypotheses. The present study took an alternative approach to the traditional structure of HBM, by examining perceived benefits and perceived barriers separately. While "Perceived Expectations", a composite score of perceived benefits and perceived barriers, was not considered within the alternative hypotheses, the perceived expectations score was not significantly different between helmet groups. Additionally, self-efficacy was also not included in the instrument and therefore cannot represent the entire model. The rejection of the null hypothesis confirms the predictive nature of HBM; similar studies should follow the model as intended.

Both helmet use groups seem to be in agreement with the benefits of helmet use and the severity of injury, yet differ in their perceptions of risks of injury. The next steps in this field of study include a) decreasing perceptions of risk exemption, particularly for older and experienced riders, b) reduce perception of barriers and c) increase cues for not-always helmet users.

Local Program & Policy Recommendations

INDIVIDUAL

Despite agreement in the protective nature of helmets, only 52.6% of not-always helmet users felt 'unsafe' riding without a helmet in the present study, compared to 73.7% of always-helmet users.

Health promotion messaging should focus on individual risk for motorcyclists. Improved access to a **risk assessment tool** could provide awareness and be widely utilized throughout the web, in training courses, and at licensing departments.

COMMUNITY

Greater self-reported motorcycling experience was significantly negatively correlated with always wearing a helmet. Greater experience on the road decreases rates of crash risks (12). Those who have been riding for many years and have never had a crash may also tie this experience level with not needing a helmet; the present study also found significant differences between groups in their perceptions of risk exemption.

Helmet use, training and safety measures are critical prevention tools as our population ages and motorcycling increases as a recreational activity.

Health education specialists should:
- Promote **free/low cost trainings in communities**
- Develop **public health messages tailored towards older/experienced riders**

- **Improve and helmet fit campaigns** following strategies set in place by NHSTA car seats campaign (13)

Organizations and businesses should:

- Advocate for **protective gear reminders** in routine medial screenings, workplace safety trainings, and local advertisements'
- **require participants to wear helmets at sponsored group rides**, fundraisers, and "poker runs"

Research Recommendations

If the in-person recruitment were repeated, a methodology that incorporates in-person data collection and uses a shorter survey may be beneficial to increase survey response rates. Further research utilizing social media will offer insight to the ways helmet messaging is created and received beyond traditional routes.

A statewide registry of motorcyclists is another resource that is recommended, but was not explicitly accessible within the scope of the present study. Such a database may have resolved gaps in sample size, demographics, and geographic distribution.

Limitations and Generalizability: The four main limitations included a convenience sampling methodology, utilizing an adapted instrument, small sample size and social desirability bias.

As this is a pilot study in southeastern Michigan, it is unreliable to generalize to other regions of the country, as they have differing helmet use polices and riding seasons.

Several common demographic items (including race, income and marital status) were omitted in this study, which may have had confounding effects in regards to helmet knowledge and beliefs, social structures and personal experiences. In future studies, this information may also be beneficial for tailored messaging and we also recognize that female riders are underrepresented in this study and in the literature.

Table 1
Correlations between exploratory constructs and always helmet use.

Item	Pearson's r	P value
Helmet as a passenger	.822	**.000**
Protective gear	.509	**.000**
Seatbelt in other vehicles	.353	**.002**
Affiliated with motorcycling organization	.138	.235
Motorcycle training	.168	.148
MI motorcycle endorsement	-.095	.415
Experience level	-.234	**.042**

Table 2
Differences in sub-construct scores by reported helmet use

Sub-Construct	Always Helmet User Mean Rank (n=57)	Not Always Helmet User Mean Rank (n=19)	Kruskal Wallis K	Sig. (two-tailed)
Perceived Threat of Injury (Composite Score)	34.97	49.08	5.838	**.016**
Risk Exemption	30.59	62.24	29.72	**.001**
Perceived Danger	41.68	28.95	4.92	**.026**
Perceived Severity	39.61	35.18	.653	.419
Perceived Benefits	41.20	30.39	3.42	.064
Intangible Benefits	40.55	32.34	1.98	.159
Tangible Benefits	42.18	27.45	6.59	**.010**
Perceived Barriers	32.00	58.00	20.17	**.000**
Intangible Barriers	42.18	58.50	25.12	**.001**
Tangible Barriers	31.83	55.42	15.24	**.001**
Cues To Action	44.76	19.71	18.43	**.000**
Visual Cues	42.72	25.84	8.54	**.003**
Social Cues	44.23	21.32	15.71	**.001**
Media Cues	43.69	22.92	12.73	**.001**

Table 3

Questionnaire: modified HBM scale (8), demographics & behavior/experience items

Item	Response options (only one selected per question)
What type of motorcycle do you most often ride?	Standard, Cruiser, Sport, Touring, Sport Bike, Dual Sport, Scooter, Moped
What is your main purpose for motorcycle riding?	Long distance trips, Recreation/fun, Getting to work/school, Racing/Sport
What type of helmet do you mostly use?	Full-face, Open face (3-quarter), Half helmet, No helmet, Other (text reply)
Do you wear your helmet as a motorcycle operator every time you ride?	Yes, No
Do you always wear your helmet as a motorcycle passenger?	Yes, No
Do you wear protective gear made for motorcycle riding, such as gloves, boots, jackets, pants and/or full race leathers?	'I wear full protective gear every time I ride', 'I wear full protective gear almost every time I ride', 'I wear some protective gear- but not every item listed', 'I rarely wear any protective gear',

'I never wear any protective gear'

I do not go fast enough to need head protection in a crash.	Likert Scale (Strongly Disagree-Strongly Agree)
I feel that helmets are unnecessary for very short rides.	Likert Scale (Strongly Disagree-Strongly Agree)
Being an adult who has been riding for years, I can easily avoid a crash when riding.	Likert Scale (Strongly Disagree-Strongly Agree)
Helmets are more important for those who ride infrequently	Likert Scale (Strongly Disagree-Strongly Agree)
Motorcycle helmets are more important for those who ride long distances.	Likert Scale (Strongly Disagree-Strongly Agree)
Generally speaking, I believe that motorcycling can be a dangerous activity.	Likert Scale (Strongly Disagree-Strongly Agree)
When I'm riding a motorcycle, I am at risk of being injured by motor vehicles.	Likert Scale (Strongly Disagree-Strongly Agree)
If I had an accident while riding and I hit my head, I would be likely to suffer brain damage.	Likert Scale (Strongly Disagree-Strongly Agree)
There is a good chance that I could get hurt riding a motorcycle.	Likert Scale (Strongly Disagree-Strongly Agree)
If I injured my head while riding my motorcycle, it could seriously affect my social life with my friends.	Likert Scale (Strongly Disagree-Strongly Agree)
If I injured my head while riding my motorcycle, it could seriously affect my ability to function at work/school.	Likert Scale (Strongly Disagree-Strongly Agree)
If I injured my head while riding my motorcycle, it could seriously affect my relationships with my family members.	Likert Scale (Strongly Disagree-Strongly Agree)
I feel unsafe riding without a helmet.	Likert Scale (Strongly Disagree-Strongly Agree)
I feel guilty riding without a helmet.	Likert Scale (Strongly Disagree-Strongly Agree)
Wearing a helmet would make me feel less anxious when I ride.	Likert Scale (Strongly Disagree-Strongly Agree)
When I wear helmets I feel more aware of the potential dangers of motorcycling.	Likert Scale (Strongly Disagree-Strongly Agree)
Wearing a helmet makes me more likely to 'take care' when I ride.	Likert Scale (Strongly Disagree-Strongly Agree)
In general, I think people who choose to wear helmets are being safe and responsible.	Likert Scale (Strongly Disagree-Strongly Agree)
Helmets are effective at reducing my risk of injury.	Likert Scale (Strongly Disagree-Strongly Agree)
In the event of a crash, a helmet would protect my head.	Likert Scale (Strongly Disagree-Strongly Agree)

I believe that wearing a helmet can prevent a serious head injury if I have a motorcycle crash.	Likert Scale (Strongly Disagree-Strongly Agree)
If I had a crash, wearing a helmet could save me money by avoiding expensive medical treatments.	Likert Scale (Strongly Disagree-Strongly Agree)
I would feel embarrassed wearing a helmet.	Likert Scale (Strongly Disagree-Strongly Agree)
I feel foolish wearing a helmet just to ride around town.	Likert Scale (Strongly Disagree-Strongly Agree)
Quite frankly, wearing a helmet looks stupid.	Likert Scale (Strongly Disagree-Strongly Agree)
Wearing a helmet makes me look foolish if no one else is wearing one.	Likert Scale (Strongly Disagree-Strongly Agree)
Wearing a helmet makes me too hot.	Likert Scale (Strongly Disagree-Strongly Agree)
A helmet is uncomfortable.	Likert Scale (Strongly Disagree-Strongly Agree)
The cost of a helmet is generally more than they're worth.	Likert Scale (Strongly Disagree-Strongly Agree)
I have several friends that routinely wear helmets when they ride.	Likert Scale (Strongly Disagree-Strongly Agree)
I keep my helmet in a visible place so I do not forget to wear it.	Likert Scale (Strongly Disagree-Strongly Agree)
I usually keep my helmet on or near my motorcycle.	Likert Scale (Strongly Disagree-Strongly Agree)
I know that I will feel bad if I don't wear a helmet, because somebody that cares about me wants me to wear it.	Likert Scale (Strongly Disagree-Strongly Agree)
My friends that ride think I should wear a helmet.	Likert Scale (Strongly Disagree-Strongly Agree)
My family members that ride think that I should wear a helmet.	Likert Scale (Strongly Disagree-Strongly Agree)
I recall seeing TV commercials, billboard ads or posters about the importance of wearing a helmet during the past year.	Likert Scale (Strongly Disagree-Strongly Agree)
During the past year I have received advice from my doctor about wearing a helmet while motorcycling.	Likert Scale (Strongly Disagree-Strongly Agree)
During the past year I recall seeing advertisements or flyers advertising helmet sales/discounts.	Likert Scale (Strongly Disagree-Strongly Agree)
During the past year I recall some form of a helmet use promotion event in my community.	Likert Scale (Strongly Disagree-Strongly Agree)
What is your age?	[Pull-down menu -under 18- 18 – 99]
What is your sex?	Male, Female, Prefer not to say

What county do you live in?	[Pull-down menu: all MI counties and 'non-Michigan resident']
Do you have a motorcycle endorsement for the state of Michigan?	Yes, No
Have you ever taken a motorcycle safety-training course in Michigan?	Yes, No
If so, was it before April 13th, 2012?	Yes, No
How would you describe your motorcycling experience level?	Beginning, Intermediate, Experienced
Please check all the situations that have happened to you (responses were downloaded as Yes or No for each situation option).	Minor motorcycle crash
	Major motorcycle crash,
	'Close call' or nearly crashed,
	Friend had a motorcycle crash,
	Family member had a motorcycle crash,
	Witnessed a crash,
	Lost a friend to motorcycle crash,
	Lost a family member to a motorcycle crash
Do you always wear a seatbelt when you travel in a car?	Yes, No
Do you belong to any local, state or national motorcycle groups or clubs?	Yes, No (additional text option to write in affiliations)
How did you find this survey?	Facebook Post,
	In-Person Event,
	Both Event and Facebook,
	Other (text box)
Have you completed this survey before?	Yes, No

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