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Applying the Health Belief Model to Michigan motorcyclist helmet use

Emily Ann VanWormer

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Applying the Health Belief Model to Michigan Motorcyclist Helmet Use

by

Emily A. VanWormer

Thesis

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Thesis Committee:

Kathleen Conley, Ph.D, Chair
Joan Cowdery, Ph.D
Christopher Herman, Ph.D

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Abstract

Helmets can offer significant injury protection to motorcyclists, yet usage is inconsistent across the United States. In 2012, the state of Michigan switched from a universal helmet law to partial helmet law. Michigan motorcyclists (n = 76) were recruited through two motorcycling events and two motorcycling social media pages to participate in an online survey that applied Health Belief Model constructs to examine attitudes and beliefs around the decision to wear or not wear a helmet. Significant differences in perceptions of Health Belief Model constructs were found between always-helmeted and not-always-helmeted respondents. Always-helmeted respondents reported significantly greater perceived susceptibility of injury, cited fewer barriers of helmet use, and identified more cues to action than not-always-helmeted respondents. This pilot study contributes to the body of research following the weakened helmet law in Michigan and offers a springboard for identifying perceptions of Michigan motorcyclists for future health messaging.
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Chapter 1: Introduction

Helmets are significantly beneficial for reducing the severity of injury and overall fatality rates (Cook, Kerns, Burch, Thomas & Bell, 2009; Michigan Secretary of State, 2013; Norvell & Cummings, 2002), yet many individuals choose to not wear a helmet when they ride a motorcycle (Derrick & Faucher, 2009; Heldt, Hackett Renner, Boarini & Swegle, 2012). Laws regulating helmet use for motorcyclists vary from state to state. Universal helmet law, which requires every person riding a motorcycle to wear a helmet, is in place in less than half of the nation (Centers for Disease Control and Prevention [CDC], 2012). Michigan, Ohio, Indiana, and 25 other states have partial helmet laws, which generally require helmets only for young people and those who are inexperienced (CDC, 2012; National Highway Traffic Safety Administration [NHTSA], 2009). In Michigan, those who are 21 years or older, with appropriate insurance coverage ($20,000 in medical benefits) who have completed a motorcycle safety course or have been riding for two years are not required to wear helmets (Michigan Secretary of State [MI SOS], 2013).

Purpose Statement

The purpose of this study was to apply constructs of the Health Belief Model to identify the major reasons that licensed motorcyclists choose to wear or not wear a helmet.

Significance of Research

The results of this study identified differences in perceptions between helmeted and not-always-helmeted motorcyclists. Nationwide, the Midwest has the lowest rates of helmet use (Philip, Fangman, Liao, Lilienthal, & Choi, 2013) due to two states without helmet laws, and several other Midwest states with partial helmet laws. This study contributes to the growing body of research of motorcyclists’ safety choices and perceptions and may act as a
springboard for larger studies of Michigan motorcyclists. The long-term goal of research in this field of study is to decrease fatality rates, and decrease costs of medical treatments and property damage.

**Variables and Hypotheses**

The study attempted to understand the motorcyclists’ choice about wearing helmets by examining the attitudes and beliefs about helmet use and risks associated with motorcycling in general. The dependent variable was helmet use. The independent variables included the following constructs of the Health Belief Model. *Perceived susceptibility of injury* included confidence in riding skills and personal belief of risk. *Perceived severity of injury* included the impact of injury on daily life and prior injury history. *Perceived benefits of helmet use* included comfort, peace of mind, style/aesthetics, and financial savings. *Perceived barriers of helmet use* included physical and/or emotional discomfort, cost, visibility, and temperature. The last construct, *cues to action* included media influence, family, and riding groups. Finally, exploratory constructs included *injury risk behaviors*, such as wearing or not wearing protective gear and wearing or not wearing a seatbelt in a car, and *riding/social history*, which included prior crashes, and friend and family history.

**Alternative hypothesis I.** 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.

**Alternative hypothesis II.** 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.
Null hypothesis. The decision to wear a motorcycle helmet will not be influenced by Health Belief Model constructs.

Theoretical Framework

Developed in the 1950s by Hochbaum, Leventhal, Kegeles, and Rosenstock, the Health Belief Model is a theoretical framework to identify individual’s perceptions regarding preventative health behavior decisions (Rosenstock, Strecher, & Becker, 1988). The Health Belief Model has been notably used in increasing disease screening efforts such as breast self-exams, promoting immunizations, and increasing use of protective measures such as condoms (Hayden, 2009).

Definitions, Abbreviations, and Terminology

Health Belief Model (HBM). A behavior change theory that focuses on individual’s perceptions. It includes constructs such as perceived benefits and barriers, perceived susceptibility and severity, cues to action, and self-efficacy. The combination of these constructs helps determine the individual’s decision to change or adopt a behavior (Rosenstock, Strecher, & Becker, 1988).

Universal helmet law. All motorcycle operators and passengers, no matter what age or experience level, must wear a helmet when on a moving motorcycle (CDC, 2012; Houston & Richardson, 2008).

Partial helmet law. A combination of criteria and limitations that allow some motorcycle operators and passengers to make the decision to wear or not wear a helmet. Those who do not meet the law’s provisions are still required to wear a helmet (CDC, 2012; Houston & Richardson, 2008).
Protective gear/apparel. This includes, but is not limited to, goggles/eyeglasses, gloves, jackets, pants, and riding boots (Mangus, Simons, Jacobson, Strieb & Gomez, 2004; de Rome et al., 2011).  

Motorcycle safety course. Offered at community colleges, sheriff's departments, and other community gathering locations, the classes take place during a weekend or several weeknight sessions (Daniello, Gabler, & Mehta, 2009). Completion of this course is a step towards meeting the criteria for exemption from the partial helmet law in Michigan (Michigan Secretary of State [MI SOS], 2014).
Chapter 2: Review of Literature

In 2010, 14% of all road traffic deaths were motorcycle operators or passengers, but motorcycles accounted for less than one percent of all vehicle miles traveled (Naumann & Shults, 2012). Motorcycle ownership and licensing has been increasing, and with this growth comes public health and safety concerns. Road traffic injuries are projected to be the third leading cause of death and disability worldwide by 2020 (Derrick & Faucher, 2009).

Research supports helmets to prevent traumatic brain injury (TBI) and fatalities, yet helmets are not universally mandated throughout the country. In the United States, there are a variety of laws and provisions that differ between states, with most states providing only a partial helmet law. The most effective policy is a universal helmet law, yet less than half of the nation currently has this type of law in effect (Houston & Richardson, 2008; Naumann & Shults, 2012). Decisions to choose not to wear a helmet are considered from the scope of policy, perceptions and beliefs, and the physical and psychological barriers to helmet use.

Injury Risks and Costs

Motorcycles carry an inherent increased risk regarding injury and fatal crashes because of the lack of protection compared to individuals in an automobile. In the National Highway Safety Administration’s (NHTSA) Fatality Analysis Reporting System (FARS) data from collisions between a motorcycle and passenger vehicle in 1997–2006 ($n = 23,146, 11,573$ motorcyclists and $11,573$ passenger vehicle occupants), $95\%$ of motorcyclists in this data sample were killed from the collision, whereas $1\%$ of passenger vehicle occupants of this sample were killed (National Highway Safety Administration [NHTSA], 2009). Risk is increased when alcohol use, speeding, or improper training occurs (Houston, 2007). The most commonly reported injuries from the Crash Outcomes Data Evaluation System
(CODES) are to the head, as well as surface abrasions to extremities (Cook et al., 2009). CODES links state crash data and medical outcome data, and the study included 104,472 motorcycle crashes from 18 states in the years 2003–2005.

Research has suggested that lower experience motorcycling leads to higher risk of crashes (Harrison & Christie, 2005). An exposure study in New South Wales, Australia, examined relationships of crash history, riding patterns, motorcycle characteristics, and odometer readings. Paper surveys were sent to addresses with registered motorcycles, with addresses stratified by region, and a six-month follow-up was sent to those who responded to the initial survey. Usable responses from this survey yielded 794 participants. Utilizing the difference in odometer readings from the two survey dates created an annual exposure estimate in kilometers. The crash rate was calculated by taking the total number reported crashes in the past five years divided by the exposure estimate. For the whole sample, the crash rate was .96/100,000 km. The youngest quartile of riders had a crash rate of 1.71/100,000 km, and those who rode trail/dual use bikes had a significantly high crash rate of 2.35/100,000 km. Sport bikes were the most popular bike type, and had a crash rate of 1.06/100,000 km. Those with 6–10 years of experience as a motorcyclist had the highest crash risk of all experience groups, which may be due to owning a motorcycle but rarely riding and/or only riding for recreation every few weekends, which does not allow for extended skill building. Crash risk was plotted by annual riding exposure, which created a power function: As time on the road increases, the risk of crashes decreases. Thus, increased experience is necessary to improve skill as a motorist and decrease risk of injury. The researchers reference the accrual of experience and guided training necessary for licensing
steps with other vehicles, wherein many programs require “contact hours” with instructors in order to complete training courses.

Overall costs of motorcycle crashes accounted for over 12 billion dollars in 2005 (Nauman, Dellinger, Zaloshnja, Lawrence, & Miller, 2010). Public funds contribute 25–50% of costs associated with motorcycle crashes due to poor insurance compliance and social services needed (Derrick & Faucher, 2009). Helmet use in the United States saved an estimated three billion dollars of medical bills and property damage costs in 2010 according to NHTSA data (Naumann & Shults, 2012). Savings per motorcycle in states with universal helmet laws were almost four times greater than those in states without helmet laws, $725 and $198, respectively (Naumann & Shults, 2012).

Benefits of Helmet Use

Helmeted motorcyclists with non-fatal injuries had less overall TBI incidents in a study of 18 states’ hospital and police records from the years 2003–2005. Using the Crash Outcome Data Evaluation System (CODES), Cook et al. (2009) found that of the 104,472 motorcyclists in the data set, approximately 4% of the crashes reported were fatal, and of those admitted to the hospital, 7.3% of helmeted riders received mild to moderate TBI compared to 8% un-helmeted, and 4.7% moderate to severe TBIs received by helmeted riders compared to 7% of un-helmeted riders. A comparison of all head injury hospitalizations between helmeted and un-helmeted riders accounted for an estimated 35% effectiveness of helmet use in preventing all head injuries (Cook et al., 2009). In a meta-analysis of helmet use studies and crash data by the Cochrane Collaboration, results from six studies agreed that helmet use prevented 69% of TBI incidents (Liu et al., 2008). Inclusion for this analysis included randomized controlled trials, non-randomized controlled trials, cohort, case-control,
and cross-sectional studies from 1976–2007. Wearing a helmet may also reduce the risk of motorcycle crash deaths by 39% compared to un-helmeted riders (RR 0.61) determined by a matched-pair cohort study of driver/passenger deaths using NHTSA data from 1980–1998 (Norvell & Cummings, 2002).

Crash survivors are also at risk of functional disability such as speech, feeding, and locomotion. In an analysis of 22,739 completed cases of motorcycle collisions from 2002–2006 reported to the National Trauma Data Bank (NTDB), researchers assessed the functional deficits, such as speech, locomotion, and feeding as a result of motorcycle crashes. The cases were sorted by reported helmet use, with 75% of patients reporting helmet use. Helmeted riders had an 18% less likely chance to develop functional deficits in speech than un-helmeted riders, but had no significant difference in locomotive or feeding functions (Crompton et al., 2010). The difference in locomotion was largely attributed to extremity injury (79%), not head trauma (10%).

A helmet is considered to be only one facet of safety promotion for motorcyclists. While trauma to the head and neck are typically the most severe, riders with or without a helmet are frequently subject to limb fractures, road rash, and/or loss of tissue, as well as potential amputation. Protective gear, such as gloves, jackets, boots and pants, all serve as barriers to the extremities (Heldt et al., 2012). Safety advocates are also increasing efforts in promotion of protective gear as well as high visibility apparel in order to reduce crashes resulting in non-fatal injury and disability (Chapman, Titus, Ferenchick, Davis, & Rodriguez, 2014).
Politics of Helmet Use

Despite these statistics promoting the benefits of 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; Figure 1). Three states, New Hampshire, Iowa and Illinois, do not have any helmet law (CDC, 2012).

![Helmet laws in the United States](image)

*Figure 1. Helmet laws in the United States (Insurance Institute for Highway Safety, 2014)*

Helmet use is hotly debated, causing states to alter their laws every few years. Privately funded groups such as A Brotherhood Aimed toward Education (ABATE) and American Motorcyclist Association (AMA) lobby against mandated helmet use (Derrick & Faucher, 2009), as these laws are considered violations of personal rights and freedom of choice (Heldt et al., 2012). A smaller national organization founded in 2007 named Skilled Motorcyclist Association–Responsible, Trained and Educated Riders Inc. (SMARTER) also exists, whose main tenants include thorough training and preparedness, full protective gear use including helmets, and advocacy for policy change (Skilled Motorcyclist Association,
SMARTEST has been active in the distribution of research and awareness since the 2012 Michigan policy change (Skilled Motorcyclist Association, 2015).

Motorcycle fatalities are colloquially called “donorcycles” due to the large amount of organ donations resulting from these crashes (Dickert-Conlin, Elder, & Moore, 2011). Dickert-Conlin et al. (2011) identified an economical and ethical debate regarding a reduction of eligible organ donations if national helmet laws were mandatory.

For those states that allow riders to choose to wear a helmet, riders must meet certain provisions such as age restrictions (ranging from 15 years and older to 21 years and older), high insurance protection (typically $10,000 or higher), two years riding experience, and/or completion of a safety course (Houston, 2007; Houston & Richardson, 2008). The state of Michigan requires prospective motorcyclists under 18 to take a motorcycle safety course and have proper insurance protection, but helmets are still required until the age of 21 (MI SOS, 2013).

Managing these stipulations is where legislation can become blurry. Houston and Richardson (2008) discuss the implications of helmet use in states with universal law compared to partial law, stating the potential difficulties of enforcing partial law when there are several stipulations to determine if an un-helmeted rider is breaking the law. If law enforcement is unable to consistently and quickly identify law-breakers, the likelihood of being punished may be perceived as less severe for residents in partial helmet law states who decide to take a risk and disobey the law (Houston, 2007).

Houston and Richardson (2008) examined NHTSA’s FARS data from 1975 to 2004 and assessed three models of motorcycle fatalities of each state; fatalities per 10,000 registered motorcycles, fatalities per 100,000 residents, and fatalities per 10 billion estimated
motorcycle vehicle miles traveled (VMT). These three models, referenced as “per vehicle”, “per capita” and “per VMT”, were used to compensate for state differences and gaps in data. The study found that there were 21.7% less fatalities per vehicle, 33.1% less per capita, and 32.1% less per VMT in states with universal helmet law compared to states without a helmet law. States that adopted partial law from no helmet laws experienced a 10% decrease in fatalities per vehicle, 7.5% reduction per capita, and 8.2% reduction per VMT. The researchers concluded that while there are benefits to any type of helmet law, the most significant gains are from a universal helmet law.

Houston (2007) also examined FARS data for fatal crashes by riders 15–20 years of age from 1975–2004 along with state policies including helmet laws, legal drinking age, and speed limits. The purpose of the study was to determine if partial law provisions protect young motorcycle riders. He found that there was no statistically significant data to support reduction of young motorcyclist fatalities under partial law, but under a universal helmet law, there is a 31% reduction in fatalities for youth aged 15–20. This supports the need for universal helmet laws, which have been shown to also reduce fatalities in all age groups.

Other findings suggest that helmet laws dictate helmet use. A recent telephone study of current motorcyclists in the United States confirmed this concept. McCartt, Blanar, Teoh, and Strouse (2011) interviewed a random sample from a list of likely motorcyclists provided by InfoUSA.com, with an additional random sampling of names from the states without helmet laws (Illinois, Iowa, and New Hampshire) to oversample responses based on types of helmet laws. A total of 1,818 responses were collected. Nearly all participants were male (90%), and age varied by type of motorcycle ridden, with 30% of participants aged 40–49 years. Ninety-four percent of residents in universal helmet law states reported always
wearing helmets, compared to 57% of partial law state residents and 53% of no helmet law residents. With crash scene reporting, the most often cited data, helmet use data collection provides insight for usage among motorcyclists that were injured or killed (Dee, 2009). This study referred to this trend in data as a “downward bias in effectiveness of helmets” because those whose injuries were lessened or avoided by helmet use will often go unreported.

**Safety Training Courses**

National organizations and businesses, such as Harley Davidson, provide motorcycle safety training curriculum that are used around the country. A motorcycle safety training series used in 45 of the 50 states is the RiderCourse by the Motorcycle Safety Foundation (MSF). Various formats and skill level courses are available from the MSF, but in many states, the “Rider and Street Skills” or the “Basic RiderCourse” is available for a very low cost through state sponsored training sites (Daniello et al., 2009). The MSF courses include classroom instruction and hands-on motorcycle skill training. During the skill sessions, riders are required to wear a helmet, eye protection, long pants and shirtsleeves, gloves, and sturdy boots. The educational material advocates for consistent use of helmets and protective gear (Motorcycle Safety Foundation [MSF], 2014) but few states require full protective gear on the road (American Motorcyclist Association, 2014). Forty-seven states sponsor some sort of motorcycle training, usually as a step in licensing procedures for young and inexperienced drivers. Waivers of skills tests and or knowledge tests may also be offered if the applicant completes a training course. Since the rules differ between states, not every motorcyclist is required to have training before licensure (American Motorcyclist Association, 2014). In Michigan, you are required to complete the motorcycle safety course if you are under 18
years, and those over 18 who failed a skills test twice must also complete the training course before obtaining endorsement (Michigan Secretary of State, n.d.).

Daniello et al. (2009) analyzed results of seven studies regarding the effectiveness of safety trainings in the United States and Canada. The common metric in these studies was the measurement of accidents or traffic violations following the training. Each study examined trained and untrained motorcyclists, through data collection methods including survey, accident records, driving records, and/or interview. The researchers noted that no standardized methodologies of evaluation for these courses exist. From the data there was no consensus to the idea that training reduces accident rates, but in the three studies that measured protective equipment, it was found that helmet use was more likely in those who have completed training. Notable considerations for this review included the fact that most of those who take safety training courses are self-selecting and do not represent all motorcyclists. The reasons to take a safety course may have several confounding variables, including lack of skill efficacy, increased personal safety concerns, and/or other legal/policy related motivators.

**Michigan Helmet Law**

**History of helmet policy.** Jones and Bayer (2007) reviewed the history of helmet use and the development of a federal law. Helmets were introduced into mainstream culture of the United States after World War II. Helmet legislation was sparsely enforced, but in 1966 the National Highway Safety Act passed. This act included a provision to withhold federal funding for highway safety programs to states that did not have universal helmet law, so nearly every state obliged in the following years. The Insurance Institute for Highway Safety (2014) has documented the changes and challenges following this major provision. Michigan
adopted a universal helmet law in 1967. Advocacy groups and individuals brought several constitutional challenges to lawmakers, and in 1968, the helmet law was repealed in Michigan. Universal helmet law was reinstated a year later in 1969. Federal regulations for highway safety funding were lifted in 1976, which ended the universal helmet law and gave states more autonomy in their helmet laws.

**Michigan's partial law.** In 2012, the state of Michigan repealed its universal helmet law for a set of criteria (MCL 257.658) to enable partial law status (Legislative Council, State of Michigan, 2012). For endorsed motorcyclists who choose to go without a helmet legally, they must meet several criteria: (a) be 21 years or older, (b) have at least $20,000 in first-party medical benefits, (c) have held a motorcycle endorsement for at least two years or have passed an approved motorcycle safety course. Passengers of motorcyclists with the age and insurance requirements may also ride without a helmet. All individuals under the age of 21 must wear a helmet, regardless of experience, training, and insurance coverage.

Ensuring helmet law compliance is difficult to mandate, as Houston and Richardson (2008) explained. Michigan motorcyclists are not required to carry proof of safety training or two years of endorsement history, nor does their insurance card have to identify the $20,000 medical benefit (Michigan State Police, 2012). Violations of helmet law are not a primary cause to stop a motorist unless there is “reasonable suspicion” of violation.

**Early impacts of policy change.** With the repeal of the helmet law being relatively new, the impact of these changes is beginning to develop in the research. A recent study examined hospital data and crash-scene fatalities in West Michigan from motorcycle seasons (April through November) in 2011 through 2014 (Striker, Chapman, Titus, Davis, & Rodriguez, 2016). In comparing the crash scene rates, un-helmeted motorcyclist fatalities
were four times higher in the period after the policy change (2012–2014) compared to the baseline in 2011. For those who visited the hospital, the researchers found that 72% of motorcyclists were wearing a helmet, a significant drop from the 93% compliance of motorcycle crash patients before the policy change. Several data sets were used to determine the severity of the hospital visit, including the Injury Severity Scale (ISS), ventilator use, cost of stay, length of stay, Abbreviated Injury Scale (AIS) to the head, and intoxication levels. Un-helmeted patients who were hospitalized had significantly greater intensive care unit stays and ventilator use than the helmeted counterparts, as well as significant differences in other severity categories such as hospital mortality rates, ISS rankings, and head AIS rankings. The average hospital stay cost between the years of 2011 and 2014 was $20,760 for helmeted Michigan riders and $27,760 for un-helmeted riders, both of which exceed the mandated $20,000 insurance coverage to legally ride without a helmet in the state of Michigan. The same hospital and data set also reported a one-year retrospective analysis of the hospital stays and crash scene fatalities to describe the early impact (Chapman et al, 2014). In the one year of policy changes, the number of un-helmeted hospitalized patients (29% in 2012 compared to 7% in 2011), and un-helmeted crash-scene fatalities (77% compared to 14%) significantly increased. There was also a significantly higher percentage of blood alcohol content (BAC) in un-helmeted patients for both the 2012 and 2014 studies, which may imply greater risk-taking and implications for motorist safety education.

Murdock and Waxman (1991) examined 45-months of southern California hospital’s trauma center data collected when the state also had a partial helmet law enforced. Of the 474 patients involved in motorcycle collisions at this hospital, 50% were un-helmeted and 23% wore a helmet. The remaining 27% of patients had unknown helmet status and their cases
were not used for analysis. Un-helmeted patients had significantly higher ventilator support, greater AIS overall, decreased cognitive functioning, and greater risk of death from head injury than helmeted patients. A similar correlation of risk-taking and alcohol use with un-helmeted patients was concluded, with un-helmeted patients having significantly higher BAC than helmeted patients.

**Current Helmet Use in Michigan**

Michigan motorcyclists’ helmet compliance has been observed most recently in 2013 (Wayne State University-Transportation Research Group, 2013). The researchers set up video cameras during the months of May through September at 167 randomly selected locations around the state based on the heaviest traffic patterns and counties with higher motorcycle registrations. The video recordings were then reviewed and noted the day of the week, time of day, the type of helmet used by operator and/or passenger, type of motorcycle, and rider demographic information when determinable, including age range, gender, and ethnicity. Of the sample of 1,252 riders, 73% wore helmets. The researchers also observed events and motorcycle rallies utilizing the same video camera technique. At the nine events, 1,332 riders were observed, and 58.8% of attendees wore helmets. The researchers noted that the type of event and/or amount of travel to the events may have varied for attendees, and thus, their helmet use at the events was not reflective of their helmet use on the roads. The researchers cited a decrease in helmet use since the last statewide observational study of helmet use in 2006 when helmet use compliance was 99%. After the passage of the weakened helmet law in 2012, there has been a significant decrease of helmet use in Michigan.
Perceptions of Helmet Use and Safety

The perceptions that helmets are protective and beneficial for health are two major factors in the choice to use helmets. McCartt et al. (2011) examined safety perceptions and behavior trends through their telephone survey. Their sample was compiled from a list of likely motorcyclists provided by InfoUSA.com, with an additional random sampling of names from the states without helmet laws (Illinois, Iowa, and New Hampshire) to oversample responses based on types of helmet laws. A total of 1,818 responses were collected. Seventy-six percent of respondents believed that helmets kept riders safe, and this belief was strongest with 18–29 year olds (83%) and those who ride sport touring/super sport motorcycles (81–94%) compared to traditional touring or cruiser motorcycles (67%, 72% respectively). Similarly, the most frequent helmet users were those who ride high performance sport style motorcycles (87-98%) as well as those in the 18-29 year demographic (78%), regardless of state laws. The 60+ demographic had the highest overall always-helmet use at 80%. Interestingly, 65% of those opposed to a universal helmet law still supported the benefits of helmet use, and although 27% of infrequent helmet wearers said “nothing” would make them wear a helmet, almost all residents in universal law states were frequent helmet wearers. McCartt et al. concluded that this finding might be a testament of policy effectiveness for even the most stubborn riders.

Mangus et al. (2004) hypothesized that those with prior injury were most likely to change behavior and use protective measures. Two hundred and eighty surveys were collected over four weeks at a recreation site for all terrain vehicles (ATV) and stunt motorcycles in the United States. The anonymous self-report questionnaire examined ATV/motorcycle usage, protective gear, injury history, and demographic information. Most
participants (70%) were male, and 40% were ages 16–20. From this study, they found that those with prior injury were actually less likely to be currently using a helmet or protective gear. A lower report of current helmet use for those with history of major injury compared to those without was statistically significant at a 95% CI. The researchers suggested that those with a pattern of risk-taking behaviors are less likely to adopt protective behavioral changes and further research is needed for modifying risk patterns.

**Risk-Taking and Susceptibility**

Research has suggested a connection between individuals’ perceived susceptibility and risk-taking behaviors, such as speeding, not wearing a helmet, and alcohol use. Lin and Kraus (2009) conducted a comprehensive review of 220 studies from 1980–2008 to identify the factors causing motorcycle injuries. Articles and reports included NHTSA data, hospital trauma data, and police reports, obtained utilizing a Medline search of “motorcycles”, and “wound and injury”. Non-English papers and reviews/commentary were excluded. Identified modifiable risk factors from these injury reports included helmets, helmet laws, alcohol and other drug use, inexperience, headlight use and visibility, licensure, riding speed, and other risk-taking behaviors. Young motorcyclists ages 15–29 were at the greatest risk for injury. Sixty percent of crashes in this age group involved an increased BAC, and the researchers found themes of young motorcyclists self-reporting higher rates of other modifiable risks such as speeding, not wearing a helmet, and unsafe driving skills such as running yellow lights and short following distances. Younger motorcyclists perceive their risk as medium or high compared to older drivers, yet they are less likely to modify their risk. These risk-taking behaviors may be a stress or aggression outlet for some riders, and the psychosocial benefits may outweigh the measures to modify their risk.
Rutter, Quine, and Alberty (1998) identified relationships between risk-taking behaviors and perceived risk. A two-part paper questionnaire using the Health Belief Model was mailed to a random sample of 2051 registered motorcyclists in the United Kingdom. The first questionnaire included comparative risk, perceived absolute risk of death, perceived absolute risk of injury, and perceived severity of consequences after an injury. History of injuries, crashes, and risk-taking behaviors were collected with the first questionnaire, as well as in a one-year follow up survey. Seventy-one percent of the sample responded to the first questionnaire, and 84% of those who completed the first survey also completed the follow-up survey one year later. The majority (90%) of the respondents were men, 15% were young riders (under 24 years old) and 24% had formal motorcycle training. Respondents had a perceived "unrealistic optimism" that they were less likely than other motorcyclists, bicyclists, and pedestrians to have an accident. However, if an accident were to occur, the majority of respondents anticipated moderately severe consequences. Greater education levels, years of experience, and age were all positively correlated with optimism regarding comparative risk, perceived risk of injury, and perceived risk of death. Those with greater comparative risk also reported greater frequency of traffic violations and behaviors such as speeding, riding too close, and losing concentration. A personal history of an accident and close friend or relative's death from a motorcycle accident were correlated with greater perceived risk of injury and risk of death. Yet, when comparing the year's difference in traffic behaviors, those with a history of injured friends or relatives reported significantly more violations ($p < .01$), speeding ($p < .01$) and alcohol use ($p < .05$). The researchers suggested that these motorcyclists, despite the related risk of injury and death, might perceive these known risky behaviors positively.
The theory of planned behavior was used to approach intentions behind motorcyclists' safe and unsafe behaviors. Tunnicliff et al. (2012) determined three safe behaviors, handling skillfully, maintaining 100% awareness, and refusing to ride impaired (by sleepiness, alcohol, drugs or other), and three unsafe or riskier behaviors, bending traffic rules, pushing personal limits, and performing stunts/extreme speed. These six behaviors were applied to each TPB item: intentions, attitudes, subjective norms (including specific reference of riding group), perceived behavioral control, and self-identity. Sensation seeking and aggression were also measured using separate scales. Participants were recruited through a random sample of motorcycle riders from an Australian training company's database and in person at government sponsored Rider Survivor events. The training company distributed the surveys to the sampled database and completed surveys were returned by mail. Between these two recruiting sources, 229 valid responses were completed. Sixty-six percent of respondents were male, and the average age 42 years old. Sixty percent of respondents had professional training, and 11% had injury or disability from a previous crash. Perceived behavioral control consistently predicted intention to perform all three safe behaviors. The specific subjective norm of group ride partners was a significant predictor for the intention to refuse riding impaired, while the general subjective norm (people important to me) did not have significant predictors for behaviors. High scores for sensation seeking predicted intention to all three risk behaviors; higher scores of aggression only predicted intention to bend traffic rules. Younger riders were more likely to intend to perform stunt behaviors than older riders.

**Barriers to Helmet Use**

Barriers include physical, functional, mechanical, emotional, and social factors that inhibit helmet use. These barriers may be real or perceived and are enhanced by beliefs,
attitudes, and skills about helmet use. Orsi et al. (2012) compared 598 European individuals with \( n = 208 \) and without \( n = 390 \) a prior motorcycle injury using a two-point data collection system. The six countries that participated in the study had slightly different methodology for collecting participants based on resources available but the instruments for data collection were the same. Those with injury were sampled on site after an accident, in their own homes after the accident, and/or solicited from police records and accident report data. Those without injury history were recruited at gas stations, police checkpoints, and motorcycling enthusiast groups. The questionnaire asked both groups about their complaints regarding helmet noisiness, ventilation systems, vision distortion and comfort. They also used standard measuring tools to determine the objective functionality of the individual’s actual helmets regarding light transmission and diffusion, as well as proper fit of helmet and ventilation systems. The most common complaints about helmets were discomfort (69.2%), noise levels (32.9%), visor steam (27.8%), and faulty ventilation (27%). The relationships between individual complaints and issues of the actual helmet’s structure or functionality were not significantly correlated. It was found that over 70% of study participants did not have proper fitting helmets. The study determined that helmet complaints or malfunction were not significantly correlated with those involved in motorcycle crashes.

Contrary to helmet law objectors, it has been found that helmet use is not affiliated with increased neck injury, specifically in the lower cervical spine. Crompton et al. (2011) examined the National Trauma Data Bank's data of 40,890 hospitalized motorcyclists submitted between the years of 2002 and 2006. The study identified mortality and cervical spine injuries of helmeted and un-helmeted patients. Seventy-seven percent of patients wore helmets, and of all the patient data submitted, 4% died from injuries. Over 85% of patients
were male. The researchers found that helmeted patients had a lower percentage of cervical spine injury (3.5% vs. 5.4%) than un-helmeted riders. Helmeted patients also had 22% decreased odds of cervical injury, 65% decreased odds of TBI, and a 37% decreased odds of death compared to un-helmeted patients. The researchers noted that while this is one of the largest studies of trauma hospital data, the submission to NTDB is voluntary, and unreported lesser injuries or those who died at the scene of the crash are not reflected in this four-year span of data.

**Health Education Applications**

There are three methods of injury prevention in public health and policy: persuasion of behavior change to those at risk, require behavior change by law, or automatic protection through product and environmental design (Hedlund, 2000). Regarding motorcycle safety, the last method is enacted by industry standards of motorcycle and helmet design (Orsi et al., 2012). The second method has been discussed and shows that enforcing policy requiring at least some of the population to wear a helmet, as well as laws and policies for training and licensure, can prevent injury and death. The first method, however, is possibly the most difficult and an area where health behavior change theory is most needed. Application of health behavior change theory for helmet use is relatively scarce in the United States. However, there have been a handful of studies in other countries using behavior change theories such as the theory of planned behavior (TPB) and the Health Belief Model (HBM).

**Theory of planned behavior.** Developed from the theory of reasoned action (Azjen, 1991), TPB’s constructs predict and explain behavioral intentions through attitudes and beliefs about the behavior, subjective norm (based on perception of other's beliefs about the behavior) and perceived control of the behavior. While all constructs feed into intention to
perform the behavior, an individual's perceived and actual behavioral control has its own direct relation to the behavior (Figure 2).

Figure 2. Theory of planned behavior (Azjen, 1991)

**Health Belief Model.** Hochbaum, Leventhal, Kegeles, and Rosenstock are attributed to the early stages of the HBM in the 1950s (Rosenstock et al., 1988). The theoretical framework of this theory uses constructs to identify individual’s perceptions regarding health behavior decisions (Figure 3). The major constructs include threat perception (a combination of perceived susceptibility and severity of a health breakdown, such as a motorcycle crash) and behavioral expectations (the balance [or imbalance] of perceived benefits and barriers to performing the behavior, such as wearing a helmet). Additional constructs of health motivation and cues to action have been added through revisions of the model, which include factors like social influence, health messaging, and readiness for concern. Self-efficacy, adapted from social learning theory, also contributes to expectations and the likelihood of a behavior performed.
Aghamolaei, Tavafian, and Madani (2011) recruited motorcyclists at gas stations in Iran to examine perceptions regarding helmet use. Rates of helmet use are extremely low in Iran, yet motorcycles account for 40% of registered vehicles. The researchers used a written survey with 5-point Likert scales with three to five relevant statements for each behavior change construct. TPB constructs included attitudes, subjective norms, perceived behavioral control, and intentions. HBM constructs included perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action. The study recruited 221 participants by collecting data at two points per day (morning and night) at eight locations over the course of three days. At each station, researchers asked every tenth motorcyclist to participate and screened for eligibility (based on language and residency). The mean age was 26.8 years, and the mean years of motorcycle experience was 7.1 years. Age and higher education levels predicted greater helmet use. From the theory-based questions, higher perceived behavioral control and behavioral intention significantly predicted helmet use. Those with the highest ratings of self-efficacy and perceived cues to
action and with the least barriers were most likely to use helmets. The researchers acknowledged that culturally, encouragement and public enforcement are the strongest cues to action in Iran. This was a relatively small study, and it is also important to note that only men are permitted to ride motorcycles in Iran, so the results are not universally applicable.

The predominant mode of transportation is by motorcycle in Vietnam, with motorcycles accounting for up to 94% of registered vehicles. Throughout the country, only certain roads and highways have helmet requirements, but failure to comply has a steep penalty. Viet Hang, Stephenson, and Ivers (2008) also used gas stations as a recruitment tool to assess risk behaviors, attitudes about helmets, and barriers to use of helmets. Driver and passenger helmet use/possession was also observed by researchers to compare to participant responses. Twenty-three sites were selected, and researchers collected data from every tenth motorcyclist between the hours of 8 am to 5 pm. A verbal interview lasting approximately 20 minutes was conducted, and a small compensation was provided to participants. In total, 808 participants completed the interviews, 716 were drivers and 92 were passengers. The majority of participants (80.9%) were male. Of all the participants, 95.6% reported owning a helmet, only 23.1% were wearing helmets at the time of recruitment, and about 2% had their helmets with them but were not wearing them. From the interview, the study found that 95% believed helmets were effective, and the most common reason to wear a helmet was for extended trips. Barriers to helmet use included cost, inconvenience, and lack of storage, as well as obstruction of hearing and seeing. Most participants did not wear helmets for short trips or when they were on slower speed roads, despite helmets being most effective at slower speeds and in minor collisions.
In Australia, where helmets are mandatory, de Rome et al (2011) examined the barriers and perceptions of protective clothing. Using the TPB in a written questionnaire, researchers recruited participants after a safety training class. Ninety-four percent of class attendees participated, and 776 usable surveys were collected in the four-month period of 2008. Eighty-two percent of participants were new to motorcycle riding, and the majority was male (82.7%). The responses were sorted by unprotected riders (those who never, rarely or sometimes wear protective gear) and protected (often and always). The responses were also sorted by leg protection, i.e., wearing motorcycle pants or non-motorcycle pants.

Increased information seeking about protective clothing responses was greater in participants identifying as rider organization members (94.3% vs. 86.3% of non-members) and those who participated in group riding (93.4% vs. 83.6% of solo riders). Participants who did not seek knowledge about protective clothing were less likely to wear protective clothing in hot weather (32.3% vs. 56.7% of those knowledge seeking riders). Younger riders (ages 17–25) were less likely to seek information about protective clothing (82.2% vs. 89.3% of older riders). Sixty-seven percent of participants indicated an intention to buy more protective gear within the next three months, which researchers attributed to their fairly novice experience as a motorcyclist. The researchers concluded that more accessible information and messaging are needed to target young riders, as well as increasing hot-weather protective clothing compliance.

In many states, motorcycle safety courses are required for new riders, and in partial law states, it may be a provision to be exempt from wearing a helmet (Houston, 2007; MI SOS, 2013). Ranney, Mello, Baird, Chai, and Clark (2010) applied the TPB to recent graduates of motorcycle safety courses in Rhode Island to investigate if their education
affected attitudes, beliefs, intentions, subjective norms, and behaviors regarding helmet use. Participants were recruited through postcard mailings sent to motorcycle training course registrants. Data was collected through an online survey with 445 respondents. It was found that 68.4% of the group always wore helmets, and the researchers combined all other responses as not-always-helmet wearers. There were significant differences in beliefs, norms and health behaviors between groups of always vs. not-always-helmet wearers. Notably, not-always-helmet wearers were more likely to have friends who also do not wear helmets, believe helmets look “uncool” and that wearing a helmet would increase injury. Not-always-helmet wearers were also 22% less likely than always-helmet wearers to use a seatbelt in a car. Despite the study being for registrants of a safety course and the participant’s state requiring the training, 10% of not-always-helmet wearers reported not taking the safety course, and only a quarter of not-always-helmet wearers first learned to ride at the training courses, compared to about half of always-helmet wearers. This may imply that behaviors and influence are coming from nonprofessional sources. The researchers also noted that it is unknown if postcards correctly reached all intended respondents.

Use of the Health Belief Model constructs to understand motorcycle helmet use in the United States has not been thoroughly studied; however, a recent application of the HBM was applied to bicycle helmets in a study of college students (Ross, Ross, Rahman, & Cataldo, 2010). This study’s purpose was to create, identify, and measure scales of attitudes and motives for bicycle helmet use as they align with the HBM. The researchers coined this tool as the Bicycle Helmet Attitude Scale. The constructs included perceived vulnerability, perceived severity of harm, perceived benefits, perceived barriers, and cues to action. The initial survey contained 127 statements using a 6-point Likert scale. Survey responses were
collected through a self-selecting convenience sample of psychology students at the researchers' university. With this sample, the respondents were mostly young (average age 19.5), White (87%), and female (78%). Most reported that they do not wear a helmet and do not intend to do so in the future (72%). A little less than half (46%) owned a helmet and 12% wore a helmet regularly. From the results, the questionnaire was reduced to a 57-item scale using principle components analysis. Items were retained for high primary loading scores using factor analysis. In terms of perceived danger and safety issues, helmet wearers perceived themselves at lower risk of harm but found the severity of potential harm to be higher than non-wearers. Helmet wearers perceived more benefits to helmet wearing, fewer barriers, and identified more cues to action than non-wearers. All constructs of HBM included showed predictive values for helmet wearing behavior.

Applying the behavior change theories to bicycle helmet use was also approached in a study of 426 Finnish teenagers. Lajunen and Rasanen (2004) used HBM, TPB, and locus of control (LC) to explain teenager’s intentions to use their helmet. Students from a suburban high school completed the survey in their classes. A total of 965 students completed the survey, but the inclusion criterion was the self-reported behavior of having a helmet but not consistently using it. Slightly more girls (53%) owned helmets than boys, but differences in helmet use were not significant by gender. The best fit of theory to the data was TPB and LC. The strongest predictor of helmet use intention was the subjective norm (from parents and/or friends). The survey found that externality of the LC model, which explains that one’s risk is dependent on other’s actions, was a predictor to wear a helmet. Concerning use of the HBM, researchers recommended reducing barriers and increasing cues to action. Both constructs, they suggested, could be addressed by attaching helmets to bicycles when not in use so that
use of a helmet is an obvious choice. Several motorcycle styles are already equipped with a space for keeping a helmet, but the body types and storage capacities vary so this recommendation may not apply to every motorcyclist.

Communication and Messaging

In many areas of health behaviors, a dichotomy exists regarding the tone of messages; should messages exploit fear and negative consequences to encourage a behavior or take a pragmatic approach that recognizes positive aspects and personal empowerment for making choices? A few recent qualitative studies have attempted to answer this question by examining the perceptions of safety messaging through the lens of socio-communication theories for an interdisciplinary approach to prevention.

Voight (2013) explored the themes of terror management theory (TMT) and the theory of reasoned action (TRA) in a small qualitative study of Midwestern motorcyclists. Briefly described, TMT suggest that humans will not think about thoughts of trauma/death until something cues the thoughts. TRA, a predecessor to TPB, predicts behavior based on expectations of the outcome through attitudes and subjective norms. A convenience sample was implemented through recruitment on university websites, social media, and personal contacts. Eighteen subjects were recruited, 82% were male, ages ranged from 28–62 years old, and about half of the sample always wore motorcycle helmets. Semi-structured interviews were conducted around the themes of motivation to be a motorcyclist, social interaction as a motorcyclist, injury prevention behaviors, and media/messaging influence. Grounded theory analysis was used to align themes with TMT and TRA. Many respondents in this study gained interest in motorcycling from a young age from other motorcyclists in their families and social circles, and identified the sense of belonging to a culture as a
valuable characteristic. Respondents agreed that drinking alcohol and not wearing protective
gear are irresponsible risk behaviors, and behaviors to reduce risk include staying alert while
riding, and increasing conspicuity to other motorists by use of headlights and distance.
Examples of TMT by this motorcycling sample included a respondent not wearing a helmet
until witnessing a friend have a major crash. Other factors that lead to helmet use included
mandatory law, and a sense of personal responsibility to family and/or riding group. A
culture of safety was echoed in the respondents’ attitudes and behaviors. Those who sought
professional riding instruction were also the most frequent helmet wearers. However, staying
alert and having proper training was rated more highly as a way to avoid injury and death.
The author recommends (a) campaigns to highlight the risk of brain injury rather than
fatalities from motorcycle crashes, (b) information on safe riding to all potential
motorcyclists, such as a high school program, and (c) increased awareness of training
programs for adults.

Harm reduction theory (HRT), a health practice methodology often used in substance
abuse treatments, aims to reduce the negative health-related outcomes related to practicing
risky behavior (Haas, 2012). Components of HRT also include goal setting and motivational
interviewing and tenants based in choice and empowerment. The author argues that HRT is a
metatheory guiding the HBM, which further explains the variance in predicting and
sustaining behavior change, particularly in motorcycle safety practice. Taking these
principles, interviews were conducted to determine the relationship of HRT and HBM as it
pertains to risky motorcycle behaviors. Recruitment utilized newspapers, flyers, a university
research study site, and event recruitment, as well as snowball sampling and personal
contacts. Participants needed to be a resident of Indiana, a state without a helmet law, and
engaged in at least one risky motorcycle behavior, such as speeding, not wearing a helmet, having been in an accident, consuming alcohol before driving a motorcycle, and/or does not consistently wear safety gear. Thirty-seven motorcyclists participated; 78% were male, ages ranged from 18–70 years old, and the average riding experience was 17.5 years. A major theme within the interviews included the importance of family/significant others, both as a voice that encourages them to wear a helmet/safety gear, and as an emotional reminder to use caution regarding motorcycling. Motorcyclists shared sentiments that motorcycling safety messages do not reach other motorists enough, yet other drivers are just as responsible for traffic safety. The interviewees expressed a desire for targeted accurate and realistic messaging. In this study, ABATE was listed by participants as the most credible source for safety messaging, and they also mentioned trainings and seminars at local bike stores and within club meetings or group rides as a source of messages. Other sources of messaging desired by the motorcyclists included law enforcement and a community-based approach that understands the unique aspects of motorcycling. Despite the limitations of a qualitative study, this dissertation provides a promising first step to integrating components of HRT to improve health communications and theoretical approaches to safety messages.

Tunnicliff, Watson, White, Lewis, and Wishart (2011) conducted a series of focus groups with Australian motorcyclists. Participants were recruited through email listings, advertisements, and in-person recruitment at rest stops. Forty-three individuals representing current riders, safety trainers, and law enforcement were included in the study. Participants were mostly male (79%) and ranged from 18–65 years old. The focus group questions followed theory of planned behavior constructs, particularly regarding group norms and personal/moral norms. Ten key findings were identified for use in the field. These findings
included themes of emphasizing positive outcomes and the “escape” or “freedom” that riding entails, rather than a negative consequence approach. The authors suggest that a skilled rider is one who knows their limits, follows traffic laws and does not encourage others to “keep up” beyond their skill level. Participants indicated that in general, risky behavior, such as lack of protective gear, and engaging in stunts and high speeds, projected a negative image of motorcyclists, but recognized in some sub-cultures of motorcycling these activities may be viewed positively which perpetuates the behaviors. Images should emphasize groups, as social riding is a popular activity, but reinforce that each rider is an individual, and everyone on the road is responsible for a safe and responsible ride.

While most motorcycling safety and helmet messages come in the form of secondary prevention, perspectives from medical professionals recommend messages during “teachable moments” as a form of tertiary prevention. Blanchard and Tabloski (2006) suggest a few strategies for emergency nurses to utilize when interacting with patients of a motorcycle crash. These suggestions include providing safety resources such as posters and pamphlets, as well as education about injury prevention, including headlight and protective gear usage, and sharing the relationship between experience on the road and injury risk.

**Summary and Research Rationale**

Through this review of literature, it can be inferred that helmets are effective injury prevention tools, and universal helmet law is the most effective strategy for preventing motorcycle fatalities. Injury and fatality rates from serious motorcycle crashes can be severe due to the nature of the vehicle, but helmet use can provide protection to users, especially in situations of mild or moderate crashes and spinouts. The personal reasons for not wearing a
helmet are varied, but universal helmet laws encourage and properly enforce the use of helmets.

Further research is needed to understand risk-taking behaviors, the connections between education and training, and the perceptions and barriers to proper helmet use. Motorcycle helmet use is a multi-factored decision based on experience, values and social/demographic qualities, and thus, health-messaging needs to be targeted based on these different variables and/or to subpopulations. HBM constructs are intended to identify perceptions and largely have been used in health education for changing individual health-directed behaviors. HBM is used to measure health directed behaviors, such as vaccinations, screenings, and condom use, which are behaviors that directly reduce the risk of disease or injury. In the case of motorcycle helmet use, the helmet is a tool that has demonstrated effectiveness for injury risk prevention. The range of motorcyclists from this sample will attempt to represent the various subpopulations of motorcyclists and identify major themes of perceived threats, expectations and cues to action for wearing motorcycle helmets. By identifying themes within subpopulations, such as types of motorcycles, those who pursue safety training, and demographics such as age or gender, the knowledge, perceptions, and skills can be applied to better suit individual needs for increasing motorcycle helmet use. The purpose of this study is to use the HBM to identify the major reasons that motorcyclists choose to wear or not wear helmets and contribute to the literature so that these perceptions can be utilized in health communication strategies to improve helmet use for subpopulations of motorcyclists.
Chapter 3: Methods

Michigan motorcyclists were surveyed on their beliefs and perceptions regarding helmet use using the Health Belief Model (HBM). Due to the seasonal dichotomy of Midwest weather, most motorcycling takes place in the summer, and thus, this study’s data collection attempted to coincide with warmer weather to reach the most motorcyclists. A low response rate from data collection at motorcycle events lead to study extension into the fall and winter months and utilized additional social media recruitment.

Research Design

The study used correlational cross sectional design and convenience sampling. The independent variable is helmet use frequency. The dependent variables included the following constructs from the HBM: perceived benefits, perceived barriers, perceived susceptibility to injury, perceived severity of injury, and cues to action. The study's instrument, methods, risks, and incentives were reviewed and found to be exempt by the Eastern Michigan University Human Subjects Review Committee and Institutional Review Board in August 2015 (see Appendix A).

Sample Selection

Convenience sampling was used to collect data on Michigan motorcyclists. The participants of this study were recruited at a series of southeastern Michigan motorcycling events in August and September 2015, as well as through a social media component for extended recruitment (Table 1). A second wave of recruitment reached motorcyclists in person in October 2015 at a motorcycle parts swap. The third wave of recruitment utilized motorcycle event groups on social media to reach motorcyclists towards the end of the season.
Participants

Subject eligibility included Michigan residency and being 18 years or older. Subjects who identified with these eligibility requirements clicked on an additional box on the online consent form before beginning the study. Those excluded included residents of other states or countries and those under the age of 18. There were no eligibility exclusions for race, gender, religion, creed, ability or orientation.

Data Collection Instrument

The data was collected through a web-based survey hosted by Survey Monkey. The first page was the informed consent (see Appendix B), followed by the Motorcycle Helmet Use Survey (see Appendix C). The first survey section included self-reported, behavior-based questions such as type of motorcycle and helmet, and use of motorcycle helmets and protective gear. The next section included the two-page HBM instrument (perceived severity and perceived susceptibility on page one, perceived barriers, perceived benefits and cues to action on page two), followed by a section with demographic questions. The last section

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Table 1

**Participant Recruitment Dates and Locations**

<table>
<thead>
<tr>
<th>Date</th>
<th>Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/18/2015</td>
<td>Ypsilanti Bike Night</td>
<td>Ypsilanti, MI</td>
</tr>
<tr>
<td>08/20/2015</td>
<td>Café Racer</td>
<td>Facebook Page</td>
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<tr>
<td>09/15/2015</td>
<td>Ypsilanti Bike Night</td>
<td>Ypsilanti, MI</td>
</tr>
<tr>
<td>10/18/2015</td>
<td>Birch Run Motorcycle Swap Meet</td>
<td>Birch Run, MI</td>
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<td>Facebook Group</td>
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</tr>
<tr>
<td>12/08/2015</td>
<td>Café Racer</td>
<td>Facebook Page</td>
</tr>
</tbody>
</table>
included researcher contact information and an external link to a gas card drawing as an incentive for participating.

The Health Belief Model statements in the instrument for this study were adapted from the Bicycle Helmet Attitudes Scale (BHAS; see Appendix D; Ross et al., 2010). With permission from the authors, these HBM statements were modified to reflect motorcycle helmet use (see Appendix E). The wording of the statements was changed when necessary from “bicycle” to “motorcycle”, and “accident(s)” was changed to “crash(-es)” as this term is used more widely when discussing motorcycle collisions. The scale was reduced from 57 items to 42, eliminating repetitive and/or difficult to read items from the scale (five items) as well as removing items and/or sections that were irrelevant when comparing bicycles to motorcycles such as parental recommendations to wear a helmet as a child (four items) and costs of helmets (six items) when considering the costs of motorcycle upkeep. This also included modifying items such as the safety of riding in the streets rather than sidewalks (see Appendix F for detailed description of specific changes by question). The BHAS was tested for theoretical reliability and validity (Ross et al., 2010). The BHAS captured 52% of variance associated with helmet use between wearers and non-wearers, and each item had a high primary loading (typically .50 or higher) without a secondary loading (.29 or less) in factor analysis. Reliability was tested for $\alpha \geq .80$ for each item in the scale using Chronbach’s alpha values. The changes made to the BHAS for this study of motorcycle helmet use were not expected to significantly change the HBM statements’ reliability, validity, and factor analysis loading.

Demographic information on the survey was limited to age, sex, Michigan County of residence, riding experience, motorcycle license endorsement, and affiliation in local and
national motorcycle organizations. Optional response to motorcycle organization affiliation was asked to determine possible causes of bias (Derrick & Faucher, 2009) and also social cues to action (de Rome et al., 2011). Helmet use included type of helmet used and frequency of helmet use. Type of motorcycle and primary purpose of motorcycle use were also examined. Injury risk behaviors included the frequency of protective gear, such as gloves, boots, jackets and pants, and seat belt use. The survey was written at a 7.1 Flesch Kincaid reading level. The informed consent page was written at an 8.6 reading level. The gas card drawing page was at an 8th grade reading level.

**Participant Recruitment**

The recruitment process used two strategies: southeast Michigan motorcycling events and Michigan-based Facebook pages.

**Motorcycling events.** The first method was in-person recruitment. The primary investigator attended three events at two southeast Michigan motorcycling events. E-mail confirmation of participation at Ypsilanti Bike Night was obtained for August 18, 2015 and September 15, 2015 as well as the Birch Run Motorcycle Swap Meet on October 18, 2015 (see Appendix G). Business-card-sized invitations were distributed at the motorcycling events (see Appendix H). Interested participants were instructed to manually enter the address of the survey website at their own personal computer.

**Social media.** Secondly, participants were recruited to access the survey website through Facebook postings. The first wave of social media recruitment was with the Café Racer Facebook page, which is a local business that also conducts the organization of the Ypsilanti Bike Nights. The link to the survey website was posted the week of August 24, 2015 and September 7, 2015. The second wave of social media recruitment was through the
Café Racer Facebook page, and on the Southeast Michigan Motorcycle Events and Bike Nights Facebook group page during the weeks of November 23 and November 30, 2015. The page administrator received an email with the recruitment text (see Appendix I) and the message was posted.

Both recruitment strategies lead to the same survey website. The text for recruitment described the study, the eligibility, the incentive drawing, the primary investigator’s contact information, and the website to access the survey.

**Data Collection Procedures**

Interested participants at the events and on Facebook accessed the survey website from a personal computer. This website link was available from August 18–December 28, 2015. Participants recruited at the events manually entered the survey website into a web browser after the event that they attended. Those who were recruited on Facebook clicked on the survey website link provided and completed the survey at their will. Other survey participants obtained the survey link through digital sharing, such as having the link forwarded to them via email, and/or postings by other members of the motorcycling social media groups.

An informed consent form was included on the first page of the survey (see Appendix B) before the questionnaire began. A study overview briefly described the study's purpose, the eligibility criteria, instructions to complete the survey and information about the gas card drawing following the study. The informed consent page reviewed eligibility, potential risks, and information about the study and researchers. Upon reviewing the eligibility criteria and agreeing to the informed consent page, participants clicked 'I agree' and continued to the following pages of the survey. After completing the HBM questionnaire and the
demographic information, the survey resulted in a closing page. A link to the separate incentive drawing form was included on the closing page.

**Incentive**

An external link to a drawing for five $20 gas cards was provided upon completion of the study (See Appendix J). Those interested completed a brief entry including their first name and email. The form and data was contained in a separate Survey Monkey survey webpage and was only used to contact the five recipients of the drawing. Fifteen random numbers were generated using a web-based tool to select the recipients of the gas cards, and the first five numbers were used to distribute the gas cards. Those who were randomly selected to receive the gas cards were contacted by email (See Appendix K). These participants had five days to respond with their mailing address to receive the gas card. If there was no response, the sixth participant was contacted, and so forth until all five cards were distributed. Upon distribution of the five cards, the form, data and email correspondence was deleted.

**Power Analysis**

Based on the 2013 sample of observed Michigan motorcyclists, approximately 73% of the riders in the state wear helmets on the roads (Wayne State University Traffic Research Group, 2013). This study also observed motorcycle event attendees, where only 58% were observed wearing helmets. Since recruitment occurred at motorcycling events and social media affiliated with motorcycle events, it was predicted that this convenience sample would more closely align with the later percentage of helmet use. After conducting a power analysis for a dichotomous endpoint, one-sample study, the minimum sample size was 73 participants (Table 2).
Table 2

<table>
<thead>
<tr>
<th>Study Parameters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence, population</td>
<td>73%</td>
</tr>
<tr>
<td>Incidence, study group</td>
<td>58%</td>
</tr>
<tr>
<td>Alpha</td>
<td>0.05</td>
</tr>
<tr>
<td>Beta</td>
<td>0.2</td>
</tr>
<tr>
<td>Power</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Data Analysis

Participant data was downloaded from the Survey Monkey web server and used with the Statistical Package for the Social Science version 20 for Windows (SPSS) for analysis. Additional data charts were developed in Microsoft Excel. The participants entered their age numerically on the survey instrument, and the data was then grouped into age groups of 19–29, 30–39, 40–49, 50–59 and 60–69. SPSS was used to conduct frequency analysis and correlations between participant’s reported helmet use and their perceived barriers, perceived benefits, perceived severity of injury, and perceived susceptibility. Correlational analyses were also conducted regarding demographic information and other injury risk behaviors, such as use of protective gear, participation in safety training, experience level, and type/purpose of motorcycle riding.

Privacy and Confidentiality

All downloaded data was saved and accessed on password-protected university owned computers. Data will be kept for three years following the study’s completion on the research committee chair’s password protected university computer.

The survey was anonymous. No information collected in data sets identified individual participants. Subjects voluntarily participated from when they were recruited until December 28, 2015, when the survey closed. The information collected did not disclose
individual’s participation to the primary investigator. Demographic information on the survey was limited to age, sex, Michigan County of residence, riding experience, motorcycle license endorsement, and affiliation in local and national motorcycle organizations.

Completing the survey at their own personal home protected the subjects’ privacy. The primary investigator had no knowledge of who participated or when subjects participated in the study during the time that the survey website was accessible.

**Risks**

Potential risk included possible emotional or psychological triggers when asked about their history of motorcycle crashes and other losses as well as injuries by friends and family’s motorcycle crashes. To reduce the risk of emotional/psychological triggers, there were two procedures in place. First, subjects were informed that questions were not mandatory, and all information was anonymous and confidential. This allowed subjects to decide if they wanted to participate in the study and if they wanted to answer possibly emotionally triggering questions. Secondly, the conclusion page included resources to the National Alliance for Mental Health for any potential questions or resources regarding mental health concerns.

**Limitations**

Using a convenience sample to reach the largest amount of motorcyclists in a short amount of time eliminated the possibility of random sampling. The sampling set contributed to limitations of the study. Both the eligibility and participation were self-selected activities; participants chose to attend the events or “like” the Facebook pages, and elected to participate in the survey. A major limitation was that some motorcyclists that attended these events may not have received their license endorsement at the time of the survey, and/or may have had limited experience on the road. Although this group was not the intended
population for this study, they were able to complete the survey online. With that and other unpredictable variables that accompany an online survey, such as the fact that the survey could have been shared easily and anonymously, other unintended individuals had the ability to find the survey link and take it, including some without meeting the eligibility criteria. Nonresidents were excluded from data analysis as the policies of other states differ from Michigan, and the purpose was to identify helmet use perceptions of Michigan motorcyclists. There was also the possibility that those who attended the events were the same people being reached through the social media. The benefit of this possibility was that those individuals may have found one method of recruitment as a stronger cue to action to complete the survey, but the limitation is that these participants may have attempted to complete the survey more than once. Participants were asked if they have ever completed this survey before and those who stated yes were excluded from the analysis.
Chapter 4: Results & Discussion

A total of 94 responses were collected using the online survey. One non-Michigan respondent who completed the survey 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 those who may have completed the Health Belief Model (HBM) scales, but skipped the demographics or vice versa. In total, there were 76 usable responses. All participants were at least 18 years or older and consented to participate in the study. The following chapter presents the demographic profile, Health Belief Model constructs, and hypotheses testing for the present study, as well as a discussion of the results and implications for future research and practical applications.

Demographics

The majority of respondents (90.8%) reported living in Southeast Michigan (Figure 4), and thus, the following demographic profile is assumed to best describe the sampled population of motorcyclists in this geographic region.

Figure 4: Map of individual responses by Michigan county (Image created with www.diymaps.net)
Table 3 displays a comparison of the demographic profiles among all respondents and within always-helmeted and not-always-helmeted groups. Three quarters of respondents in the present study stated that they always wear a helmet when operating a motorcycle. The majority of participants were male (85.5%). Age was positively skewed and ranged from 19 to 68, with 68.4% of total respondents over 40 years old; the highest participating age group was 60–69 (27.5%). Most respondents cited recreation as their primary purpose (71%). Full face helmets were the most popular helmet style that respondents used (55.3%) followed by half helmets (17.1%) or no helmet at all (17.1%). Respondents most often rode cruiser style (37%), followed by sport/touring (29%) and standard style (25%). Nearly all respondents reported always wearing some or all protective gear (94.7%). Helmet use as a passenger was high at 76%, and even more respondents wore seatbelts in cars (88%).

**Differences between groups.** Age, sex and primary motorcycling purposes were proportionally similar between groups of always-helmeted and not-always-helmeted motorcyclists. Always-helmet use was in the majority for all age groups, with over 90% of 19–29 year olds reporting that they always wear helmets. The lowest always-helmet-wearing group was 40–49 year olds, with only 63.2% always-helmet use. Nearly all women who participated reported always wearing helmets \(n = 10, 90.9\%\) compared to 72.3% always-helmet use in male respondents \(n = 47\).

Most full face helmets were used by always-helmeted users \(n=40, 95.2\%\) and wearing no helmet at all was reported only by not-always-helmet users \(n=13, 100\%\). Over two-thirds of not-always-helmeted motorcyclists rode cruiser style motorcycles (68.4%); always-helmeted motorcyclists reported standard (33.3%) motorcycles and sport/touring (29.8%) as their most popular bikes of choice. All respondents who reported wearing full
protective gear were from the always-helmeted group, whereas all respondents that reported not wearing protective gear were from the not-always-helmeted group. Most of those who used a helmet as a passenger were from the always-helmeted group ($n = 55, 94.8\%$) as well as using seatbelts while in other vehicles ($n = 54, 80.6\%$).
| Demographics and Behaviors of Survey Respondents According to Self-Reported Helmet Use (N = 76) |
|-------------------------------------------|-----------------|-----------------|-----------------|
|                                           | Total Responses (N=76) | Always-Helmeted (N=57) (75%) | Not-Always-Helmeted (N=19) (25%) |
| **Age**                                   | **n(%)**          | **n(%)**         | **n(%)**        |
| 19–29                                     | 11 (14.5)         | 10 (90.9)        | 1 (9.1)         |
| 30–39                                     | 13 (17.1)         | 10 (76.9)        | 3 (23.1)        |
| 40–49                                     | 19 (25.0)         | 12 (63.2)        | 7 (36.8)        |
| 50–59                                     | 12 (15.8)         | 10 (83.3)        | 2 (16.6)        |
| 60–69                                     | 21 (27.6)         | 15 (71.4)        | 6 (28.6)        |
| **Sex**                                   |                  |                  |                 |
| Male                                      | 65 (85.5)         | 47 (72.3)        | 18 (27.7)       |
| Female                                    | 11 (14.5)         | 10 (90.9)        | 1 (9.1)         |
| **Primary Motorcycling Purpose**          |                  |                  |                 |
| Long Distance Touring                     | 6 (7.9)           | 5 (83.3)         | 1 (16.6)        |
| Commute to work/school                    | 13 (17.1)         | 10 (76.9)        | 3 (23.1)        |
| Recreation                                | 54 (71.1)         | 39 (72.2)        | 15 (27.8)       |
| Sport                                     | 2 (2.6)           | 2 (100)          | 0 (0.0)         |
| No Response                               | 1 (1.3)           | 1 (100)          | 0 (0.0)         |
| **Type of Helmet Most Frequently Used**   |                  |                  |                 |
| No Helmet                                 | 13 (17.1)         | 0 (0.0)          | 13 (100)        |
| Half Helmet                               | 13 (17.1)         | 9 (69.2)         | 4 (30.7)        |
| Open-Face Helmet                          | 6 (7.9)           | 6 (100)          | 0 (0.0)         |
| Modular                                   | 2 (2.6)           | 2 (100)          | 0 (0.0)         |
| Full Face                                 | 42 (55.3)         | 40 (95.2)        | 2 (4.8)         |
| **Type of Motorcycle Most Frequently Used** |                  |                  |                 |
| Standard                                  | 22 (28.9)         | 19 (86.4)        | 3 (13.6)        |
| Sport/Touring                             | 19 (25.0)         | 17 (89.5)        | 2 (10.5)        |
| Cruiser                                   | 28 (36.8)         | 15 (53.6)        | 13 (46.4)       |
| Dual Sport                                | 6 (7.9)           | 5 (83.3)         | 1 (16.6)        |
| Scooter                                   | 1 (1.3)           | 1 (100)          | 0 (0.0)         |
| **Protective Gear Use**                   |                  |                  |                 |
| Always full protective gear               | 25 (32.9)         | 25 (100)         | 0 (0.0)         |
| Always some, but not full protective gear | 47 (61.8)         | 32 (68.1)        | 15 (31.9)       |
| Not-always use of protective gear         | 4 (5.3)           | 0 (0.0)          | 4 (100)         |
| **Use of Helmet as Passenger**            |                  |                  |                 |
| Always                                    | 58 (76.3)         | 55 (94.8)        | 3 (5.2)         |
| Not-always                                | 18 (23.7)         | 2 (11.1)         | 16 (88.9)       |
| **Use of Seatbelt in Other Vehicles**     |                  |                  |                 |
| Always                                    | 67 (88.2)         | 54 (80.6)        | 13 (19.4)       |
| Not-always                                | 9 (11.8)          | 3 (33.3)         | 6 (66.7)        |
Table 4 reports experiences specific to motorcycling in Michigan. Almost all respondents had a Michigan motorcycle license endorsement (97.4%). All not-always-helmet users reported having a Michigan license endorsement, but two always-helmet respondents did not. Most had completed a training course in Michigan (71.1%) and about half (51.3%) completed this training before the date of the Michigan helmet law policy change, April 13th, 2012.

Almost half of the participants (43.4%) self-reported involvement in one or more motorcycle related organizations. Of the 22 local and national organization affiliations shared by participants, the most popular affiliations were the Harley Owners Group (35.2%), BMW Touring Club of Detroit (17.6%) and American Motorcyclist Association (14.7%). Not-always-helmeted motorcyclists reported less participation in organizations (47.3% of always-helmeted vs. 31.6% not-always-helmeted).

Nearly two thirds of respondents rated themselves as advanced in motorcycling experience (60.5%). Both groups most frequently rated their motorcycling skills as advanced (54.4% of always-helmeted and 78.9% of not-always-helmeted) however, those who identified with a beginning experience level were only found in the always-helmet group.

The survey was accessed primarily from the social media recruitment (59.2%), with an additional 25% of participants recruited from the southeast Michigan motorcycling events, and 14.5% of respondents from a survey link forwarded by another person.
### Table 4

**Experiences of Survey Respondents According to Self-Reported Helmet Use (N = 76)**

<table>
<thead>
<tr>
<th></th>
<th>Total Responses (N = 76)</th>
<th>Always-helmeted (N = 57) (75%)</th>
<th>Not-always-helmeted (N = 19) (25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Has Michigan Motorcycle License Endorsement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>74 (97.4)</td>
<td>55 (94.0)</td>
<td>19 (25.6)</td>
</tr>
<tr>
<td>No</td>
<td>2 (2.6)</td>
<td>2 (100)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Took Motorcycle Safety Training in Michigan</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>54 (71.1)</td>
<td>43 (79.6)</td>
<td>11 (20.4)</td>
</tr>
<tr>
<td>No</td>
<td>22 (28.9)</td>
<td>14 (63.6)</td>
<td>8 (36.4)</td>
</tr>
<tr>
<td><strong>Took Training before Helmet Law Change (April 2012)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39 (51.3)</td>
<td>32 (82.1)</td>
<td>7 (17.9)</td>
</tr>
<tr>
<td>No</td>
<td>15 (19.7)</td>
<td>10 (66.7)</td>
<td>5 (33.3)</td>
</tr>
<tr>
<td><strong>Is Affiliated with Local and/or National Groups</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>33 (43.4)</td>
<td>27 (81.8)</td>
<td>6 (18.2)</td>
</tr>
<tr>
<td>No</td>
<td>43 (56.6)</td>
<td>30 (69.8)</td>
<td>13 (30.2)</td>
</tr>
<tr>
<td><strong>Self-Reported Experience Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning</td>
<td>5 (6.6)</td>
<td>5 (100)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>25 (32.9)</td>
<td>21 (84.0)</td>
<td>4 (16.0)</td>
</tr>
<tr>
<td>Advanced</td>
<td>46 (60.5)</td>
<td>31 (67.4)</td>
<td>15 (32.6)</td>
</tr>
<tr>
<td><strong>Survey Recruitment Method</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-Person Event</td>
<td>19 (25.0)</td>
<td>16 (84.2)</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>Social Media</td>
<td>45 (59.2)</td>
<td>31 (68.9)</td>
<td>14 (31.1)</td>
</tr>
<tr>
<td>Forwarded by Friend</td>
<td>11 (14.5)</td>
<td>9 (81.8)</td>
<td>2 (18.2)</td>
</tr>
<tr>
<td>Both In-Person and Online</td>
<td>1 (1.3)</td>
<td>1 (100)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>
Helmet Use and the Health Belief Model

All HBM items were answered with a Likert scale ranging from one to five, with three as the neutral response. Responses greater than three indicate agreement with the statement, and below three indicate disagreement with the statement. A cumulative score was calculated for each construct and sub-construct (see Appendix E) as well as a composite score of “Perceived Threat”, which included the scores of perceived susceptibility of injury (exemption from risk and perceived danger of motorcycling) and perceived severity of injury, and a composite score of “Perceived Expectations” which included scores of perceived benefits and perceived barriers. Items specifically regarding perceived self-efficacy were not included in the present study.

All HBM constructs but perceived severity of injury had sub-constructs based on item themes. Perceived susceptibility had two sub-constructs: risk exemption and perceived danger. A higher score on the first susceptibility sub-construct (five items) indicates a greater belief in exemption from risks associated with motorcycling, or conversely, a lower score indicates a greater perception of risk in motorcycling. Higher scores for perceived danger (four items) indicate a greater perceived inherent danger in motorcycling. Perceived severity of injury (three items) included items in which higher scores reflect the perceived social and practical consequences resulting from a motorcycle induced head injury. Perceived benefits included intangible and tangible benefits. A higher score of intangible benefits (six items) indicates a perception of emotional peace of mind and responsibility. Tangible benefits (four items) included physical injury prevention characteristics of helmets. Perceived barriers also included intangible and tangible sub-constructs. Higher scores in intangible barriers (four items) represented perceptions of emotional and social characteristics such as
embarrassment. Tangible barriers (three items) included the physical aspects of helmet wearing. *Cues to action* included three sub-constructs. Visual cues (four items) included physical reminders to wear helmets. Social cues (three items) indicated the perceived influence of other’s helmet use and influence. Finally, higher scores in media cues (four items) indicated a greater perception of outside influences such as advertising, community events and medical professionals in regards to wearing helmets.

As these item categories were adapted from a previous study (Ross et al., 2010), a Chronbach’s Alpha test was ran for the subcategories to test inter-item reliability, as presented in Table 5. All but social cues surpassed the .60 alpha acceptability level.

<table>
<thead>
<tr>
<th>Inter-Item Reliability for HBM Sub-Constructs (N = 76)</th>
<th>Chronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructs and Sub-Constructs</td>
<td></td>
</tr>
<tr>
<td>Perceived Threat of Injury</td>
<td></td>
</tr>
<tr>
<td>Risk Exemption</td>
<td>.727</td>
</tr>
<tr>
<td>Perceived Danger</td>
<td>.682</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>.853</td>
</tr>
<tr>
<td>Perceived Benefits</td>
<td></td>
</tr>
<tr>
<td>Intangible Benefits</td>
<td>.818</td>
</tr>
<tr>
<td>Tangible Benefits</td>
<td>.913</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td></td>
</tr>
<tr>
<td>Intangible Barriers</td>
<td>.936</td>
</tr>
<tr>
<td>Tangible Barriers</td>
<td>.778</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td></td>
</tr>
<tr>
<td>Visual Cues</td>
<td>.642</td>
</tr>
<tr>
<td>Social Cues</td>
<td>.533</td>
</tr>
<tr>
<td>Media Cues</td>
<td>.687</td>
</tr>
</tbody>
</table>

**Hypothesis Testing**

The present study examined relationships within and between three HBM constructs: perceived threat, perceived expectations, and cues to action. Alternative hypotheses explored
perceived benefits and perceived barriers as standalone constructs to test with the composite construct of perceived threat.

**Null Hypothesis**

The null hypothesis for the present study states that the decision to wear a motorcycle helmet will not be influenced by health belief constructs. To test this hypothesis, each constructs’ total scores, and each sub-construct score were compared between always-helmet users and not-always-helmet users with a Kruskal Wallis test, with statistics displayed in table 6. The testing revealed significant differences ($\alpha = .05$) in construct and sub-construct scores for always-helmeted and not-always-helmeted groups in all but four areas. Perceived threat of injury, which combined scores from risk exemption, perceived danger, and perceived severity of injury, was significant ($p = .016$). Both sub-constructs of perceived susceptibility, risk exemption ($p = .001$) and perceived danger ($p = .026$), were significant, but perceived severity as a standalone construct was not. Perceived expectations, which combined perceived benefits and barriers, was insignificant between groups ($p = .517$). Overall, perceived benefits was not significant ($p = .064$) but significance was found in one sub-construct, tangible benefits ($p = .010$). Differences between total perceived barriers were significant ($p = .000$), as were the two sub-constructs (tangible barriers, $p = .001$, intangible barriers, $p = .001$). Cues to action as a total construct score ($p = .000$), as well as all three sub-constructs of visual cues ($p = .003$), social cues ($p = .001$), and media cues ($p = .001$) were significant.
Table 6

Differences in Sub-Construct Scores by Self-Reported Helmet Use

<table>
<thead>
<tr>
<th></th>
<th>Always-helmet User Mean Rank (n = 57)</th>
<th>Not-always-helmet User Mean Rank (n = 19)</th>
<th>Kruskal Wallis K</th>
<th>Sig. (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Threat of Injury</td>
<td>34.97</td>
<td>49.08</td>
<td>5.838</td>
<td>0.016</td>
</tr>
<tr>
<td>(Composite Score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Exemption</td>
<td>30.59</td>
<td>62.24</td>
<td>29.72</td>
<td>0.001</td>
</tr>
<tr>
<td>Perceived Danger</td>
<td>41.68</td>
<td>28.95</td>
<td>4.92</td>
<td>0.026</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>39.61</td>
<td>35.18</td>
<td>6.53</td>
<td>0.419</td>
</tr>
<tr>
<td>Perceived Expectations</td>
<td>37.55</td>
<td>41.34</td>
<td>5.42</td>
<td>0.517</td>
</tr>
<tr>
<td>(Composite Score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Perceived Benefits</td>
<td>41.20</td>
<td>30.39</td>
<td>3.42</td>
<td>0.064</td>
</tr>
<tr>
<td>Intangible Benefits</td>
<td>40.55</td>
<td>32.34</td>
<td>1.98</td>
<td>0.159</td>
</tr>
<tr>
<td>Tangible Benefits</td>
<td>42.18</td>
<td>27.45</td>
<td>6.59</td>
<td>0.010</td>
</tr>
<tr>
<td>Total Perceived Barriers</td>
<td>32.00</td>
<td>58.00</td>
<td>20.17</td>
<td>0.000</td>
</tr>
<tr>
<td>Intangible Barriers</td>
<td>42.18</td>
<td>58.50</td>
<td>25.12</td>
<td>0.001</td>
</tr>
<tr>
<td>Tangible Barriers</td>
<td>31.83</td>
<td>55.42</td>
<td>15.24</td>
<td>0.001</td>
</tr>
<tr>
<td>Total Cues To Action</td>
<td>44.76</td>
<td>19.71</td>
<td>18.43</td>
<td>0.000</td>
</tr>
<tr>
<td>Visual Cues</td>
<td>42.72</td>
<td>25.84</td>
<td>8.54</td>
<td>0.003</td>
</tr>
<tr>
<td>Social Cues</td>
<td>44.23</td>
<td>21.32</td>
<td>15.71</td>
<td>0.001</td>
</tr>
<tr>
<td>Media Cues</td>
<td>43.69</td>
<td>22.92</td>
<td>12.73</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note: In this study, the composite score of Perceived Threat of Injury included both perceived susceptibility sub-constructs as well as the construct of perceived severity. Perceived susceptibility was divided into two sub-constructs, risk exemption and perceived danger. The composite score for Perceived Expectations included the total scores from perceived benefits and perceived barriers. Self-efficacy was not included as a construct in this study.
Alternative Hypotheses

**Alternative Hypothesis I.** Individuals with greater perceived benefits of wearing motorcycle helmets and greater perceived threat (susceptibility and severity) of injury will be more likely to report always wearing motorcycle helmets. Figure 5 displays a scatterplot of participants’ scores for Perceived Threat of Injury (Perceived susceptibility *risk exemption and perceived danger of motorcycling*) and perceived severity of injury) and Perceived Benefits of Helmet Use. A very weak positive correlation was found between the constructs for always-helmeted respondents (Spearman’s $\rho = 0.019$), and not-always-helmeted respondents had a weak negative correlation (Spearman’s $\rho = -0.136$). Both groups’ construct relationships were insignificant at an alpha of 0.05 (always-helmeted: $p = .891$, not-always-helmeted: $p = .579$).
Figure 5. Relationship of perceived benefits of helmet use score and perceived threat of injury score between self-reported “always-helmeted” and “not-always-helmeted” respondents.

Note. In this study, the composite score of Perceived Threat of Injury included both perceived susceptibility sub-constructs as well as the construct of perceived severity. The alternative hypotheses examined perceived expectations as two separate analyses utilizing perceived benefits and perceived barriers. Self-efficacy was not included as a construct in this study.

Alternative Hypothesis II. Individuals with greater perceived barriers of wearing motorcycle helmets and lower perceived threat (susceptibility and severity) of injury will be less likely to report always wearing motorcycle helmets. Figure 6 includes a scatterplot of participants’ scores for Perceived Threat of Injury (Perceived susceptibility (risk exemption and perceived danger of motorcycling) and perceived severity of injury) and Perceived Barriers of Helmet Use. A somewhat moderate positive correlation was found between the constructs for always-helmeted respondents (Spearman’s rho = 0.351), and not-always-
helmeted respondents had a weak negative correlation (Spearman’s $\rho = -0.208$). 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 ($p = .392$).
Figure 6. Relationship of perceived barriers of helmet use score and perceived threat of injury score between self-reported “always-helmeted” and “not-always-helmeted” respondents.

Note. In this study, the composite score of Perceived Threat of Injury included both perceived susceptibility sub-constructs as well as the construct of perceived severity. The alternative hypotheses examined perceived expectations as two separate analyses utilizing perceived benefits and perceived barriers. Self-efficacy was not included as a construct in this study.
Exploratory Constructs

Survey items regarding experience, risk behaviors, and social history were included to investigate if helmet use was related to experience and risk behaviors. The majority of respondents had experienced a “close call” or nearly crashed (72.4%) while just under half had experienced a minor motorcycle crash (47.4%). Many reported they knew a friend who had experienced a crash (68.4%) and over one third of respondents had a friend who had died in a crash (35.5%). About one third of respondents had family members who experienced a crash (32.9%), but fewer family members had died in a crash (5.3%). These scores are reported in Table 7.
Table 8 includes the Pearson r correlations for these exploratory constructs, significant items are bold. 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, affiliation in organizations, or any life experience.
Table 8

*Correlations between Exploratory Constructs and Always-Helmet Use*

<table>
<thead>
<tr>
<th>Item</th>
<th>Pearson’s r</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helmet as a passenger</td>
<td>.822</td>
<td>.000</td>
</tr>
<tr>
<td>Protective gear</td>
<td>.509</td>
<td>.000</td>
</tr>
<tr>
<td>Seatbelt in other vehicles</td>
<td>.353</td>
<td>.002</td>
</tr>
<tr>
<td>Organization affiliation</td>
<td>.138</td>
<td>.235</td>
</tr>
<tr>
<td>Motorcycle training</td>
<td>.168</td>
<td>.148</td>
</tr>
<tr>
<td>MI motorcycle endorsement</td>
<td>-.095</td>
<td>.415</td>
</tr>
<tr>
<td>Experience level</td>
<td>-.234</td>
<td>.042</td>
</tr>
<tr>
<td>Minor motorcycle crash</td>
<td>.061</td>
<td>.602</td>
</tr>
<tr>
<td>Major motorcycle crash</td>
<td>-.075</td>
<td>.522</td>
</tr>
<tr>
<td>“Close call” or nearly crashed</td>
<td>-.085</td>
<td>.466</td>
</tr>
<tr>
<td>Witnessed a crash</td>
<td>-.049</td>
<td>.677</td>
</tr>
<tr>
<td>Friend had a crash</td>
<td>.000</td>
<td>1.00</td>
</tr>
<tr>
<td>Friend died from a crash</td>
<td>-.079</td>
<td>.496</td>
</tr>
<tr>
<td>Family member had a crash</td>
<td>.016</td>
<td>.890</td>
</tr>
<tr>
<td>Family member died from a crash</td>
<td>-.136</td>
<td>.241</td>
</tr>
</tbody>
</table>
Discussion

This study’s aim was to identify differences in beliefs and attitudes between always-helmeted motorcyclists and not-always-helmeted motorcyclists, detect correlations between Health Belief Model constructs, and attempt to identify areas for injury prevention messaging.

Hypothesis Testing

The null hypothesis for this study was that helmet use would not be influenced by any Health Belief Model constructs. The alternative hypotheses of this study were guided by relationships between Health Belief Model constructs.

The null hypothesis was tested by a Kruskal Wallis analysis for each construct and sub-construct. Of the 16 analyses conducted, only four were found to have insignificant differences between helmet groups. This finding rejects the null hypothesis. Perceived benefits of helmet use was the only construct without significant differences between groups. Additionally, there were no significant differences in perceived severity of injury and tangible benefits. It is also worth noting that while the cues to action scores were all significantly different between helmet groups, the sub-constructs had the lowest inter-item reliability, with Social Cues not surpassing a .60 Chronbach alpha level. Thus, the reliability of this component in the study may be decreased but does not negate the overall rejection of the null hypothesis.

The first alternative hypothesis was tested with Spearman's correlation, which detected very weak correlations; there were no significant differences between always-helmeted and not-always-helmeted respondents for this alternative hypothesis. The rho statistics of .019 and -.135 for always-helmeted and not-always-helmeted respondents,
respectively, rejects the first alternative hypothesis. Due to the insignificant differences within the tested constructs’ components, including perceived severity and perceived benefits, it was unlikely that a significant finding would come of construct testing in this alternative hypothesis.

For the second alternative hypothesis, always-helmet use responses regarding perceived threat and perceived barriers significantly correlated positively ($\rho = .351, p = .007$), and the not-always-helmeted group had an insignificant weak negative correlation. This result determined a contradiction as it was predicted to have a negative correlation in always-helmet users. Thus, the Spearman's test statistically rejects the second alternative hypothesis as a one-tailed test however, there are some practical results we can extract from this hypothesis testing. From the scatterplot, there are some areas within both helmet groups’ plotted data that could be visually perceived as positive and negative correlation trends, but that should be largely attributed to the small sample size and uneven distributions. It is also known that the two of the three constructs being tested were significantly different between helmet groups (perceived susceptibility and perceived barriers), which reinforces the rejection of the null hypothesis, and encourages integration of self-efficacy items to explain perceived expectations in future motorcycle helmet perception studies.

Overall, the present study found distinct differences between helmet use groups and their perceptions of motorcycling safety and helmets. However, testing the alternative hypotheses with Spearman's $\rho$ detected weak predictions of helmet use with the constructs designated. This was largely due to the fact that the differences in “perceived severity” between groups were not statistically significant, a major component of alternative hypotheses I and II. The present study took an alternative approach to the traditional structure
of the 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 scores when tested between helmet groups were not significantly different. 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 Health Belief Model, and similar studies should follow the model as it is intended. The limitations of methodology, sample size, and resulting statistical limitations also likely contributed to the findings.

**Applying Themes to Literature and Practice**

From the present study, we can deduct that health practitioners have been successful in communicating the severity of injury and the effectiveness of helmets. 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. The following themes incorporate the findings with strategies for increased helmet use and awareness.

**Strong sense of loyalty.** For those who self-reported motorcycle organization affiliation, many included the Harley Owners Group as well as national and Detroit region clubs for BMW motorcycle owners. As Tunnicliff et al. (2011) found, motorcyclists may view other motorcyclists with certain biases based on the type of bike, brand of bike, and their purpose for riding. In the case of the present study, the respondents were assumed to view social/recreational motorcycling as favorable, as they were mostly attendees of events...
and/or participants of social media pages that promote and share events. Health promotion professionals may advocate for motorcycling organization leaders to mandate helmet use for participation during group rides/poker runs. Motorcyclists that do not-always wear a helmet will do so if it is required (McCartt et al., 2011; Voight, 2013). Additionally, seeing a large group of motorcyclists all wearing helmets sets a precedent and a social norm for current and potential motorcyclists. A challenge presents itself in reaching motorcyclists who ride individually and/or perhaps only for commuting, but serves an important sub-population of motorists that has not been frequently studied in the United States.

**Perceptions of helmet use and safety.** The present study’s respondents were in agreement that motorcycling is an inherently dangerous activity (82.4% always-helmeted and 73.6% not-always-helmeted), viewed helmets as effective (89.5% always and 73.6% not-always), and believe helmets can prevent serious head injuries (87.8% always and 78.9% not-always). This is in agreement with previous findings by McCartt et al. (2010), where 76% of participants thought that helmets kept riders safe, and by Viet Hang et al. (2008), where 95% believed helmets prevent injury. 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. Most respondents also perceived those who wear helmets as safe and responsible. (87.7% always and 68.4% not-always). Respondents agreed that a head injury from a motorcycle crash would seriously affect social relationships (93% always and 94.7% not-always), family relationships (86% always and 84.2% not-always), and work or school functioning (93% always and 94.7% not-always). 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 motorist licensing departments.

**Barriers.** About one third of both groups identified heat as a physical barrier to helmet use (31.6% of always-helmet users and 36.8% not-always-helmet users) but greatly differed in agreement about helmets being uncomfortable (15.8% always vs. 68.4% not-always). The most common physical complaint of helmet use was general discomfort in the 2012 study of European motorcyclists (Orsi et al., 2012) however, of those participants, over 70% did not have properly fitted helmets. Perhaps a similar issue could be detected in current populations who are find helmets unfavorable. Media campaigns for proper fitting child car-seats are widespread from the National Highway Traffic Safety Administration (NHTSA, 2016) and the organization provides fitting guidelines (NHTSA, 2004), but greater advocacy is needed for motorcycle safety gear. As predicted, the cost of helmets was not a notable barrier for this population (8.8% always and 20.8% not-always).

Total intangible barrier scores were significantly different between groups, but examining item trends showed that perceived barriers were still deemed quite low. Few respondents found wearing a helmet to look stupid (3.5% always and 15.8% not-always). Only not-always-helmeted respondents agreed to the statement that wearing a helmet is embarrassing (15.6%); none of the always-helmet users agreed with this statement. In Ranney et al.’s 2010 study infrequent helmet users from Rhode Island respondents identified “looking uncool” as the main emotional barrier to helmet use.

**Cues to action.** The cues to action items had the lowest overall inter-item reliability. Most respondents had friends who wear helmets (94.8% always-helmeted and 89.5% not-always-helmeted), but always-helmet users were more in agreement that their friends that
ride (79% vs. 36.8%), and family members (82.5% and 31.6%) that ride would want them to wear a helmet. However, it is unclear if this influence affects helmet use, as there was very little agreement (1.8% and 5.3%) to the statement "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." These social cues reflect previous studies, such as the higher rates of information seeking and use of protective gear for those in motorcycling organizations (de Rome et al., 2011), as well Tunnicliff et al.’s (2011) qualitative study of motorcyclists, who rated group belonging as a very high influence for helmet decision making.

More always-helmet users keep their helmet in a visible place (71.9% always vs. 31.6% not-always), while about two-thirds of both groups keep helmet on or near motorcycle (68.5% always vs. 63.2% not-always). Traditional media was seen more by always-helmet users (85.9 vs. 57.9% not-always) as well as greater recall of a helmet use promotion event (63.2% always vs. 42% not-always). Fewer reported seeing merchandising promotions for helmets (21% always vs. 15.8% not-always), and slightly more always-helmet users received helmet recommendations from their doctor (43.9% always vs. 31.6% not-always).

Social media seems to be a promising venue for developing pro-helmet messages as it can be tailored for a self-selecting group. Another benefit of an online presence includes the potential for anonymity, where others can their experiences and stories to a variety of audiences. All interventions and messaging should follow the Centers for Disease Control and Prevention’s guide for social media use (CDC: Electronic Media Branch, 2014). From the cues to action items examined in the present study, interventions targeting influential non-motorcyclists may also be productive, such as during preventative care visits with physicians. Continued and increased use of easy to remember acronyms and phrases that
remind and encourage helmet use and other protective features such as the phrase “All the gear, all the time” (MSF, 2014) can be incorporated into digital messages, training sessions, medical visits, and even merchandise sales.

Political influence. Only about 8% of respondents identified affiliation with motorcycle advocacy groups. Of those responses, two individuals identified American Bikers Aimed Towards Education (ABATE), an organization with that advocates for proper safety and training, and five individuals identified the American Motorcyclist Association (AMA), an organization that advocates for individual’s freedom of choice to wear or not wear a helmet. Both organizations have been considered to be “pro-choice” in the helmet law debate. From this small sample, it can be inferred that this population may not be influenced as strongly by helmet advocacy groups as other groups such as social organizations and interpersonal relationships. However, further research is encouraged to identify how beliefs may change based on policy status and vice versa with advocacy campaigns.

Risk-taking behaviors. Those who identified with wearing always-helmets on their own motorcycle strongly correlated with other prevention strategies such as wearing helmets as a passenger, wearing protective gear, and using seatbelts. Participants in this study differed by helmet use according to their perception of personal risk, but perceptions of injury severity were more closely in agreement. This finding is similar to the findings of Rutter, Quine and Alberty (1998) in which participants identified themselves at low perceived risk of injury, but anticipated moderately severe consequences if injury were to occur. At the individual level, health specialists can utilize motivational interviewing as a means to develop strategies to increase risk reduction behaviors.
Greater self-reported motorcycling experience was significantly correlated with not wearing a helmet. As Harrison and Christie (2005) found, greater experience on the road statistically decreases rates of crash risks. 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 as significant differences in perceptions of risk exemption were also found in the present study between helmet groups. Health education specialists can encourage sponsorship of free or low cost trainings in their communities and develop public health messages tailored towards older/experienced riders. Helmet use, training, and safety measures are critical prevention tools as our population ages and motorcycling increases as a recreational activity.

Limitations

The two major limitations in this present study were the method of sampling and the sample collected. Other limitations included social biases.

Methodology. Self-selected convenience sampling was utilized to reach the largest amount of motorcyclists. Previous concepts of this study intended to collect responses through a statewide or district database but efforts were unsuccessful in obtaining such a database for Michigan motorcyclists. Wayne State University Traffic Research Group’s 2013 study observed Michigan motorcyclists on the road and at events within the state. It was an assumption the present study’s sample of motorcyclists who participated in motorcycle events would align with the helmet usage of those observed at previous motorcycling events in said 2013 study, and these percentages were used to calculate the power analysis for the present study. The present study had a lower sample size, but a greater percentage of always-helmet use participants than the 2013 study and was non-representative of the expected sample. The two recruitment strategies sought participants who attend or plan to attend
motorcycling events in southeastern Michigan. A majority of responses in this study were collected through the social media recruitment method rather than the event recruitment, and the social media method also broadened the scope of Michigan residents able to participate, with approximately 10% of responses representing regions outside of Southeast Michigan.

The instrument was modified from a study examining helmet use in college age bicyclists (Appendix D). In developing the current instrument, several items were omitted and edited (Appendix F), but inter-item reliability was expected to remain near the previous study’s alpha levels. This held true for most of the sub-constructs, save for the cues to action. With the positively-skewed age representation in the present study, it is possible that the original questions were intended for a younger audience and were not received as well.

**Sample size.** The sample size met the minimum requirement, but was quite modest, and therefore, results cannot be generalized to the general population of motorcyclists. A particular downfall is that the data analysis is restricted. More robust testing, such as using multiple regression analysis, could be applied to a larger sample however, there is not enough data compared to the amount of variables in the present study. The proportion of always-helmet users and not-always-helmet users also created a non-representative distribution in both groups, particularly disruptive in the not-always-helmeted ($n = 19$) where a greater range of scores within the small sample lead to outliers. While equal group sizes would not reflect the population of motorcyclists, having nearly three times as many always-helmeted respondents to not-always-helmeted respondents also limited the types of nonparametric analysis that could be conducted.

In generous terms, the study’s recruitment could have reached as many as 3,000 eligible participants through the social media and in-person recruitment methods. As Ranney
et al. (2010) discussed, other self-reported motorcycle behavior studies have resulted in low response rates, and in the present study, it is implausible to determine what percentage of attendees of events and/or members of social media sites were invited but chose not to participate without violating confidentiality.

**Other biases.** Despite the survey being anonymous, it is possible that social desirability bias played a role when answering the dichotomous item of always or not-always wearing a helmet. Additionally, those with stronger opinions about helmets may have been more inclined to respond than those who are ambivalent. The methodology of the study also contributed to a bias towards those with basic computer access and literacy.

**Suggestions for Future Studies**

The present study serves as a starting point for injury prevention professionals as we navigate the consequences of a decreased helmet law. Were the study to be repeated, a methodology that incorporates in-person data collection and using a shorter survey may be beneficial to increase survey response rates. There is no shortage of finding motorcyclists in a particular area through events, trades and swaps, and community bike nights. However, the interpersonal response by motorcyclists at events was mixed in response to the distribution of the survey cards as recruitment, particularity towards a young female non-rider. Having event organizer buy-in to the present study was the most successful component for in-person recruitment, as the organizers were familiar with the attendees and endorsed participation. The present study found that the social media component had a significantly higher rate of responses as well as rate of sharing to other motorcyclists. The *Southwest Michigan Motorcycle Events and Bike Nights* Facebook page is quite active even during the off-season and provides activities and interactions between members that may not have otherwise
existed before the digital age. Further research utilizing social media may offer insight to the ways health messaging is created and received beyond traditional routes.

The original concept for the present study was to recruit recent attendees from motorcycle safety training sites. These trainings are often sponsored by the state and can be taken at community colleges and other centralized locations. Institutional policies such as the Family Educational Rights and Privacy Act (FERPA) for those enrolled in courses taught at community colleges makes accessing participants difficult, and those who attend the classes may not choose to receive endorsement or even ride at all. If these issues could be resolved by partnerships and research design strategies, this might be an important target population to study. A statewide registry of motorcyclists is another resource that is recommended, but was not explicitly accessible in the state of Michigan within the scope and timeframe of the present study. Such a database may have resolved some gaps in sample size, and demographic and geographic distributions.

The sample was reflective of other studies in terms of demographics (McCartt et al., 2011; Mangus et al., 2004; Rutter, Quine, & Alberty, 1998; Tunincliff et al., 2012). The sex of participants was mostly male and positively skewed in age. A large majority of respondents identified recreation as their primary reason for motorcycling, which was positively correlated with older age, and may be related to more free time and flexible income compared to younger age groups. A larger sample is necessary to examine gender distributions, as female riders are underrepresented in the current literature. The present study also elected to approach the demographic profile lightly and did not include traditional variables such as race, income level marital status, or education level. These variables may have 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.

A major influence to begin the present study was the recent helmet law policy changes in Michigan. The policy changes may or may not be a confounding factor for the sampled motorcyclists’ helmet decisions however, this was not the main aim of the study and policy items were not included. To our knowledge this is the first Michigan specific study that considers the beliefs and behaviors of living motorcyclists, rather than utilizing observations, or hospital/crash scene data. Without self-reported beliefs and behavior data from Michigan motorcyclists before the policy changed, there is not an accurate baseline to compare the current study.

**Conclusion of Results and Discussion**

The present study examined a small sample of southeast Michigan motorcyclists and analyzed Health Belief Model constructs with self-reported helmet use. Most respondents were male, over 40 years old, 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. The study found significant differences in perceptions of HBM constructs between helmet use groups, rejecting the null hypothesis. Alternative hypotheses, which utilized a composite score of perceived susceptibility and perceived severity of injury, labeled “Perceived Threat,” had mixed findings, as the perceptions of severity of injury were insignificantly different. While “Perceived Expectations,” a composite score of perceived benefits and perceived barriers, was not considered within the alternative hypotheses, it is worth noting that differences in this score was insignificant between helmet groups as well. Risk reduction behaviors such as protective gear use and seatbelt use in cars were
significantly positively correlated to helmet use. Experience level was significantly negatively correlated to helmet use.

Helmet use will continue to be a hotly debated topic in medical and political realms, but with greater understanding of the behaviors and beliefs of motorcyclists, we can improve programs and messages to save lives and taxpayer money. Health promotion professionals can utilize behavior change strategies through community partnerships, social media, and motivational interviewing to improve helmet use rates for all riders regardless of policy status. Further research is needed as health promotion professionals navigate the realities of decreased helmet laws.
References


dissatisfaction. *Accident Analysis and Prevention, 44*, 111-117.


Ranney, M. L. Mello, M.J., Baird, J.B., Chai, P.R., & Clark, M.A. (November 2010). Correlates of motorcycle helmet use among recent graduates of a motorcycle training course. *Accident Analysis & Prevention, 42* (6), 2057–2062


doi:10.1080/07448481.2010.483702


Appendix

A: IRB Exemption Letter

B: Informed Consent

C: Michigan Motorcycle Helmet Use Survey (MMHUS)

D: Bicycle Helmet Use Attitude Scale (BHAS), Ross et al, 2010

E: Health Belief Model Item Scale

F: Rationale for BHAS Item Modifications and Omissions for the MMHUS

G: Participation and Permissions Correspondence

H: In-Person Recruitment Materials

I: Facebook Recruitment Text

J: Gas Card Drawing Form Submission Text

K: Gas Card Recipient Email Text
UHSRC Determination: EXEMPT

DATE: August 16, 2015

TO: Emily VanWormer
Eastern Michigan University

Re: UHSRC: # 660960-1
Category: Exempt category 2
Approval Date: August 16, 2015

Title: Applying the health belief model to Michigan motorcyclist helmet use

Your research project, entitled Applying the health belief model to Michigan motorcyclist helmet use, has been determined Exempt in accordance with federal regulation 45 CFR 46.102. UHSRC policy states that you, as the Principal Investigator, are responsible for protecting the rights and welfare of your research subjects and conducting your research as described in your protocol.

Renewals: Exempt protocols do not need to be renewed. When the project is completed, please submit the Human Subjects Study Completion Form (access through IRBNet on the UHSRC website).

Modifications: You may make minor changes (e.g., study staff changes, sample size changes, contact information changes, etc.) without submitting for review. However, if you plan to make changes that alter study design or any study instruments, you must submit a Human Subjects Approval Request Form and obtain approval prior to implementation. The form is available through IRBNet on the UHSRC website.

Problems: All major deviations from the reviewed protocol, unanticipated problems, adverse events, subject complaints, or other problems that may increase the risk to human subjects or change the category of review must be reported to the UHSRC via an Event Report form, available through IRBNet on the UHSRC website.

Follow-up: If your Exempt project is not completed and closed after three years, the UHSRC office will contact you regarding the status of the project.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,
April Nelson, MS
Research Compliance Administrator
University Human Subjects Review Committee
UHSRC Determination: EXEMPT

DATE: August 16, 2015

TO: Emily VanWormer
 Eastern Michigan University

Re: UHSRC: # 660960-4
 Category: Exempt category 2
 Approval Date: November 24, 2015

Title: Applying the health belief model to Michigan motorcyclist helmet use

Your research project, entitled Applying the health belief model to Michigan motorcyclist helmet use, has been determined Exempt in accordance with federal regulation 45 CFR 46.102. UHSRC policy states that you, as the Principal Investigator, are responsible for protecting the rights and welfare of your research subjects and conducting your research as described in your protocol.

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Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,
April Nelson, MS
Research Compliance Administrator
University Human Subjects Review Committee
Appendix B: Informed Consent

**Purpose:** The purpose of this study is to explore what people think about using a motorcycle helmet and how they might use a helmet.

**Funding:** This study is not funded.

**Summary:** You will be asked to fill out an online survey. It should take no more than 20 minutes to finish. The survey questions will be about the pros and cons of helmet use. It will also ask what you think about your risk of injury, and what might influence you to wear or not wear a helmet. The survey will also ask about your motorcycle use, if you use a helmet and/or other gear, and your riding experience.

**Risks:** The survey is anonymous, so your responses will not identify you. However, some of the survey questions are somewhat personal. Questions might make you feel uncomfortable. You do not have to answer any questions that you do not want to answer.

**Benefits:** There is no direct benefit to you. Benefits to society include learning about motorcycle helmet use.

**Confidentiality:** We will protect your responses by using a password-protected computer file. We will not collect any identifiable information so that you cannot be identified. We may share the group summary data from the study with other students and teachers outside of EMU. Individual responses will not be shared. The results of this research may be published or used for teaching.

**Incentive:** After finishing the survey you may enter a drawing for a $20 gas card. This is a separate survey webpage. It will collect your first name and email. If your name is drawn we will contact you by email. Your contact information will not be linked to your survey. All contact information will be deleted after the drawing.

**Contact Information:** Emily VanWormer is the graduate student in charge of this study. You may email Emily at evanwor1@emich.edu or call 419-699-4495. You can also contact Emily’s adviser, Dr. Kathleen Conley. Her email is kconley@emich.edu, or call 734-487-0090. The EMU Research Compliance Office also is a resource about your rights as a subject. You can contact the office at human.subjects@emich.edu or by phone at 734-487-3090.

**Participation by Choice:** It is your choice to be in this study. You may stop at any time with no penalty. If you leave the survey, the information you shared will be kept confidential. The data is being collected anonymously.

**Eligibility:** Participants eligible for the survey are at least 18 years old and live in the state of Michigan.

**Statement of Consent:** I have read this form. I meet eligibility requirements. I have had a chance to ask questions. By clicking “continue”, I consent to participate in this research. [Continue]
Appendix C: Michigan Motorcycle Helmet Use Survey (MMHUS)

This study will explore motorcyclists’ thoughts about helmets and their use. This research is for a health education master’s thesis at Eastern Michigan University (EMU). Please read through the consent form. There are four sections to this survey. Answer all questions to the best of your ability. At the end, there is a link to a $20 gas card drawing. You may complete this survey and enter the drawing only once.

To begin, please share some of your motorcycling behaviors.

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 (three quarters)
- Half helmet
- No helmet
- other__________________

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 rarely wear any protective gear
- I wear full protective gear almost every time I ride
- I never wear any protective gear
- I wear some protective gear, but not every item listed
The statements below are about what you think about using a motorcycle helmet. Choose the box that best fits your opinion. [Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree] Please read each statement before choosing an answer. There is no right or wrong answer. If the statement does not apply to you, please select ‘no opinion’.

- I do not go fast enough to need head protection in a crash.
- I feel that helmets are unnecessary for very short rides.
- Being an adult who has been riding for years, I can easily avoid a crash when riding.
- Helmets are more important for those who ride infrequently.
- Motorcycle helmets are more important for those who ride long distances.
- Generally speaking, I believe that motorcycling can be a dangerous activity.
- When I’m riding a motorcycle, I am at risk of being injured by motor vehicles.
- If I had an accident while riding and I hit my head, I would be likely to suffer brain damage.
- There is a good chance that I could get hurt riding a motorcycle.
- If I injured my head while riding my motorcycle, it could seriously affect my social life with my friends.
- If I injured my head while riding my motorcycle, it could seriously affect my ability to function at work/school.
- If I injured my head while riding my motorcycle, it could seriously affect my relationships with my family members.
- I feel unsafe riding without a helmet.
- I feel guilty riding without a helmet.
- Wearing a helmet would make me feel less anxious when I ride.
- When I wear helmets I feel more aware of the potential dangers of motorcycling.
- Wearing a helmet makes me more likely to ‘take care’ when I ride.
- In general, I think people who choose to wear helmets are being safe and responsible.
- Helmets are effective at reducing my risk of injury.
- In the event of a crash, a helmet would protect my head.
- I believe that wearing a helmet can prevent a serious head injury if I have a motorcycle crash.
- If I had a crash, wearing a helmet could save me money by avoiding expensive medical treatments.
- I would feel embarrassed wearing a helmet.
- I feel foolish wearing a helmet just to ride around town.
- Quite frankly, wearing a helmet looks stupid.
- Wearing a helmet makes me look foolish if no one else is wearing one.
- Wearing a helmet makes me too hot.
- A helmet is uncomfortable.
- The cost of a helmet is generally more than they’re worth.
- I have several friends that routinely wear helmets when they ride.
- I keep my helmet in a visible place so I do not forget to wear it.
- I usually keep my helmet on or near my motorcycle.
- 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.
- My friends that ride think I should wear a helmet.
- My family members that ride think that I should wear a helmet.
- I recall seeing TV commercials, billboard ads or posters about the importance of wearing a helmet during the past year.
- During the past year I have received advice from my doctor about wearing a helmet while motorcycling.
- During the past year I recall seeing advertisements or flyers advertising helmet sales/discounts.
- During the past year I recall some form of a helmet use promotion event in my community.
Finally, we would like to know a little more about your lifestyle and experience.

What is your age?

[pull down menu: under 18-18–99]

What is your sex?

Male    Female    Prefer not to share

What county do you live in?

[pull down menu: *all 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    Advanced

Please check all the situations that have happened to you.

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? If so, please list them here: _______________________________________________________

How did you find this survey?
Facebook Post    In-Person Event`    Both Event and Facebook    Other

Have you completed this survey before?
Yes    No
Thank you for taking this survey. It will help us learn more about motorcycle helmet use in Michigan.

Emily VanWormer is the graduate student in charge of this study. You may email Emily at evanwor1@emich.edu or call 419-699-4495. You can also contact Emily’s adviser, Dr. Kathleen Conley. Her email is kconley@emich.edu or call 734-487-0090.

If you have been in a crash or witnessed a crash, you may be feeling sad, fearful or numb. Help is available from the National Alliance of Mental Health. Their helpline is offered Mon-Fri 10 am – 6 pm EST. The number is 800-950-NAMI(6264). Their email is info@nami.org. They can connect you to local resources and more information.

Would you like to enter the drawing for one of five $20 gas cards? If so, please click here. This drawing will not be linked to your survey data. It will be saved in a separate, password protected form.

You can quit the survey by closing your browser.

Thank you!
## Appendix D: Bicycle Helmet Attitude Scale (BHAS), Ross et al., 2010

### TABLE 1. Health Belief Model Subscales: Bicycle Helmet Attitude Items and Factor Loadings

<table>
<thead>
<tr>
<th>Factor</th>
<th>F1</th>
<th>F2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived Exemption From Harm</strong> (α = .79, M = 3.2, SD = 1.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I do not go fast enough to need head protection in a crash.</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td>2. I feel that helmets are unnecessary for very short rides.</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>3. Being an adult who has been riding for years, I can easily avoid an accident when riding.</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>4. Bicycle helmets are less important for those who ride their bikes infrequently.</td>
<td>.71</td>
<td></td>
</tr>
<tr>
<td>5. Bicycle helmets are more important for those who ride their bikes long distances.</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>6. Since I’m not racing or doing any bike stunts, I don’t really need a helmet.</td>
<td>.73</td>
<td></td>
</tr>
<tr>
<td><strong>Perceived Danger of Cycling</strong> (α = .80, M = 4.3, SD = .84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. When I’m bicycling, I am at risk of being injured by other bicyclists.</td>
<td>.69</td>
<td></td>
</tr>
<tr>
<td>2. When I’m bicycling, I am at risk of being injured by motor vehicles.</td>
<td>.73</td>
<td></td>
</tr>
<tr>
<td>3. If I had an accident while riding to school or work and hit my head, I would be likely to suffer brain damage.</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>4. Bicycling is dangerous on slippery/wet roads.</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>5. There is a good chance that I could get hurt while riding my bicycle.</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td>6. Generally speaking, I believe that bicycling in the street is a dangerous activity.</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td><strong>Perceived Severity of Harm</strong> (α = .80, M = 4.7, SD = .99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. If I injured my head while riding my bike, it could seriously affect my social life with my friends.</td>
<td>.66</td>
<td></td>
</tr>
<tr>
<td>2. If I injured my head while riding my bike, it could seriously affect my relationships with my family members.</td>
<td>.69</td>
<td></td>
</tr>
<tr>
<td>3. If I injured my head while riding my bike, it could seriously affect my ability to function at school.</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>4. If I injured my head while riding my bike, it could seriously affect my ability to function at work.</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td><strong>Perceived Benefits</strong> (α = .86, M = 3.0, SD = 1.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I feel unsafe bicycling without a helmet.</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>2. I feel guilty bicycling without a helmet.</td>
<td>.77</td>
<td></td>
</tr>
<tr>
<td>3. Wearing a helmet would make me feel less anxious when I ride a bike.</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>4. I think it is my obligation to keep myself safe for the people who care about me by wearing a helmet when I ride.</td>
<td>.73</td>
<td></td>
</tr>
<tr>
<td>5. Wearing a helmet while bicycling makes me feel safer.</td>
<td>.69</td>
<td></td>
</tr>
<tr>
<td>6. When I wear helmets I feel more aware of the potential dangers of bicycling.</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>7. Wearing a helmet makes me more likely to “take care” when I ride.</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td><strong>Safety Benefits</strong> (α = .84, M = 4.9, SD = .89)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I general, I think people who choose to wear helmets are being safe and responsible.</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>2. Helmets are effective at reducing my risk of injury during a bicycle-related accident.</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>3. The event of an accident, a helmet would protect my head.</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td>4. I believe that wearing a helmet can prevent a serious head injury if I have a bicycle accident.</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td>5. In the event of an accident, wearing a helmet could save me money by avoiding expensive medical treatment.</td>
<td>.76</td>
<td></td>
</tr>
<tr>
<td><strong>Perceived Barriers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I would feel embarrassed wearing a bicycle helmet.</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>2. As an adult, I feel foolish wearing a helmet just to ride around town.</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>3. Wearing a helmet makes me look foolish if no one else is wearing one.</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>4. Quite frankly, wearing a helmet looks stupid.</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>5. Wearing a helmet is too hot.</td>
<td>.56</td>
<td>.32</td>
</tr>
<tr>
<td>6. Wearing a bike helmet strap pinches/would pinch my neck or sometimes irritates my skin.</td>
<td>.52</td>
<td></td>
</tr>
<tr>
<td>7. A bike helmet strap is uncomfortable, and it feels like I’m being choked.</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td><strong>Cost Barriers</strong> (α = .75, M = 2.9, SD = .90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. The cost of helmets is generally more than they are worth.</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>2. The cost of buying a helmet would affect whether I wore one or not.</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>3. The best helmets (that look the coolest and are most comfortable) are too expensive for me to buy.</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>4. I would not want to spend money to buy a bicycle helmet.</td>
<td>.35</td>
<td>.59</td>
</tr>
<tr>
<td>5. A helmet is not a worthwhile way to spend my money.</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>6. A bicycle helmet is not worth the cost.</td>
<td>.31</td>
<td>.71</td>
</tr>
<tr>
<td>7. I believe that bicycle helmets are over priced.</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td>Eigen values</td>
<td>4.62</td>
<td>2.30</td>
</tr>
<tr>
<td><strong>Personal Vanity and Discomfort Barriers</strong> (α = .87, M = 3.8, SD = 1.15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I would feel embarrassed wearing a bicycle helmet.</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>2. Wearing a helmet makes me look foolish if no one else is wearing one.</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>3. Quite frankly, wearing a helmet looks stupid.</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>4. Wearing a helmet is too hot.</td>
<td>.56</td>
<td>.32</td>
</tr>
<tr>
<td>5. A bike helmet strap is uncomfortable, and it feels like I’m being choked.</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td><strong>Cost Barriers</strong> (α = .75, M = 2.9, SD = .90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. The cost of helmets is generally more than they are worth.</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>2. The cost of buying a helmet would affect whether I wore one or not.</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>3. The best helmets (that look the coolest and are most comfortable) are too expensive for me to buy.</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>4. I would not want to spend money to buy a bicycle helmet.</td>
<td>.35</td>
<td>.59</td>
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<tr>
<td>5. A helmet is not a worthwhile way to spend my money.</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>6. A bicycle helmet is not worth the cost.</td>
<td>.31</td>
<td>.71</td>
</tr>
<tr>
<td>7. I believe that bicycle helmets are over priced.</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td>Eigen values</td>
<td>5.07</td>
<td>1.92</td>
</tr>
</tbody>
</table>
### TABLE 1. Health Belief Model Subscales: Bicycle Helmet Attitude Items and Factor Loadings (Continued)

<table>
<thead>
<tr>
<th></th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cues To Action</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Friends and Family (α = .80, M = 1.7, SD = .99)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I have several friends that routinely wear helmets when they ride.</td>
<td>.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I keep my helmet in a visible place so I won’t forget to wear it.”</td>
<td>.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I usually keep my helmet on or near my bike.</td>
<td>.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I know that I will feel bad if I don’t wear a helmet, because my parents or somebody that cares about me wants me to wear it.</td>
<td>.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. My friends think I should wear a helmet when riding my bike.</td>
<td>.69</td>
<td>.32</td>
<td></td>
</tr>
<tr>
<td>6. My close friends think I should wear a helmet when I ride my bike.</td>
<td>.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Parent Rules in Childhood (α = .90, M = 4.4, SD = 1.60)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. My parents made me wear a helmet when I was a child.</td>
<td>.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. My parents never insisted I wear a helmet. (recoded)</td>
<td>.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. My parents used to make me wear a helmet when I use a child.</td>
<td>.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. My parents encouraged me to wear a helmet during adolescence.</td>
<td>.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Media (α = .70, M = 1.7, SD = .77)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I recall seeing TV commercials, billboard ads or posters about the importance of wearing a helmet while bicycling during the past year.</td>
<td>.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. During the past year, I have received advice from my doctor about wearing a helmet while bicycling.</td>
<td>.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. During the past year, I have received a post card or other form of reminder in the mail from my doctor advising me to wear a helmet while bicycling.</td>
<td>.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. During the past year, I recall seeing magazine ads or newspaper flyers from sporting goods stores or bike shops advertising helmet sales/discounts.</td>
<td>.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. During the past year, I recall some form of helmet use promotion event on campus or in the community.</td>
<td>.71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Eigen values**

<table>
<thead>
<tr>
<th></th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.38</td>
<td>2.73</td>
<td>1.53</td>
</tr>
</tbody>
</table>

*Note. If you do not own a helmet or ride a bike, circle zero for nonapplicable.*
Appendix E: Health Belief Model Item Scale

Perceived Susceptibility: 9 items

Sub-construct: Risk Exemption (min. 5, max. 25)

- I do not go fast enough to need head protection in a crash.
- I feel that helmets are unnecessary for very short rides.
- Being an adult who has been riding for years, I can easily avoid a crash when riding.
- Helmets are more important for those who ride infrequently.
- Motorcycle helmets are more important for those who ride long distances.

Sub-construct: Perceived Danger (min. 4, max. 20)

- Generally speaking, I believe that motorcycling can be a dangerous activity.
- When I’m riding a motorcycle, I am at risk of being injured by motor vehicles.
- If I had an accident while riding and I hit my head, I would be likely to suffer brain damage.
- There is a good chance that I could get hurt riding a motorcycle.

Perceived Severity: 3 items (min. 3, max. 15)

- If I injured my head while riding my motorcycle, it could seriously affect my social life with my friends.
- If I injured my head while riding my motorcycle, it could seriously affect my ability to function at work/school.
If I injured my head while riding my motorcycle, it could seriously affect my relationships with my family members.

NOTE: Composite construct utilized in Alternative Hypotheses I and II, Perceived Threat of Injury, is a combined score of perceived susceptibility and perceived severity items. (min. 12, max. 60)

Perceived Benefits: 11 items

Sub-construct: Intangible Benefits (min. 6, max. 30)
- I feel unsafe riding without a helmet.
- I feel guilty riding without a helmet
- Wearing a helmet would make me feel less anxious when I ride.
- When I wear helmets I feel more aware of the potential dangers of motorcycling.
- Wearing a helmet makes me more likely to ‘take care’ when I ride.
- Wearing a helmet while riding makes me feel safer.

Sub-construct: Tangible Benefits (min. 5, max. 25)
- In general, I think people who choose to wear helmets are being safe and responsible.
- Helmets are effective at reducing my risk of injury.
- In the event of a crash, a helmet would protect my head.
- I believe that wearing a helmet can prevent a serious head injury if I have a motorcycle crash.
- If I had a crash, wearing a helmet could save me money by avoiding expensive medical treatments.
Perceived Barriers: 7 items

Sub-construct: Intangible Barriers (min. 4, max 20)
- I would feel embarrassed wearing a helmet.
- I feel foolish wearing a helmet just to ride around town.
- Quite frankly, wearing a helmet looks stupid.
- Wearing a helmet makes me look foolish if no one else is wearing one.

Sub-construct: Tangible Barriers (min. 3, max. 15)
- Wearing a helmet makes me too hot.
- A helmet is uncomfortable.
- The cost of a helmet is generally more than they’re worth.

Cues to Action: 11 items

Sub-construct: Visual Cues (min. 3, max 15)
- I have several friends that routinely wear helmets when they ride.
- I keep my helmet in a visible place so I do not forget to wear it.
- I usually keep my helmet on or near my motorcycle.

Sub-construct: Social Cues (min. 3, max 15)
- 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.
- My friends that ride think I should wear a helmet.
- My family members that ride think that I should wear a helmet.

Sub-construct: Media Cues (min. 5, max. 25)
- I recall seeing TV commercials, billboard ads or posters about the importance of wearing a helmet during the past year.
• During the past year I have received advice from my doctor about wearing a helmet while motorcycling.

• During the past year I recall receiving a post card or other form of reminder from my doctor advising me to wear a helmet.

• During the past year I recall seeing advertisements or flyers advertising helmet sales/discounts.

• During the past year I recall some form of a helmet use promotion event in my community.
Appendix F: Rationale for BHAS Item Modifications and Omissions for the MMHUS

<table>
<thead>
<tr>
<th>HBM Construct</th>
<th>BHAS Item</th>
<th>MMHUS Item</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived Susceptibility: Danger of Cycling</strong></td>
<td>When I am [bicycling] I am at risk of being injured by other [bicyclists]</td>
<td>Omitted</td>
<td>Motorcycle with motorcycle collisions are less common due to less motorcycles on the road, and typically less severe than the risks of a motorcycle and motor vehicle collision.</td>
</tr>
<tr>
<td></td>
<td>[Bicycling] is dangerous on slippery/wet roads.</td>
<td>Omitted</td>
<td>This survey is not asking any other questions about the riding conditions so this item is not necessary.</td>
</tr>
<tr>
<td></td>
<td>Generally speaking I believe that [bicycling] in the street is a dangerous activity</td>
<td>Generally speaking I believe that motorcycling is a dangerous activity</td>
<td>Motorcycles are mostly rode only on streets, so the item was modified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HBM Construct</th>
<th>BHAS Item</th>
<th>MMHUS Item</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived Severity of Harm</strong></td>
<td>If I injured my head while riding my [bike], it could seriously affect my ability to function at school.</td>
<td>Omitted</td>
<td>Combined work and school items “If I injured my head while riding my motorcycle, it could seriously affect my ability to function at work/school” since there is a wider spectrum of ages being recruited.</td>
</tr>
<tr>
<td>HBM Construct</td>
<td>BHAS Item</td>
<td>MMHUS Item</td>
<td>Rationale</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Perceived Benefits: Emotional</td>
<td>I think it is my obligation to keep myself safe for the people who care about me by wearing a helmet when I ride.</td>
<td>Omitted</td>
<td>This item is long-winded, hard to read, and sounds more like a cue to action than a benefit of helmet use.</td>
</tr>
<tr>
<td>Perceived Benefits: Safety</td>
<td>Helmets are effective at reducing my risk of injury during a bicycle related accident.</td>
<td>Helmets are effective at reducing my risk of injury.</td>
<td>The item was modified to reflect a more concise statement.</td>
</tr>
<tr>
<td>HBM Construct</td>
<td>BHAS Item</td>
<td>MMHUS Item</td>
<td>Rationale</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td><strong>Perceived Barriers: Personal Vanity and Discomfort</strong></td>
<td>As an adult I feel foolish wearing a helmet just to ride around town.</td>
<td>I feel foolish wearing a helmet just to ride around town.</td>
<td>The targeted audience is only adults, while this original statement was intended for college students who may have been required to wear a helmet in youth.</td>
</tr>
<tr>
<td></td>
<td>Wearing a bike helmet strap pinches/ would pinch my neck or sometimes irritates my skin.</td>
<td>Omitted</td>
<td>This item was deleted as it can be answered with the following modified item.</td>
</tr>
<tr>
<td></td>
<td>A [bike] helmet strap is uncomfortable and it feels like I am being choked.</td>
<td>A helmet is uncomfortable.</td>
<td>This item was modified to reflect the many possible components of an improperly fitted helmet that can cause discomfort.</td>
</tr>
<tr>
<td><strong>Perceived Barriers: Cost</strong></td>
<td>The cost of a buying a helmet would affect whether I wore one or not.</td>
<td>Omitted</td>
<td>With this study focusing on motorcycles, a vehicle requiring licensure, upkeep, refueling, parts and modifications, cost of a helmet was not perceived by the researcher to be a significant barrier. The item which was included “The cost of a helmet is more than its worth” answers barriers regarding perceived safety effectiveness.</td>
</tr>
<tr>
<td>Perceived Barriers: Cost (Continued)</td>
<td>The best helmets (that look the coolest and are most comfortable) are too expensive for me to buy.</td>
<td>Omitted</td>
<td>““ “ “</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>I would not want to spend money to buy a bicycle helmet.</td>
<td>Omitted</td>
<td>““ “ “</td>
</tr>
<tr>
<td></td>
<td>A helmet is not a worthwhile way to spend my money.</td>
<td>Omitted</td>
<td>““ “ “</td>
</tr>
<tr>
<td></td>
<td>A [bicycle] helmet is not worth the cost.</td>
<td>Omitted</td>
<td>““ “ “</td>
</tr>
<tr>
<td></td>
<td>I believe that [bicycle] helmets are overpriced.</td>
<td>Omitted</td>
<td>““ “ “</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HBM Construct</th>
<th>BHAS Item</th>
<th>MMHUS Item</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cues to Action: Parent Rules in Childhood</td>
<td>My parents made me wear a helmet when I was a child.</td>
<td>Omitted</td>
<td>Most people do not begin motorcycling until their teen years, not as a child.</td>
</tr>
<tr>
<td></td>
<td>My parents never insisted I wear a helmet.</td>
<td>Omitted</td>
<td>“ “ “ “</td>
</tr>
<tr>
<td></td>
<td>My parents used to make me wear a helmet when I was a child.</td>
<td>Omitted</td>
<td>“ “ “ “</td>
</tr>
<tr>
<td></td>
<td>My parents encouraged me to wear a helmet during adolescence.</td>
<td>Omitted</td>
<td>“ “ “ “</td>
</tr>
</tbody>
</table>
Appendix G: Participation and Permissions Correspondence

- Email correspondence with Thomas Ross, author of the Bicycle Helmet Use Scale, for permission to adapt the scale for the present study.
- Email correspondence with Malisa Hinderliter (sales@caferacerypsi.com) for August 18th and September 15th Ypsilanti Bike Night, and Café Racer Facebook page.
- Email correspondence with Bubba from Bubba’s Tri-City Cycle, for participation at Birch Run Motorcycle Swap Meet on October 18th, 2015.
- Email correspondence with Malisa Hinderliter (sales@caferacerypsi.com) for November postings on Café Racer Facebook page.
- Facebook messenger correspondence with Jason Al, administrator for the Southeast Michigan Motorcycle Events and Bike Nights for November postings.
Bicycle Helmet Attitudes Scale

3 messages

Emily Van Wormer <evanwormer@emich.edu>  Mon, Mar 23, 2015 at 2:24 PM
To: ross@cofc.edu

Hello Dr. Ross,

My name is Emily VanWormer. I am a graduate student in the health education masters program at Eastern Michigan University. I am writing to you today to inquire about the use of the Bicycle Helmet Attitudes Scale for a research study I am hoping to pursue. My proposed study is examine Michigan motorcyclists' helmet use with health belief model constructs as the predictors to helmet use or non-use. I am hoping to adapt the HBM statements you and your team developed and apply them to motorcycle helmets in an abbreviated online survey.

Please let me know if you would allow this instrument to be used for this research, and if you have any other questions about my proposed study.

Also, I have a copy of the publication with the 57 item scale, however if you have other resources that would be helpful I would appreciate it.

Best wishes,
Emily VanWormer
Health Education student
Eastern Michigan University
410-890-4465
evanwormer@emich.edu | vanwormeremily@gmail.com

Ross, Thomas P <RossTP@cofc.edu>  Mon, Mar 23, 2015 at 2:33 PM
To: Emily Van Wormer <evanwormer@emich.edu>

Hi Emily,

Thank you for writing to ask about our scale! Yes, of course you have our permission. All we ask is that you cite us (our article) in any published or presented work and that you let us know what you find!

Thanks again, and best wishes for success in your research endeavors!

T. Ross

Thomas P. Ross, Ph.D.
Professor,
Department of Psychology
59 Coming Street, Room 3008
Charleston, SC 29403
Voice Mail: (843) 953-3339
Fax: (843) 953-7151
Email: ross@cofc.edu
Hi Malisa,

I wanted to confirm the dates that are written in my thesis proposal so we are all on the same page.

Ypsilanti Bike Night: August 18th & September 15th
Cafe Racer Facebook posting: August 24th & September 7th

I will email you the on the Monday of the weeks when the online postings should occur with a text that describes the study and the website. The exact day or time of that week when it is posted is at your discretion. No social media announcement is needed for the in-person recruitment when I pass out survey invitation cards.

Thanks so much for your help!

Emily
That is fine, you are in the calendar.

Malisa
Cafe Racer Ypsi
10 E. Cross St.
Ypsilanti, MI 48198
734.879.1201

On Thu, May 21, 2015 at 9:50 AM, Emily Van Wormer <evanwor1@emich.edu> wrote:
Hi Malisa,
I am encountering a few set-backs in the research process and I need to move my survey collection date to later in the summer. The methods are staying the same, but I would like to recruit on July 14th instead, and potentially also August 18th.

Would you please check about these dates?

Thanks so much,

Emily VanWormer

On Wed, May 6, 2015 at 10:43 AM, malisa hinderliter <sales@caferacerypsi.com> wrote:
Hi Emily,
You are very welcome. I am excited about your research and look forward to working with you. As I mentioned last night, I would be interested in seeing the survey and the final product. See you next month.

Malisa
Cafe Racer Ypsi
10 E. Cross St.
Ypsilanti, MI 48198
734.879.1201

On Tue, May 5, 2015 at 10:57 PM, Emily Van Wormer <evanwor1@emich.edu> wrote:
Hi Malisa,
Thanks so much for a great chat about my research today. Would you mind replying to this email as a paper-trail for my plan to recruit participants at 6/16 Depot Town Bike Night and utilization of the Cafe Racer facebook page?

Best wishes,
Emily VanWormer
419-699-4495
Hello!
My name is Emily. I'm a graduate student at Eastern Michigan University, studying community health education. My thesis is about motorcycle helmets: why and when riders wear or not wear them. I am collecting data through an online survey and I'm looking for a whole range of responses.
I was wondering if I could distribute cards that have the survey website on them at the swap this month. I only need a small amount of responses, but I know the time to catch motorcyclists is quickly going by as the weather gets colder.

You can take a look at the survey (and/or complete it yourself as a rider) at www.surveymonkey.com/r/MMHUS.

Hope to hear from you soon and thanks!

Emily VanWormer
Community Health Education
Eastern Michigan University
419-699-4495

---

Yes you will be able to do this at the event and looking forward to meeting you

Bubba
Tri City Cycle
804 S. Huron
Linwood, MI. 48634
989-697-5525
www.Bubbastricitycycle.com
bubba@bubbastricitycycle.com
www.facebook.com/bubbastraße
Motorcycle helmet survey- reposting

Emily VanWormer <evanwort@emich.edu>  Thu, Nov 19, 2015 at 8:12 PM
To: John Craddock <sales@caferacerypsi.com>

Hey Malisa,
I wanted to check in about my survey. I am still a little short of the responses needed, and I was wondering if you could post the link sometime next week on Facebook?
If it is okay, I will send you a revised 'script' to post. I'm also requesting that a post may occur before the new year if needed.

Let me know if you have any questions or feedback!

Thanks,
Emily VanWormer

Malisa hinderliter <sales@caferacerypsi.com>  Fri, Nov 20, 2015 at 11:36 AM
To: Emily VanWormer <evanwort@emich.edu>

Yes I can. Send it on Monday if possible.

Malisa
Cafe Racer Ypsi
10 E. Cross St.
Ypsilanti, MI 48198
734.879.1201
[Quoted text hidden]

Emily VanWormer <evanwort@emich.edu>  Sun, Nov 22, 2015 at 9:40 PM
To: Malisa hinderliter <sales@caferacerypsi.com>

Great thanks! I need to do an IRB extension request but that should be very prompt. Unlikely by the end of Monday though, I will let you know as soon as I get the approval.

Emily VanWormer
[Quoted text hidden]
Also a member of Southeast Michigan MOTORCYCLE EVENTS AND BIKE NIGHTS
Self-Employed
Studied at Harvard University

Emily VanWormer
Hi Jason, thanks for adding me to the group. I'm a graduate student at Eastern Michigan University in the community health education program. My thesis research is on Michigan motorcycle helmet use and I am collecting data through an online survey. I know the season has ended but I would like to reach motorcyclists in the area to complete my survey. I am requesting that my survey could be posted on your page. If this would be okay, and/or you have any questions, please let me know. You can also email me at evanwor1@emich.edu. Thanks!!

Jason Al accepted your request.

Jason Al
Sounds great! Hep your self
I am a police motorcycle officer and i am a strong believer in helmet use.

Emily VanWormer
Thanks a lot! I will likely post next week. I've got a variety of responses so far and hopefully my research will help us learn more about the reasons why people do and do not wear them. Please feel free to complete the survey when it is posted!
Appendix H: In-Person Recruitment Materials

Event invitation mock-up created on Vista Print website.

Actual text to be used on card invitations:

FRONT: Michigan Motorcycle Helmet Use Survey
Primary Investigator: Emily VanWormer
Community Health Education
Eastern Michigan University

BACK: [WEBSITE URL]
Share your experience as a motorcyclist! Take the Michigan Motorcycle Helmet Use survey by entering the website link above. Eligible participants are 18 years or older and live in the state of Michigan. This survey is anonymous. After finishing the survey, you can enter a drawing for a $20 gas card. Don’t delay; the survey closes on October 28th!
Appendix I: Facebook Recruitment Text

First Phase (August and September, 2015)

“Share your experience as a motorcyclist! Take the Michigan Motorcycle Helmet Use survey – https://www.surveymonkey.com/r/MMHUS. Eligible participants are 18 years or older and live in the state of Michigan. This survey is anonymous. After finishing the survey, you can enter a drawing for a $20 gas card.

The primary investigator is Emily VanWormer. This data will be used for her master’s thesis in Health Education at Eastern Michigan University. You can contact her for questions about the survey at evanwor1@emich.edu. Don’t delay; the survey closes on September 18th.”

Second Phase (November, 2015)

"The biking season have come to an end, but research is still in full swing. Emily, a graduate student at Eastern Michigan University is doing research on motorcyclists in Michigan. The anonymous online survey asks about your motorcycling and helmet use behaviors. You may be eligible to enter a drawing for a $20 gas card following the survey. Please give a little time and follow the link below. Feel free to share with friends. https://www.surveymonkey.com/r/MMHUS"
Appendix J: Gas Card Drawing Form Submission Text

Thank you for finishing the motorcycle helmet use survey. Please fill out this form for a drawing to receive a $20 gas card. There are five cards available.

The drawing will take place on January 1st. Emails will be sent out to those whose names were drawn.

All information collected will be deleted once all five cards are distributed.

Please contact Emily VanWormer. 419-699-4495 or evanwor1@emich.edu with any questions.

_I finished the survey and would like to enter the gas card drawing. I consent to give my home address to receive the gas card if my name is drawn. I understand that this information will not be linked to my helmet survey._

FIRST NAME__________________

EMAIL _________________________

[SUBMIT ENTRY BUTTON]
Appendix K: Gas Card Recipient Email Text

Hello (First Name)!

Congratulations, your entry was selected to receive the $20 gas card. I will send this card by mail, so please reply with your mailing address or P.O. Box address. Please respond to this email within five days [MM/DD/YYYY]. A new recipient will be drawn if you do not reply.

Happy Trails,

Emily VanWormer
Health Education
Eastern Michigan University
419-699-4495