RESEARCH ARTICLE

Factors Associated with the Helmet use among Motorcycle Drivers in District IV, Quezon City

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ABSTRACT

Background: In the Philippines, 34 Filipinos are killed daily due to road injuries. Of the reported road traffic fatalities, 25% in the world, 34% in South East Asia, and 53% in the Philippines are riders of motorized two- or three-wheeled vehicles.

Objectives: Considering that motorcycle drivers are most affected by road-related injuries in Metro Manila, this study aimed to determine the prevalence of helmet use, identify the factors affecting the intent to use helmets, and determine the factors associated with consistent helmet use among motorcycle drivers in District IV, Quezon City.

Methodology: Eight barangays were included in the sample and respondents were chosen through systematic random sampling.

Results: A self-administered questionnaire was used. There were 421 respondents with a prevalence for consistent helmet-use of 67.46% (CI 95%: 62.81-71.78). It was found that the aggregate belief score was associated with the intention to use helmets. Meanwhile, every unit increase in knowledge score increased the odds of consistent helmet use by 1.21 (95% CI: 1.06-1.37). In addition, those with intention were 7.48 times more likely to consistently wear helmets than those who do not (95% CI: 2.80- 19.97).

Conclusion: Various sub-factors such as experience, formal driving education, perceived behavioral control, benefits, and ergonomic barriers may have contributed to the result; however, further studies are needed to establish these relationships.

Keywords: *Quezon City, intention, helmet use, health belief model, theory of planned behavior*

Introduction

Worldwide, over 1.2 million people die each year on the world's roads, with millions more sustaining injuries and long-term disabilities that have adverse health consequences [1]. In the Philippines, 34 Filipinos are killed daily in road injuries, with motorcycle users being the top victim of road traffic injuries since 2010 [3]. The use of two-wheeled motor vehicles (TWMV) has become a very common form of transportation in recent years. The situation for motorcyclists is particularly worrying since nearly 25% of reported road traffic fatalities in the world, 34% in South East Asia, and 53% in the Philippines, are riders of motorized two- or three-wheeled vehicles [1].

In the Philippines alone, there are currently over 6 million registered motorcycles [4] and these motorists' safety is a cause for concern. According to the Philippine Department of Health (DOH), motorcycle users have been the top victim of road traffic injuries since 2010 [3]. There has been a progressive trend in the number of injuries since, increasing to 23,105 recorded road vehicular crashes involving motorcycles in 2016 [5]. Alarmingly, these crash victims not only stay longer in hospitals but also experience a reduced quality of life due to the burden caused by injury [6].

With this, helmets are an essential tool for ensuring motorists' safety since there are clear indications that helmets have the ability to reduce the severity of potentially fatal injuries to the face and head of motorcycle users [7,8].

However, the helmet-wearing rates in the Philippines are at 51% for riders and 87% for drivers [1]. This fact poses a concern on the proper implementation of the Philippine law RA 10054 which mandates all motorcycle riders, including drivers and riders, to wear standard protective motorcycle helmets while driving at all times [9]. Currently, there are no updated studies on the prevalence of motorcycle helmet use behavior in Philippine cities. This is a gap in knowledge the current study intends to fill. The study will also aid in the implementation of the DOH's Violence and Injury Prevention Program which aims to reduce disability and death due to violence and injuries in areas such as road traffic injuries, among others [18]. Information gathered from this research will also be able to aid in the stricter implementation and comprehensive revision of RA 10054. This is of particular concern because the selected study population who are motorcycle drivers in Quezon City, saw a 33% relative increase in the number of no safety helmet apprehensions from 2016 to October of 2018 [10].

Aside from the technical gaps in knowledge, the United Nations (UN) has cited the importance of protective equipment for reducing the severity of TWMV crashes [6]. In addition, the UN has identified road safety as a primary issue especially in the South East Asian region. The Sustainable Development Goals include a target of 50% reduction in road traffic deaths and injuries by 2020. This study will be able to provide vital information to future projects tackling motorist safety and helmet use.

In the Philippines, there have been studies conducted on the topic of helmet use but most are qualitative, lacking an established association. On the other hand, there have been foreign studies on the psychological, cognitive, and behavioral predictors of motorcycle helmet use [11-13], but these studies suffer from sampling limitations which in turn affect generalizability. This study intended to fill the mentioned data gap and examine specific factors and their effect on the intent to use helmets and their subsequent effect on actual helmet use. By identifying the association between these factors and actual behavior, effective interventions can be created that promote motorcycle safety and helmet use – offering guidance to policymakers on what areas to focus on for future projects and programs.

This study aimed to determine how knowledge, beliefs, and social support factors are associated with the intention and the consistent use of helmets by motorcycle drivers in District IV, Quezon City.

Conceptual Framework

In this study, the Health Belief Model (HBM), the Theory of Planned Behavior (TPB), and the Knowledge Factor in Attitude-Behavior Consistency Theory were utilized. These theories were used to explain the association of the three identified factors (Knowledge, Beliefs, and Social Support) to behavioral intention, and subsequently, intention to actual behavior. Similar studies in Cambodia [12] and Vietnam [59] have been done to examine psychological models (i.e. HBM and TPB) used in health promotion and education, and verified their efficacy in predicting behavior. However, this current study delineated itself by examining knowledge through the lens of Attitude-Behavior Consistency theory as well.

Moving forward, knowledge with its sub-factors was represented as is, and was analyzed in relation to intention and directly to behavior in congruence to the Attitude-Behavior Consistency theory. Identified subfactors include years of driving experience, professional driving education, first-hand experience of injuries, and knowledge of the law are all possible contributors to knowledge.

Next, belief factors in relation to actual behavior were based on the HBM. Perceived susceptibility and severity were taken as one subfactor: perceived threat. On the other hand, perceived benefits and perceived barriers were taken as is, but perceived barriers were anchored to the idea of ergonomic factors. On the other hand, perceived behavioral control, a major belief factor to be explored in relation to intention, was taken directly from the TPB. Lastly, the social support factor examined for intention comes from the TPB as well. Its subfactors include personal norm, subjective norm, family relations, peer support, and law. Intention in itself was taken as a factor contributing to behavior and was included in the analysis of other factors in association with behavior (Figure 1).

The association of the three factors amongst themselves is not included in the scope of study. There were identified confounders such as age, sex, and socioeconomic status affecting both phases of analysis. In the diagram, these intervene in the relationship of the three factors to intention, and its subsequent association to actual proper usage.

Methodology

The study employed an analytical cross-sectional design to measure associations in two phases: first for knowledge, belief, social support, and intention; and second for the three aforementioned factors including intention, and actual behavior,

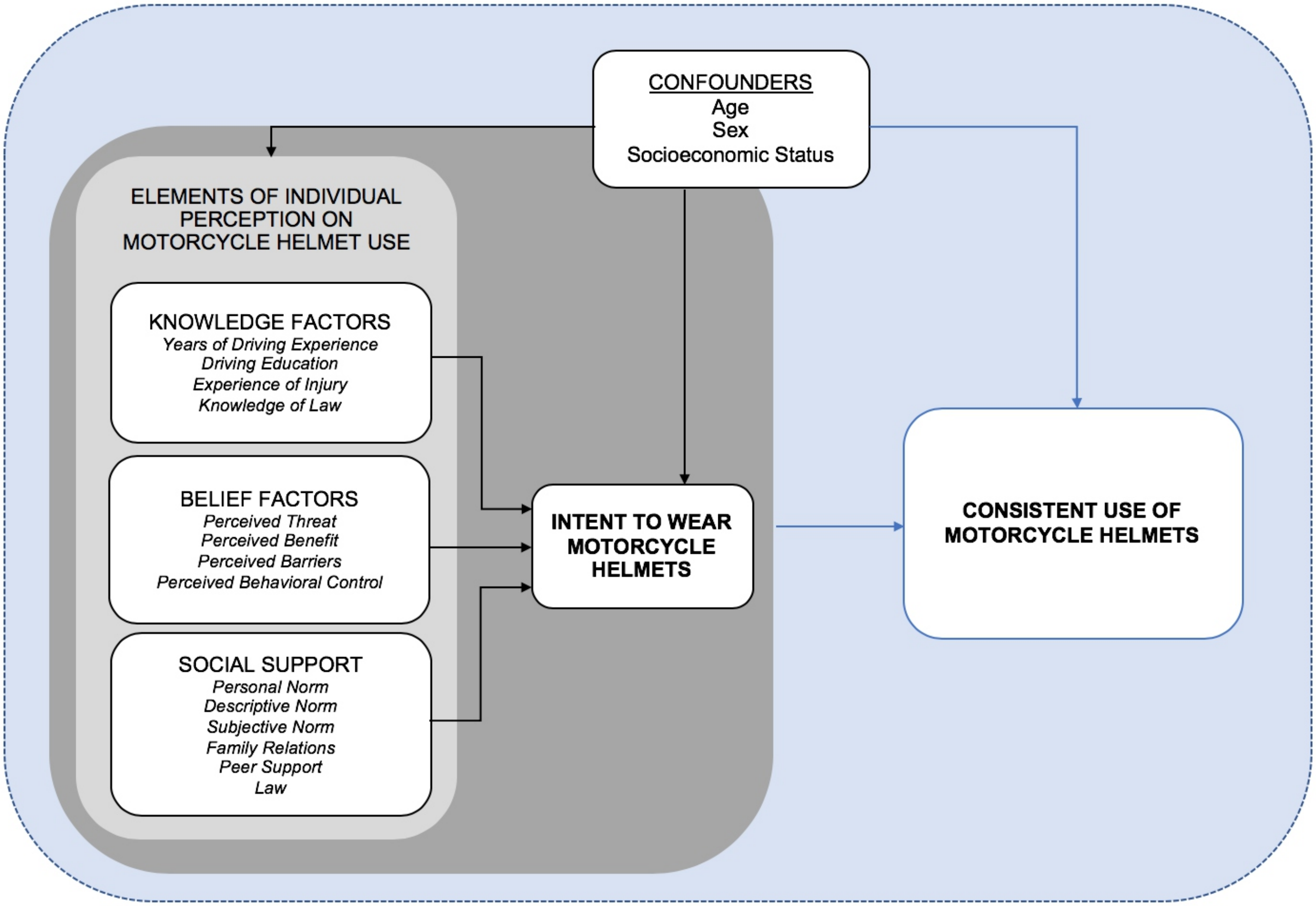

Figure 1. *General overview of the Conceptual Framework*

respectively. Data was collected via a Self-Administered Questionnaire (SAQ) which was checked on the spot by the researchers to ensure complete and verified data.

Setting

Quezon City ranks the highest amongst the cities in the National Capital Region in terms of road-traffic injuries according to the Metro Manila Accident Recording and Analysis System (MMARAS) [5]. District IV was selected due to (1) the presence of national roads such as Aurora Blvd., East Ave., Quezon Ave., E. Rodriguez Blvd., and Kalayaan Ave.; (2) indications that these areas have high incidences of motor-vehicular crashes which were related to the greater volume of vehicular traffic, assuming that those involved in these accidents were residents of District IV; and (3) the lack of traffic enforcers present in the area to implement road regulations as compared to Commonwealth and EDSA [62]. The district has 38 barangays under its jurisdiction with a total population of 437,577 as per the 2015 census [61]. Eight barangays, constituting 20% of the barangays in the district, were randomly selected to participate in the study. These were (1) Santol, (2) Obrero, (3) San Isidro Galas, (4) Pinagkaisahan, (5) San Vicente, (6) Kalusugan, (7) Doña Imelda, and (8) Sikatuna Village.

Study Size

A two-sided confidence level of 95% was used. The district's total population according to the latest census [63] was calibrated to arrive at the eligible population. Due to the absence of a district-wide registry, the researchers used the proportion of registered motorcycles in NCR in 2010 to the 2010 total population of NCR which was acquired from the Land Transportation Office [64] and PSA [65], respectively. Thus, the value for the total number of registered motorcycle riders in NCR was divided by the total population of NCR, yielding 5.629%. Multiplying this to the total population of

District IV, the researchers acquired the approximate number of motorcycle drivers in District IV, Quezon City that is 24,633 people.

Based on related literature [12], the required sample size to be used in the study was 880 as calculated using G*Power. Considering a 20% non-response rate, 1056 respondents must be interviewed. Therefore, 132 responses must be gathered from each target barangay, assuming that all barangay population sizes are the same.

Sampling Design

A systematic random sampling of residential structures was implemented within the eight barangays. Spot maps, along with local knowledge to confirm the validity of these maps, were utilized as sampling frames. Structures indicated on these maps were assigned a number. Systematic random sampling began at a number specified by a random number generator. A specified interval was utilized until the quota of 132 respondents per barangay was reached. The interval was calculated by dividing the average number of structures in a barangay by the total number of respondents per barangay – equaling 7.

The total number of respondents served as a proxy for the number of structures with motorcycle drivers eligible to participate in the study. Structures were then treated as a cluster and had undergone cluster sampling. Every individual present who passed the eligibility criteria in the structure, no matter the number of households present in the structure, was qualified as a respondent to the survey. These individuals were then considered the elementary units.

Inclusion/Exclusion Criteria

Only those who were above 18 years old were eligible respondents to the study. In addition, only those who were drivers of a motorcycle were accepted into the study. These inclusion criteria disregarded the following: ownership of a motorcycle, ownership of a license, and driving status (i.e. past or current driver).

Data Collection and Data Processing

Data Collection Tool

Data was collected through the use of a self-administered questionnaire (SAQ) that was developed and translated into Filipino by the researchers. Related studies [12,70] were adapted as reference for the development of the SAQ. It was divided into four main parts: demographic data, knowledge, beliefs, and social support factors. Age, sex, educational attainment, and monthly income were asked as part of the demographic data. Consistent helmet use, defined as the habit of wearing a helmet in every recalled motorcycle ride for the last month, was measured using a three-point scale (i.e., Always, Sometimes, Never; the last two corresponding to inconsistent helmet use). Intention to wear helmets was measured by asking respondents if they agreed or disagreed with a statement in the SAQ. Knowledge factors were measured by the sum of points from correct answers to questions on the subfactors under knowledge. A binary standardized scoring system was used for each question. Meanwhile, the belief and social factors were measured based on a 5-point Likert scale questions based on validated tools used in Cambodia [12] and United States [70]. The questions were made to measure the sub-factors included under each factor. The sum of the values from each answer under the same aggregate variable was added together to get a summative value for the factor. The scores of the individual in each aggregate factor then corresponded to a low, middle, or high rating according to cut-offs (i.e., 0-4 for Low, 5-8 for Acceptable, 9-12 for High Knowledge; 18-36 for Low, 37-63 for Some, 64-90 for High level of belief; 11-22 for Weak social support; 23-43 for Moderate social support; and 44-55 = Strong social support).

The questionnaire was translated to Filipino and back-translated to English by the group. For pre-testing, the researchers contacted a barangay (i.e. Brgy. Bagong Lipunan ng Crame) which was not included in the sample population yet part of District IV to participate in the pre-testing of the data collection tool and other documents (i.e. informed consent form, and tokens). The same sampling techniques were applied until 15 responses were acquired. Pre-testing focused on improving the (1) clarity of questions and how the respondents then process the questions in a systematic order including the language and organization of questions; and (2) duration and conduct of SAQ administration.

Data Collection

The data collection process was done within February 26, 2019 to March 6, 2019. Upon reaching the barangay, they employed the sampling protocol. The participants were randomly selected and had no prior contact or association with the researchers. The research objectives, methods, risks, benefits, voluntary participation, withdrawal, and respondent rights were all discussed with the respondent prior to the administration of the SAQ. Only those who signified consent by signing the consent form and answering the survey were counted as a proper response. The informed consent and process were reviewed and approved by the University of the Philippines Manila Research Ethics Board (UPM REB). All measures to anonymize entries were taken from the point of collection (e.g., assignment of code numbers, etc.).

The entire SAQ was answered within 15 minutes; after which the researchers were available to check responses and verify if the respondent had answered all the questions. No callbacks were done to ease time and resource constraints. The absence of an eligible respondent denoted the team moving forward to the next structure in the vicinity for sampling. In the event that the interval has already exhausted the entire sampling frame, yet the target proportionate sample size for the barangay has not been reached, the group then moved on to collect responses from the next randomly selected barangay.

Data Processing

Data was encoded through an encrypted Google Sheet accessible only through team members' email addresses and checked. Missing information, erroneous entries, and inconsistencies were counted as non-response and were then taken out of the sheet as part of data cleaning.

Each question answered in the data collection tool yielded a score. No weights per subfactor were utilized. Some concepts utilized multiple questions; therefore, the points garnered from every question added up to the total score for that specific concept. The total scores were then used as quantitative values for each factor (i.e., knowledge, beliefs, social support) and these were used to examine the association with the dependent variable through logistic regression. All analyses indicated were done through STATA v.12.0 (STATA LLC).

Statistical Analysis

Summary statistics were derived to describe the sample population. Subfactors, accounted for in the questionnaire using the Likert scale method through different questions, were analyzed by acquiring the mean score of respondents in each category (i.e. with intent vs. without intent; consistent vs. non-consistent helmet users).

In addition, the prevalence of helmet users was also computed. Two-phase logistic regression was done as seen in Figure 2 below. Firstly, bivariate analysis was done per independent variable to the outcome of intention to wear a helmet. This yielded crude associations of the exposure variables and outcome variables. Only those variables which had a p-value of <0.20 were incorporated in the full model.

Next, multivariable analysis was done using all factors (i.e., knowledge, belief, and social support clusters) to the outcome of actual helmet use. Only descriptive analysis was done on the level of subfactors (e.g., years of driving experience, perceived behavioral control, family support, etc.); however, the proportion of respondents falling into categories dictated by their scores was used to guide interpretation and discussion of overall data. In this full model, the associations of each variable were measured, considering confounders (i.e. age, sex, educational attainment, and monthly income) and their effects on each other. Responses to confounders were stratified to control for their effects. A lower level of significance of 0.05 was applied, and from this, the final

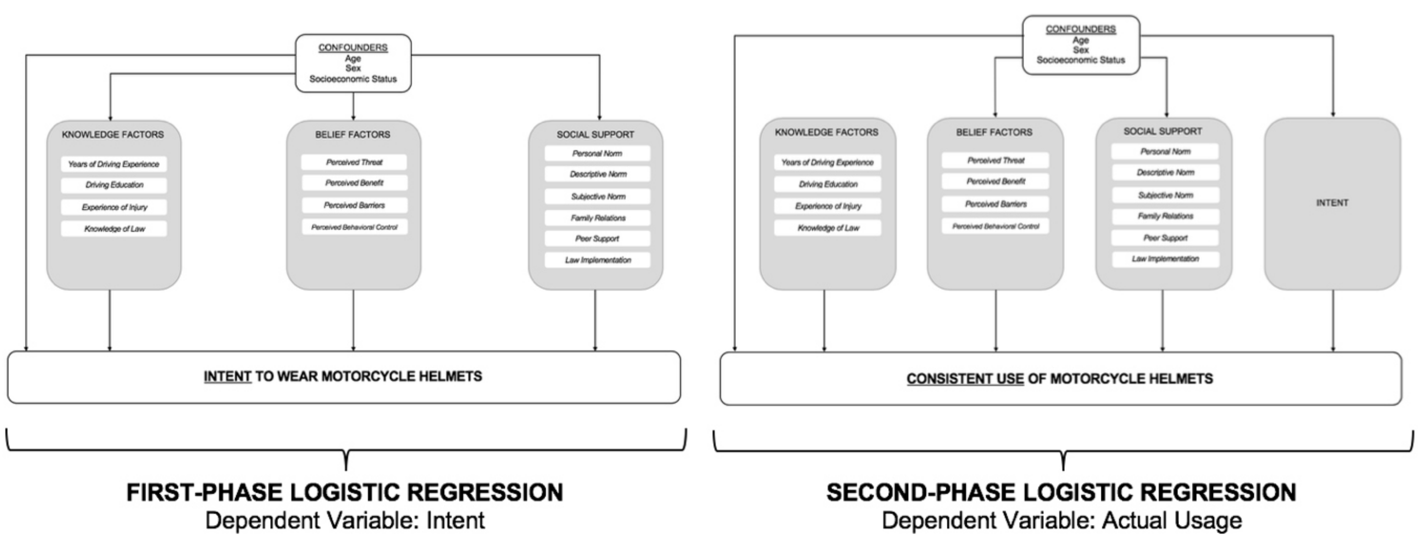

Figure 2. Overview of Data Analysis Process

model was derived. The final model presented only those associations which had sufficient evidence to be deemed significant (i.e., p-value <0.05; Confidence Interval not equal to 1).

Results

Demographic Profile

Seven hundred thirty eight (738) structures were approached with a response rate of 44%. 421 responses were gathered from eight barangays in District IV, Quezon City, with 83 incomplete questionnaires. The mean and median age of the sample was 35.41 and 33 years old, respectively. More than fifty percent (50.36%) of the respondents were from 18-33 years old. Three hundred ninety one (92.87%) respondents were males, while only 30 (7.13%) were females. Ninety four percent (94.54%) earned less than PHP 40,000 monthly, and 60.33% had received a high school diploma.

Table 1 illustrates the consistently greater amount of consistent helmet users in all categories. However, the proportion of consistent helmet users was observed to increase

Table 1. *Frequency and proportion of helmet-wearing respondents per socio-demographic variable (n=421).*

Variable	Frequency (Proportion %)	
	Consistent Users	Non-consistent users
Age (in years)		
18-25	56 (57.14)	42 (42.86)
26-33	82 (71.93)	32 (28.07)
34-41	70 (75.27)	23 (24.73)
42-49	45 (75.00)	15 (25.00)
50-57	22 (55.00)	18 (45.00)
58 and above	9 (56.25)	7 (43.75)
Sex		
Male	268 (68.54)	123 (31.46)
Income (PHP per month)		
<40,000	270 (67.84)	128 (32.16)
40,000-59,999	10 (71.43)	4 (28.57)
60,000-99,999	2 (40.00)	3 (60.00)
>100,000	2 (50.00)	2 (50.00)
Educational Attainment		
Primary/Elementary	11 (57.89)	8 (42.11)
Secondary/High school	149 (63.40)	86 (36.60)
Vocational	53 (72.60)	20 (27.40)
Bachelor-Level	64 (76.19)	20 (23.81)
Post-Graduate	7 (70.00)	3 (30.00)
Relationship		
With Partner (Married/Living-in)	164 (71.00)	67 (29.00)
Without Partner (Single/Divorced/Widowed)	120 (63.16)	70 (36.84)
Status as Head		
Household Head	165 (70.51)	69 (29.49)
Not Head	119 (63.64)	68 (36.36)
Barangay		
Doña Imelda	61 (55.96)	48 (44.04)
Obrero	41 (73.21)	15 (26.79)
Santol	25 (65.79)	13 (34.21)
Sikatuna Village	31 (81.58)	7 (18.42)
Kalusugan	36 (81.82)	8 (18.18)
San Vicente	38 (71.70)	15 (28.30)
Pinagkaisahan	15 (65.22)	8 (34.78)
San Isidro Galas	37 (61.67)	23 (38.33)

with educational attainment. In addition, a higher proportion of consistent helmet users was found among those with a partner (71.00%) and those who were household heads (70.51%). A geographic distribution of consistent helmet use is also seen.

Additional tabulated results, like other frequency distributions, may be accessed at https://tinyurl.com/OtherTables-HelmetUseinQC.

Prevalence

The prevalence of consistent helmet-use among 421 respondents in the study was 67.46% (95% CI: 62.81-71.78). Meanwhile, 397 of the respondents (94.30%; 95% CI: 91.62-96.16) expressed intention to wear a helmet while driving their motorcycles throughout the next month.

The respondents were assessed on three facets and their scores were classified as low, medium, and high according to pre-set cut-offs. Sixty eight percent (68.88%)demonstrated high scores in knowledge. A majority of the respondents scored in the medium range for belief (86.46%) and social support (74.58%).

Factors to Intention

Table 2 illustrates the difference in means per subfactor. Note that most respondents with intention scored higher and/or agreed more with statements in the questionnaire per subfactor than those without intention. Exceptions would be experience of injuries and law implementation where those without intention were seen as having more experience suffering injuries while agreeing with statements regarding the law. The largest difference in means between those with and without intention is presented in the ergonomics (i.e., perceived barriers) sub-factor.

There was enough evidence presented in the bivariate analysis under the first-phase logistic regression (i.e.

Table 2. *Means per sub-factor comparing those with and without intention.*

Factor	Mean ± SD (CI)	
	With Intention	Without Intention
Knowledge		
Knowledge of the Law	6.85 ± 1.04 (6.75-6.96)	6.46 ± 1.18 (5.96-6.96)
Years of driving experience	1.45 ± 0.77 (1.38-1.53)	1.42 ± 0.88 (1.04-1.79)
Driving Education	0.13 ± 0.33 (0.09-0.16)	0.13 ± 0.34 (-0.02-0.27)
Experience of Injuries	0.58 ± 0.49 (0.42-0.83)	0.63 ± 0.49 (0.53-0.63)
Belief		
Perceived behavioral control	13.64 ± 2.68 (13.38-13.91)	11.67 ± 3.95 (10.00-13.34)
Perceived threat	11.61 ± 3.17 (11.30-11.93)	11.33 ± 3.13 (10.01-12.66)
Perceived benefit	14.34 ± 2.06 (14.13-14.54)	13.75 ± 2.77 (12.58-14.92)
Perceived barriers	14.64 ± 5.53 (14.10-15.19)	12.13 ± 4.90 (10.06-14.19)
Social Support		
Status as Head of Household	0.58 ± 0.03 (0.52-0.64)	0.50 ± 0.04 (0.42-0.59)
Relationship with Partner	0.58 ± 0.49 (0.52-0.64)	0.49 ± 0.50 (0.40-0.57)
Law Implementation	6.55 ± 2.05 (6.31-6.78)	6.83 ± 1.68 (6.55-7.11)
Family Support	7.23 ± 1.43 (7.07-7.40)	7.13 ± 1.45 (6.89-7.38)
Peer Support	3.46 ± 0.97 (3.34-3.57)	3.39 ± 1.00 (3.22-3.56)
Descriptive Norms	6.77 ± 1.69 (6.58-6.97)	6.39 ± 1.83 (6.08-6.70)
Subjective Norms	3.61 ± 0.75 (3.53-3.70)	3.53 ± 0.71 (3.41-3.65)
Personal Norms	10.33 ± 1.87 (10.11-10.55)	10.01 ± 2.17 (9.64-10.37)

Table 3. *Crude association of independent variables (knowledge, belief, social support, intention) with Intent*

Variable	OR (95% CI)	p-value
Knowledge $_{Aggregate}$	1.18 (0.94-1.49)	0.154
Belief* $_{Aggregate}$	1.09 (1.04-1.15)	0.001
Social Support* $_{Aggregate}$	1.06 (1.00-1.13)	0.044

*Significant

independent variables to intent) to note that belief (OR: 1.09; CI: 1.04-1.15) and social support (OR: 1.06; CI: 1.00-1.13) were significantly associated to intent, not considering other effects. These results were presented in Table 3.

On the other hand, controlling for confounders such as age, sex, educational attainment, and monthly income, the first-phase multivariate logistic regression found that there was sufficient evidence to conclude that belief was associated with intent (OR: 1.11; CI: 1.05-1.17). This means that for every one unit increase in belief score, the odds of intent increase by a factor of 1.11. This result is tabulated in Table 4.

Factors to Consistent Helmet Use

Table 5 illustrates the difference in means per subfactor. Note that most consistent helmet users scored higher and/or agreed more with statements in the questionnaire per subfactor. Exceptions were perceived threat, status as household head, and relationship with a partner whereas non-consistent helmet users were observed as more perceptive of the costs of injury, were breadwinners of their families, and had a partner. The largest difference in means between consistent and non-consistent helmet users is presented in the ergonomics (i.e., perceived barriers) and personal norms sub-factor.

Table 4. *Results of first-phase logistic regression*

Variable	OR (95% CI)	p-value
Belief* $_{Aggregate}$	1.11 (1.05-1.17)	<0.001
Social Support* $_{Aggregate}$	1.04 (0.97-1.11)	0.305

*Significant

Table 5. *Means per sub-factor comparing those with consistent helmet use and non-consistent helmet use.*

Factor	Mean ± SD (CI)	
	Consistent Use	Non-consistent Use
Knowledge		
Knowledge of the Law	6.87 ± 1.03 (6.75-6.99)	6.74 ± 1.08 (6.56-6.93)
Years of driving experience	1.51 ± 0.04 (1.42-1.60)	1.33 ± 0.07 (1.19-1.46)
Driving Education	0.15 ± 0.27 (0.11-0.19)	0.08 ± 0.36 (0.03-0.13)
Experience of Injuries	0.61 ± 0.47 (0.55-0.66)	0.54 ± 0.50 (0.46-0.62)
Belief		
Perceived behavioral control	13.68 ± 2.76 (13.36-14.01)	13.22 ± 2.86 (12.74-13.70)
Perceived threat	11.51 ± 3.24 (11.13-11.88)	11.79 ± 3.02 (11.28-12.30)
Perceived benefit	14.45 ± 2.01 (14.22-14.69)	13.99 ± 2.26 (13.60-14.37)
Perceived barriers	14.90 ± 5.32 (14.26-15.55)	13.66 ± 5.44 (12.74-14.56)
Social Support		
Status as Head of Household	0.55 ± 0.50 (0.50-0.60)	0.63 ± 0.49 (0.42-0.83)
Relationship with Partner	0.54 ± 0.49 (0.49-0.59)	0.63 ± 0.50 (0.42-0.83)
Law Implementation	6.64 ± 1.95 (6.45-6.83)	6.58 ± 1.82 (5.82-7.35)
Family Support	7.22 ± 1.40 (7.09-7.36)	6.79 ± 1.86 (6.00-7.58)
Peer Support	3.45 ± 0.05 (3.35-3.55)	3.21 ± 1.14 (2.73-3.69)
Descriptive Norms	6.69 ± 1.72 (6.52-6.86)	5.92 ± 2.06 (5.05-6.79)
Subjective Norms	3.60 ± 0.71 (3.53-3.67)	3.38 ± 1.01 (2.95-3.80)
Personal Norms	10.28 ± 1.95 (10.09-10.47)	9.29 ± 2.24 (8.35-10.24)

Table 6. *Crude association of independent variables (knowledge, belief, social support, intention) with Use*

Variable	No. of consistent helmet users / total %	OR (95% CI)	p-value
Belief* $_{Aggregate}$	-	1.25 (1.11-1.41)	<0.001
Social Support* $_{Aggregate}$	-	1.03 (1.01-1.06)	0.017
Social Support $_{Aggregate}$	-	1.03 (0.99-1.06)	0.142
Intent			
Without intent	6/24 (25.00)	1.00	
*With intent**	278/397 (70.03)	7.01 (2.71-18.10)	<0.001

*Significant

Table 7. *Results of Second-Phase Logistic Regression*

Variable	aOR (95% CI)	p-value
Knowledge* $_{Aggregate}$	1.21 (1.06-1.37)	0.003
Belief* $_{Aggregate}$	1.02 (0.98-1.05)	0.233
Intention*	7.48 (2.80-19.97)	<0.001

*Significant

Meanwhile, there was enough evidence in the second-phase regression bivariate analysis to say that knowledge (OR: 1.25; CI: 1.11-1.41), belief (OR: 1.03; CI: 1.01-1.06), and intent (OR: 7.01; CI: 2.71-18.10) were associated with consistent helmet use, not considering other relationships (seen in Table 6).

Controlling for the confounding effect of age, sex, educational attainment, and monthly income, the second-phase multivariate logistic regression found that there was sufficient evidence to conclude that knowledge (OR: 1.21; 95% CI: 1.06-1.37) and intent (OR: 7.48; 95% CI: 2.80-19.97) were associated with consistent helmet use. It meansthat for every one unit increase in knowledge score, the odds of consistent helmet use increased by a factor of 1.21. In addition, those with intention were 7.48 times more likely to consistently wear helmets than those without intention (seen in Table 7).

Discussion

Prevalence

The prevalence of consistent helmet use in District IV, Quezon City was 67.46 (95% CI: 62.81-71.78) which was lower compared to the 87% from the World Health Organization's report in 2015 on road safety in the Philippines [1]. This may be attributed to local ordinances (e.g., QC Ord. No. 20CC-040) aiming to hinder criminals from using helmets to conceal their identity by requiring all riders to remove their helmets whenever at full stop within the city. Moreover, different areas having different protocols and degrees of stringency could influence road behavior [8].

Intention

Intention is an index of a person to do a specified behavior. This makes up both the decision of whether or not to do the said behavior and the effort to which s/he is willing to spend in pursuit of the behavior. In Theory of Planned Behavior (TPB), intention is seen as the product of attitudes, norms, and perceived behavioral control and the antecedent to actual behavior [46,76,77]. Studies in different fields have both supported and refuted this idea, leading to the rise of the so-called "intention-behavior gap". Multiple factors such as one's inhibiting social environment, personal characteristics, unexpected events (e.g. helmet price drops and accidents), and personal involvement with the object affect intention.

In the current study, those with intention were 7.48 times more likely to consistently wear helmets than those without intention (95% CI: 2.80-19.97) which is consistent with literature; albeit, to different extents [12,30,32]. Setting bias aside, this result may be due to the vast number of experienced drivers with experience of helmet use whilst being involved in accidents as reported in a 2016 meta-analysis by Sheeran et. al. [78]. Further, it was noted that intention may be induced by previous experience, even more so if the helmet saved the wearer's life. Secondly, habits may have also taken root in this sample, since most are experienced drivers whose second instinct is to wear a helmet [78]. It is also possible that self-determination (i.e. the desire for change coming from within the individual instead of change being a product of norms forced upon oneself) played a role. However, such factors must be further studied.

Knowledge

Knowledge has been a verified predictor for intention and actual use. Similarly, the study has found that knowledge is a significant factor in actual helmet use, but lacks evidence to show an association with intention. This is against the attitude-behavior consistency theory where knowledge works to reinforce certain attitudes – these, then, influence behavior [27,58]. These attitudes also modulate behavior through intention and are subject to the availability of opportunities to enact the behavior, competition with other attitudes, and the individual's self-monitoring [79-82]. Therefore, this bypass of intention is quite odd and may be attributed to lack of power. Nevertheless, for a unit increase in knowledge, the odds of having consistent helmet use increased by a factor of 1.21 (95% CI: 1.06-1.37). Multiple studies, albeit on different topics, have displayed the same association [79,82]. The factor of knowledge can be subdivided into years of driving experience, professional driving education, first-hand experience of injuries, and knowledge of the law.

A Greek study found that overall driving experience is part of the learning process [28]. In fact, "on-road driving experience is the way higher-order cognitive skills related to driving (e.g. hazard perception) are developed and maintained [83].” Therefore, the longer one has adapted to driving a motorcycle and its risks, the higher one will prioritize individual safety. This study measured experience as a subfactor of knowledge. The results of the study agree with the observation that higher knowledge scores are associated with intention because motorists who have integrated helmet use as part of their identities self-reinforces the behavior [78]. However, the extent to which years of experience is the reason for the intention is unclear since there are other subfactors under the knowledge construct measured.

Education embodies a cue to action that can encourage and support behaviors such as consistent helmet use [32]. It also helps in attitude formation that can therefore affect behavior [41]. A formal driving course may not only provide drivers an avenue to be more informed about technical operating procedures, safety techniques and maneuvers, and road law knowledge but also gain an “experience bank” which has shown to be preventive against crashes [83]. This is consistent with the observation that consistent helmet users were seen among those who enrolled in a driving course compared to their non-consistent counterparts – the same pattern is seen for intention. However, one must be wary since not all training courses may change behavior due to psychological and motivational factors and the false sense of security these programs afford [83]. Therefore, the solution lies in longer hours of supervised driving, long-term education focused on beliefs, and even a graduated licensing program. The last being a scheme that provides probationary status to new drivers until they have proven to have learned higher order skills, resulting in a less restricted license, and eventually graduating to a “full” licensing status.

Experience of injuries is a subset of the overall driving experience which is again, part of the learning process [28]. Theoretically, those who have experienced injuries while riding a motorcycle are more likely to use protective gear as a preventive response to harm. A study found an association between experience of injuries and actual helmet usage (OR: 4.83, 95%; CI: 2.6-9.10, p<0.001) [29]. This is consistent with the current study that found a slightly higher percentage for consistent use in those who experienced an injury (69.62%) than those that never experienced an injury (64.00%). Although, the opposite is true for intention: those without intention made up a greater percentage (6.10%) of those who have experienced accidents than their counterparts who have never experienced an accident (5.14%). This can be explained by their inherent risk-taking personality [28,34], an aspect not covered in this study.

Belief

In this study, belief was found to be a strong predictor for intention (OR = 1.11; 95% CI: 1.05-1.17). The Theory of Planned Behavior (TPB) model would show that certain control beliefs, specifically perceived behavioral control, positively influences the intention of an individual to perform the desired behavior [46]. An individual having the perception of being in control (PBC?) of their own actions would encourage the intent to perform the behavior. In this study, this concept is translated to the ability, autonomy, and difficulty to practice consistent use of helmets as perceived by the motorcycle driver. Other studies have consistently shown a significant association between PBC and intention to wear helmets while driving. For example, Brijs and team have demonstrated that a strong correlation exists between PBC and intention to helmet use (OR = 1.58, 95%; p-value: <0.001), as well as between PBC and the use of helmets (OR = 1.72, 95%; p-value: 0.022) [12]. An Iranian study also noted that PBC was an important predictor of behavior of helmet use (OR = 1.23, 95%; p-value: < 0.001) [30].

However, in this study, there was no sufficient evidence to conclude that belief has a significant correlation to the consistent use of helmets (OR = 1.02; 95% CI: 0.98-1.05). This is in contrast to the Health Belief Model (HBM) which illustrates how certain aspects of belief (i.e., perceived threat, perceived benefits, perceived barriers, cues to action, and self-efficacy) influence whether or not a person will perform a desired behavior. The relevant sub-factors under this model are discussed below.

Perceived threat describes how one sees the susceptibility and severity of acquiring a condition which would therefore give urgency to performing the behavior. This was measured by the respondent's estimated susceptibility and severity of a potential motorcycle injury based on his or her agreement to certain items in the questionnaire. The same Cambodian study showed that perceived susceptibility (OR: 1.17, 95%; p-value: <0.001) is considered a factor that is associated with helmet use [12].

Perceived benefit and perceived barriers as modifying variables in the HBM would show that an increased perception of benefits and a decreased perception of its risks or barriers would encourage a healthy behavior. According to the HBM, the benefits from the consistent use of motorcycle helmets for the person must outweigh the barriers or burden of its consistent use. Some beliefs tied to the ergonomics and accessibility measured by questions under the perceived barrier sub-factor may be significant detractors to helmet use. These include heat-insulating capacity, an issue of importance in a tropical country. Efforts must be directed towards better, more tropical-climate-friendly helmets in order to convince non-consistent users to embrace helmet wearing as a habit.

In this study, perceived threat is described as how one sees the susceptibility and severity of acquiring a condition, which would give urgency to perform the behavior. Perceived benefits in the study, according to the HBM, is when the benefits from the consistent use of motorcycle helmets outweigh the perceived barriers or burden of its consistent use. The perceived barriers are those that are tied to beliefs on ergonomics and accessibility, which includes the heat-insulating capacity of the helmet. These relevant subfactors of beliefs were part of the items for the belief component of the questionnaire, with the scores all added together to compute the overall scores on the beliefs factor. The strong belief denoting strong intention but non-consistency in helmet use is contradictory to the models used in the study. This may be due to certain factors that may have influenced the results which are discussed under Limitations.

Social Support

Social influence or the behavior that is caused by the people around one's self is a factor that contributes to the everyday use of helmets. Important social referents such as family, partners, friends, and the general social milieu may support or discourage the rider's use of helmets. In contrast, this study found that social support has insufficient evidence to have a significant association with intention and consistent helmet use in both phases of logistic regression. With these findings

In a study done among students in a Florida university, it was found that normative beliefs were the predominant influence on intention (OR: 1.28, 95%; p-value: <0.005) [31]. A few studies have also indicated the influence of social referent groups on the use of helmets by riders [12,49]. Psychosocial support and an encouraging social environment may pressure someone to develop or practice a certain behavior.

Studies have shown that the concern of parents, legal guardians, and other relatives have a strong influence on the rider's helmet use [12,49]. Being the head of the household or family entails an increased concern for personal safety which is a factor that facilitates helmet use [11]. Supporting this is a study stating that parents are more likely to wear helmets for their children and also make children wear helmets while riding [43]. Family relations and significant others are associated with the intention to use a helmet (OR: 0.20, 95%; p-value: <0.001) [12].

On the other hand, perceived support among friends is remarkably lower than that of support from family. Perceptions about whether important social referents, such as friends, will carry out the behavior themselves influences behavioral intention by informing a person about the extent to which the behavior significantly affects the decision of the rider as to whether or not he/she will use a helmet [12].

Meanwhile, the presence of safety helmet laws does not necessarily lead to helmet use. The probability of receiving a ticket and being fined may cause the rider to wear a helmet; however, motorcyclists may still take risky reactions despite the mandatory helmet law. Motorcyclists take advantage of the lack of enforcement to engage in the dangerous behavior of swerving through traffic and surpassing speed limits [44]. A study in Ghana identified that knowledge on helmet laws does not greatly affect the helmet use of motorcyclists in the area but rather the motorcyclists' own decision to apply their knowledge to their riding practice. The study suggested that stricter enforcement of motorcycle legislation would greatly increase the helmet-wearing population in the area [29].

In this study, other factors weighing more heavily on the consistent helmet users' decision such as knowledge of the consequences, personal beliefs, and familial support may explain some difference in the result vis-a-vis their non-consistent counterparts. After all, these users may already view helmet use as a necessary obligation with or without the law in place. However, those who fail to consistently use helmets either due to lack of knowledge, belief, or other forms of social support may feel the urge to wear helmets simply because of the penalty presented by the law and its enforcers.

Limitations of the Study

The cross-sectional study design utilized was limited to examining behaviors in a single instance and cannot establish temporality. Furthermore, the behavior was not directly observed, but only self-reported via the questionnaire. Social desirability could lead to an overreporting of consistent helmet use as non-use is illegal; however, this was mitigated during data collection by reassuring respondents of the confidentiality of their answers, encouraging them to answer honestly, and thoroughly explaining the contents and mechanics of the questionnaire to them. Crown and Marlowe's social desirability scale [70] was not utilized. Recall bias was mitigated by limiting the recall period to a month.

Questionnaires were checked on-site to determine errors and skipped questions to further minimize errors and potential misclassification.

The researchers designed their own questionnaire by integrating validated samples in existing literature [12,70]. However, some questions were not validated and the questionnaire was not translated into Filipino according to WHO standards. Misclassification bias due to this was mitigated through consultation with a health promotion and education expert as well as pilot testing to verify the tool's clarity and content.

Uncontrollable factors (e.g., non-presence, non-participation in study) could also contribute to selection bias during data collection. The results are not generalizable to the population as only 39.86% of the 1,056 respondents were included in the study. Power analysis was not done. Logical collapsing of categories was done to those having zero responses. Confounding was mitigated in the data analysis stage via logistic regression models while stratification was employed to examine the exposure-outcome association within the strata of the confounders. However, the Mantel-Haenzel method was not employed to compare crude and adjusted odds ratios among strata.

Conclusion

This study was the first to determine the associations between knowledge, belief, social support, intention, and consistent helmet use among motorcycle drivers in Quezon City through two separate phases of analysis. An integrated theoretical framework combining the Theory of Planned Behavior and the Health Belief Model was used to examine the associations of the exposure variables to the outcome variable. Firstly, the prevalence of consistent helmet use among respondents in District IV, Quezon City was 67.46%. Through multiple logistic regression analysis, the intention to use a helmet was found to be significantly associated with the beliefs of an individual (OR: 1.11; 95% CI: 1.05-1.17), while the consistent use of helmet was significantly associated with knowledge (OR: 1.21; 95% CI: 1.06-1.37) and intention (OR: 7.48; 95% CI: 2.80-19.97).

The researchers suggest that future studies on the same topic should focus on the consistent use of the standard ICC-registered helmets that can be generalizable to the Filipino population. It is also recommended that a standardized validated tool in Filipino be used to increase the accuracy and validity of the results that will be gathered by future researchers. Moreover, the researchers recommend employing a longitudinal study design in the next similar studies to observe behaviors on helmet use and consider the use of quantitative and qualitative data collection methods such as focused group discussions (FGD) and key informant interviews (KII).

The results of this study can be utilized to address concerns on policy implementation such as training and orientation of policy implementers (i.e., traffic enforcers) and evaluation of current policies in place for helmet use in Quezon City. Additionally, interventions such as community-based driving education involving the driver and extending to family members can help encourage drivers to use helmets consistently.

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