Abstract

The present study was set out to identify variables which predict intention to use helmet among bicyclists. The theoretical framework was based on the Health Belief Model (HBM) integrated with risk perception and comparative optimism, as relevant constructs from the risk theories. The results were based on an internet survey carried out among bicyclists ($n=256$). A second-order SEM revealed that while controlling for gender, age and cycling experience, risk perception ($B=.113$, $p<.05$) fully mediated the effect of comparative optimism ($B=-.201$, $p<.05$) on intention to use a helmet. Perceived exemption from harm ($B=-.340$, $p<.05$) and perceived barriers ($B=-.507$, $p<.001$) were also found to be significant predictors of intention to use a bicycle helmet. The hypothesized model explained 55.8 percent of the variance within the intention to use a bicycle helmet. Theoretical implications of these findings are discussed.

Keywords: bicycle helmet, intention, health belief model, risk perception, comparative optimism

1. Introduction

Cycling is considered as a health promoting non-motorized mode of transport, consistent with the goals and policies of sustainable transport use. Bicyclists are, however, a vulnerable group in terms of crash risk. According to World Health Organization (WHO) statistics, four percent of the global total road traffic fatalities include bicyclists (WHO, 2015). However, the cyclists' exposure to traffic is relatively lower than the motorists. For instance in most European countries, the cycling average trip length is only three kilometers (ERSO 2015).

Research shows that the cyclists' share of total road traffic victims is disproportionately higher than the share of cycling in annual travels. For instance based on an international review of the frequencies of cyclists' casualties in different countries, while cycling accounts for a share of 31, 19, 17, 2 and 1 percent in modal split in the Netherlands, Denmark, Sweden, Canada and Australia; the share of victims in single-bicycle crashes from the total road traffic injuries are 41, 33, 23, 15 and 9 percent, respectively (Schepers et al. 2015). These figures tend to be relatively higher if one estimates the share of victims in all bicycle crashes from the total road injuries. Therefore, the World Health Organization requires promotion of safe cycling for achieving the goals described in the Decade of Action for Road Safety (2011-2020) in reducing road traffic deaths and injuries (WHO, 2015).

The majority of traumatic brain injuries are due to road crashes (Wolfe et al. 2010). Head and brain injuries are highly frequent among bicyclists (Boström and Nilsson 2001) and such injuries are considered as major causes of mortality and morbidity among them (Noakes 1995; Airaksinen et al. 2010; Munivenkatappa et al. 2013; Kaushik et al. 2015). For instance, Leijdesdorff et al. (2014) revealed that out of the 1250 road traffic casualties with severe traumatic brain injuries admitted to hospitals in the Trauma Center West-Netherlands from 2003 to 2011, the majority (51.3%) were bicyclists. This share was comparatively lower for other road users e.g. pedestrians (12.3%), motorists (12.5%), and moped riders (21.4%). Nowadays, it is well-established that bicycle helmet use could reduce not only the serious head injuries among bicyclists (Thompson et al. 1999; Amoros et al. 2012; Sethi et al. 2015), but also the brain injuries, facial injuries and fatal injuries (Attewell et al. 2001). For example, based on a systematic review and meta-analysis of 40 studies including 64,000 injured cyclists, Olivier and Creighton (2016) estimated the odds of reduction in head injuries, serious head injuries, fatal head injuries and face injuries due to bicycle helmet use to be 51%, 69%, 65% and 33%, respectively. Alternatively, using reconstruction methods Fahlstedt et al. (2016) found that bicycle helmet caused up to 43% reduction in strain tissue, which is associated with up to 54% reduction in risk of concussion. They also estimated that the bicycle helmet could reduce the risk of skull bone fracture by up to 98%.

Despite the evidence of the effectiveness of using a bicycle helmet, a relatively large proportion of bicyclists are still reluctant to this safety gear (Joseph et al. 2016). Even though bicycle helmet non-use is common both in high income and low and middle income countries, non-use is more common in the latter countries due to the lack of legislations and enforcement (Secginli et al. 2014). Review of literature indicates the effectiveness of compulsory bicycle helmet legislation on helmet use (Karkhaneh et al. 2006) and head injury hospitalization (Karkhaneh et al. 2013). Based on a systematic review, Karkhaneh et al. (2006) concluded that the effect of bicycle helmet legislation on change in bicycle helmet use could vary widely from modest (37% increase) to massive (91% increase). They found that more change is associated with less helmet wearing rate during the pre-legislation period. The authors, however, argue that the effects could also be due to change in other (not understood) factors such as socio-economics, social motivations and enforcement level.

It is, however, arguable whether mandatory legislation and enforcement alone could be sufficient to sustainably change road users' behaviours. First, the influence of mandatory legislation on road users' behaviour was shown to be directly related to the intensity of enforcement. For instance, the effects of road safety legislation tend to disappear if enforcement system is not effectively in place (SafetyNet 2009; Rousseau and Blondiau 2013). As an example, if the camera surveillance was stopped, effects of speed enforcement was shown to disappear immediately in a short time (SWOV 2011). Moreover, it is argued that the change due to enforcement will fade away and devaluate, if it does not correspond to the social motivations (Rocakova-Filemon, Quimby, and Zaidel 2008). This suggests that using legislation and enforcement activities is not sufficient to promote bicycle helmet use and deliver sustainable safety results, if complimentary promoting activities are not combined with mandatory legislation and enforcement. Therefore, it is prudent to investigate the underlying social psychological precursors that lead to bicyclists' helmet use behaviour.

The role of personal motivation has been underlined within the literature, as an important predictor of health related behaviours. Intention has been recognized as a key construct that reflects personal motivation in theories of social cognition and health behavioural models (Sheeran 2002). Reviewing the precursors of different health related behaviours, Godin and Kok (1996) reported that the average correlation between intention and behaviour ranged from 0.35 to 0.56, suggesting that a moderate amount of variability in health related behaviours could be explained by behavioural intention. A similar proportion of variance in behaviour was reported by Armitage and Conner (2001). A meta-analysis study by Sheeran (2002) also revealed that one third of the variance in behaviour could be explained by behavioural intention.

Previous research indicates the efficacy of behavioural intention to explain bicycle helmet wearing behaviour (Quine et al. 1998; O'Callaghan and Nausbaum 2006; Ali et al. 2011). Conducting an intervention study based on the Theory of Planned Behaviour, Quine et al. (2001) argued that change in behavioural and normative beliefs as well as perceived behavioural control could change intention to wear a bicycle helmet. However, meta-analysis of intervention studies that assess behavioural change due to change in intention showed that a large manipulation of intention due to interventions may lead to only a low to moderate behavioural effect (Webb and Sheeran 2006).

Several theoretical models attempt to explain the adoption of health-protective behaviours. From the cognitive perspective, the focus is on theories that deal with cognitive variables and assume that attitudes, beliefs and expectations of future outcomes contribute to health related behaviour (Munro et al. 2007). Some theories in this category (e.g. the health belief model (HBM), the protection motivation theory (PMT), and the social cognitive theory (SCT)) share the idea that protection motivation is a result of perceived risk and desire to avoid the potential negative outcome, as well as the perceived costs and benefits of taking the precautionary action (Floyd et al. 2000). In contrast, theory of reasoned action (TRA), theory of planned behaviour (TPB) and the subjective expected utility (SEU) assume that the individual's assessment of response efficacy (belief that the protective action is effective) is determined indirectly (Floyd et al. 2000).

The Health Belief Model (HBM) is one of the most widely used theoretical cognitive frameworks in explaining a wide range of health-protective behaviours or behavioural intention. Using HBM is less cumbersome than the PMT and SCT, as the HBM organizes a catalog of variables contributing to protection motivation, without explicitly splitting out the relationship between the variables (Munro et al. 2007). On the other hand the SCT is usually mentioned as a difficult to operationalize and often partly used theory, because of its wide range of focus (Munro et al. 2007). The HBM well reflects the perceived seriousness of and perceived susceptibility to a health problem. This characteristic in addition to the simplicity of the framework help researchers to easily combine the HBM with other theories to further scrutinize the origins of motivation-related beliefs and behaviours.

The HBM is based on a value expectancy approach to human decision making (Rosenstock 1974) and is widely used to explain the people's deliberate failure to accept health-related preventive measures. As previously explained, the model consists of beliefs about personal susceptibility to (likelihood of experiencing) health problems and the perceived severity of outcome (consequences of the health problem) which are labeled together as risk or threat perception. Risk or threat perception concerns an individual's understandings and experiences about the risk (Sjöberg et al. 2004). The HBM also includes perceived benefits and perceived barriers of health behaviour, which are jointly labeled as behavioural evaluations (Mark and Paul 2005). Further, the model maintains that cues (or triggers) are also required as instigating agents to turn out the achieved levels of intensity (accumulated from the other components) into appropriate overt action (Rosenstock 1974).

Meta-analysis showed significant positive relationships between HBM components and health behaviours (Harrison et al. 1992). In a relatively recent meta-analysis study, Carpenter (2010) found that while benefits and barriers were consistently the strongest predictors of behaviour, perceived severity and susceptibility were weakly related and nearly non-relevant beliefs to the behaviour. Therefore, Carpenter (2010) recommended to use moderators for the HBM variables, other than directly connecting to the behaviour.

The literature also consists of the studies in which health beliefs are used to explain road users' behaviour and behavioural intention. More specifically, behavioural intention has been considered whether as an outcome variable (Quine et al. 1998) or in the form of a mediating variable between health beliefs and behaviour (Becker et al. 1977). In the context of traffic safety, HBM has been subject of recent studies seeking to explain road users' behaviours, such as seat belt use (Şimşekoğlu and Lajunen 2008; Ali et al. 2011; Aghamolaei et al. 2011), motorcycle riding behaviour (Aghamolaei et al. 2011; Özkan et al. 2012) and risky driving behaviours (Morowatisharifabad, 2009). For example, Şimşekoğlu and Lajunen (2008) found that while the total fit of the model was moderate, perceived benefits, perceived barriers and cues to action were significant predictors of seat belt use in a Turkish sample. Further to behaviour, the HBM has been used to explain the road users' behavioural intentions (Lajunen and Räsänen 2004; Brijs et al. 2014). For example Lajunen and Räsänen (2004) found that perceived barriers, perceived severity and cues to action significantly explain the intention to use bicycle helmet.

As explained, HBM contains components of risk or threat perception, with implicit assumption that the risks associated with behaviour could be adequately perceived by people (van der Pligt 1996). However, HBM does not originally take into account the other explaining constructs that explicate the mechanisms forming the risk or threat perception. On the other hand, the risk and the constructs relevant for it (such as risk perception and unrealistic optimism explained as follows) are central in risk theories. From this point of view, making a link between the HBM and the risk theories may shed light into the mediation between the constructs from the two theories and hence can give a better understanding of the mechanisms which shape the behaviour or behavioural intention, from the risk perception point of view. To the best of the authors' knowledge there are no studies which have integrated the risk theories into the HBM in the field of road traffic safety, particularly in the context of developing countries in road traffic safety and hence, this study aims to propose such a link in the form of an integrated framework.

To enter the risk perception into the integrated framework including HBM and risk theories, it should be first noted that the research on the relationship between risk perception and behaviour or intention has shown inconsistent results. In some studies, traffic risk behaviours have been shown to be statistically related to the subjective assessment of the probability of a specified type of accident and the magnitudes of its potential consequences (perceived risk) (Iversen and Rundmo 2004; Machin and Sankey 2008; Nordfjærn et al. 2011). For example, Fyhri et al (2012) showed that risk perception is positively related to bicyclists' helmet use. On a reverse order, however, some cases revealed that a more frequent risky behaviour may be statistically associated with higher risk perception (Rutter et al. 1998). Other studies also found that risk perception had a modest effect on behaviour (Lund and Rundmo 2009) and suggested that risk perception indirectly affects intention or behavior through mediating mechanisms e.g. affecting subjective norms and attitudes (Nordfjærn et al., 2014; Stasson and Fishbein 1990).

In further dealing with risk theories, sense of controllability is also critical to explain risk perception (Sjöberg et al., 2004). This theoretical framework argues that less risk perception is associated with perceptions of higher personal control. Subjective estimation of risk, however, has been shown to be biased among drivers; i.e. they tend to believe that compared to their peers, they are less vulnerable to traffic accidents, more skillful and have better than average reflexes (van der Pligt 1996; Martha, Laurendeau, and Griffet 2010), less risky drivers (Svenson 1981), commit fewer offences (Delhomme 1991) and have lower crash risks while driving (Harré et al. 2005; Gosselin et al. 2010). This tendency that is attributed to the drivers' overestimation of the probability of positive events and underestimation of the likelihood of negative events occurring to them in comparison to others, is called comparative optimism or overconfidence bias (Stephens and Ohtsuka 2014). The field of road traffic safety has focused on comparative optimism bias since the 1980's (White et al. 2011). This bias has been shown to be a result of illusion of control (DeJoy 1989) which is defined as the people's tendency to believe that their personal success probability is inappropriately higher than that of the objective probability (Langer 1975). Optimism bias has been shown to be increased with driving experience and age (DeJoy 1989; Harré et al. 2005; White et al. 2011). Furthermore, males were shown to be more prone to comparative optimism bias than females (DeJoy 1990; DeJoy 1992).

To provide a more insightful explanation of intention to use bicycle helmet from a risk perception point of view, we added more predictors from the risk theory (i.e. risk perception and optimism bias) into the HBM in the form of a proposed framework. Such an integrated framework would give a more powerful reasoning to explain the intention to use bicycle helmet, since it contains the construct explaining the risk perception and hence, could be more useful in further programming for a safer cycling, because it includes mechanisms forming the risk perception.

1-1. Aim and hypotheses

For a clear explication of mechanisms forming the risk perception in HBM, the present study aims to investigate the feasibility of an integrated framework combining the HBM components (from health behaviour theory) and risk perception and unrealistic comparative optimism (both from the risk theories) in explaining underlying factors in bicyclists' intention to use helmet (Figure 1). In this postulated framework the HBM constitutes the core part of the integrated framework. The risk perception and its predictors, however, are added to provide a more meaningful picture of mechanisms underlying behavioural intention to wear bicycle helmet. This will provide the road safety planners and practitioners with more perceptive decisions when thinking of smart changes required to alter people's intention to use bicycle helmet.

<Figure 1 around here>

As shown in Figure 1, risk perception (personal susceptibility to and perceived severity of outcome) constitutes a common construct between the HBM and the risk theories. It is hypothesized that the lower comparative optimism is associated with higher risk perception. The framework also hypothesizes that risk perception mediates the relation between comparative optimism and intention to use bicycle helmet. As people have enough control over wearing a helmet, it is hypothesized that more risk perception is related to more intention to wear helmet. The intention is also hypothesized to be positively associated with perceived benefits and cues to action and negatively associated with perceived barriers. Finally, it hypothesizes that the bicyclists' demographics (cycling experience, gender and age) could also relate to comparative optimism.

2. Sampling and statistical procedures

2-1. Sampling procedure

The questionnaire was developed in Farsi and uploaded on Google Docs. About 15 administrators of big cycling and non-cycling web groups were contacted and the study aims and methods were explained to them. They helped the authors to distribute a web URL linked to the questionnaire, embedded in an invitation letter to conduct a self-administered survey.

For those with very low levels of cycling activity, there was a risk that the respondents had no proper conception to rate on the subscales of HBM, risk perception and comparative optimism related to cycling. Moreover, from a technical perspective, this might increase the responses' variance which could degrade the reliability of the results. On the other hand, ignoring the respondents who do not cycle more regularly might cause excluding those who rarely cycle in daily travels from the analysis. Missing this important proportion of respondents within the sample might prevent a comprehensive investigation. To make a trade off, we set out a modest criterion of minimum cycling activity of once a week (regardless of cycling hours) for being included in this survey.

The invitation letter was distributed among the respondents through different media, mainly by email, instant messaging applications on smart phones, Facebook and Linkedin. Furthermore, the respondents were encouraged to share the questionnaire with their friends, acquaintances and colleagues, if they also used to cycle. Several previous surveys used similar methods to recruit respondents (e.g. Nordfjærn et al. 2015)).

The web questionnaire consisted of seven pages and the respondents were required to complete all questions before being able to submit the responses. Therefore, there were no missing values in the data. The link was active for a couple of weeks in June 2016. Among an unknown number of visits to the invitation letter, 771 clicks on the link were registered. A total of 256 (33.2%) respondents, however, completed the questionnaire; a relatively feasible response rate in web surveys (Shih and Fan 2008).

2-2. Questionnaire

The questionnaire consisted of instruments to measure socio-economic characteristics of respondents, including gender, age, the highest completed education, years of cycling experience and cycling hours a week. We also asked the respondents to report if they owned a bicycle helmet, and that if they used the helmet in the last time they had cycled. The questionnaire also included instruments to measure items in the Health Belief Model, risk perception and self-optimism as well as bicyclists' intention to use helmet.

The HBM instrument used in the study was a revised shortened version of the Ross et al. (2010). It included subscales of Personal Vulnerability (8 items), Perceived Severity of Harm (2 items), Perceived Benefits (4 items), Perceived Barriers (7 items) and Cues to Action (2 items). The respondents were asked to rate their consent with each item on a 5-point Likert scale (1: strongly disagree to 5: strongly agree).

Respondents' risk perception was measured by a two-item instrument developed by Ulleberg and Rundmo (2003). The first item asked about the respondents' subjective evaluation of the probability of being involved in a road crash as a bicyclist on a 5-point Likert scale (1: Not probable at all to 5: Very probable). The second item measured the perceived severity of consequence that the respondents would expect in a potential road crash as a bicyclist, by asking them how worried and concerned they were regarding being physically injured in a crash while cycling. Perceived severity of consequence was also measured on a 5-point Likert scale (1: not worried at all to 5: very worried).

Comparative optimism (CO) was measured by asking the respondents to compare their cautiousness, road accident probability, quality of reflexes, general goodness and competence, with an average cyclist of the same age and gender. The instrument was a combination of items used by Delhomme (1991) and Martha et al. (2010) and the CO was measured on a 3-point Likert scale with scores of -2: worse, 0: the same and 2: better.

Finally, the bicyclists' intention to use helmet was measured by asking the respondents to rate their intention to use a helmet during their everyday cycling. This was scored on a 5-point Likert scale (1: very low to 5: very high).

Mean score and standard deviation for items of HBM subscales, risk perception components, comparative optimism and intention to use bicycle helmet are presented in Table 1[1].

<Table 1 around here>

2-3. Sample characteristics

The sample consisted of 24% (n = 61) females and 76% (n = 195) males. The mean age of the respondents was 31.9 years (min= 15, max= 71, SD=10.02). Most participants in the survey had a full-time job (42%), while 18% had a part-time job and 21% were students. A total of 42% of respondents had not completed a university degree, while 38% had completed a bachelor's degree and the rest 20% had a graduate degree as the highest completed level of education. On

[1] The Likert scale considers the responses as an ordinal data. Since the differences between responses is not equidistance in an ordinal scale, treating the ordinal data similar to interval data has been challenging, and applicability of mean, standard deviation and ordinary parametric tests for ordinal data has been skeptic. Recent debates based on actual examples and compelling evidence, however, argue that parametric tests are robust to violation of these assumptions (Norman 2010; Sullivan and Artino 2013). This is a plausible reason when calculating the mean score and standard deviation for ordinal scale items, particularly when dealing with less concrete measures such as personal satisfaction, attitudes, etc.

average the bicyclists had a cycling experience of 10.2 years (SD=9.4). It was also revealed that on average each respondent spent 9.2 hours (SD=7.3) cycling a week. A majority of respondents (79%) declared that they owned a bicycle helmet, out of which 87% stated that they wore the helmet in the last time they cycled.

2-4- Design of the study

We developed and compared two separated second-ordered structural equation models (SEMs), while using gender and cycling experience as control variables. In the first model an HBM was developed using all original subscales (in the form of latent variables) directly connected to intention to wear bicycle helmet. The second tested framework was specified in close relation to the original HBM, but we substituted the subscales of personal vulnerability (perceived danger of cycling) and perceived severity, with original components of risk perception. However, as perceived exemption from harm (a component of personal vulnerability subscale in the HBM) had no corresponding component in risk perception theory, it was also kept in its original form, as a separated variable in the proposed integrated framework.

2-5. Statistical procedures

The statistical procedures in this study were conducted using PASW statistics 18.0 and IBM SPSS AMOS 22.0.

The instrument used to measure HBM subscales for cycling helmet use is still rather new and has not previously been validated in Iran. We used a two-step procedure. First the measurement model was fitted and then complete structural equation models were tested and compared.

By definition, dimensionality is “the number of common factors or latent constructs needed to account for the correlation among the variables” (Netemeyer et al. 2003, p. 27). An exploratory factor analysis (EFA) with alpha factoring method and varimax rotation was carried out to explore the underlying dimensionality of the HBM subscales. The same method was also applied to explore the construct of comparative optimism. Items with factor loadings greater than 0.3 were included and items with weaker loadings were removed from the analysis. For each construct the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was reported. KMO ranges between 0 to 1.0. Values between 0.7 to 0.8, 0.8 to 0.9 and 0.9 to 1.0 are generally rated as good, great and superb statistics, respectively (Hutcheson and Sofroniou 1999).

For each component, Cronbach's Alphas were reported as the coefficient of internal reliability. As has been recommended, Cronbach's Alphas greater than 0.5, 0.6, 0.7, 0.8 and 0.9 are considered as questionable, acceptable, good and excellent, respectively (George and Mallery 2003). Average corrected item-total correlations were also calculated. As a rule of thumb, values greater than 0.4 are considered satisfactory (Gliem and Gliem 2003)

Further, the dimensionality of the instruments was confirmed using a confirmatory factor analysis (CFA). For each construct, minimum value of discrepancy function (chi-square which reflects the difference between the observed covariance matrix and the predicted covariance matrix (Moss 2017)), degrees of freedom (df), comparative fit index (CFI which reflects the difference between the model of interest and the null model (Moss 2017)) and the root mean squared error of approximation (RMSEA which represents the degree to which the model fits the population covariance matrix, while controlling for degree of freedom and sample size (Kline 2016)) are reported. To approach a close fit, it is recommended that the CFI has values greater than 0.90 to 0.95 (Kim and Bentler 2006), although the range of 0.85 to 0.90 reflects a mediocre fit (Little 2013). While RMSEA values less than 0.05 indicates a good model fit, values ranging from 0.05 to 0.08 are also considered acceptable (Ho 2013). Furthermore, for adequate model fit, the Chi square to df ratio is recommended to be less than 5.0 (Bentler and Bonett 1980).

Bi-variate correlations were also reported to describe the univariate relations between HBM subscales, components of risk perception, comparative optimism, age, gender, cycling experience and intention to wear bicycle helmet.

The structural equation modeling (SEM) captures the complex and dynamic relationships between a number of observed and unobserved (latent) variables, based on a postulated framework (conceptual model). In this way, the paths of relationships form a system of linked regression-style equations. Therefore, in contrast to the ordinary regression analysis, dependent and independent variables are defined on a relative basis, that is a dependent variable in one model equation could act as an independent variable in another model equation (Gunzler et al. 2013).

In the tested SEM models, all latent variables were entered with their indicators. All variables in the model were considered as latent variables except the control variables of gender, cycling experience and age, and the main outcome variable intention to wear a helmet. Standardized regression weights (path coefficients) were calculated for the structural relations. When variable X2 is assumed to be explained by variable X1 (X1→X2), the standardized regression weight (beta) for the path could be interpreted in such a way that a unit of standard deviation in X1 variable gives beta units of standard deviation change in X2. Furthermore, squared multiple correlations were calculated to provide an estimate of explained variance and various fit indices (Chi-Square, CFI, RMSEA) were used to examine the correspondence between the hypothesized model and the data. For an acceptable fit, the same thresholds as explained for the goodness of fit in CFA analysis, are also applicable for these fit indices.

3. Results

3-1. Dimensionality and reliability of the instruments

Table 2 shows the results of factor analyses for the comparative optimism and HBM subscales. The KMO results show that the sample was adequate for subjecting the CO and each HBM subscale to EFA. As shown in Table 2 the Cronbach's Alphas and average corrected item-total correlations were satisfactory for all scales. For each factor, values of mean and standard deviation have also been reported.

<Table 2 around here>

EFA of the items of comparative optimism showed that the instrument segmented in one factor which explained 40.93% of the variance. EFA of the first subscale of HBM (personal vulnerability) resulted in a two-factor solution called perceived exemption from harm (explaining 34.71% of the total variance) and perceived danger of cycling (explaining 15.23% of the total variance). The second subscale of HBM was shown to consist of one factor termed perceived severity of harm which explained 62.95% of the total variance. A two-factor solution was identified for the third subscale of HBM (perceived benefits), namely the safety benefits and the emotional benefits, explaining 42.60% and 37.66% of the total variance, respectively. The construct of the fourth HBM subscale (perceived barriers) was composed of two factors i.e. personal vanity barriers explaining 24.71% of the total variance and personal discomfort and cost barriers explaining 22.07% of the total variance. Finally, the construct in the last subscale of HBM i.e. cues to action includes parental rules in childhood explaining 38.48% of the total variance.

To confirm the dimensionality established by the EFA, we also conducted a confirmatory factor analysis (CFA) to further measure the construct fit. The results were satisfactory (based on the previously explained thresholds) for both the HBM (Chi-Square=439.182, DF=257, Chi-Square/DF= 1.709, CFI=0.935, RMSEA=0.053) and CO (Chi-Square=10.419, DF=5, Chi-Square/DF= 2.084, CFI=0.982, RMSEA=0.065) constructs.

3-2. Associations between the study variables

Table 3 shows bivariate correlations between the HBM subscales, components of risk perception, comparative optimism, age, gender, cycling experience and intention to wear a bicycle helmet. Intention to use a helmet statistically correlated with all the HBM subscales, except for perceived severity of harm. Components of perceived benefits (safety and emotional benefits) were negatively correlated with components of perceived barriers (personal vanity barriers and personal discomfort and cost barriers). Perceived exemption from harm was also negatively correlated with the components of perceived barriers (personal vanity barriers and personal discomfort and cost barriers).

<Table 3 around here>

Further, comparative optimism was weakly correlated with both the components of HBM subscales and intention to use a helmet, but moderately correlated with cycling experience and risk perception (road crash probability). The risk perception components were also correlated with Perceived exemption from harm.

3-3. Predicting intention to use a bicycle helmet

The next step was to apply SEM to examine the hypothesized framework (Figure 1) to predict intention to use a bicycle helmet.

First, we established and ran a health belief model with all components of original subscales (as latent variables) directly connected to intention to wear a helmet (Figure 2). In this figure, e and R^2 represents the error variance in endogenous variable and squared multiple correlation, respectively. Ellipses and rectangles stand for latent and observed variables, respectively. The solid arrows show the hypothesized relationships, the values on which are the standardized regression weights (the signs reflect the direction of each relationship). An endogenous variable is the independent variable in at least one of the model equations. An exogenous variable also refer to an independent variable in the SEM. For parsimony, the indicators of the latent factors and variables and the covariances considered in the analysis are not depicted on this figure.

The results showed that the model had a moderate fit to the data, based upon the previously explained thresholds (Chi-Square= 537.957, DF=236, Chi-Square/DF=2.279, CFI=.897, RMSEA=.071 (CI90%=.063; .079)); however, the path coefficients (standardized regression weights) between the subscales and intention were all insignificant, except for perceived barriers (B=-.502, p<.01). More importantly the model yielded no explanations about formation of risk perception and how this mechanism might be related to intention to use bicycle helmet.

<Figure 2 around here>

To explore the mechanisms behind risk perception, we substituted the factors of perceived severity of harm and perceived danger of cycling from the HBM with the components of risk perception adopted from the risk theory. It was, however, noted that the substituted measure of risk perception did not exactly address the factor of perceived exemption from harm in the subscale of personal vulnerability, so we kept this factor as a separated component (with one factor) besides the other remained subscales of HBM, i.e. perceived benefits, perceived barriers and cues to action. Finally, comparative optimism (with age, gender and cycling experience as explaining variables) was entered into analysis to explore the underlying mechanisms (Figure 3). Similar to Figure 2, the solid arrows in Figure 3 also show the hypothesized relationships, the values on which are the standardized regression weights.

<Figure 3 around here>

Comparing the direct and indirect (using risk perception as mediator) effects of comparative optimism on intention to use helmet, the SEM proposed a fully mediated relationship, that is while in the absence of a mediator (risk perception) the independent variable (comparative optimism) was statistically significantly related to the dependent variable (intention to use bicycle helmet), adding the mediator negated the significant relationship between independent and dependent variables, but maintained a statistically significant relationship between the independent variable and mediator and between the mediator and the dependent variable.

Repeating similar analysis with perceived exemption from harm as a mediating variable, comparative optimism as a causal variable and intention to use helmet as outcome variable, however, returned no indication of a fully or partially mediating effect. Furthermore, perceived exemption from harm was not recognized as a mediator, neither in a full, nor in a partial effect, in assessing the risk perception effect on intention to use helmet. Therefore, the second-order SEM illustrated in Figure 3 was considered a better alternative model explaining intention to use helmet, compared to Figure 2. The fit indices showed a satisfactory fit between the model and the data (Chi-Square= 457.285, DF=329, Chi-Square/DF=1.390, CFI=.960, RMSEA=.039 (CI90%=0.030; 0.047)).

As depicted on Figure 3, the model explained a total of 55.8% of the variance in intention to use a bicycle helmet. However, similar to the model shown in Figure 2, the HBM subscales of perceived benefits and parents' rules in childhood (cues to action) loaded non-significant standardized regression weights, but risk perception ($B=.113$ $p<.05$), perceived exemption from harm ($B=-.340$, $p<.05$) and the HBM subscale of perceived barriers ($B=-.507$, $p<.05$) were all found to be significantly related to intention to use helmet. More perceived barriers were related with less intention to use a helmet. More risk perception was also corresponding with less intention to wear a bicycle helmet. Less perception of risk was associated with more comparative optimism. Male gender and more experienced bicyclists also predicted more comparative optimism.

4. Discussion

The effectiveness of wearing bicycle helmet on reducing crash severity has been well demonstrated in the literature. A few studies, however, have argued the importance of intention to wear helmet as an important precursor of bicycle helmet use (e.g. Lajunen and Räsänen 2004). Behavioural models in similar studies were mainly based on the health behavioural theories. The Health Belief Model (HBM) was found to return relatively acceptable results.

Although the HBM consists of constructs of threat or risk perception, the model does not deliver more explications about the mechanisms forming the risk or threat perception. The risk perception, however, is central in risk theories. Hence, the authors were motivated to include the precursors of risk perception from the risk theories linked into the HBM in order to explore the mechanism behind risk perception. To do this, we substituted the risk perception components in the original HBM with the risk perception components from the risk theories, while adding the comparative optimism as its explaining factor to the same framework.

Compared with the HBM to predict the intention to use bicycle helmet, the hypothesized integrated framework had a considerably higher fit to the data, and significant paths were detected between some precursors and the intention to use helmet. In comparison, the original HBM to predict the intention to wear bicycle helmet resulted in all insignificant regression weights, except for the perceived barriers. This could suggest that the postulated framework could be considered as a useful framework in predicting the intention to use helmet by the bicyclists, and hence, the framework could have feasible implications in policy making and intervention design with the aim of increasing in the proportion of helmeted bicyclists.

Out of the HBM subscales in the proposed framework, the perceived barriers from harm significantly predicted intention to use bicycle helmet. Perceived exemption from harm as a factor of personal vulnerability also significantly explained intention to use bicycle helmet. Perceived benefits and cues to action, however, yielded insignificant weights when they were directly connected to intention to use helmet. This suggests that change in those subscales does not make any significant change in the mean intention to use helmet. This may be related to a likely low variance in such subscales in our study, which may be attributable to the working sample.

In line with our findings, particularly from the original HBM, the associations between HBM subscales and intention or behaviour, have not been consistently significant in the previous studies. For instance, perceived susceptibility (Joshi et al. 1994; Quine et al. 1998; Lajunen and Räsänen 2004; Ambak et al. 2010), perceived severity (Joshi at al. 1994; Quine et al. 1998; Ambak et al. 2010; Peachey et al. 2015), perceived benefits (Joshi et al. 1994; Lajunen and Räsänen 2001; Lajunen and Räsänen 2004; Ambak et al. 2010; Brijs et al. 2014) and perceived cues to action (Joshi et al. 1994; Quine et al. 1998; Lajunen and Räsänen 2001; Brijs et al. 2014) were found to be insignificant predictors of intention to wear helmet or helmet use behaviour in previous studies.

The proposed integrated model enhanced the overall fit of the model. More particularly and in line with findings in other studied (Quine et al. 1998; Lajunen and Räsänen 2004), the model revealed that perceived barriers (including personal vanity barriers and personal discomfort and cost barriers) are associated with less intention to wear the bicycle helmet.

Our study also showed that the perceived exemption from harm is a strong predictor of intention to use bicycle helmet. This finding is consistent with Ross et al. (2010) where perceived exemption from harm represented a contributing factor with a relatively great effect size in differentiating helmeted and non-helmeted bicyclists. On this basis, the more one perceives exempted from harm, the less agreement there is for a need to wear a helmet. Alternatively, viewing the perceived exemption from harm from a different viewpoint, one may argue that the items in this subscale (e.g. not bicycle frequently, on a race, on a long ride, or so fast to need a helmet), can also contribute to control beliefs; the perceived contextual factors that facilitate or impede the performance of a behaviour (Godin et al. 2004). In other words, the items can be interpreted as beliefs that address resistance to contextual factors that prevent the helmet use. Since control beliefs are found to contribute in perceived behavioural control (Ajzen 2006), and that perceived behavioural control is relatively consistently associated with behavioural intention, the relatively high significant path between the perceived exemption from harm and intention to use bicycle helmet can be justified. With the same reasoning, perceived barriers can also be interpreted as control beliefs (Estabrooks and Carron 1998), although the regression weight was not shown to be as high and significant as the perceived exemption from harm is in this study.

Considering the risk perception subscales in the original HBM (perceived vulnerability and perceived severity of harm), not a significant relation was established between the measures of risk perception and intention to use helmet. This is compatible with results suggesting that risk perception is not a predictor of behaviour or intention (Ulleberg and Rundmo 2003; McKenna and Horswill 2006; Lund and Rundmo 2009; Elias and Shiftan 2012; Şimşekoğlu et al. 2013), suggesting that it may indirectly affect safety-related intentions or behaviours via subjective norms and attitudes (Stasson and Fishbein 1990). Interestingly, however, substituting the risk perception measures from the risk theories, the risk perception (in the form of a mediating variable between comparative optimism and intention), was found as a statistically significant predictor of intention to use helmet. This is consistent with studies that have identified perceived susceptibility to (Joshi et al. 1994) and perceived severity (Witte et al. 1993; Lajunen and Räsänen 2004) of adverse outcome, as significant predictors of helmet use intention or behaviour, at least after controlling for the effect of comparative optimism.

Results detected that comparative optimism was prominent among the respondents, most people perceived their competence, cautiousness, quality of reflexes and general abilities in cycling better and their risk of being involved in a road crash lower, compared with their peers. The study could also not reject the hypothesis that comparative optimism is a strong predictor of risk perception; it was revealed that more comparative optimism was associated with less feelings of vulnerability. This is in line with the literature pointing out that while people's perception of risk is accurate and they have reasonable ideas regarding the relative risks of different activities and behaviours, there is also a general tendency that people underestimate the risk when compared to their peers (van der Pligt 1996; Clarke et al. 2000). The more control one perceives to have over an event; and the less prior experience one has regarding the unfavourable outcome, he or she might be more optimistic regarding the chance of avoiding the reoccurrence (Shepperd et al. 2015).

Finally, looking at background variables related to the sample, one may argue that relative optimism could be attributable to overrepresentation of young male respondents, owing to the fact that more optimism is associated with male gender (DeJoy 1990; DeJoy 1992) and that younger road users may underestimate the risk of a road crash and overestimate their own skills (Deery 1999). This interpretation is not plausible, since the analysis has controlled for age, gender and cycling experience. It was shown that while age insignificantly relates to optimism, more optimism is associated with male gender and being a more experienced bicyclist.

4-1. Limitations of the study

Since there is no officially registered database of bicyclists in the country, it was considered too complicated to conduct random sampling in the study. A web survey was used to establish the sample for the current study. It should be noted that there have been concerns associated with internet surveys in terms of sampling bias and the external validity of data (Braithwaite et al. 2003).

The sample size in this study assumed to be adequate to get reliable results. Samples in electronic surveys are usually less representative of the society as the research designers have usually no idea regarding the characteristics of respondents, and usually it is not possible to follow them up for further reminders, or even calculate the return rate. However, this method is still a feasible and widely used method for collecting data in transportation research (e.g. Nordfjærn et al. 2015).

The present study assumed that change in personal motivation is associated with helmet use behaviour as a health related behaviour. However, developing models of behavioural change will be intensively required to examine the effect of policies on behavioural change. More importantly, it should be noted that not a large behavioural change might be expected from the interventions targeting the behavioural intentions. For example conducting a meta-analysis Webb and Sheeran (2006) concluded that a “medium-to-large” change in intention may lead to a "small-to-medium" change in behaviour. This suggests that more research is needed to measure the effects of change in behavioural intention on helmet wearing behaviour.

5. Conclusions and implications

The present study aimed to connect the health belief model with the risk perception theory in the context of cycling safety. Compared with the original HBM, the new framework better suits the needs of policy makers and practitioners in adopting the required countermeasures for increasing the prevalence of bicycle safety helmets.

Assuming a significant positive relationship between intention and behaviour, the mechanism of intention to bicycle helmet use underlying the HBM components gives promising indications concerning promotion of bicycle helmets, and consequently helmet use. It suggests that stress on benefits of helmet use builds on the beliefs that already exist and hence, does not alter bicyclists' intention to wear helmet. The study also shows that further stimulating overt behaviour in the childhood through delivering cues to action (parental rules) might not spark intention to bicycle helmet use in the adulthood.

However, as an efficient way of promoting bicycle helmet, the study proposes that emphasis on reducing (or ideally removing) barriers of helmet use (vanity, cost or discomfort barriers) may bring about advanced intentions regarding bicycle helmet use in an efficient fashion.

Furthermore, in enhancing intention to use bicycle helmet, an emphasis on human vulnerability is a key. Enhancement programs to promote bicycle helmet should focus on both the probability and severity components of the general risk perception through cognitive mechanisms, enlightening that there is always a high chance of being involved in a road crash while cycling; severe consequences (coming to death or severe injuries) are always foreseen in bicycle crashes, and that there is no excused person or no exempted circumstances. This might be possible through mechanisms increasing the behavioural control and beliefs on personal susceptibility and at the same time trying to combat the comparative optimism bias. Particularly, road safety enhancement programs should pay more attention to male gender (compared to females) and more experienced bicyclists, as they are more prone to the comparative optimism bias. Care should, however, be taken when designing interventions to enhance behavioural intention, since identifying some correlations between variables could be different from designing actions for implementation in practice. For example, focus on bicyclists' vulnerability in safety enhancement programs might be considered objectionable, met with resistance and become counterproductive. Assessing the effect of measures on change in behaviour or behavioural intention is out of the scope of the present study.

Considering the above factors in devising effective road safety enhancement programs combined with mandatory legislation and enforcement, would most probably leads to more sustainable improvements in bicycle helmet use. Enhancing intentions would provoke voluntary change in behaviour in the medium and long term, while without profoundly considering the factors affecting intentions, unhelmeted cycling could easily reoccur, even where helmet use is mandatory (e.g. in the occasion of low level of perceived deterrence).

The research conducted in the present study considered intention to use bicycle helmet in relation to components of HBM and risk perception theory. However, other theoretical frameworks (e.g. protection motivation theory and social cognitive theory) can be used in further studies, separately or in combination to each other, to explain the helmet use, helmet possession and intention to use helmet. Furthermore, testing the efficacy of the postulated framework in explaining the bicycle helmet use behaviour could be conducted in further research. Further models of behavioural change in the context of bicycle helmet use could be developed in future studies.

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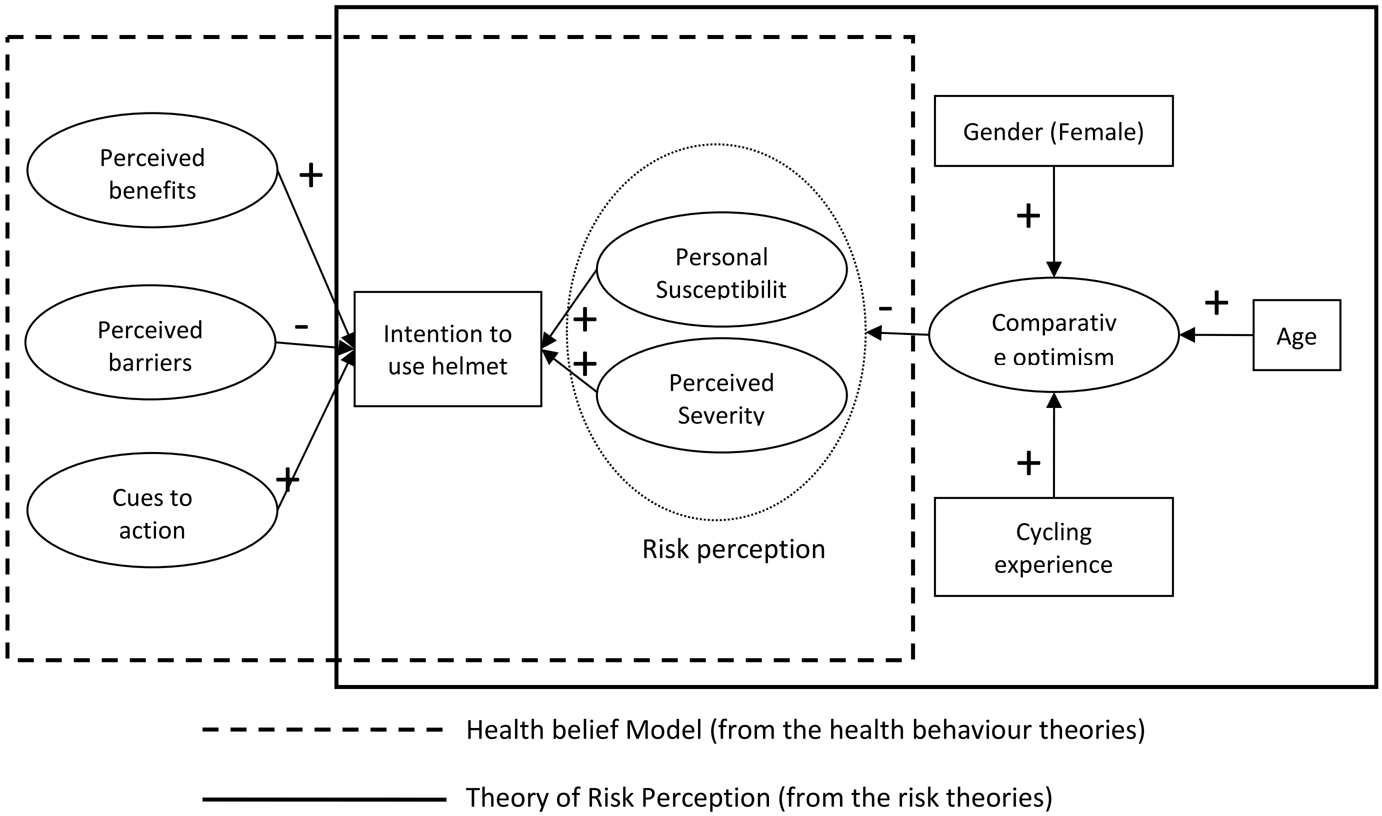
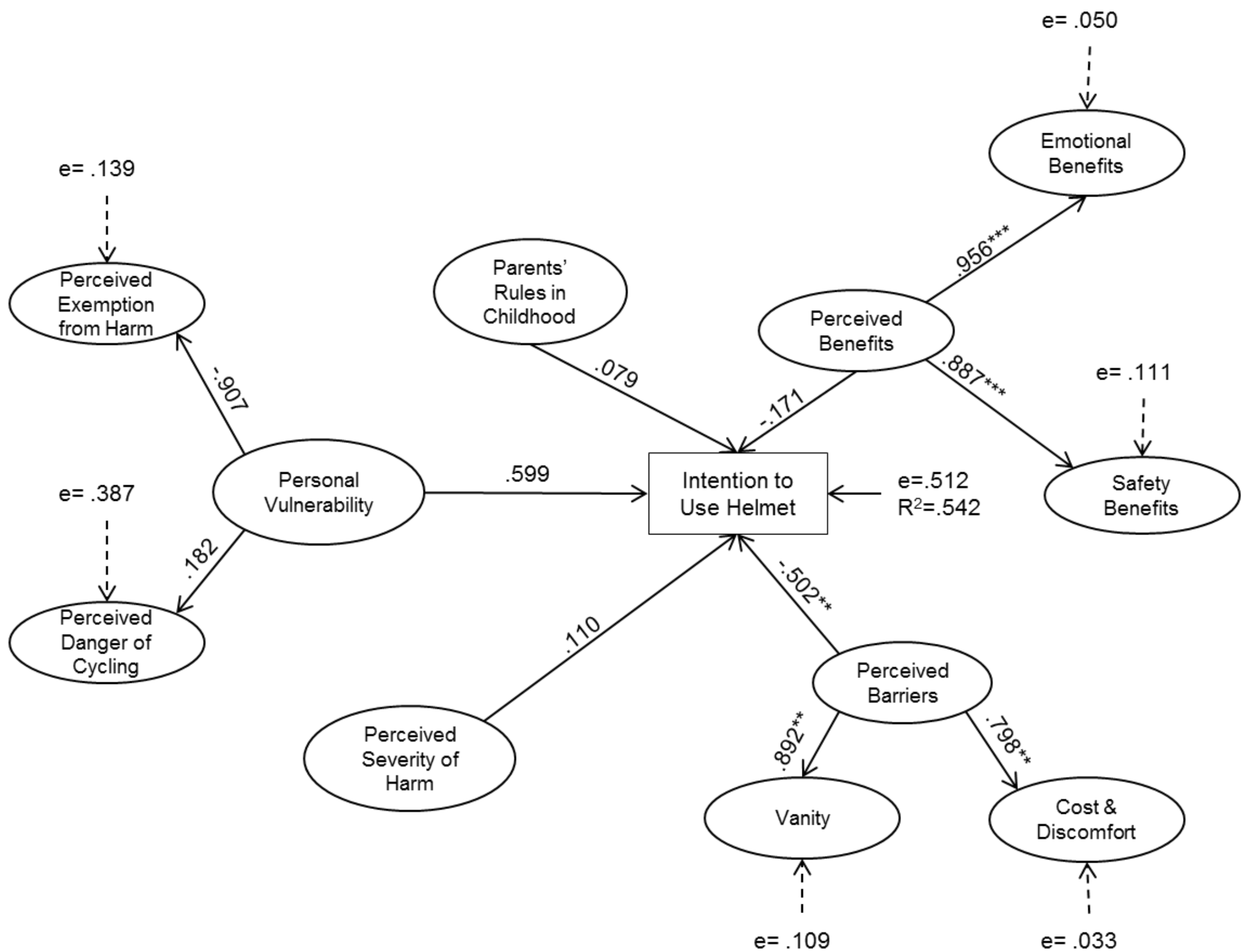


+: Hypothesized positive association

-: Hypothesized negative association

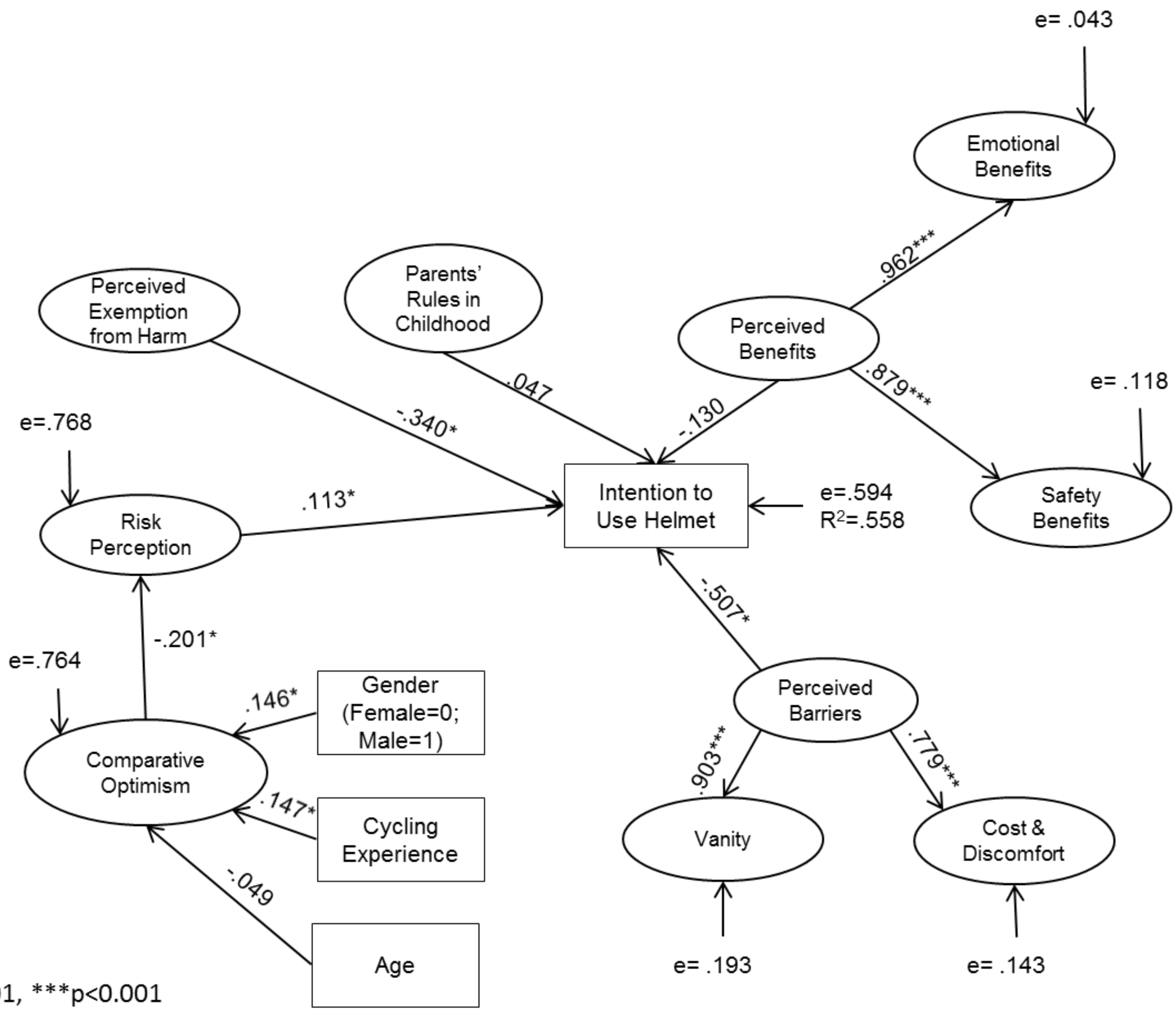
Figure 1. Heuristic framework for the study



* p<0.05, **p<0.01, ***p<0.001

Chi-Square= 537.957, DF=236, Chi-Square/DF=2.279, CFI=.897, RMSEA=.071 (CI90%=.063;.079)

Figure 2. SEM analysis including the HBM subscales to predict intention to use helmet by cyclists in the sample



* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Chi-Square= 457.285, DF=329, Chi-Square/DF=1.390, CFI=.960, RMSEA=.039 (CI90%=0.030; 0.047)

Figure 3. SEM analysis including the HBM subscales and comparative optimism to predict intention to use helmet by cyclists in the sample

Table 1. Means and standard deviations for items of HBM subscales, risk perception components, comparative optimism and intention to use bicycle helmet†

Item	Mean	Std. Deviation
HBM Subscale 1: Perceived exemption from harm*		
1. I do not go fast enough to need head protection in a crash*	4.32	.973
2. I feel that helmets are unnecessary for very short rides*	4.02	1.180
3. Bicycle helmets are less important for those who ride their bikes infrequently*	4.33	.926
4. Since I'm not racing or doing any bike stunts, I don't really need a helmet*	4.32	1.024
5. When I'm bicycling, I am at risk of being injured by motor vehicles*	4.64	.829
6. Bicycling is dangerous on slippery/wet roads*	4.39	.870
7. There is a good chance that I could get hurt while riding my bicycle*	3.84	1.076
8. Generally speaking, I believe that bicycling in the street is a dangerous activity*	3.33	1.278
HBM Subscale 2: Perceived Severity of Harm		
9. If I injured my head while riding my bike, it could seriously affect my social life and relationship with my friends and family.	3.69	1.173
10. If I injured my head while riding my bike, it could seriously affect my ability to function at school/work.	3.82	1.091
HBM Subscale 3: Perceived Benefits		
11. Wearing a helmet would make me feel less anxious when I ride a bike.	4.34	.982
12. Wearing a helmet while bicycling makes me feel safer.	4.52	.816
13. In the event of an accident, a helmet would protect my head.	4.57	.774
14. I believe that wearing a helmet can prevent a serious head injury if I have a bicycle accident.	4.55	.857
HBM Subscale 4: Perceived Barriers		
15. I would feel embarrassed wearing a bicycle helmet.	1.94	1.285
16. As an adult, I feel foolish wearing a helmet just to ride around town, or where no one else is wearing one.	2.08	1.270
17. Quite frankly, wearing a helmet looks stupid.	1.53	.966
18. Wearing a helmet is too hot.	2.82	1.267
19. Wearing a bike helmet strap pinches/would pinch my neck or sometimes irritates my skin.	2.31	1.206
20. The cost of buying a helmet would affect whether I wore one or not.	2.14	1.229
21. The best helmets (that look the coolest and are most comfortable) are too expensive for me to buy.	3.57	1.287
HBM Subscale 5: Cues To Action		
22. My parents never made me wear a helmet when I was a child.*	2.40	1.245
23. I don't remember that I was bought a helmet by parents when I was a child.*	2.01	1.173
Risk perception		
Probability	3.00	1.09
Severity	3.00	1.07
Comparative Optimism		
1- Competence	.90	1.143
2- Cautiousness	1.12	1.142
3- Road accident probability	.63	1.195
4- Quality of reflexes	1.07	1.199
5- General abilities	.98	1.106
Intention		
Intention to wear a helmet while cycling	4.11	1.17

† Answer categories for each item in HBM subscales ranges from 1: strongly disagree to 5: strongly agree. Answer categories for probability evaluation in risk perception ranges from 1: not probable at all to 5: very probable. Answer categories for severity evaluation in risk perceptions ranges from 1: not worried at all to 5: very worried. Answer categories for comparative optimism ranges from -2: worse to 2: better. Answer categories for intention ranges from 1: very low to 5: very high.

* Scores for these items were reversed, so that the higher scores reflect the higher personal vulnerabilities

Table 2. Factorial structure of comparative optimism and HBM subscales, factor loading scores and the results of reliability analysis

Comparative Optimism (KMO=0.779)**		
F1: Comparative Optimism (M=.94, SD=.83)	F1	
5- General abilities	.815	
1- Competence	.738	
4- Quality of reflexes	.612	
3- Road accident probability	.496	
2- Cautiousness	.466	
% of variance explained	40.93	
Cronbach's Alpha	.758	
Average corrected item-total correlations	.529	
HBM Subscales		
Subscale 1: Personal Vulnerability * (KMO=0.806)		
F1: Perceived Exemption From Harm (M=4.25, SD=.90)	F1	F2
1. I do not go fast enough to need head protection in a crash.	.862	
4. Since I'm not racing or doing any bike stunts, I don't really need a helmet.	.856	
2. I feel that helmets are unnecessary for very short rides.	.810	
3. Bicycle helmets are less important for those who ride their bikes infrequently.	.796	
F2: Perceived Danger of Cycling (M=4.05, SD=.70)		
7. There is a good chance that I could get hurt while riding my bicycle.		.671
6. Bicycling is dangerous on slippery/wet roads.		.545
5. When I'm bicycling, I am at risk of being injured by motor vehicles.		.486
8. Generally speaking, I believe that bicycling in the street is a dangerous activity.		.466
% of variance explained	34.71	15.23
Cronbach's Alpha	.897	.624
Average corrected item-total correlations	.778	.401
Subscale 2: Perceived Severity of Harm (KMO=0.500) **		
F1: Perceived Severity of Harm (M=3.75, SD=1.03)	F1	
9. If I injured my head while riding my bike, it could seriously affect my social life and relationship with my friends and family.	.812	
10. If I injured my head while riding my bike, it could seriously affect my ability to function at school/work.	.812	
% of variance explained	62.95	
Cronbach's Alpha	.794	
Average corrected item-total correlations	.660	
Subscale 3: Perceived Benefits (KMO=0.789)		
F1: Safety Benefits (M=4.56, SD=.78)	F1	F2
14. I believe that wearing a helmet can prevent a serious head injury if I have a bicycle accident.	.813	.418
13. In the event of an accident, a helmet would protect my head.	.810	.441
F2: Emotional Benefits (M=4.43, SD=.84)		
12. Wearing a helmet while bicycling makes me feel safer.	.518	.770
11. Wearing a helmet would make me feel less anxious when I ride a bike.	.344	.738
% of variance explained	42.60	37.66
Cronbach's Alpha	.912	.847
Average corrected item-total correlations	.843	.747

Table 2 (Cont'). Factorial structure of comparative optimism and HBM subscales, factor loading scores and the results of reliability analysis

Subscale 4: Perceived Barriers (KMO=0.735)	F1	F2
F1: Personal Vanity Barriers (M=1.85, SD=.99)		
15. I would feel embarrassed wearing a bicycle helmet.	.803	
17. Quite frankly, wearing a helmet looks stupid.	.724	
16. As an adult, I feel foolish wearing a helmet just to ride around town, or where no one else is wearing one.	.609	
F2: Personal Discomfort and Cost Barriers (M=2.71, SD=.89)		
19. Wearing a bike helmet strap pinches/would pinch my neck or sometimes irritates my skin.		.749
18. Wearing a helmet is too hot.		.735
20. The cost of buying a helmet would affect whether I wore one or not.		.464
21. The best helmets (that look the coolest and are most comfortable) are too expensive for me to buy.		.301
% of variance explained	24.71	22.07
Cronbach's Alpha	.784	.675
Average corrected item-total correlations	.634	.461
Subscale 5: Cues To Action (KMO=0.518)	F1	
F1: Parent Rules in Childhood (M=3.79, SD=1.14)*		
22. My parents never made me wear a helmet when I was a child.	.876	
23. I don't remember that I was bought a helmet by parents when I was a child.	.875	
% of variance explained	38.48	
Cronbach's Alpha	.878	
Average corrected item-total correlations	.783	

* Item scores for these items were reversed in this table, so that the higher scores reflect the higher personal vulnerabilities
** As only one factor was extracted, no rotation method was applied.

Table 3. Bivariate correlations between the HBM components, risk perception components, comparative optimism, age, gender, experience and intention to use a bicycle helmet

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Perceived exemption from harm	1	.127*	0.09	.300**	.380**	-.607**	-.399**	-0.04	0.048	.143*	.125*	0.115	-0.09	0.013	.655**
2. Perceived Danger of Cycling		1	.361**	.205**	.279**	-0.06	.143*	0.027	-0.06	.353**	.371**	.152*	0.033	-0.05	.137*
3. Perceived Severity of Harm			1	0.09	.139*	-0.01	0.052	-0.08	-0.03	.230**	.239**	0.107	0.013	0.011	0.1
4. Safety benefits				1	.742**	-.428**	-.280**	-0.04	0.051	-0.01	0.047	0.058	-0.02	-0.06	.303**
5. Emotional benefits					1	-.445**	-.299**	-0.02	0.028	0.079	0.101	0.096	0.002	-0.09	.332**
6. Personal Vanity Barriers						1	.433**	0.093	-0.02	-0.09	-0.09	-0.05	.128*	.124*	-.547**
7. Personal Discomfort and Cost Barriers							1	0.102	0.048	0.003	0.082	-0.01	-0.02	-0.02	-.410**
8. Parent Rules in Childhood								1	0.102	-0.03	0.037	0.098	.145*	0.091	-.125*
9. Comparative Optimism									1	-.178**	-.159*	0.041	.156*	.160*	0.049
10. Risk perception (Probability)										1	.759**	0.024	-0.06	-0.11	.197**
11. Risk perception (severity)											1	0.098	-0.09	-0.05	.162**
12. Age												1	0.014	.325**	0.031
13. Gender													1	.242**	-0.1
14. Cycling experience														1	-0.04
15. Intention to wear helmet															1

*. $p<0.05$
**. $p<0.01$