Health Behaviour & Public Health

www.academyjournals.net

ISSN 2146 9334

Original Article

The Influence of Self-efficacy and Compensatory Health Behavior in Bicycle Helmet Use

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Received: 18.03.2013 ***Accepted: 01.08.2013*** ***Published: 22.11.2013***

Abstract

Individuals show compensatory health behavior (e.g. safer cycling without helmet) to compensate for risky behavior. Compensatory health behavior is facilitated by high self-efficacy. A total of 134 cyclists with different helmet wearing frequencies (occasionally (OH) or never helmet (NH)) were asked to fill out a questionnaire on their compensatory health behavior when cycling without a helmet and on their general self-efficacy. An interaction between self-efficacy and use of a helmet on compensatory health behavior was found. OH-users with high self-efficacy showed more compensatory health behavior than OH-users with low self-efficacy. This effect was not present in NH-users. We assume that OH-users engage in compensatory health behavior, whereas NH-users remain unprotected by behavioral adaptation. These persons are vulnerable and may require specific attention in preventive actions.

***Key words**: Risk Behavior, Cycling, Prevention, Protection*

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INTRODUCTION

Compensatory health beliefs are cognitive strategies to compensate for a certain risk behavior by adapting their actual behavior (Rabiau et al. 2006). As a consequence, individuals with these beliefs show compensatory health behavior. This behavior counterbalances for an unhealthy or risky behavior (e.g. slowing down or cycling more carefully when not wearing a helmet) and is considered to be a part of the model of compensatory health beliefs (Rabiau et al. 2006). This model includes a motivational conflict, such as cognitive dissonance between desires and health goals. This motivational conflict can be alleviated through three different strategies: 1) activating the compensatory beliefs, which lead to compensatory health behavior (e.g. cycling without helmet but slowly), 2) resisting the temptations (e.g. wearing a helmet), 3) or adapting the risk perception and/or reevaluating the outcome expectancy (e.g. following the idea that cycling on this road is not dangerous or diminishing the perceived safety potential of helmet use). Activating compensatory beliefs that lead to compensatory health behavior result in an effective reduction of motivational conflict. Thus, by availing themselves of a compensatory behavior, individuals believe they have neutralized an unhealthy behavior (Rabiau et al. 2006).

Cycling without helmet protection is an unhealthy behavior. Helmet protection has been found to reduce significantly the consequences of accidents (Thompson et al. 1999), and its perceived protection has led some individuals to take more risks when wearing a helmet. This phenomenon of risk compensation has been found in different areas of research, including traffic and sports (Mok et al. 2004;

Sagberg et al. 1997). Even in experimental situations, risk compensation could be manipulated (Phillips et al. 2011). Routine helmet users showed increased risk perception and decreased cycling speed in an unprotected condition (no bicycle helmet) compared to a protected condition. Similar results were found in other studies on safety gear (Mok et al. 2004; Morrongiello et al. 2007). Within the theory of risk compensation, safety behavior was expected to be compensated by higher risk taking. In contrast, in the theory of compensatory health beliefs, the compensatory behavior occurs when safety behavior is lacking and in order to counterbalance (i.e. reduce) the perceived increased risk.

The theory of risk compensation explains differences between protected and unprotected individuals. However, some cyclists wear a helmet only occasionally and therefore do not fit in one or the other group. Besides the fact that data on bicycle helmet use in adults is limited (Bungum and Bungum 2003; Dannenberg et al. 1993; Finnoff et al. 2001; Villamor et al. 2008), only 10% were found to wear a bicycle helmet occasionally, whereas 50% never wore a helmet (Bolen et al. 1998; McDonald's Corporation & Consumer Product Safety Commission 1999; Royal and Miller-Steiger 2008). Reasons to wear a helmet are different. Safety was one of the most often mentioned (McDonald's Corporation & Consumer Product Safety Commission 1999) due to the cyclist's belief that helmets reduce head injuries (Finnoff et al. 2001; Villamor et al. 2008). However, a recently published meta analysis showed that the safety benefits of bicycle helmets are smaller than expected (Elvik 2011).

This overestimation of safety benefits might influence helmet use in those individuals who wear a helmet occasionally. However, OH and NH could still differ regarding the beliefs in protection and compensatory health behavior. We suspect a difference in compensatory health behavior between the two groups, because OH-users show higher risk awareness due to their inconsistent behavior and are therefore more susceptible to display it. We also assume that OH-users with high self-efficacy show more compensatory health behavior due to the fact that OH-users take more responsibility in risk taking. Similar patterns of risk behavior have been observed in rock climbers or participants in other high risk undertakings, such as diving, suggesting a risk homeostasis (Wilde 1994).

In general, there is evidence that high self-efficacy predicts health behavior. High self-efficacy seems to facilitate compensatory health behavior (Rabiau et al. 2006). It is unclear whether self-efficacy plays a role in the specific use of safety gear such as bicycle helmet. Furthermore, no data exist on the effect of regularity of bicycle helmet use and self-efficacy on compensatory health behavior.

Therefore, this study aims to investigate whether compensatory health behavior is enhanced by self-efficacy in subjects who never wear a bicycle helmet or who wear it on an irregular basis. The following research questions were examined:

1. Do participants show more compensatory health behavior if they wear a helmet occasionally (OH) compared to participants who never (NH) wear a helmet?
2. Can compensatory health behavior be predicted by self-efficacy in OH and NH-users?
3. Is compensatory health behavior predicted by an interaction between the frequency of helmet use (OH or NH) and self-efficacy?

MATERIAL AND METHODS

Study sample and procedure

308 participants were recruited at a recreational health promotion event in Switzerland. At this event, all the people who were using human-powered vehicles were allowed to use a specific road closed for other traffic (i.e. cars). In one of the recreation areas, participants were asked to complete a two-page questionnaire on the regular use of a bicycle helmet, their compensatory health behavior in case of not wearing a helmet, their risk behavior and sense of protection, their self-efficacy, and their socio-demographics.

Measures

The following measures were used:

Regular use of a bicycle helmet: Participants responded to the question "*Do you wear a bicycle helmet on a regular basis?"* with three options "always" (AH), "occasionally" (OH), or "never" (NH).

Compensatory health behavior: According to the compensatory health belief questionnaire (Knäuper et al. 2004) two specific questions were developed to capture the compensatory behavior for persons not wearing a helmet: "*I do not wear a bicycle helmet therefore I slow down"* and "*I do not wear a bicycle helmet therefore I cycle more carefully*." The two items were rated on a four-point scale ranging from 1 (*not true at all*) to 4 (*absolutely true*) and summed up. Due to the skewed distribution of the scale a logarithmic transformation was used.

Risk behavior and sense of protection: Three specific questions were developed to assess participants' estimated risk in traffic situations such as risk awareness: "*Traffic is dangerous*", risk compensation: "*I tend to take more risks when wearing a helmet*" and sense of protection: "*I feel safer when wearing a helmet"*. All items were rated on a four-point scale ranging from 1 (*not at all true*) to 4 (*exactly true*).

General self-efficacy: General self-efficacy (Schwarzer and Jerusalem 1999) reflects an optimistic self-belief

(Schwarzer 1992), which helps to cope with difficult demands in life. The questionnaire consists of 10 items, each rated on a four-point scale ranging from 1 *(not true at all)* to 4 *(exactly true)* and summed up (Cronbach's alpha 0.90). In this study, participants' general self-efficacy was modified according to the median value (*Mdn* = 29) into low and high self-efficacy.

Sociodemographics: Participants were asked for demographic information such as age, gender, and level of education.

Statistics

Cross-tabulation with Pearson's χ^2 Tests and *t* tests were used to analyze sociodemographic differences between the group of OH and NH. A two-way ANOVA was conducted to examine the effect of helmet use and self-efficacy on compensatory health behavior. Due to the significant interaction found between helmet use and self-efficacy on compensatory health behavior we examined the simple main effects between self-efficacy (high and low) and helmet use (occasionally and never). A *p*-value of less than .05 was considered significant. The analyses were performed with the Statistical Package for Social Sciences (IBM SPSS; version 19 for Windows).

RESULTS

Out of a total of 308 individuals, 153 always wore a helmet (AH), 83 occasionally (OH) and 51 never (NH). For the analyses, participants were excluded due to regular use of helmet (AH) (*n* = 153) or incomplete data on compensatory health behavior (n = 21).

Participants with incomplete data (*n* = 21) were older (*M* = 52.94, *SD* = 11.32) than the rest of the group (*n* = 134) (*M* = 39.57, *SD* = 13.19), $t(139) = 4.68$, $p < .001$) but did not differ in gender, educational level and helmet use compared to the rest of the group.

Participants who declared always wearing a helmet (AH) had to be excluded due to limitations of the research questions. The AH-users were not able to respond adequately because compensatory health behavior was assessed as part of an unhealthy behavior, that is, not in case of the absence of unhealthy behaviors (i.e. I do not wear a helmet, therefore I slow down). AH did not differ from the other two groups (OH and NH) in risk awareness or sense of protection ($F(2, 262) =2.57$, $p = .08$, $\omega^2 = .002$).
However, AH and NH differed in risk compensation ($F(2, 138,85) = 4.35$, $p < .05$, $\omega^2 = .009$). AH (*M* = 1.56, *SD* = 0.85) showed lower scores in risk compensation than NH (*M* = 1.78, *SD* = 1.03).

Table 1 Socio-demographics of the two groups (participants wearing a helmet occasionally (OH) or never (NH)) (*N* = 134)

	OH (n = 83)	NH (n = 51)	*p*
Gender[a] %			0.67
Female	55.0	58.8	
Male	45.0	41.2	
Highest education[b] %			0.96
Lower	57.3	56.9	
Upper	42.7	43.1	
Age[c] *M (SD)*	40.5 (13.81)	37.9 (12)	0.29

Note.[a] Missing = 3. [b] Missing = 1. [c] Missing = 12.
n=sample size; M= mean; SD=standard deviation; p= level of significance

Table 2 Descriptives of all variables of the two groups (participants wearing a helmet occasionally (OH) or never (NH))

	OH (n = 83)				NH (n = 51)			
	M	SD	Min	Max	M	SD	Min	Max
Compensatory health behavior [a]	1.31	0.5	0.69	2.08	1.24	0.48	0.69	2.08
Risk awareness [b]	3.54	0.63	1	4	3.45	0.73	1	4
Risk compensation [c]	1.56	0.85	1	4	1.78	1.03	1	4
Sense of protection [d]	2.87	1.03	1	4	2.36	1.09	1	4
General self-efficacy	29.43	4.23	17	39	29.54	3.69	19	39

Note. [a] Items: 'I do not wear a helmet therefore I slow down' and 'I do not wear a helmet therefore I cycle more carefully'; [b] Item: 'Traffic is dangerous'; [c] Item: 'I tend to take more risks when wearing a helmet'; [d] Item: ' I feel safer when wearing a helmet'; n=sample size; M=mean; SD=standard deviation; Min=minimum; Max=maximum

Overall a sample of 134 participants wearing a helmet occasionally (OH) or never (NH) provided data for this study. Sixty-two percent (*n* = 83) wore a helmet occasionally (OH) and 38.1% (*n* = 51) never (NH). The OH and NH did not differ significantly in gender, educational level, or age (table 1). The sample included more women (55% (OH) and 58%

(NH)) with mainly lower education levels (57% (OH) and 56% (NH)) at middle age (40.5yrs (OH) and 37.9yrs (NH)). The OH-users felt significantly more secure wearing a helmet while cycling (M = 2.87, SD = 1.03) than NH-users (M = 2.36, SD = 1.09), $t(140) = 2.70$, $p < .01$, Cohen's d =0.49. All variables are presented in Table 2.

Table 3 Results of the two-way ANOVA

	df	*F*	ω^2	*p*
Helmet use (H)	1	0.69	0.005	0.407
Self-efficacy (S)	1	0.40	0.004	0.529
H X S	1	7.31	0.049	0.008

Note: df= degrees of freedom; F=test value; ω^2=effect size; p=level of significance

As shown in table 3, there was no significant main effect of helmet use ($F(1, 133) = 0.69$, $p = .41$, $\omega^2 = .005$) on compensatory health behavior (OH: M = 1.31, SD = 0.5; NH: M = 1.24, SD = 0.48). Nor did we find a main effect for self-efficacy ($F(1, 133) = 0.40$, $p = .53$, $\omega^2 = .004$) on compensatory health behavior (low self-efficacy: M = 1.23, SD = 0.5; high self-efficacy: M = 1.34, SD = 0.48). Yet, we found a significant interaction between helmet use and self-efficacy on compensatory health behavior ($F(1, 133) = 7.31$, $p < .01$, $\omega^2 = .04$).

As shown in Figure 1, OH-user with low self-efficacy showed significantly less compensatory behavior and vice versa ($p < .01$, Cohen's d = 0.59). However, no difference in compensatory behavior in NH-users was found ($p = .19$).

DISCUSSION

The assumption that high self-efficacy predicts the performance of compensatory health behavior was confirmed in OH-users. OH-users with high self-efficacy showed more compensatory health behavior than participants with low self-efficacy. In this case, compensatory health behavior may lead to a reduction of motivational conflicts according to the theoretical model of Rabiau et al. (2006). The associated negative effects such as guilty feelings are reduced because the individual might believe that the unhealthy behavior can be compensated (Rabiau et al. 2006). According to Rabiau's theory, the motivational conflict itself can be generated by increased risk perception. In this case, OH-users would be more aware of their risk taking and would compensate their unhealthy behavior more often than NH. Previous studies have reported similar differences. Participants who used their helmet often changed their pace when not wearing it, but not NH-user (Fyhri and Phillips 2013).

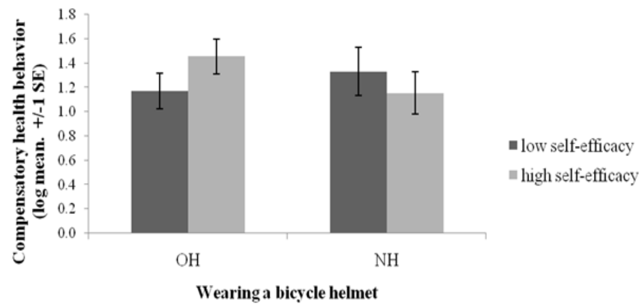

Figure 1 Comparison of OH-user (OH) and NH-user (NH) with high and low self-efficacy on compensatory health behavior

We found that OH-users with higher self-efficacy showed higher compensatory behavior and vice versa. However, these findings were not observed in the NH-group. The outcome can be explained by the fact that NH-user might be lacking a sufficient motivational conflict regarding wearing a helmet and limited risk awareness. One explanation has been already mentioned in the model of Rabiau et al. (2006), namely that individuals sometimes adapt their own risk perception with the goal of reducing their awareness of taking risks.

The risk awareness itself might change depending on the situation and is not seen as a trait. In OH-users, the helmet might only be used in specific situations, such as downhill biking. The way risk awareness was measured in our study was a general approach. Participants were not asked to evaluate specific bicycle riding risk situations. This might be a reason why there was no difference between the groups in terms of risk awareness.

Several limitations have to be considered in this study. Firstly, due to the fact that recruitment was carried out at a national recreational health promotion event, our sample may not be representative of all people in Switzerland; indeed, mainly individuals using their bicycle during leisure time were present. However, we think that field studies are important to consult the population of interest.

Secondly, all participants were asked if they showed risk compensation by using a single item. However, as has been observed in other studies, we did not find increased compensation in regular use of safety gear (Pless et al. 2006; Scott et al. 2007). Further research should compare compensatory health behavior in all three groups of helmet use.

Thirdly, we used a validated general self-efficacy scale (Schwarzer and Jerusalem 1999), which is known to refer to one's beliefs in coping with stressful or demanding situations, but it is not specific to the way someone believes they are able to change or perform a specific health-related behavior.

We think that a specific self-efficacy should be assessed in further studies on cycling and assume that the relation between specific self-efficacy and the health behavior might be stronger.

Besides this, another limitation is that we developed traffic-specific items to assess compensatory health behavior. Due to the nature of a combined question on regularity of helmet use and compensatory behavior (if you do not wear a helmet regularly, do you change your behavior in terms of 'I drive slowly or 'I drive more carefully'), we were not able to assess compensatory health behavior in participants who wore a helmet regularly.

These results have been discussed under the perspective of the compensatory health beliefs model. Other possible factors, which have not been assessed in this study (e.g. general cycling behavior including frequency, skill, or speed levels), might influence compensatory health behavior in cycling.

Taken together, OH-users with high self-efficacy show more compensatory health behavior than OH-users with low self-efficacy, whereas in NH-users no such finding exists. OH-users increase their compensatory health behavior with increased self-efficacy instead of improving the regularity of a helmet use. An increase in risk awareness combined with a focus on illusory beliefs in terms of self-efficacy must be the primary focus in preventive measures for NH participants.

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