



Brief report: Compensatory health beliefs are negatively associated with intentions for regular fruit and vegetable consumption when self-efficacy is low

Journal of Health Psychology
2017, Vol. 22(8) 1094–1100
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sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/1359105315625358
journals.sagepub.com/home/hpq
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Abstract

Compensatory health beliefs (the beliefs that an unhealthy behaviour can be compensated by a healthy behaviour) can interfere with adherence to fruit and vegetable consumption recommendations. Fruit and vegetable consumption, social cognitive variables and compensatory health beliefs were investigated via self-report at baseline (T0) and 8-week follow-up (T1) in $N=790$ participants. Self-efficacy predicted fruit and vegetable consumption intentions. Planning mediated between intentions and T1 fruit and vegetable consumption. Compensatory health beliefs negatively predicted intentions at low self-efficacy levels only. The results propose the use of self-efficacy interventions to diminish the negative effects of compensatory health beliefs when forming fruit and vegetable consumption intentions and foster planning to translate intentions into behaviour.

Keywords

cardiovascular disease, compensatory health beliefs, fruit and vegetable consumption, intention, self-efficacy

Coronary vascular diseases (CVD) are the main cause of mortality and morbidity in men aged over 45 years and women aged over 65 years in most developed European countries, including Germany and the Netherlands (Nichols et al., 2014). The prevalence of many of these conditions increases with age and is often affected by lifestyle factors such as physical inactivity and having an unhealthy diet (Mendis et al., 2011). There is accumulating evidence that especially fruit and vegetable consumption (FVC) plays an important role in preventing other chronic conditions associated with CVD, such as diabetes mellitus or (future) cardiovascular issues

(Boeing et al., 2012). Despite the widely used recommendations to eat at least five portions of fruit and vegetable a day, few adults adhere to these guidelines (Organisation for Economy, Cooperation and Development (OECD), 2013).

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Models and theories in health psychology are usually founded upon the common ‘meta-theory’ that some form of intention is central to initiating health behaviour or behaviour change. However, compensatory health beliefs (CHBs; Rabiau et al., 2006) can interfere with successful health behaviour change. CHBs implicate the belief that the negative consequences of an unhealthy behaviour (e.g. eating unhealthily) can be compensated by engaging in another, more healthy behaviour (e.g. exercising). In the Compensatory Carry-Over Action Model (CCAM; Lippke, 2014), CHBs are proposed to be disturbing in the motivational phase of behaviour change and they can be harmful if negatively related to behavioural intentions. Negative effects of CHBs on intentions have already been found in the context of physical activity (Berli et al., 2013) and dietary intake (Radtke et al., 2014). These negative effects imply that high CHBs are associated with low intentions to show the target behaviour. Nonetheless, the effects of CHBs on intention may also be influenced by certain motivational variables. However, moderation effects have been widely overlooked, with the exception of one study by Radtke et al. (2014), finding that CHBs were positively related to physical activity intentions in women with high levels of risk perception. This could imply that when people perceive high risks and observe possibilities to compensate low physical activity levels with other behaviours, they still have positive intentions, regardless of high CHBs.

In accordance with Rabiau et al. (2006), it is likely that the effect of CHBs on intentions also depends on self-efficacy beliefs, whereby individuals with low levels of self-efficacy are less likely to behave according to their intentions (Ochsner et al., 2013). Therefore, individuals low in self-efficacy might be more likely to subdue their temptations and show CHBs, which negatively influence intentions to undertake a health behaviour. Even if people have developed intentions to perform such a behaviour, they fail to translate them into action, which is commonly referred to as the intention-behaviour gap (Webb and Sheeran, 2006).

Intervention research tries to bridge this gap with self-regulation strategies such as planning (Hagger and Luszczynska, 2014). Through specifying when and where a certain behaviour will be carried out or how potential barriers will be tackled, the goal behaviour is more likely to be shown. Indeed, this has already been found in the field of FVC (Adriaanse et al., 2011), especially when self-efficacy beliefs are high (Luszczynska and Haynes, 2009). However, research including intentions, CHBs and planning has been scarce to date.

Given the little research on CHBs thus far, the direction of the effect of CHBs on intentions and behaviour needs to be tested more systematically. Accordingly, this longitudinal study aims to examine the role of CHBs in predicting FVC intentions and actual FVC among people motivated to reduce their cardiovascular risk in a longitudinal randomised controlled trial (RCT). First, in accordance with Radtke et al. (2014) and Lippke (2014), we assume that CHBs negatively interrelate with FVC intentions (hypothesis 1). Furthermore, as Rabiau et al. (2006) posit, people with low levels of self-efficacy lack the necessary self-control to realise health goals, which means that they are more likely to have CHBs and less likely to show intentions for regular FVC. Therefore, we hypothesise that the negative effect of CHBs on intentions is augmented by low levels of self-efficacy (hypothesis 2). Finally, we hypothesise that planning mediates between intentions and follow-up FVC (hypothesis 3), as already shown for various health behaviours besides FVC (De Vries et al., 2014; Hagger and Luszczynska, 2014; Reuter et al., 2010).

Method

Participants and procedure

In all, 790 study participants were recruited by the authors in cardiac rehabilitation facilities, heart training groups, online panels and different Internet platforms in Germany and the Netherlands. Participation in the study was voluntary and data were anonymised. No

incentives for participation were provided. The inclusion criteria were as follows: being at least 20 years old, no contra-indications for physical activity and FVC, having an interest in reducing cardiovascular risk, sufficient reading and writing skills in the relevant language, and Internet access and Internet literacy. The follow-up (T1) with $n=209$ took place 9 weeks after the T0 baseline measurement. This study was designed as a RCT to investigate whether a computer-tailored intervention is effective in increasing self-reported physical activity and FVC. For the present analyses, the quasi-experimental longitudinal design does not hold interest. The T0 and T1 questionnaires were the same for the intervention and control group. *T*-tests revealed no baseline differences between the intervention and control group. Specific information on the study design has been published elsewhere (Reinwand et al., 2013).

Measures

Besides socio-demographic information (i.e. gender, year of birth), height (in cm) and body weight (in kg) were assessed to calculate body mass index (BMI). All mentioned measures were obtained via web-based self-report questionnaires.

CHBs. The CHB scale by Knäuper et al. (2004) proved valid regarding construct- and criterion-related validity. From the original CHB scale, items related to dieting were used and slightly revised in this study. Therefore, the scale comprised only four items (Cronbach's $\alpha=.72$); for example, 'If one is physically active, it's okay to eat as much as one wants to'. Participants rated all answers of compensatory cognitions from *do not agree at all* (1) to *agree completely* (7) (Lippke et al., 2015).

Study participants indicated the following social cognitive items on Likert scales ranging from 'not true (1)' to 'exactly true (7)'. All social cognitive measures had been validated in previous studies (Lippke et al., 2009; Luszczynska et al., 2007).

FVC intentions. Intentions concerning FVC were assessed using the item: 'I seriously intent to eat at least five portions of fruit and vegetable daily'.

Self-efficacy. Self-efficacy towards eating fruit and vegetable (Cronbach's $\alpha=.92$) was assessed with five items; for example, 'I am certain that I can eat five portions of fruit and vegetable a day even it is difficult'.

Planning. Planning was assessed with the use of six items (Cronbach's $\alpha=.92$), such as, 'For the next month I already planned in detail at which meals I will eat fruits and vegetables (e.g. additional salad)'.

FVC. FVC on a typical day during the last 7 days was assessed using four items, whereby study participants reported their (1) daily consumption of portions of fruit, (2) cooked or steamed vegetables, (3) salad and raw vegetables, and (4) glasses of fruit and vegetable juice. Portions were added to a daily FVC sum score.

Statistical analysis

Data analysis was conducted with SPSS 22 and SPSS 22 AMOS, using structural equation modelling to explore the links between the mentioned constructs and validate the full model. Missing values (0%–19%) were estimated with full information maximum likelihood (FIML) methods. For moderation analysis (hypothesis 2), the independent variables self-efficacy and CHBs were *z*-standardised and multiplied for the interaction term. For the simple slopes analysis, we grouped self-efficacy into three categories (low, medium, high). Mediation analysis with bootstrapping (5,000 samples) according to Preacher and Hayes (2004) was undertaken to test hypothesis 3. For the analyses, gender, country of residence, age, BMI, marital status, employment status, group condition (intervention group vs. waiting control group), baseline FVC and baseline planning were included as covariates. Results of indicate BMI differences regarding the relationship

Table 1. Summary of the main study variables and baseline equivalency.

	Total (N=790)	German (n=371)	Dutch (n=419)	T-test	p
	M (SD)	M (SD)	M (SD)		
Age	50.85 (12.51)	52.18 (11.18)	49.67 (12.85)	8.51	.004
BMI	27.55 (5.41)	28.02 (5.56)	27.13 (5.24)	5.38	.021
T0 FVC intention	4.75 (1.52)	4.56 (1.88)	4.92 (1.62)	8.37	.004
T0 CHBs	2.65 (1.00)	2.72 (1.14)	2.58 (0.86)	3.61	.058
T0 FVC self-efficacy	4.66 (1.46)	4.81 (1.45)	4.52 (1.44)	7.78	.005
T1 FVC planning	4.06 (2.17)	3.92 (1.73)	4.17 (1.39)	1.33	.251
T1 FVC	4.09 (2.17)	3.04 (1.28)	4.89 (2.37)	44.61	<.001
	N (%)	n (%)	n (%)	χ^2	p
Gender, female	497 (62.9)	213 (57.4)	284 (67.8)	9.07	.004

between fruit and vegetable intake (FVI) and the health action process approach (HAPA)-based social cognitive variables.

Results

Sample characteristics

The sample had a mean age of 50.85 years ($SD=12.15$, range: 20–84), 62.9 per cent were females ($n=497$), 71.8 per cent ($n=646$) of the participants were married or in a relationship and 52.5 per cent ($n=415$) were employed either full- or part-time. Table 1 provides an overview of all descriptive variables and baseline equivalency.

Preliminary analysis and missing values

There were no significant differences between those who participated in both measurement points and those who dropped out after T0 ($n=581$) regarding gender ($\chi^2(1, N=789)=2.08$, $p=.149$), country ($\chi^2(1, N=789)=1.20$, $p=.274$), age ($F(1, 789)=1.11$, $p=.293$), BMI ($F(1, 789)=0.38$, $p=.535$), baseline CHBs ($F(1, 789)=0.06$, $p=.812$), baseline FVC intentions ($F(1, 789)=0.03$, $p=.776$), baseline self-efficacy ($F(1, 789)=0.63$, $p=.430$), baseline planning ($F(1, 789)=0.66$, $p=.417$) and baseline FVC ($F(1, 789)=2.49$, $p=.131$). T0–T1 attrition was 73.9 per cent ($n=584$).

Specification of the conceptual model and testing of the hypotheses

The full proposed model is portrayed in Figure 1 and shows an acceptable model fit ($\chi^2(27, N=790)=5.20$, $p<.001$, comparative fit index (CFI)=.91, Tucker–Lewis index (TLI)=.72, root mean squared error of approximation (RMSEA)=.07 (.06; .08)) to the data.

In contrast to hypothesis 1, CHBs did not interrelate with FVC intentions directly ($\beta=-.05$, $p=.114$). However, in line with hypothesis 2, the interaction between CHBs and self-efficacy predicted FVC intentions ($\beta=.07$, $p=.020$), thus indicating a moderation effect of self-efficacy with CHBs, whereby CHBs negatively influenced FVC intentions for those with low self-efficacy only. The simple slopes analyses demonstrated that the higher the CHBs, the lower the intentions for FVC in participants with low levels of self-efficacy ($t(780)=-2.55$, $p=.011$), but not those with medium ($t(780)=-1.32$, $p=.187$) nor high levels ($t(780)=0.87$, $p=.384$).

In line with hypothesis 3, T1 planning mediated between T0 FVC intentions and T1 FVC: the effect of T0 FVC intention on T1 FVC was not significant ($\beta=.09$, $p=.215$). However, the effect of T0 FVC intentions on T1 planning was $\beta=.14$ ($p=.031$) and the effect of T1 planning on T1 FVC was $\beta=.16$ ($p=.022$). The bootstrapped standardised indirect effect of T0 FVC

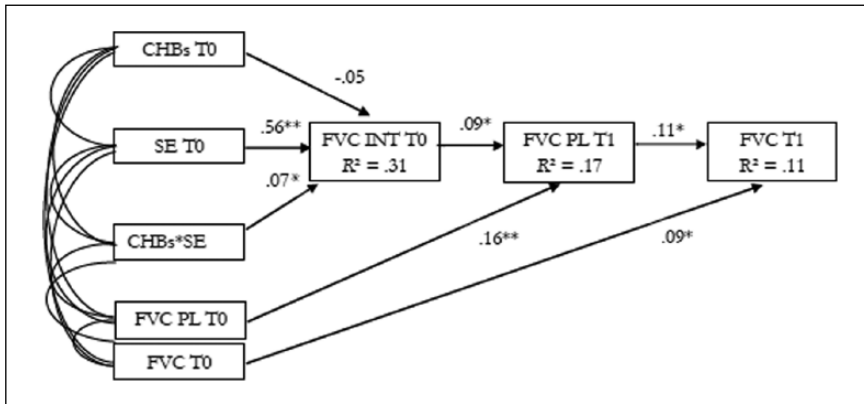


Figure 1. Conceptual model with standardised regression coefficients showing the longitudinal effect of CHBs in the health behaviour change process for fruit and vegetable consumption controlling for age, marital status, employment status, gender, group, country of residence, and BMI.

Note: T0 = baseline; T1 = follow-up at 8 weeks; CHBs = compensatory health beliefs; SE = self-efficacy, FVC = fruit and vegetable consumption; PL = planning; INT = intention; $N = 790$.

* $p < .05$, ** $p < .001$.

intentions on T1 FVC via T1 planning was $\beta = .03$ (95% confidence interval (CI): .01–.15).

Self-efficacy significantly interrelates with intentions ($\beta = .56$, $p < .001$), indicating that high self-efficacy levels are associated with high intentions. In addition, baseline FVC significantly predicted follow-up behaviour FVC ($\beta = .09$, $p = .002$). The explained variances are portrayed in Figure 1.

Discussion

This longitudinal study aimed at examining the role of CHBs in predicting FVC intentions and actual FVC among people motivated to reduce their cardiovascular risk. CHBs within the health behaviour change process for FVC held special interest in this study. In contrast to Radtke et al. (2014), we found that CHBs did not directly interrelate with intentions to eat fruit and vegetables. Nonetheless, CHBs are negatively interrelated with intentions when self-efficacy levels were particularly low. One possible explanation might be that when self-efficacy exceeds a certain threshold, CHB cannot exhibit its conflicting effect on intentions. This is in line with Rabiau et al. (2006), given that individuals high in self-efficacy are more

likely to resist temptations and practice barrier relapse management. Higher levels of self-efficacy were associated with higher intentions to eat fruit and vegetables, which is a typical finding in health behaviour research (Luszczynska et al., 2007; Luszczynska and Haynes, 2009). This suggests that improving a person's confidence in their ability (e.g. by mastery experience) to eat in a healthy way may set the stage for successful behaviour change by strengthening intentions and diminishing the negative effects of CHBs, for instance.

Higher intentions lead to more planning, which subsequently enables higher levels of FVC at a later stage. This is in accordance with previous findings on the effects of planning (Hagger and Luszczynska, 2014; Reuter et al., 2010) and suggests the further use of self-regulatory strategies in supporting people to change to healthier lifestyles.

Limitations and future research

This study is not without limitations; first, the high dropout needs to be addressed. Although there were no differences between dropouts and those who completed both waves of measurements,

future studies should aim to obtain larger sample sizes, especially at follow-up.

Second, the dietary behaviour data here are based upon self-report only and might be prone to bias, such as recall bias. Future studies should consider more objective measures in addition to self-report such as biomarkers, which are already frequently applied in dietary research (Combs et al., 2013).

A third limitation refers to the measurement of subjects' CHBs, which were measured with four items for parsimonious reasons only. Despite showing good internal consistency among our sample, future researchers might want to measure CHBs with more sophisticated fruit- and vegetable-specific scales and investigate whether and how compensatory behaviour is actually carried out as 'believed' earlier.

Finally, there were small yet significant differences between German and Dutch participants regarding the measures that we used. Nonetheless, we assume that such differences do not relate to the respective countries, as both countries have similar nutrition recommendations (WHO, 2003, 2006) and prevention campaigns (e.g. '5 a day'; Deutsche Gesellschaft für Ernährung e.V., 2012; Voedingcentrum Den Haag, 2011).

Conclusion

This study provides new insights into the concept of CHBs, with our results highlighting the negative effect of CHBs in the intention formation process for regular FVC, particularly at low levels of self-efficacy. Implications for theory development and practice could be as follows: future researchers might want to include extra self-efficacy modules (e.g. self-efficacy boosting exercises) to ensure diminishing the negative effect of CHBs when forming intentions to eat healthy or tailor an intervention to self-efficacy levels of participants, whereby people low in self-efficacy can profit equally in terms of intention formation. Moreover, planning components should be integrated to help translate people's good intentions into action. Especially people who are at

risk of developing cardiovascular diseases should be made aware of the tendency to form CHBs (i.e. through discussions with medical professionals or eHealth programmes) and how to couple these maladaptive thoughts with goal-oriented planning strategies to stick to their health goals.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded by the Wilhelm-Stiftung für Rehabilitationsforschung within the Donors' Association for the Promotion of Humanities and Sciences in Germany.

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