When Freedom of Choice Leads to Bias: How Threat Fosters Selective Exposure to Health Information

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Abstract

Selective exposure to online health information can be ascribed to two related defense motives: the motivation to confirm one's subjective perceptions, and the motivation to protect relevant parts of the self-image, such as physical integrity. Our aim was to identify how these motives come into effect in the context of a health threat (risk of developing a heart disease). In a preregistered online study with $N = 763$ individuals, we analyzed the impact of perceived and suggested risk on the degree of bias in selecting risk-related information on an alleged Google search result page. Applying a 2x2 design with the experimental factor 'risk feedback' and the quasi-experimental factor 'perceived risk', we formulated six hypotheses. First, we expected a main effect of perceived risk on selective exposure to information suggesting no risk and second, we hypothesized a main effect of perceived risk on mean quality rating of information suggesting a risk. Third, we proposed a main effect of risk feedback on selective exposure to information which suggests no risk and fourth, we proposed a main effect of risk feedback on mean quality rating of information suggesting a risk. Fifth, we expected an interaction effect between perceived and suggested risk in and sixth, we proposed an interaction effect between perceived and suggested risk in different forms for each of the four conditions on quality ratings. Only the third hypothesis was confirmed: Receiving information which suggested a health risk increased the tendency to select information denying the risk. Additional exploratory analyses revealed a moderator effect of health information literacy on the relationship between risk feedback and selective exposure. In sum, our results underline the crucial role of defense motives in the context of a suggested health threat.

Introduction

Health information plays a major role in everyday life. It not only predetermines, for example, how you shape your nutrition, how and how often you brush your teeth, and the amount of sleep you try to get. It also helps you to recognize potential alarm symptoms, and it may shape your opinion on political agendas (e.g., on vaccination programs or on coronavirus quarantining) and the interaction with and the view on other people. Nowadays, vast amounts of health information are freely accessible through all kinds of information sources, especially the internet with its increasing use [1]. Health information is often multifaceted and can be very contradictory, too. Therefore, the question of how and why specific information is considered by the seeker while other information is denied, is of utter importance to improve the access to helpful, objective, and scientifically proven information material.

Many explicit and implicit intentions play a role due to the self-responsibility of an independent information search and the peculiarities of the health domain, which, for example, can threaten psychological well-being as well as physical integrity. So called defense motives are triggered in response to threatening information and foster to favor and specifically search for information corresponding to one's self-image [2–4]. Sometimes, defense motives can also engender a devaluation of non-conforming or threatening information [5,6]. These defensive mechanisms, which emerge as behavioral consequences from defense motives, oppose aspirations of a holistic, accurate and complete search [7,8]. Correspondingly, bias within the information selection, consideration and evaluation process are increasingly observed [9–11]. As threat plays a huge role in triggering defense motives, the present paper investigates the relationship between different intensities of an induced health threat and the selection of health information. In order to induce threat, fictitious connections between a personality disposition

and a health issue were suggested. In the literature, the phenomenon of a biased selection of information (primarily with a preference for non-threatening information that serves one's self-image) is often referred to by different terminologies, such as 'confirmation bias' [12] or 'motivated reasoning'[2]. However, we will use the term 'selective exposure' [13] for every bias related to the selection and consideration of information, as we think it suits best as a generic term for these phenomena.

Defense Motives and Selective Exposure

Health information can be threatening in various ways. For example, it may implicate that a health condition is present, or it may suggest a necessity of changing beloved everyday routines to maintain sufficient health. Different defense motives may be triggered by different kinds of threats. In this context, Knobloch-Westerwick, Johnson and Westerwick [14] distinguish two motivational processes that are relevant for our research purposes. These encompass not only defense motives, but also the consequential motivated behavior: self-bolstering and self-defending. Self-bolstering encompasses the motivation to maintain the current status quo and thus to be reassured that there is no significant threat to one's health and physical integrity. For example, wine lovers often quote that the daily glass of wine is good for the cardiovascular system. Self-defending motivation promotes discrediting, ignoring and avoiding information which (potentially) implies a threat to one's health and physical wellbeing. For example, fear-appealing information which suggests an increased risk of developing cancer tends to be avoided by smokers – a classic example of selective exposure triggered by self-defending motivation. While the defense motives described by Knobloch-Westerwick et al. [14] are specific for the health context, more general motives for selective exposure may be considered, too. For example, one may selectively search for and select information to confirm one's opinion or

expectation about a specific topic [7], or one may try to confirm one's specific self-image as a way of self-affirmation [15]. In line with this is the motivation to devaluate and downplay information that disconfirms opposing attitudes and opinions. These different motives may be responsible for biased approaches to (health) information seeking fulfilling a specific goal that is not related to finding out about facts and approaching the 'truth', but to protect an intact self-image and to fend off any threats to self-integrity [7]. One crucial similarity can be identified in these different motives: They strive to protect parts of the self, may it be the self-image, attitudes, and opinions (general motives), or the physical integrity (health-specific motives), as a consequence of a potential (health) threat and as a precondition for biased information seeking and/or appraisal [15,16]. Thus, in health information seeking, defense motives aiming at protecting the self-image, especially with regard to subjective opinions and physical integrity, come into effect as a result of a potential health threat.

Threat, however, is highly subjective and dependent on one's perceived risk. For example, leaflets suggesting an increased risk for lung cancer in smokers do not imply a threat for non-smokers. Therefore, non-smokers would not have any motivation to discredit or ignore the leaflets, while smokers, on the other hand, may well try to actively disregard the leaflets. Thus, a threat can be regarded as a necessary precondition for selective exposure to information in health contexts. Therefore, perceived risk for a certain disease should be taken into consideration as a principal basis to appraise health information as threatening or not. In this line of reasoning, the higher the perceived risk, the higher should be the perceived threat and thus, a greater bias in information seeking should occur, as various defense motives come into effect.

Taking "risk" into account as a precursor for selective exposure however requires a differentiated look at the concept of risk. While perceived risk represents a potential precondition

to perceiving a threat, suggested risk (i.e., by an information leaflet) must also be taken into account. A suggested risk implies that a certain individual characteristic like, for example, the Body Mass Index (BMI), is suggested to be associated with an increased risk of suffering from a health impairment (e.g., in an information leaflet on high BMI as a risk factor for cardiovascular disease). Depending on your individual BMI, this message might thus involve a threat (if your BMI is high) or not (if your BMI is low). Moreover, you may have perceived a high risk for cardiovascular diseases in the first place or not. Hence, with suggested as well as perceived risk taken into account, several scenarios which may or may not trigger defense motives (and selective exposure) are conceivable. In fact, combining perceived and suggested risk (or risk feedback) leads to four possible combinations in individuals who are confronted with health information: *perceived risk* (low or high) crossed with *risk feedback* (suggested risk or no suggested risk).

Hence, the present study aims to investigate the effects of defense motives on selective exposure to health information when a threat is induced via risk feedback – depending on an individual's perceived risk. Based on our theoretical considerations from above, we distinguish between the following two types of defense motives that may be triggered by threatening information (e.g., risk feedback): Type 1, the general motive to defend one's opinion and attitudes by approaching confirming information and avoiding disconfirming information (which we denote as 'self-confirming motivation'; see 7); and type 2, the more (health-)specific motive to defend one's self-image with regard to health and physical integrity, as referred to by Knobloch-Westerwick et al. [14] by the term 'self-bolstering' and 'self-defending' motivation. Although generally acknowledged as two central precursors of a biased search for information,

both types of defense motives have – to our knowledge – never been considered in one study simultaneously, let alone in the context of health information seeking

The present study

Our study, including research design, study hypotheses and statistical analyses, was pre-registered in an user-friendly online disciplinary public open access free of charge digital research objects repository for psychology with 21 different publication types (preprints, primary, and secondary publications), research data, tests, preregistrations, multimedia and code before data collection [17]. We applied a 2x2 design with one experimental factor 'risk feedback' (suggested risk vs. no suggested risk, yes vs. no in short) and one quasi-experimental factor 'self-assessed risk' (high vs. low). With this, we tested the notion that feedback of a higher health risk (threat to self in the form of health/physical integrity; [14]) and feedback mismatching the self-assessed health risk (threat to self in the form of opinion or attitude; [7] lead to selective exposure to health information. Crossing the two factors results in four different groups, each of which implies different conditions for showing selective exposure. The first group (*No* risk feedback and *Low* risk perception = NL; see Figure 1) is characterized by the absence of an experimentally suggested risk and consists of participants who perceive themselves at low risk. Thus, in this group, there is an accordance between self-assessment and risk feedback, which is why the defense motive type 1 may not be triggered. Type 2 should not play a role either, as no risk feedback is given here. No risk feedback is also given to another group (NH), which is, however, characterized by the fact that risk self-assessment (high risk) does not correspond to the given feedback (no risk). In this case, a type 1 defense motive would be conceivable, since potentially long established beliefs about the self are challenged and the participants want to protect their own beliefs. Conversely, this also results in two groups receiving risk feedback. In

one of these two groups (risk feedback: *Yes*, self-assessed risk: *High*; YH), the reported risk corresponds to one's own perception, which is why type 1 has no relevance here. However, for the protection of one's own physical integrity, as a reaction to the risk feedback, type 2 may be relevant. While type 2 maintains relevant in the last group (YL), type 1 also becomes relevant. This group is characterized by risk feedback, while one's own perception assumes a rather low risk. Therefore, a conflict between risk self-assessment and risk feedback arises, which is the precondition for type 1. For an overview of the four resulting groups see Figure 1.

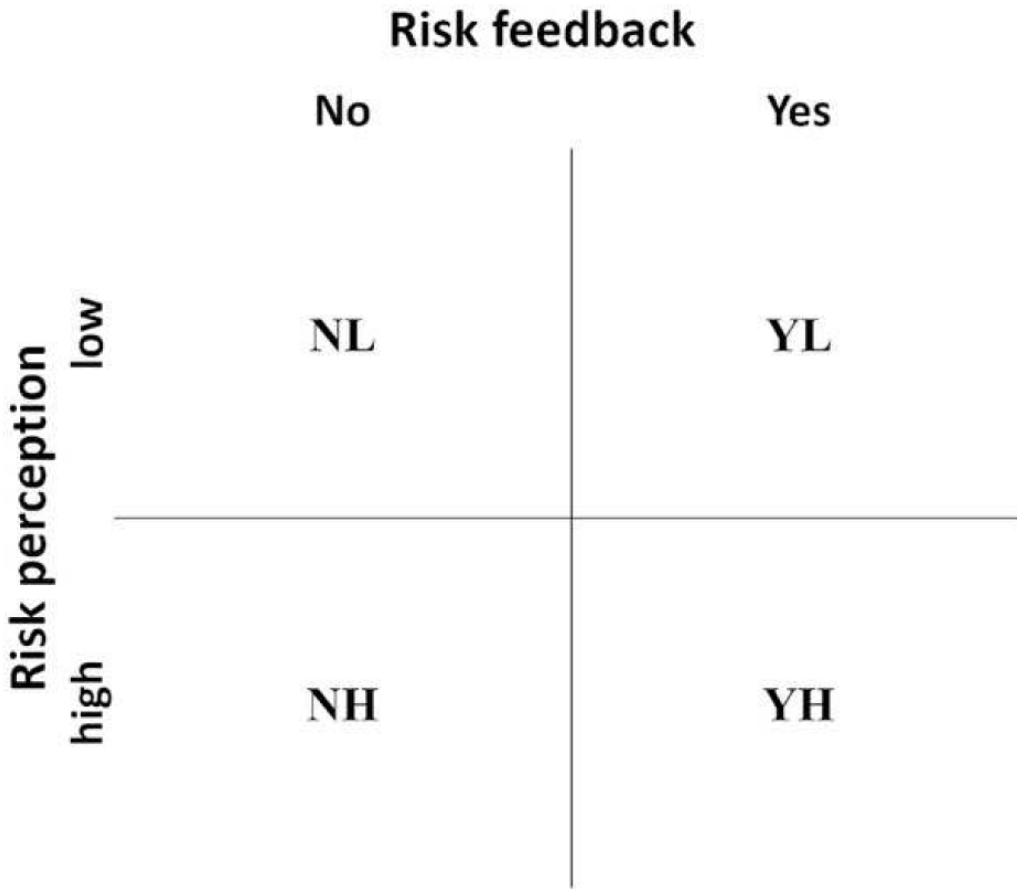

Figure 1. Experimental design.

The dependent variables are the amount of one-sided information chosen in an information selection task and the quality ratings of every piece of information at disposal. Based on this, six hypotheses were formulated, one for each main effect of the two factors on each of the two dependent measures for selective exposure, and respectively, one for the interaction between the two factors. To ensure that a health threat is experienced by the participants, a scenario that is realistic, relevant and understandable is essential. We decided to suggest an increased risk for the development of a heart disease due to a specific degree of achievement motivation to half of the participants. This ensures a certain level of comprehensibility: the background is understandable and credible, while, at the same time, purely fictitious (without the participants being aware of it). Moreover, from an ethical standpoint, an experimental manipulation based on the suggestion of a risk is not as problematic as a more direct induction of a health threat (e.g., by means of a fake medical exam suggesting that participants indeed *have* a health condition). The suggested risk functions as a threat in two ways, which can trigger the two defensive motives: First, it may be a threat to physical integrity (related to the suggested risk induced by the experimental condition). Second, it may be a threat to the self-image as it contradicts one's opinion about the individual risk (i.e., perceived risk) – at least in certain experimental groups. This leads to the following hypotheses regarding main effects:

H1. We expect a main effect of the perceived heart disease risk on selective exposure to information which suggests no risk.

H2. We expect a main effect of the perceived heart disease risk on mean quality rating of information which suggests a risk.

H3. We expect a main effect of the risk feedback on selective exposure to information which suggests no risk.

H4. We expect a main effect of the risk feedback on mean quality rating of information which suggests a risk.

Concerning the four groups resulting from the combination of the two factors, we expect different outcomes in the amount of selective exposure, as different motives may be addressed varyingly across conditions. While the condition of a low perceived risk and high-risk feedback, for example, may trigger both defense motives (type 1 and type 2), the condition of high perceived risk and high-risk feedback should only trigger the defense motive of bodily integrity (type 2). Therefore, the following hypotheses for an interaction effect are also assumed.

H5. We expect an interaction effect between the perceived and the suggested risk of heart diseases in different forms for each of the four conditions on selective exposure.

H6. We expect an interaction effect between the perceived and the suggested risk of heart diseases in different forms for each of the four conditions on quality ratings.

Materials and Methods

Sample

To determine the sample size, we conducted a power analysis in GPower 3.1 [18]. With power set to .80 and alpha to .05, a sample size of $N = 800$ is required to detect a small effect size ($f = .10$) in our experimental design. Overall, 847 German-speaking citizens of the Federal Republic of Germany, aged between 30 and 65 and with no medical history of heart diseases, participated in the study. Eighty-four participants failed to complete the study or showed conspicuous response patterns (e.g., they needed less than half the median of the processing time, used the same response implausibly frequently, or stated that they "just clicked their way through" and did not read the instructions in open ended questions, etc.) and were removed from the analysis, which resulted in a final sample of $N = 763$ (52.2 % females; $M_{age} = 51.17$, $SD_{age} =$

10.42). The distribution of educational attainment levels was representative for the population of Germany. The sample was recruited through a panel, administered by a professional agency, and data collection was performed solely online.

Procedure and materials

Ethical clearance for the study was obtained through the Ethics Committee of the German Psychological Society (DGPs). After an informed consent form and a check on whether the conditions for the sampling restrictions were fulfilled, participants were told that current research is investigating how the relationship between achievement motivation and heart disease can be explained. This was followed by an explanation that the study ties in and investigates how achievement motivation is distributed among the population and how people assess their risk of heart disease. After this introduction, potential moderators were measured. Health information literacy (HIL) was assessed by a slightly adapted version of the Health Information Literacy Knowledge Test (HILK; [19]), and self-efficacy mas measured by the Self-Efficacy Scale for Information Searching Behavior [20] using an instruction adapted to the search for health information. Additionally, for potential exploratory analyses, behavioral inhibition and behavioral approach system sensitivity [21] were assessed by a short-form of the ARES (Action Regulating Emotion Systems [22]) scales. Furthermore, a self-report instrument for the assessment of emotion-specific regulation skills (SEK-ES; [23]) was administered. To control whether the threat induction worked, the Positive and Negative Affect Schedule (PANAS; [24] were applied before and after the induction, which would allow to detect potential affective changes. Next, the independent factor 'perceived risk' was measured by a self-developed single item ("*My risk of developing a heart disease in the next 5 years*...") with six response levels (1=*"... is much lower compared to other people my age*." to 6=*"... is much higher compared to*

other people my age."). Dispositional achievement motivation was assessed by the subscale 'achievement motivation' of a German language instrument measuring occupation-related personality variables, the 'Bochumer Inventar zur berufsbezogenen Persönlichkeitsbeschreibung' [25]. After completing the questionnaire, a 50-second loading screen was presented along with the explanation that the inputs are processed, analyzed and compared with a norm sample. This was to ensure a higher fidelity of the upcoming threat intervention. The participants were then automatically randomly assigned to one of two conditions of the experimental factor 'risk feedback', which should induce a threat or no threat. Every participant's real score and result of the BIP were displayed as well as the notion if it was higher or lower than the average. This statement was combined with a text indicating a higher risk or indicating no risk for developing a heart disease (depending on the experimental condition), which also included a reference to a fictitious research report that makes this assumption. Besides the PANAS, three self-constructed items were presented an additional manipulation check, which assessed subjective feelings of threat and the corresponding information need (e.g.: *"I find the information disturbing."* and *"I need more information on the subject."*) with five response levels each (1=*"Strongly disagree*" to 5=*"Strongly agree"*). Finally, participants completed a selection task to assess the dependent variable selective exposure. The task is a variation of the task used by Adams, Hart, Richardson, Tortoriello and Rentschler [26], and was framed as an opportunity to obtain additional information about the relationship between heart disease and achievement motivation. They were presented with a (fictitious) Google results page including 16 search results drawing on a combination of the words 'achievement motivation' and 'heart disease', from which they were asked to select eight results for further research. At the same time, they were asked to rate each search result concerning the quality of the information it provides (values from 1 to 6, with 6

corresponding to the highest quality). The search results included a title and short text snippets and were as realistic as possible in length and wording as well as in visual appearance, thus reminding of an actual Google page. The results differed in that they suggested either an increased or a reduced risk for the respective participant's development of a heart disease, and, furthermore, whether they were serious (e.g., scientific articles, universities, public submissions) or dubious (e.g., yellow press, individual reports) sources. They represented the best selection from a twice as large pool of snippets, which were checked for credibility and comprehensibility in a preliminary pilot study ($N = 56$). After completion of the task, participants were asked to rate the perceived authenticity of the snippets and were presented with the last page containing a comprehensive debriefing.

Results

Preliminary Analyses

To test whether the manipulation of induced risk through the feedback of potential risk for a heart disease worked, the mean score of the variables for the subjective feeling of threat was investigated. The score ranged between 1 ("*no threat*") and 5 ("*high threat*"). The two groups 'no risk feedback' and 'risk feedback' differed significantly in their perception of threat ($t = -11.53$, $df = 735$, $p < .001$). The average score for the 'no risk feedback' group was $M = 1.55$ with 58% of the participants having a score of 1. In the 'risk feedback' group the average score was M = 2.40 with 28% of the participants having a score of 1. Concerning the PANAS scores, only the 'risk feedback' group showed a significant ($t = 6.18$, $df = 414$, $p < .001$, $M_{T1} = 3.10$, $SD_{T1} = 0.80$ $M_{T2} = 2.95$, $SD_{T2} = 0.82$) reduction of positive affect between the two measurement points. Therefore, it seems that the induction of risk for the corresponding condition has worked

sufficiently. Additionally, all prerequisites (independence of groups, normal distribution of the dependent variable and homogeneity) for further analyses were tested and were fulfilled.

Confirmatory Analyses

To examine the impact of self-perceived risk (high vs. low) and risk-feedback (yes vs. no) on respondents' selective exposure, univariate analyses of variance were conducted with these two factors. The difference between the number of selected snippets suggesting a higher risk and the snippets suggesting no risk was used as one of two dependent variables, whereas the average quality rating of these two kinds of snippets constituted the other dependent variable. Numbers above zero indicate a bias towards snippets speaking of no risk, whereas numbers below zero indicate a bias towards snippets speaking of higher risk for the respondent. A score of exactly zero suggests a balanced selection of snippets, as it indicates that four snippets of each kind had been selected.

Effects on selective exposure

A main effect for risk feedback was found with F (1, 759) = 52.92, $p < .001$, $\eta^2 = .065$. Examination of estimated marginal means indicated that participants with feedback of a higher risk selected more snippets which speak of no risk than participants with feedback of no risk (M_{noRisk} = -.45, SE_{noRisk} = 2.80 vs. M_{Risk} = 1.06, SE_{Risk} = 2.86), thus supporting hypothesis H3. Neither the hypothesized main effect of self-assessed risk (F (1, 759) = .182, p = .67), nor the postulated interaction between self-assessed risk and risk feedback became significant (F (1, 759) = .71, p = .40). Hypotheses H1 and H5 thus were not confirmed.

Effects on quality rating

There were no significant results for the dependent variable quality rating. Thus, the hypotheses H2, H4, and H6 could not be confirmed.

Exploratory Analyses

Since the regarded topic is extremely complex and largely unexplored in the context under consideration, we decided, also against the background of the non-significant hypotheses, to carry out further explorative analyses. We thereby aimed to gain further insight into factors that moderate how the two independent factors (perceived risk and risk feedback) influence the dependent variables of selective exposure and quality assessment. In this regard, two influential and often mentioned constructs come into mind: HIL [27] and emotion regulation [16,28]. As we had found a significant main effect of risk feedback on selective exposure, we investigated the corresponding interactions for the risk feedback factor. Hayes' PROCESS macro [29] was used to test for the potential moderation of both HIL and emotion regulation on the relation between risk feedback and selective exposure and quality rating (see Table 1).

Health Information Literacy

HIL is defined by the Medical Library Association, as "*the set of abilities needed to recognize health information need; identify likely information sources and use them to retrieve relevant information; assess the quality of the information; and analyze, understand, and use the information to make good health decisions*" [30, p. 294]. Although the notion 'set of abilities' is a bit unspecific, HIL is necessarily involved in every health information gathering process. Hence, HIL should also play an important role when it comes to the phenomenon of selective exposure, as it supports searching and selecting specific information. However, it is left unclear how exactly HIL influences the incidence of selective exposure. Two possibilities are conceivable: (1) A more pronounced HIL promotes a balanced search, as all relevant information is considered and used for good health decisions; or (2) with higher HIL, the well-developed ability to search and evaluate information enables a stronger selection of information according

to the objectives of the defensive motives [27]. Empirically, we found a significant interaction between risk feedback and HIL ($b = 6.70$, $p < .001$, see Table 1) as predictors of selective exposure, while the direct effect of risk feedback also remained significant. Closer inspection showed that respondents who received feedback on an existing risk tended, overall, to select more snippets which deny the possibility of a risk (see Figure 1). In contrast, respondents who received feedback of no existing risk tended to select more snippets which suggest a higher risk. This effect was amplified by HIL: While respondents with higher HIL showed stronger selective exposure in the consistent feedback condition, lower HIL was associated with nearly no selective exposure in both conditions. For quality ratings, no significant results were found.

Table 1

PROCESS results for moderator analyses with selective exposure as outcome

Model	Variable	*R*	coefficient	*t*	*p*
1		.31			.000
	Constant		.80	.99	.32
	(X) Risk Feedback		-3.13	-2.90	.000
	(W) HIL		-1.79	-1.57	.12
	Interaction		6.70	4.38	.000
2		.28			.000
	Constant		-.65	-.91	.36
	(X) Risk Feedback		-.21	-.21	.83
	(W) Emotion Regulation		.06	.29	.77
	Interaction		.49	1.83	.06

Note: Results are from concurrent regression analyses. The resulting coefficients are unstandardized B parameters; X = independent variable; W = moderator; HIL = Health Information Literacy.

Emotion Regulation

Emotion regulation is the ability to leave or alter an emotional state [31,32]. In a state where a health threat is present, the discussed defensive motives aim to minimize negative feelings through reassuring or confirming information [7], which may be in contrast to a comprehensive search. In previous studies, a negative affective state was found to explain interindividual differences and to predict health information seeking behavior [33]. A neutral or less negative affective state should therefore promote a more balanced and comprehensive search. In relation to this, it is important for an adequate search while facing a threat, that one has a certain ability to regulate potentially negative emotions that may arise [28]. Accordingly, van 't Riet and Ruiter [16] state that emotion regulation ability affects the exposure to various kinds of health-promoting information. Hence, we also assume a moderating effect on the relation of the regarded factors with selective exposure and quality rating. As negative emotions have a higher relevance for defense motives [34], we only considered emotion regulation for negative emotions. However, only a marginally significant effect on the interaction of risk feedback and emotion regulation to predict selective exposure was found ($b = .49$, $p = .06$, see Table 1), and, interestingly, the main effect of risk feedback that was found before disappeared when including the interaction term. While these results must be considered with some caution since the interaction (closely) missed the $p < .05$ criterion, a closer inspection revealed that the participants in the risk feedback condition tended to select more information which denies a threat (i.e., higher selective exposure) with increasing emotion regulation ability. In contrast, participants in the no risk-feedback condition seemed not to be affected by different levels of emotion regulation ability, as they did not differ in their selective exposure results.

Discussion

The present paper aimed to gain further insight into the effects of two defense motives – a self-confirming and a self-defending motive – on respondents' selective exposure to health information. Overall, our findings indicate that a suggested health risk influences selective exposure to health information, while a self-perceived risk seems to have no significant effect in this context. As predicted in our preregistration, we found that risk feedback leads to a stronger bias toward the preference of information which denies the risk: Receiving feedback which suggests a potential health risk shifted task performance from a rather balanced selection of snippets to a biased selection of snippets which deny a particular risk. Furthermore, it seems that in the context of one's own health, the motivation to defend from a threat (i.e., type 2 defense motive; see above) is superior to the motivation to confirm one's opinion (i.e., type 1 defense motive). This is because, in the condition of no risk feedback, respondents showed no significant bias in either direction – even in the case of a high self-perceived risk. This means that they did neither confirm their own risk perception when they saw themselves as being at higher risk, nor did they deny a risk and therefore confirm the 'no risk' feedback. Together with the significant effects of the risk feedback, this can be interpreted as an indication that in such an essential and potentially existentially relevant context as the health context, coping with a health threat has a higher implicit value than the need to confirm one's opinion.

This is in line with other findings in the area of coping research, which, in general, suggest that there is a stronger bias when individuals are in a negative emotional state, which may be more strongly triggered by an unexpected and immediate risk feedback compared to self-perceptions that have probably been present for a long time [35]. Moreover, selective exposure seems to be stronger when the focus lies more on losses instead of gains [36]. In this case, the

threat of physical integrity can be seen as a loss (losing health status), while the defense of the own opinion is mentally represented rather as a gain (one wants to be proven correct) and thus, is less susceptible to bias.

In this sense, a confirmation bias, meaning a mere confirmation of preconceived opinions (type 1 defense motive), seems less likely to come into effect in the case of health threats and the associated autonomous search for information. Rather, it is conceivable that potential risks and threats are avoided via the self-directed (biased) choice of information channels, a process which is described in the theory of counter-regulation [37]. According to this theory, negative states, for example elicited through health threatening information, are understood to be "counteracted" by actively turning towards positive (e.g., reassuring or unrelated) information. Our explorative findings also partly support this claim: Participants with a higher ability to regulate their negative emotions showed a more biased selection towards positive information, which may help to reassure themselves, and therefore to downregulate their negative feelings. Our results regarding the moderating effect of HIL further support these assumptions. In fact, higher HIL led to a stronger selective exposure. This means that with a higher ability, less balanced information is considered, which at first seems to be counter-intuitive. In general, HIL is positively associated with health outcomes in the literature [38], which initially does not seem to match with an unbalanced consideration of relevant health information. However, since the performance test we used primarily measures the abilities to search, acquire and evaluate suitable sources and health information (according to the definition of HIL), this effect suggests that basic abilities of information processing may be 'misused' in the present case to meet one's needs and motives. In this regard, Meppelink, Smit, Fransen and Diviani [27] also showed a biased selection of messages that were in line with their own beliefs concerning vaccination (regardless of the line

of argumentation, against or in favor) for participants with higher HL. They also showed a higher prevalence of biased perceptions of message convincingness for people with higher HL. Accordingly, future research and interventions should consider extending the HIL construct to include the aspect of a balanced search. Moreover, it should further investigate the relationship between literacy and selective exposure and its possible implications.

Moreover, the rather small effect size of the impact of risk feedback, and the non-significant results for perceived risk indicate a need for further research. As stated before, the type 1 defense motive (defending one's opinion) may not be as important when one's own health is threatened. Nevertheless, our experiment shows an overall tendency towards biased information selection when it comes to health topics, and, furthermore, we concede that our claims that type 1 would be less important are based on the interpretation of non-significant results. To disentangle the effects of the two defense motives in future studies, some adjustments to the paradigm and evaluation task are advisable. In contrast to the currently used cover story, it could be beneficial to use a more ambivalent and controversial health topic where the own opinion is held at high stake. At the same time, the cover story should not induce such a large threat in order to prevent triggering *only* the self-defending motive – at least for a portion of the participants. Such topics could include, for example, efficacy of homeopathic drugs or vaccine hesitancy [27]. This makes it possible to develop scenarios in which the two motives are activated both separately and simultaneously (e.g., in different experimental groups). In the case of homeopathy, for example, risk feedback based on a homeopathic 'assessment' may be perceived as much more threatening to physical well-being by homeopathy supporters. In contrast, homeopathy sceptics would supposedly rather doubt the content and see their own convictions threatened.

Another possible explanation that only one of our hypotheses was confirmed could be ascribed to the nature of the selection task. With eight to-be-selected snippets out of a total of 16 snippets, the resulting cognitive load when performing the task might be excessive, which could also lead to a rather balanced selection almost automatically. A significant reduction of the number of snippets should force a selection according to the currently active motive(s). However, a disadvantage of this procedure would be that the lower number of selected snippets leads to a lower variance in the dependent variable, because possible resulting values are restricted. Our initial idea was that the relatively high number of eight selected snippets would result in more detailed differences in the extent of selective exposure, depending on the independent variables and moderators. Another solution to this problem was recently implemented by Kerwer, Rosman, Wedderhoff and Chasiotis (in-principle accepted). In their study, only four snippets were presented at a time, from which one had to be selected for further reading. This was done four times, so that a total number of 16 snippets were presented while simultaneously reducing cognitive load.

Implications

The findings from the present study have some rather ambivalent implications. In line with Sassenberg and Greving [11], our results suggest that an autonomous selection of information may help patients to react to a health threat via consulting reassuring information about their health. One could argue that this is a positive implication in the sense that it may help them to develop a more positive view of their own health and make them feel better. However, the findings also implicate that a suggested health threat leads to a bias in information selection. This might be because, as we have discussed, a suggested risk increases negative affective states like anxiety, which trigger defense motives to feel better and/or reassured. This is also in line

with previous research, which states that the likelihood of a unilateral selection of positive information is higher when a negative affective state is present, which is also referred to as "counter-regulation" [36,39,40]. Research on health message perception and on the effects of fear appeals in health promoting information also supports our findings and points to further implications [16,41]. In fact, health information which emphasizes individual risk factors does not automatically cause the recipient to implement appropriate behavior to reduce the risk (i.e., giving up smoking). On the contrary, such information often evokes defensive cognitive and behavioral reactions, such as ignoring, denying or downplaying it [16]. In contrast, messages which, besides pointing to a significant health threat, suggest ways to diminish the threat and enhance the recipients' self-efficacy, seem to be more effective with regard to changes in health behavior [41,42]. Positive affect and a substantial amount of confidence to be able to deal with the threat thus seem to be essential in order to avoid a bias towards positive information and to select information in a less biased manner [28,41]. It is therefore conceivable that, as a consequence, individuals who are in a negative affective state because they have been threatened by risk suggesting information, have a biased (positive) picture of their own health, resulting from biased information retrieval in the past. This poses the danger that they underestimate potential health risks and do not consider necessary interventions. In this respect, Sassenberg and Greving [11] also refer to the risk of a potential negative impact on the doctor-patient relationship, as patients could be too confident about their health status and be inaccessible to reasonable arguments that point in another direction.

Conclusions

Our study provides evidence for selective exposure and bias in health information seeking. In the presence of an externally suggested threat to their health, individuals tend to

reassure themselves, and therefore show a selective exposure to positive information. This may also override a potential motivation to defend one's own opinion (often referred to as confirmation bias) when it is in conflict with the reassuring information. However, further research and adjustments to the information selection task are required to investigate these rather tentative conclusions.

What is certain, however, is that an independent search for health information is increasingly deemed necessary and seems to be implicated by modern health care systems in terms of the promotion of patient empowerment and informed decision making. Nevertheless, the wide availability of health-related information to the general population (via internet), also creates new risks for imbalanced information acquisition and use. Selective exposure might help patients to reassure themselves and cope with their emotional states, but it may also lead to an incorrect assessment of their individual health (risk) status.

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