# Intended Coping Responses to Cancer Symptoms in Healthy Adults: The Roles of Symptom Knowledge, Detection Behavior, and Perceived Threat

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## Abstract

Background: **To date, the causal effects of the knowledge of cancer-related symptoms and detection behavior on coping with cancer-related symptoms have not been identified. Therefore, the current study explored the effects of active or passive detection of supposedly well-known or less-known cancer-related symptoms on intended coping responses. In addition, we were interested in the extent to which these effects are driven by heightened perceptions of threat.**

Methods: **In an experimental study using a 2 × 2 within-subject design, 221 Dutch adults from the general population responded to a survey study sent to their homes (18.4% response). They were asked to read scenario information about four cancer-related symptoms that were (*a*) well known or less known and (*b*) actively or passively detected (e.g., self-examination versus unusual blood loss). The authors measured intended coping responses to the detection of cancer-related symptoms as either adaptive (e.g., visiting a general practitioner) or maladaptive (e.g., denial of the symptom).**

Results: **As expected, the findings revealed that well-known symptoms resulted in more anticipated adaptive coping and less anticipated maladaptive coping than less-known symptoms. Unfortunately, the findings also suggest that the active as opposed to passive detection of cancer symptoms (e.g., self-examination versus unusual blood loss) is likely to result in more maladaptive coping. These effects were mediated by heightened perceptions of threat.**

Conclusions: **Future health education programs that aim to motivate people to be more active in the early detection of cancer symptoms should first focus on increasing people's knowledge about the early warning signs of cancer.** (Cancer Epidemiol Biomarkers Prev 2008;17(4):818–26)

## Introduction

Cancer is a major cause of illness and mortality around the world and in the Netherlands, where the present study was conducted (1-4). Secondary prevention pertaining to the early detection of cancer not only helps to reduce the burden of illness but also increases one's chances of survival because treatment is more effective in the early stages of the disease (5). Early detection can be realized through participation in cancer screening programs (that is, breast and cervical cancer screening programs), but it can also be done individually, as is the case in skin self-examination. The present study focuses on the latter category, which is cancer detection by the individual. In particular, we are interested in the effects of symptom knowledge and kind of detection behavior on maladaptive and adaptive coping with cancer-related symptoms. In addition, we are interested in the extent to which these effects are driven by heightened perceptions of threat.

It is possible for individuals to detect possible cancer-related symptoms by simply noticing the appearance of symptoms. This kind of detection behavior is considered *passive detection behavior*, which means that no conscious action is undertaken to detect a symptom (6). Examples include becoming aware of changes in the skin, changes in bowel habits, or unusual blood loss. Unfortunately, these symptoms are often nonspecific and can thus result in delays with respect to seeking medical consultation. *Active detection behavior*, in contrast, refers to a particular action that can be conducted to detect cancer symptoms. This kind of detection behavior includes regularly checking the breasts, testicles, or skin for abnormalities.

Detection of cancer symptoms alone is insufficient. To reduce the burden of illness and increase chances of survival, detection must be followed by an adequate response, such as consulting a general practitioner about the symptom or closely monitoring the development of the symptom. In the context of disease prevention and health promotion, these kinds of responses are considered *adaptive coping responses* because they positively contribute to the early detection of malignant symptoms and thus can increase one's chances of survival. Those who respond inadequately following detection display

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*maladaptive coping responses.* An example of a maladaptive response is choosing not to think about the symptom and instead focusing on more pleasant things. By doing this, one ignores the seriousness of the symptoms and thus delays important actions that must be taken to reduce the burden of disease (7, 8). The dichotomy of maladaptive and adaptive coping responses is thus similar to the dichotomies of fear control and danger control in the fear appeal literature (9, 10), and emotion-focused and problem-focused coping in the stress and coping literature (11).

Cancer-related organizations, such as the European School of Oncology and the American Cancer Society, have identified the early warning signs of cancer, such as a nagging cough or hoarseness, sores that fail to heal, obvious changes in warts or moles, indigestion or difficulty swallowing, swellings or lumps in breast or elsewhere, unusual bleeding or discharge, changes in bowel or bladder habits, and unusual weight loss (5, 12). For some symptoms, such as a lump in the breast or blood loss, these organizations recommend consulting a general practitioner immediately. With other symptoms, such as changes in bowel habits, cancer-related organizations recommend consulting a general practitioner when the symptom fails to heal or continues to recur.

Many patients often wait too long before consulting a general practitioner even after they have detected possible cancer symptom (13-18). To explain this delay, Andersen et al. (19) outlined various stages of perceiving, interpreting, and responding to detected symptoms. One of the impeding factors in this process of detecting cancer symptoms and inferring illness is the attribution of possible cancer symptoms to common diseases. Andersen et al. (19) further claim that attributions are largely determined by one's knowledge of possible cancer symptoms and accurate coping responses. This is termed *symptom knowledge* and is defined as the extent to which a symptom is evaluated as being typical (well known) or not typical (less known) of cancer (6, 18, 20, 21).

Several studies have shown a lack of knowledge among the general population with respect to early warning signs of cancer (22-24). However, the findings of a Dutch survey study indicated that the knowledge of cancer symptoms among respondents was relatively high (6). Furthermore, in accordance with a British study by Brunswick et al. (23), respondents in the same Dutch study displayed more attention to well-known cancer symptoms and less attention to less common symptoms. In addition, the findings in this Dutch study suggested that respondents were likely to respond adequately to the detection of well-known symptoms by consulting a general practitioner within the recommended time. This was not the case for less-known symptoms. Unfortunately, the correlations between correct recognition of cancer symptoms, attentiveness, and help-seeking behavior regarding the early detection of cancer symptoms were found to be weak (21). This suggests that, even if one is aware of cancer-related symptoms, one may fail to pay sufficient attention to those symptoms and may also not adequately respond to symptoms upon detection.

A factor that seems to be important in responding to possible cancer symptoms is fear arousal or *perceived threat*. In a study by de Nooijer et al. (14), cancer patients indicated that the detection of a possible symptom was experienced as life-threatening. This study showed that, for some people, threat perceptions motivated them to seek medical help. However, for others, threat perceptions resulted in delays, as a result of denial or an unrealistic focus on that which is positive. Evidently, threat perceptions seem to motivate both adaptive and maladaptive coping responses (8, 10).

**Overview and Hypotheses.** Although previous evidence from survey studies suggests that the knowledge of cancer symptoms is an important correlate of seeking early treatment (6, 21), to date, no causal relationship between symptom knowledge and the early detection of cancer has been identified. Furthermore, the potential differential effects of active versus passive detection of cancer-related symptoms on subsequent coping responses have not yet been studied. Consequently, the current study explores the effects of active or passive detection of well-known or less-known cancer-related symptoms on intended adaptive and maladaptive coping responses. Because the detection of cancer-related symptoms is closely associated with fear and a perceived threat of cancer (14) and because perceived threat has been found to trigger both adaptive and maladaptive coping responses (8, 10, 25, 26), we measured both adaptive and maladaptive coping responses and further investigated whether the perceived threat of cancer symptoms mediated the effects of symptom knowledge and kind of detection behavior on these two types of coping responses.

Based on previous survey research that identified the knowledge of cancer symptoms as an important correlate of early detection of cancer, we expected that well-known symptoms would result in more adaptive coping and less maladaptive coping than less-known symptoms (6, 21). We had no clear expectations, however, about the direction of the effect of active versus passive detection of cancer-related symptoms on intended adaptive and maladaptive coping responses. Furthermore, we had no expectations about the combined effect of symptom knowledge and detection behavior. One may assume that actively, rather than passively, detecting cancer-related symptoms increases the chances that one will attribute the identified irregularities to cancer, especially if the symptoms are well known. After all, the goal of actively checking is to find possible cancer-related symptoms. It is then likely that the active detection of well-known cancer-related symptoms results in more adaptive coping and less maladaptive coping than the passive detection of those symptoms.

However, one could also suggest that, driven by a need to feel good and thus a need to preserve or enhance a positive self (27), actively checking for symptoms is a method by which one can reassure one's self that no cancer-related symptoms are present. This would mean that, when potential cancer-related irregularities are detected, feelings of threat may trigger defensive responses in an effort to restore the positive self (28, 29). The active detection of well-known cancer-related symptoms would then result in less adaptive coping and more maladaptive coping than the passive detection of those symptoms. Given the opposing potential explanations, we explored the extent to which the reported effects of symptom knowledge and kind of detection behavior on intended adaptive and maladaptive coping responses are mediated by heightened perceptions of threat.

## Materials and Methods

**Participants.** Individuals older than the age of 18 years were randomly selected from an existing panel provided by a company that specializes in conducting panel studies in the Netherlands. In total, 1,200 paper-and-pencil questionnaires together with information about participation in the study were sent to the homes of the potential participants in the fall of 2004. All information was provided in Dutch. A total of 221 people (18.4% response) returned the questionnaire and thereby provided their informed consent. Respondents who returned incomplete questionnaires (>10% missing values) and respondents who had a history of cancer or had cancer at the time of the study were excluded from the analyses. Of the 221 respondents, 19 had a history of cancer, 1 had cancer at the time, and 8 returned an incomplete questionnaire. As a result, the questionnaires of 193 respondents were included in the analyses. Slightly more than half of the participants were women (54.9%). The ages of the participants ranged between 21 and 86 years, with a mean of 49.20 years (SD, 15.59). In the sample, 26%, 34%, and 39% of participants reported a low, medium, or high level of education, respectively. In addition, most respondents (71%) had a long-term partner.

**Design, Materials, and Procedure.** The questionnaire contained four scenario messages. Each message presented a different cancer-related symptom by varying independently symptom knowledge level (less known versus well known) and kind of detection behavior (passive versus active detection). This resulted in a 2 × 2 within-subjects factorial design. A within-subjects design was preferred over a between-subjects design to reduce error variance on the outcome measures caused by individual differences among participants and thus increase the statistical power of the analyses.

The questionnaires that participants completed after reading the scenarios intended to verify the manipulation of symptom knowledge, determine whether detection behavior was perceived as active or passive, and measure perceived threat and intended coping response (adaptive and maladaptive). The scenarios have been translated from Dutch as follows:

> Well-known symptom, active detection. Imagine the following: You check your skin regularly. While taking a shower, you notice a change in a mole. The last time you checked your skin, the mole was not as big as it is now. After looking very closely, you see clearly that it has changed in color and shape. Moreover, the mole is bleeding.
>
> Well-known symptom, passive detection. Imagine the following: One morning you suddenly notice blood and mucus in your stools. You had never really paid attention to this before so you had never noticed this before.
>
> Less-known symptom, active detection. Imagine the following: A few weeks ago, you noticed a sore on your face. You checked this regularly for a while because you don't like it. After a few weeks, the sore has not healed yet. It even seems to be worse.
>
> Less-known symptom, passive detection. Imagine the following: You experience severe swallowing problems quite suddenly. Food does not move easily and seems to stick in your esophagus. You never had problems with swallowing before.

The scenarios were placed in six different randomly chosen sequences that were randomly distributed across the sample. Participants were asked, after reading the scenarios, to complete the questionnaires so that their answers reflect how they would react if they found themselves in the scenario described. Participants were explicitly informed that no right or wrong answers exist and that the questionnaires would take ~25 minutes of their time. Questionnaires were returned to the university by means of a postage paid envelope. The study was approved by the Medical Ethical Committee of the Maastricht University Hospital.

### Measures

*Coping Responses.* Adaptive and maladaptive coping responses were assessed using an identical six-item set for each of the four scenarios. Each item used a five-point Likert scale to determine the extent to which the assessed response would be applicable to the participant in the specified scenario (1 = not at all applicable to me, 5 = strongly applicable to me). Three items were intended to measure adaptive coping responses: These were (*a*) ''I would see a general practitioner for this symptom''; (*b*) ''I would seek information to learn more about this symptom''; and (*c*) ''I would keep track of how this symptom progresses in the coming days.'' Reliability analyses for each scenario suggested that the scores on each of the three items were weakly correlated (Cronbach's $\alpha$ = 0.36-0.57). Nevertheless, we averaged the scores of the three items for each scenario to generate an index of adaptive coping. This was done because the scores on two (that is, consulting a general practitioner and monitoring the symptom) of the three items were strongly, negatively skewed (mean, >4.23), whereas the use of a composite measure of adaptive coping for each scenario resulted in data distributions that better fulfilled the assumption of normality. Furthermore, by averaging the scores on the three items into one index of adaptive coping, we lowered the chances of making type 1 errors due to multiple testing. Higher scores on the measure of adaptive coping indicate more adaptive coping (range, 1-5).

The other three items measured maladaptive coping responses: These were (*a*) ''I would try not to worry too much''; (*b*) ''I would try not to think about it and instead focus on pleasant things''; and (*c*) ''I would think it is not that bad.'' The reliability analyses for each scenario indicated a good internal consistency in the scores of these three items (Cronbach's $\alpha$ = 0.71-0.78). As a result, we averaged the scores of the three items for each scenario to generate an index of maladaptive coping. Higher scores indicate more maladaptive coping (range, 1-5).

*Perceived Threat.* For each scenario, perceived threat was assessed using a single item that asked participants to indicate the extent to which they evaluated the scenario as threatening (1 = not at all, 4 = very much).

*Manipulation Checks.* To test the manipulation of symptom knowledge, a single item asked participants, in an open-response format, to indicate the disease

associated with the described symptom (*recognition*). Scores on this item were jointly categorized by the second and fourth author into a four-point scale recognition index that ranged from (1) not at all correct to (4) fully correct. Answers were scored as 1 when participants filled in no answer or indicated not knowing the symptom, as 2 when participants indicated that the presented symptom belonged to a disease but failed to mention a cancer-related disease, as 3 when the symptom was ascribed to cancer but the participant failed to mention a specific type of cancer, and as 4 when a type of cancer was mentioned that was correctly linked to the described symptom (that is, cancer of the esophagus, skin cancer, or bowel cancer). To assess whether the active versus passive detection behaviors were perceived as such, a single item asked participants to indicate the extent to which they perceived the presence of the symptom as verifiable (*verifiability*; ''I can check myself to verify the presence of the described symptom''; 1 = not all, 4 = very much).

Last, demographic data (that is, age, sex, level of education, and marital status) were acquired to describe the sample in addition to information on whether participants had a history of cancer or had cancer at the time of the study (cancer history).

**Statistical Analyses.** To analyze the four repeated measures nested within persons for each dependent variable, 2 (symptom knowledge) × 2 (detection behavior) linear mixed model regression analyses were conducted using SPSS version 12.0.1 (SPSS, Inc.). This was done instead of repeated measures ANOVA to accommodate the possible mediating influence of perceived threat, which is a within-subjects covariate, on coping. We tested the main effects of symptom knowledge (coded as −1 = less known, 1 = well known) and detection behavior (coded as −1 = passive, 1 = active), and their interaction (that is, the product term symptom knowledge × detection behavior) on the manipulation checks and the indices of adaptive coping responses and maladaptive coping responses. In doing this, we assumed an unstructured 4 × 4 covariance matrix for the repeated measures. Given the relatively large sample size for a fully within-subjects design and to focus only on meaningful effects, preventing type 1 errors due to multiple testing (that is, two within-subject factors, three outcomes), we used $\alpha = 0.01$ instead of 0.05 for significance testing.

To further analyze a significant interaction effect of symptom knowledge and detection behavior on one of the outcome measures, the effect of one predictor was then analyzed per level of the other predictor (that is, simple effects). The order of presentation of the scenarios was included in the original analyses as a categorical predictor using dummy coding because six different sequences of scenarios were used. This predictor was later removed after no significant contribution to the prediction of the dependent variables was found ($P > 0.21$).

To examine whether perceptions of threat mediate the effects of symptom knowledge and detection behavior on adaptive and maladaptive coping responses, we repeated the analyses with perceived threat (centered by subtracting from all $2 \times 2 \times N$ threat scores the grand mean) as a within-subject covariate in the model.

## Results

Table 1 displays the mean, SD, and intercorrelations of the outcome variables, computed per condition and then averaged across conditions. The measure of recognition was positively associated with the measures of perceived threat and adaptive coping and negatively associated with the maladaptive coping measure. The manipulation check of kind of detection behavior, verifiability, was negatively associated with perceived threat, positively associated with maladaptive coping, and not associated with adaptive coping. Perceived threat, in turn, was positively associated with adaptive coping and negatively associated with maladaptive coping. Finally, the association between the measures of adaptive coping and maladaptive coping was negative but weak.

Table 2 displays the main effects and interaction effect of symptom knowledge and detection behavior on the manipulation checks and on the measures of perceived threat, adaptive coping, and maladaptive coping, respectively. The statistically significant findings are briefly summarized in the following paragraphs.

### Manipulation Checks

*Symptom Knowledge.* On recognition, a main effect of symptom knowledge found seemed to be qualified by a significant interaction effect with detection behavior. However, simple effect analyses showed that, for both the actively and passively detected symptoms, the symptoms believed to be well known were indeed better recognized as cancer symptoms than the symptoms believed to be less known. These findings suggest a successful manipulation of symptom knowledge.

**Table 1. Means, SD, and intercorrelations (Pearson's *r*) of recognition, verifiability, perceived threat, adaptive coping responses, and maladaptive coping responses (statistics averaged across the four experimental conditions)**

| | Mean (SD) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Recognition (1-4) | 2.95 (1.10) | 1.00 | | | | |
| Verifiability (1-4) | 2.36 (0.94) | −0.12 | 1.00 | | | |
| Perceived threat (1-4) | 2.75 (0.80) | 0.47* | −0.21 † | 1.00 | | |
| Adaptive coping (1-5) | 3.87 (0.74) | 0.33* | −0.04 | 0.36* | 1.00 | |
| Maladaptive coping (1-5) | 2.71 (0.85) | −0.23 † | 0.31* | −0.32* | −0.21 † | 1.00 |

NOTE: To prevent inflated SDs and correlations by treating all $2 \times 2 \times N$ data as $4N$ different research participants, we calculated per experimental condition the mean, SD, and intercorrelation for each (pair of) outcome variable and presented here the average of these statistics across the conditions.
*$P < 0.001$.
† $P < 0.01$.

**Table 2. Effects of symptom knowledge and detection behavior on the outcome measures**

| Predictor/outcome measures | Symptom knowledge | | | Detection behavior | | | Knowledge* Detection | | |
|---|---|---|---|---|---|---|---|---|---|
| | *B* | SE | *P* | B | SE | *P* | B | SE | *P* |
| Manipulation checks recognition | 0.24 | 0.03 | 0.000 | 0.10 | 0.03 | 0.001 | 0.11 | 0.03 | 0.000 |
| If passive | 0.13 | 0.04 | 0.001 | — | — | — | | | |
| If less known | — | — | — | −0.01 | 0.04 | 0.850 | | | |
| If active | 0.35 | 0.04 | 0.000 | — | — | — | | | |
| If well known | — | — | — | 0.22 | 0.04 | 0.000 | | | |
| Verifiability | −0.04 | 0.02 | 0.098 | 0.12 | 0.02 | 0.000 | −0.03 | 0.02 | 0.171 |
| Perceived threat | 0.16 | 0.02 | 0.000 | −0.13 | 0.03 | 0.000 | 0.10 | 0.02 | 0.000 |
| If passive | 0.07 | 0.03 | 0.011 | — | — | — | | | |
| If less known | — | — | — | −0.23 | 0.03 | 0.000 | | | |
| If active | 0.26 | 0.03 | 0.000 | — | — | — | | | |
| If well known | — | — | — | −0.04 | 0.03 | 0.197 | | | |
| Adaptive coping | 0.10 | 0.01 | 0.000 | −0.04 | 0.02 | 0.026 | 0.04 | 0.02 | 0.020 |
| If passive | 0.06 | 0.02 | 0.001 | — | — | — | | | |
| If less known | — | — | — | −0.07 | 0.02 | 0.001 | | | |
| If active | 0.13 | 0.02 | 0.000 | — | — | — | | | |
| If well known | | | | −0.00 | 0.02 | 0.891 | | | |
| Maladaptive coping | −0.10 | 0.02 | 0.000 | 0.07 | 0.02 | 0.001 | −0.01 | 0.02 | 0.407 |

NOTE: This table displays the nonstandardized regression coefficient ($B$), SE, and $P$. Because our design is balanced and both within-subject factors are coded (−1, 1) instead of (0, 1), the interaction term symptom knowledge × detection behavior is orthogonal to the main effects. Consequently, the main effects are interpretable and testable even in the presence of a nonsignificant interaction term in the model (see first row for each outcome measure). In cases where a significant interaction of symptom knowledge and detection behavior on one of the outcome measures was found, simple effects of one factor are reported for each level of the other factor. This means that the second row for that outcome measure indicates the simple effect of symptom knowledge for passively detected symptoms; the third row, the simple effect of detection behavior for less-known symptoms; the fourth row, the simple effect of symptom knowledge for actively detected symptoms; and the fifth row, the simple effect of detection behavior for well-known symptoms. Note that each main effect equals $2B$, not $B$, again because of the (−1, 1) coding. The test statistic ($Z$) per effect is equal to $B$ / SE and the confidence interval for each effect is equal to $B \pm c \times \text{SE}$, where $c = 1.96$ if $\alpha = 0.05$ and $c = 2.58$ if $\alpha = 0.01$.

Furthermore, for symptoms believed to be well known, the actively detected symptom was correctly recognized more often than the passively detected symptom. This finding supports our earlier formulated assumption that, if people actively check for well-known cancer-related symptoms, they are more likely to attribute the identified irregularity to cancer than if a well-known symptom passively presents itself.

*Detection Behavior.* Manipulating the kind of detection behavior was also successful. Analyses on the measure of verifiability revealed a main effect of detection behavior. The positive regression coefficient suggests that actively detected symptoms were perceived as more verifiable than passively detected symptoms.

**Perceived Threat.** A significant interaction effect was found on perceived threat (see Fig. 1A for the mean scores). Simple effect analyses indicated that, for actively detected symptoms, the well-known symptom was considered more threatening than the less-known symptom. A similar but smaller and almost significant difference between the well-known and less-known symptom was found for passively detected symptoms. In addition, for the less-known symptoms, the actively detected symptom was evaluated as less threatening than the passively detected symptom, whereas no effect of detection behavior was found for the well-known symptoms.

**Adaptive Coping Response.** The same pattern of results was found on intended adaptive coping responses as shown for perceived threat. Figure 1B suggests an interaction pattern between symptom knowledge and detection behavior, which approached significance. Simple effect analyses revealed that the effect of symptom knowledge was significantly positive for both the actively and passively detected symptoms (see Table 2), thus supporting the reported main effect of symptom knowledge. Furthermore, for less-known symptoms, the passively detected symptom seems to result in more adaptive coping than the actively detected symptom. However, given our $\alpha = 0.01$ to correct for multiple testing, the interaction in Fig. 1B failed to be significant ($P = 0.02$). Ignoring this interaction, the analysis showed a significant main effect of symptom knowledge (Table 2). The well-known symptoms seem to result in greater levels of adaptive coping than the less-known symptoms.

**Maladaptive Coping Response.** A main effect of symptom knowledge was found on intended maladaptive coping responses. This indicates that less-known symptoms seem to result in more denial and less intended worry than well-known symptoms. The main effect of detection behavior was also significant, meaning actively detected symptoms seem to result in more maladaptive coping responses than passively detected symptoms (see also Fig. 1C).

### The Mediating Role of Perceived Threat

*Introduction.* To better understand the psychological process that drives the reported effects on the intended coping responses, we tested the mediating role of perceived threat. In accordance with the procedure suggested by Baron and Kenny (30), we contend that perceived threat functions as a mediator of the effects of symptom knowledge (or detection behavior) on indices of adaptive (or maladaptive) coping if the following conditions are fulfilled (see Fig. 2 for relevant paths that need testing in a mediation analysis): (*a*) variations in symptom knowledge (or detection behavior) account for variance in indices of adaptive or maladaptive coping

(path C in Fig. 2 is significant if the mediator is not adjusted for; see Table 2 for significance levels); (*b*) variations in symptom knowledge (or detection behavior) account for variance in perceived threat (path A is significant; see Table 2); (*c*) variations in perceived threat account for variations in the indices of adaptive or maladaptive coping while controlling for the influence of symptom knowledge (or detection behavior; path B is significant; see Tables 3 and 4); and (*d*) the previously significant effect of symptom knowledge (or detection behavior) on the indices of adaptive or maladaptive coping is changed after controlling for the effect of perceived threat (the strength of path C is reduced; see Tables 3 and 4). Conditions *b* and *c* together imply condition *d* (31).

*Data Analysis.* Adhering to condition 2 of Baron and Kenny (30), we tailored our mediation analyses to the pattern of the significant interaction effect of symptom knowledge and detection behavior on perceived threat. This pattern shows that (*a*) the effect of symptom knowledge (that is, well-known symptoms resulting in higher perceived threat than less-known symptoms) was stronger for actively detected symptoms than for passively detected symptoms (the latter simple effect just failing to be significant, given $\alpha = 0.01$) and (*b*) the effect of detection behavior (that is, higher perceived threat in response to passive rather than active detection) was only significant for less-known symptoms. We therefore restricted the mediation analyses to (*a*) the simple effects of symptom knowledge under conditions of active detection on both the adaptive and maladaptive coping measures (see Table 3) and (*b*) the simple effects of detection behavior for less-known symptoms on both coping measures (see Table 4).[4] We further used Sobel's *Z* test to determine whether the reduction in the strength of path C, following the inclusion of the mediator, significantly differed from zero, thus indicating mediation (32).

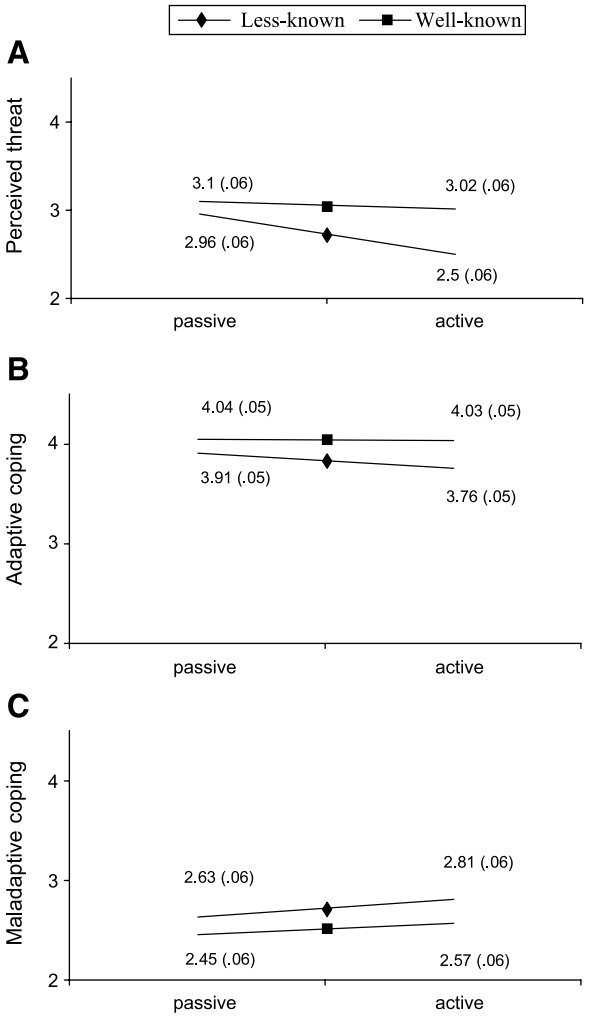


**Figure 1.** Mean scores (SE) arising from the effects of symptom knowledge and detection behavior on perceived threat (**A**), adaptive coping (**B**), and maladaptive coping (**C**).

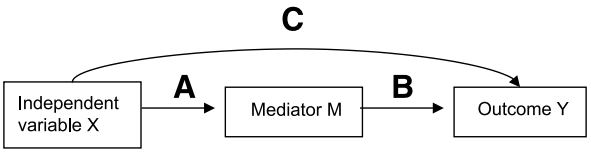


**Figure 2.** Mediation according to Baron and Kenny (30).

*Results—Symptom Knowledge*. The significant effects of perceived threat on adaptive and maladaptive coping reported in Table 3, in combination with the significant effect of symptom knowledge on perceived threat (see Table 2), indicate that perceived threat significantly mediated part of the simple effects of symptom knowledge on both coping measures under conditions of active detection. This means that, for actively detected symptoms, the well-known as opposed to less-known symptom resulted in a higher perceived threat, which in turn resulted in more adaptive coping and less maladaptive coping. Comparing the effects of symptom knowledge on adaptive and maladaptive coping in Table 3 with those under conditions of active detection in Table 2, it can be seen that ~50% of the total effect was mediated by perceived threat.[5]

*Results—Detection Behavior.* The results reported in Table 4, in combination with the significant effect of detection behavior on perceived threat (see Table 2), indicate that perceived threat also mediated part (that is, >50%) of the simple effects of detection behavior on adaptive and maladaptive coping for less-known symptoms. This suggests that, for less-known symptoms, the

[4] An alternative method would be to add perceived threat as covariate to the 2 × 2 linear mixed model regression analyses of adaptive and maladaptive coping. That analysis gave $P = 0.99$ for the symptom knowledge by kind of detection behavior interaction effect on adaptive coping. The present method was preferred for ease of interpretation because the absence of path A from symptom knowledge to threat for passive detection and of path A from kind of detection behavior to threat for well-known symptoms already ruled out mediation for two of the four simple effects.

[5] For passively detected symptoms, perceived threat was a similar but weaker mediator (that is, about 17% of the total effect mediated by perceived threat) of the effect of symptom knowledge on adaptive coping (path B: $B = 0.23$, SE = 0.04, $P = 0.000$; path C: $B = 0.05$, SE = 0.02, $P = 0.016$; $Z = 2.15$, $P = 0.016$).

**Table 3. Perceived threat (centered) as a mediator of the simple effects of symptom knowledge on adaptive and maladaptive coping responses under conditions of active detection**

| Outcome measures | Perceived threat | | | Symptom knowledge | | | Sobel's test | |
|---|---|---|---|---|---|---|---|---|
| | *B* | SE | *P* | B | SE | *P* | Z | P |
| Adaptive coping | 0.27 | 0.04 | 0.000 | 0.06 | 0.03 | 0.013 | 5.11 | 0.000 |
| Maladaptive coping | −0.26 | 0.05 | 0.000 | −0.05 | 0.03 | 0.088 | −4.39 | 0.000 |

NOTE: This table displays the nonstandardized regression coefficient (*B*), SE, and *P* for the effects of, respectively, perceived threat (centered) while controlling for symptom knowledge and symptom knowledge while controlling for perceived threat on the measures of adaptive coping and maladaptive coping. In addition, Sobel's *Z*-statistic (*Z*) and the *P* values are reported.

actively as opposed to passively detected symptom resulted in lower perceptions of threat, which in turn resulted in less adaptive coping and more maladaptive coping.

## Discussion

Using an experimental design, we examined the effects of actively or passively detecting well-known or less-known cancer-related symptoms on intended coping modes. Based on previous survey research that identified the knowledge of possible cancer symptoms as an important correlate of the early detection of cancer (6, 21), we expected that the knowledge of cancer symptoms would positively contribute to the early detection of cancer. We found convincing support for this prediction on self-report measures of intended coping responses. This means that, when the symptoms were well known (that is, blood in stool, changing wart), participants reported higher intentions to visit a general practitioner, to seek additional information, and to continuously monitor the symptom than when the symptoms were less known. In contrast, less-known symptoms (that is, sore, swallowing problems) yielded more denial in the form of trying not to think about the symptom or trying not to be worried. These findings thus confirm and support previous survey studies that identify the knowledge of cancer symptoms as an important correlate of the early detection of cancer (6, 21).

With respect to the kind of detection behavior, we had no clear predictions about the direction of its effect on adaptive and maladaptive coping responses. The significant effect on the measure of maladaptive coping suggests that, when we compare active with passive detection, passive detection of cancer-related symptoms results in less maladaptive coping. On the measure of adaptive coping, passive detection seemed to result in more intentions to control the threat than active detection but only for less-known symptoms.

The effects of both symptom knowledge and kind of detection behavior seem to be, at least partially, explained by heightened perceptions of threat when learning about well-known as opposed to less-known symptoms on the one hand and passively as opposed to actively detected symptoms on the other hand. These heightened perceptions of threat, in turn, seem to enhance adaptive and reduce maladaptive coping responses.

The evidence found for the central role of perceived threat in motivating people to take action is supported by the broader domain of fear appeal research and theoretical models, such as the protection motivation theory (8) and the extended parallel process model (33). In addition, these models propose that the specific type of action taken is largely dependent on the degree to which one believes that the recommended behavior can actually avert the threat (that is, response efficacy) and whether one feels able to perform the behavior as recommended by the message source (that is, self-efficacy). Empirical research even suggests that efficacy perceptions are stronger determinants of adaptive actions than threat perceptions (10). Furthermore, de Nooijer et al. (21) identified self-efficacy toward individual abilities to detect cancer symptoms and seek medical help as an important correlate of early detection. Unfortunately, in the current study, we did not include measures of perceived efficacy and were thus unable to estimate the extent to which threat perceptions alone, or in combination with efficacy perceptions, determined the effects of symptom knowledge and detection behavior on adaptive and maladaptive coping.

As expected, designing public health campaigns that inform people about the early warning signs of cancer may positively contribute to the early detection of

**Table 4. Perceived threat as a mediator of the simple effects of detection behavior for less-known symptoms on adaptive and maladaptive coping responses**

| Outcome measures | Perceived threat | | | Detection behavior | | | Sobel's test | |
|---|---|---|---|---|---|---|---|---|
| | *B* | SE | *P* | B | SE | *P* | Z | P |
| Adaptive coping | 0.21 | 0.04 | 0.000 | −0.03 | 0.02 | 0.263 | −4.23 | 0.000 |
| Maladaptive coping | −0.30 | 0.04 | 0.000 | 0.02 | 0.03 | 0.504 | 4.89 | 0.000 |

NOTE: This table displays the nonstandardized regression coefficient (*B*), SE, and *P* for the effects of, respectively, perceived threat (centered) while controlling for detection behavior and detection behavior while controlling for perceived threat on the measures of adaptive coping and maladaptive coping. In addition, Sobel's *Z*-statistic (*Z*) and the *P* values are reported.

cancer and thus result in reduced cancer-related mortality. The finding that surprised us, however, is that active detection seems to result in more maladaptive coping than passive detection. This lends the impression that public campaigns designed to motivate people to regularly check the skin, breast, or testicles (active detection) could have adverse effects, namely, denial of detected symptoms and—given the negative correlation between intended maladaptive and adaptive coping responses we found in the present study, which is confirmed with regard to both direction and strength in other studies (33)—even delays in seeking medical help.

However, our findings may hide a somewhat more complex relationship between the kind of detection behavior and intended coping responses. Our finding on more intended adaptive coping in response to passively as opposed to actively detected symptoms seemed to be restricted to the specific situation in which a less-known symptom is detected. Consequently, the design and implementation of health education interventions that aim to increase the public's knowledge of cancer-related symptoms and encourage them to take action to detect symptoms in the early stages of the disease (e.g., self-examination at regular time intervals) may very well generate more early help-seeking behavior and thus increase cancer survival rates.

The current study is not without limitations. Our stimulus materials were brief scenario messages of hypothetical situations with only one scenario per condition. Furthermore, the response rate in our sample was low. Therefore, the extent to which our findings can be generalized to other similar study paradigms, other Dutch adults, and real-life situations in which cancer-related symptoms are detected is unclear. In addition, we measured intended behaviors and not actual behaviors. Behavioral intention has been identified as the primary motivational determinant of individual behavior (34). Nonetheless, we are unsure about the extent to which adaptive coping intentions are translated to the expected corresponding behavior. Action may be hindered by motivational and contextual variables such as self-defense motivation and reassurance from significant others. However, an experimental study in which sufficient observations are present in the analyses of, for example, general practitioner visits upon the detection of cancer-related symptoms is practically impossible given the large study sample required to have sufficient statistical power.

In conclusion, the present study provides new empirical evidence for the causal effects of symptom knowledge and detection behavior on adaptive and maladaptive coping responses to cancer-related symptoms. The direction of the (combined) effects of both symptom characteristics on adaptive and maladaptive coping is complex and partly explained by perceptions of threat. Although further tests are needed, our findings suggest that future health education programs fostering the secondary prevention of cancer by motivating people to be more active in the early detection of cancer symptoms should focus on increasing people's knowledge about early warning signs of cancer. Last, we must be cautious with respect to promoting regular self-examination if we want to increase cancer survival rates.

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