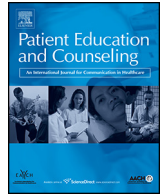




Contents lists available at ScienceDirect

## Patient Education and Counseling

journal homepage: [www.elsevier.com/locate/pateducou](http://www.elsevier.com/locate/pateducou)



### Assessment

# The cancer information overload (CIO) scale: Establishing predictive and discriminant validity

Jakob D. Jensen<sup>a,\*</sup>, Nick Carcioppolo<sup>b</sup>, Andy J. King<sup>c</sup>, Courtney L. Scherr<sup>d</sup>,  
Christina L. Jones<sup>d</sup>, Jeff Niederdieppe<sup>e</sup>

<sup>a</sup> University of Utah, USA

<sup>b</sup> University of Miami, USA

<sup>c</sup> Texas Tech University, USA

<sup>d</sup> Purdue University, USA

<sup>e</sup> Cornell University, USA

#### ARTICLE INFO

##### Article history:

Received 2 January 2013

Received in revised form 12 September 2013

Accepted 25 September 2013

##### Keywords:

Cancer information overload

Cancer fatalism

HINTS

Colonoscopy

Measurement

CIO scale

#### ABSTRACT

**Objective:** Survey data suggests that approximately three-fourths of adults are overwhelmed by cancer information – a construct we label cancer information overload (CIO). A significant limitation of existing research is that it relies on a single-item measure. The objective of the current study is to develop and validate a multi-item measure of CIO.

**Methods:** Study 1 ( $N = 209$ ) surveyed healthcare and manufacturing employees at eight worksites. Colonoscopy insurance claims data were culled eighteen months later to evaluate the predictive validity of CIO. Study 2 ( $N = 399$ ) surveyed adults at seven shopping malls. CIO and cancer fatalism were measured to examine the properties of the two constructs.

**Results:** Study 1 identified a reliable 8-item CIO scale that significantly predicted colonoscopy insurance claims 18 months after the initial survey. Study 2 confirmed the factor structure identified in Study 1, and demonstrated that CIO, cancer fatalism about prevention, and cancer fatalism about treatment are best modeled as three distinct constructs.

**Conclusion:** The perception that there are too many recommendations about cancer prevention to know which ones to follow is an indicator of CIO, a widespread disposition that predicts colon cancer screening and is related to, but distinct from, cancer fatalism.

**Practice implications:** Many adults exhibit high CIO, a disposition that undermines health efforts. Communication strategies that mitigate CIO are a priority. In the short-term, health care providers and public health professionals should monitor the amount of information provided to patients and the public.

© 2013 Elsevier Ireland Ltd. All rights reserved.

## 1. Introduction

Cancer incidence and mortality are declining in the U.S. [1]. Despite this progress, national surveys document that many Americans have troubling beliefs about cancer prevention. More than a quarter of adults (28%) believe “There’s not much people can do to lower their chances of getting cancer,” more than half (54%) agree “It seems like almost everything causes cancer,” and more than seventy percent (75%) think that “There are so many recommendations about preventing cancer, it’s hard to know which ones to follow” [2]. Some authors suggest that these beliefs demonstrate widespread cancer fatalism, the belief that nothing

can be done to prevent (or treat) cancer [3,4]. Agreement with the three items is negatively correlated with adherence to recommendations concerning smoking, diet, and exercise [3].

It is imperative that behavioral researchers first explicate and confirm the nature of the construct(s) underlying these beliefs in order to identify promising strategies to mitigate them. While we concur that two of the items (*not much people can do* and *everything causes cancer*) are likely to constitute fatalistic beliefs, the third item (*too many recommendations*) appears conceptually distinct and may reflect an alternate construct, cancer information overload (CIO). CIO is defined here as feeling overwhelmed by the amount of cancer-related material in the information environment. Thus, CIO is distinct from similar cognitions (e.g., fatalism, perceived barriers to action) as it focuses on feelings about the cancer information environment rather than the illness (fatalism) or the environment at large (perceived barriers).

\* Corresponding author. Tel.: +1 801 440 8219.

E-mail addresses: [jakobdjensen@gmail.com](mailto:jakobdjensen@gmail.com), [jakob.jensen@utah.edu](mailto:jakob.jensen@utah.edu) (J.D. Jensen).

We contend that CIO is not a trait, but rather is cultivated by exposure to information about cancer from media, in conversations, and from healthcare providers. For instance, CIO could be a response to “carcinogen of the week” style reporting or overstated research findings in the press [5–8]. If this is the case, CIO should be generally higher among individuals with a greater volume of exposure to these cancer-related information flows over time. However, individuals with higher CIO will eventually become avoidant of cancer information and perhaps disengage from certain content/channels in backlash [5]. Thus, researchers might observe complex patterns such as a positive correlation for media consumption in general (cultivation) and a negative correlation for attention to cancer/health news (avoidance). In fact, as an aversive motivational disposition, CIO should be more pronounced for individuals with an avoidance temperament [9,10]. Moreover, individuals with lower cognitive skills (e.g., education, health literacy) should be more prone to CIO.

The model of information overload [5] posits that highly arousing content (e.g., information about cancer) strains already limited storage and processing capabilities resulting in overload [11]. Overload triggers other negative reactions such as increased fatalistic thinking and decreased intentions to engage in cancer-related behaviors (e.g., screening). Concerning the latter, CIO is negatively related to cancer-related behaviors because it undermines other cognitions that drive the performance of these behaviors. For example, the extended parallel process model (EPPM) and the health belief model (HBM) suggest that several cognitions are key predictors of cancer prevention behavior. Thus, CIO should be negatively related to constructs such as self-efficacy, response efficacy, perceived barriers, perceived benefits, and health motivation [12–14].

To explore these possibilities, two studies were conducted to develop and test the validity of a multi-item measure of CIO. The goal of the research is to determine whether CIO is a valid construct and distinct from cancer fatalism.

## 2. Study 1

Study 1 develops and tests a multi-item CIO scale with the goals of identifying the underlying factor structure and eliminating suboptimal items [15]. The validity of the revised scale is further evaluated in terms of prediction – in this case, predicting colonoscopy screening over an eighteen month span – and convergence/divergence with other psychosocial constructs known to predict cancer screening and hypothesized (above) to be related to CIO.

**Table 1**  
Univariate summary statistics for CIO items, Study 1.

|         |  | M(SD)       | Skewness | Kurtosis |
|---------|--|-------------|----------|----------|
| CIO_1*  | There are so many different recommendations about preventing cancer, it's hard to know which ones to follow          | 2.92 (1.14) | -.21     | -.78*    |
| CIO_2*  | There is not enough time to do all of the things recommended to prevent cancer.                                      | 2.41 (1.14) | .37*     | .81*     |
| CIO_3   | It seems like there are new cancer recommendations every day.  | 3.35 (1.14) | -.44*    | -.47     |
| CIO_4   | It is hard to know what to make of cancer information because it is often second hand.                               | 2.52 (1.05) | .15      | -.72*    |
| CIO_5*  | It has gotten to the point where I don't even care to hear new information about cancer.                             | 1.85 (.95)  | .91*     | .29      |
| CIO_6*  | No one could actually do all of the cancer recommendations that are given.   | 2.73 (1.22) | .04      | -.96*    |
| CIO_7*  | Information about cancer all starts to sound the same after a while.   | 2.66 (1.12) | .04      | -.84*    |
| CIO_8   | It seems like no one can agree on what cancer recommendations to follow.   | 2.78 (1.12) | .00      | -.80*    |
| CIO_9   | There doesn't seem to be evidence supporting any cancer recommendations.   | 1.86 (.92)  | 1.15*    | 1.37     |
| CIO_10* | I forget most cancer information right after I hear it.  | 2.19 (.97)  | .47*     | -.29     |
| CIO_11* | Most things I hear or read about cancer seem pretty far-fetched.   | 1.70 (.77)  | 1.22*    | 2.38*    |
| CIO_12  | Since you can't keep up with information about cancer, most people just learn what they need to know if they get it. | 2.58 (1.16) | .06      | -1.09*   |
| CIO_13* | I feel overloaded by the amount of cancer information I am supposed to know.   | 2.49 (1.15) | .35*     | -.72*    |

Note: Univariate summary statistics. Response options for all items are *strongly disagree* to *strongly agree* (4 pt. scale). The eight items used in the final CIO scale are marked with an asterisk (\*).

\*  $p < .05$ .

## 3. Method

### 3.1. Sample and procedure

Data were collected as part of a larger worksite intervention. Adults ( $N = 209$ ) were recruited from one of eight worksites (six hospitals and two manufacturing plants) via their human resource representatives. Healthcare and manufacturing workers were targeted as they have lower rates of colonoscopy screening compared to the general population [16]. The HR representatives sent out recruitment emails to all employees who were 50–75 years of age. Participants completed a survey (Time 1) that assessed demographics, prior screening behavior, CIO, and other psychosocial constructs. Two years after completing the initial survey, insurance claims data (related to colonoscopy) were culled for all participants with the aid of the HR representatives and approval of the participants (Time 2). The insurance claims data were staggered, so at two years after Time 1 surveys, the research team acquired eighteen months of insurance claims data. Participants received \$25 for participation.

The mean age of participants in the current sample was 55.56 ( $SD = 4.24$ ) with a range of 50–71. Most participants were female (71.8%) and Caucasian (97.1%). Education was distributed as follows: high school degree (27.3%), some college (8.6%), associate degree (19.1%), bachelor degree or higher (45.0%). In terms of household income, approximately 18.7% of the sample earned below the U.S. average (\$51,000/year). Colonoscopy is recommended every ten years for individuals 50–75 [17]. Over half of the participants reported receiving a colonoscopy in the past (67.0%), but the majority of the sample (96%) were due to be screened based on recommendations and past reported screening behavior.

### 3.2. Measures

Cancer information overload was measured using a thirteen-item battery assessing feelings about the overwhelming quantity of cancer information (see Table 1). Four response options (*strongly disagree* to *strongly agree*) were provided for each item (i.e., higher scores for greater overload). Items were crafted based on HINTS questions, an explication of the construct (detailed in the literature review of this article), and formative research conducted by the authors. Concerning the formative research, we interviewed 131 low income adults in seven counties in Indiana. Participants were asked if “When we talk to people about health issues, one thing we hear a lot is that there are too many health recommendations to know what to follow. Have you ever felt that way?” Consistent

with the HINTS data, many participants expressed concerns about the number of health recommendations and cancer was the primary example given by most. We culled expressions and ideas from the interview transcripts to craft CIO items that would (hopefully) resonate with the lay public. Psychometric details for the CIO are provided in the results section.

Six constructs from the EPPM/HBM were measured to facilitate rigorous predictive validity testing. The six constructs were perceived susceptibility (three items;  $M = 2.75$ ,  $SD = .88$ ,  $\alpha = .84$ ) and severity (three items;  $M = 4.38$ ,  $SD = .87$ ,  $\alpha = .87$ ) of colon cancer; self-efficacy (six items;  $M = 3.67$ ,  $SD = .51$ ,  $\alpha = .95$ ) to screen and response efficacy of colon cancer screening (two items;  $M = 3.96$ ,  $SD = 1.16$ ,  $\alpha = .91$ ), perceived benefits (seven items;  $M = 3.41$ ,  $SD = .56$ ,  $\alpha = .85$ ), and perceived barriers (nine items;  $M = 1.58$ ,  $SD = .50$ ,  $\alpha = .74$ ) related of/to screening. Susceptibility, severity, and response efficacy used five-point scales and self-efficacy, benefits, and barriers used four-point scales [18–20]. Higher scores indicate increased perceptions of that construct (e.g., greater feelings of self-efficacy).

Participants' health motivation was measured using the health motivation sub-scale of Champion's health belief model scale [21]. The health motivation sub-scale consists of eight statements (e.g., "I search for new information related to my health") evaluated using five-point scales (strongly disagree to strongly agree;  $M = 3.97$ ,  $SD = .64$ ;  $\alpha = .84$ ).

### 3.3. Results

Approximately 3% of the data were missing and replaced using expectation maximization [22]. Six items were significantly skewed and ten items were significantly kurtotic (see Table 1). As a set, the items exhibited significant multivariate abnormality, skewness = 26.73, Z-score = 12.22,  $p < .001$ , and kurtosis = 228.95, Z-score = 8.31,  $p < .001$ .

Two senior colleagues were provided with the thirteen CIO items and asked whether any strayed significantly from the definition of information overload. Four items were identified as potentially problematic (items four, eight, nine, and twelve, see Table 1). Item four was deemed problematic because it focused on the source of the information rather than feelings of overload. Item eight seemed to assess perceived agreement and not overload. Item nine was a critique of the evidence base supporting cancer

recommendations, a feeling that could resonate even for those experiencing minimal overload. Item twelve was better conceptualized as a response to overload than a measure of the disposition itself. Based on these critiques, those four items were dropped from further analysis. The remaining nine items exhibited significant multivariate abnormality, skewness = 11.39, Z-score = 9.29,  $p < .001$ , and kurtosis = 112.98, Z-score = 5.55,  $p < .001$ .

### 3.4. Confirmatory factor analysis – CIO

The remaining nine CIO items were subjected to confirmatory factor analysis (CFA). The basic measurement model consisted of one latent variable (CIO) and nine indicators. Model estimation was carried out using Lisrel 8.8. Because the data were non-normal, CFA was carried out using the asymptotic covariance matrix. Thus, a Satorra–Bentler (S–B)  $\chi^2$  is reported, which adjusts for non-normal distributions [23]. In addition to the S–B  $\chi^2$ , which can be sensitive to sample size, five other fit indices were examined:  $\chi^2/df$  ratio, CFI, RMSEA, SRMR, and Model AIC. The  $\chi^2/df$  ratio adjusts for sample size by dividing the  $\chi^2$  by the degrees of freedom. Ratios below three indicate a good fit to the data [24]. For CFI, conventional standards suggest .95 to indicate good fit [25]. For RMSEA, .08 and lower indicates good fit, while .05 or lower indicates excellent fit [25,26]. The Standardized RMR (SRMR) indicates good fit at .08 or lower [25]. The Model AIC is used to compare different models; lower scores indicate better fit [27].

The basic model indicated poor fit, S–B  $\chi^2$  (27,  $N = 209$ ) = 103.06,  $p < .001$ ,  $\chi^2/df$  ratio = 3.82, CFI = .96, RMSEA = .12 (90% CI: .09, .14), SRMR = .08, Model AIC = 139.06 (Fig. 1a). An examination of the factor loadings revealed that Item 3 had the lowest loading. Item 3 may be suboptimal because it is a feeling that could be experienced regardless of overload. The sense that there are new recommendations every day does not directly equate to feeling overloaded. Item 3 was removed for the follow-up CFA. Revised Model 1 was improved, but still only provided moderate fit, S–B  $\chi^2$  (20,  $N = 209$ ) = 44.73,  $p < .001$ ,  $\chi^2/df$  ratio = 2.24, CFI = .99, RMSEA = .08 (90% CI: .05, .11), SRMR = .05, Model AIC = 76.73. Modification indices suggested that the model could be improved by allowing for error-term correlations between several items. Error correlations should only be employed when there is sufficient justification [28], although it has been noted that such modification may be necessary for many models [29]. Items 1 and

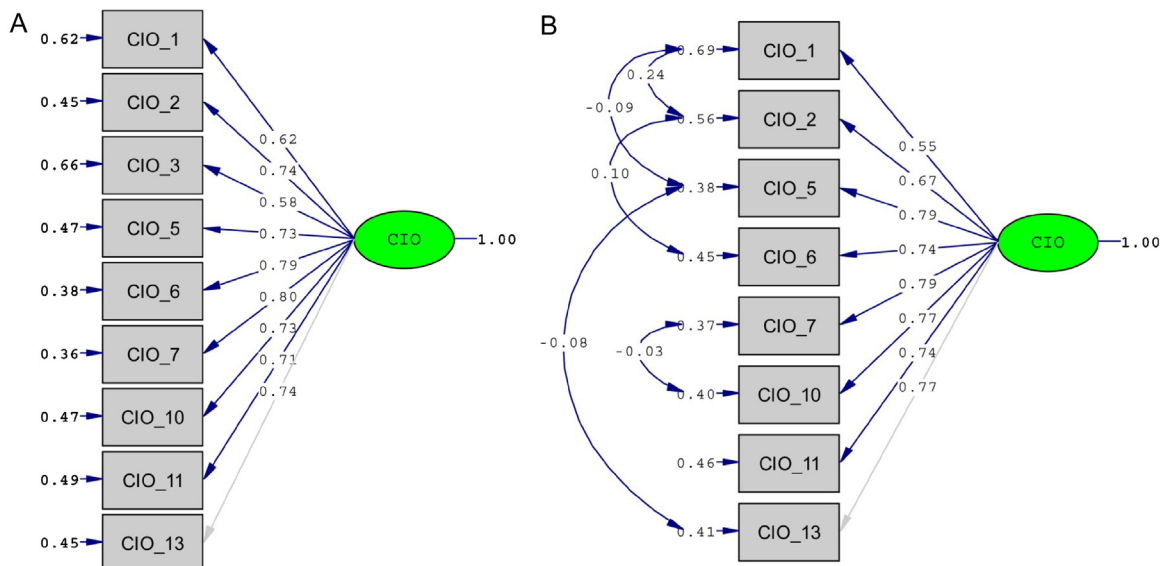


Fig. 1. Note. Basic and revised CIO model for Study 1.

2 both relate to efficiency; items 1 and 5 are about frustration; items 2 and 6 both involve time; items 5 and 13 address backlash; and items 7 and 10 deal with the rejection of information. Given the commonality of these item pairs, error correlations were allowed between all five. The adjusted model resulted in excellent fit, S-B  $\chi^2$  (15,  $N = 209$ ) = 19.10,  $p = .21$ ,  $\chi^2/df$  ratio = 1.27, CFI = 1.00, RMSEA = .04 (90% CI: .00, .08), SRMR = .03, Model AIC = 61.10 (see Fig. 1b). The final 8-item CIO proved to be highly reliable ( $M = 2.37$ ,  $SD = .77$ ,  $\alpha = .87$ , skewness = .21, kurtosis = .13).

### 3.5. Convergent and divergent validity

To evaluate convergent and divergent validity, bivariate correlations between the eight-item CIO scale and other constructs were examined. CIO was lower for females ( $r = -.19$ ) and lower for those with more education ( $r = -.27$ ). CIO was also negatively related to health motivation ( $r = -.32$ ), response efficacy ( $r = -.18$ ), self-efficacy ( $r = -.36$ ), perceived benefits of screening ( $r = -.32$ ), and colonoscopy insurance claims ( $r = -.20$ ). CIO was positively related to perceived barriers of screening ( $r = .22$ ). CIO was unrelated to perceived susceptibility and severity.

### 3.6. Predictive validity

Predictive validity is demonstrated if a measure can detect variance in outcomes consistent with its explication. For CIO, a good test of predictive validity is the ability to detect variance in a cancer prevention behavior – such as colonoscopy utilization – above and beyond other expected predictors. To test predictive validity, a logistic regression was carried out with colonoscopy utilization as the dependent variable (as assessed by eighteen months of insurance data: did not screen = 0, did screen = 1), past colonoscopy screening behavior and demographics (age, gender, race, education, income) entered in Block 1, health motivation and HBM/EPPM variables entered in Block 2, and the 8-item CIO entered in Block 3.

The model was significant at Block 3, *Cox & Snell*  $R^2 = .13$ ,  $-2 \text{ Log Likelihood} = 88.97$ ,  $\chi^2$  for Block 3 = 4.69,  $df = 1$ ,  $p = .03$  (see Table 2). CIO was a significant predictor of screening behavior,  $b = -.99$ ,  $SE = .48$ ,  $Wald = 4.20$ ,  $p = .040$ ,  $Exp(B) = .371$ . As such, a one unit increase in CIO decreased the odds of screening by 62.9%. The only other significant predictors of screening behavior were past

colonoscopy screening behavior,  $b = -2.27$ ,  $SE = 1.06$ ,  $Wald = 4.62$ ,  $p = .03$ ,  $Exp(B) = .103$ , and self-efficacy,  $b = 2.68$ ,  $SE = 1.60$ ,  $Wald = 2.81$ ,  $p = .09$ ,  $Exp(B) = 14.62$ . Those who had screened previously and those with greater self-efficacy were more likely to have screened during the 18-month monitoring.

## 4. Study 2

Study 1 demonstrated that the CIO scale is internally reliable, has a valid factor structure, converges/diverges with other constructs as expected (except for perceived susceptibility and severity), and predicts variance in behavioral outcomes. A lingering question is whether CIO is operationally different from fatalism. After all, the CIO scale includes an item, “There are so many different recommendations about preventing cancer, it’s hard to know which one to follow,” from HINTS [30] that has been utilized as an indicator of cancer fatalism [3,6]. Study 2 was conducted to confirm the factor structure identified in Study 1 and to examine whether CIO and fatalism are distinct constructs (i.e., discriminant validity). Concerning the latter, the model of information overload posits that CIO is a dispositional reaction to (real or imagined) problems with the cancer information environment; a situation that should produce widespread backlash toward health information and those (perceived to be) responsible for it. Thus, CIO should be negatively related to attention to health news, support for scientific research, and perceptions of scientific credibility.

## 5. Method

### 5.1. Sample and procedure

Adults ( $N = 399$ ) were recruited from one of seven shopping malls located in the Midwest. At each location, managers allowed the research team to set-up a table and twelve chairs in one of the main intersections of the mall. A team of three to five researchers recruited mall shoppers at different malls from 9am to 9pm on Saturdays for 7 weeks. Participants were recruited using six large canvas signs (with the name of the University supporting the research). When participants approached the research team they were randomly assigned to one of four different studies (one of which was the present protocol). People were paid \$10 for participating.

More females (66.2%) participated than males (31.6%). Participants ranged from 18 to 84 years of age, with a mean age of 36.68 years ( $SD = 16.33$ ). Race distributed as follows: Caucasian (83.2%), African American (11.7%), Hispanic, Latino, or Spanish Origin (3.1%), American Indian or Native American (1.8%), Asian or Pacific Islander (1.0%), and other (2.3%). Education distributed as follows: less than high school (3.0%), high school degree (32.6%), some college (21.5%), associate degree (8.3%), bachelor degree or higher (34.8%).

### 5.2. Measures

All 8 items from the CIO scale were measured for the purpose of validating the factor structure identified in Study 1.

The Powe fatalism inventory is a fifteen-item questionnaire assessing cancer fatalism [4]. Participants responded on a five-point scale (*strongly disagree* to *strongly agree*); higher scores suggest greater fatalism perceptions. Additional psychometric details are reported in the results.

Attention to health news and support for scientific research were assessed using single-items from HINTS [30] and the National Science Foundation [31]. Perceived credibility of scientists has three underlying dimensions – competence, trustworthiness, and

**Table 2**  
Logistic regression predicting colonoscopy screening, Study 1.

|                      | B (SE)      | Wald | p                | Exp (B) | Cox & Snell R <sup>2</sup> |
|----------------------|-------------|------|------------------|---------|----------------------------|
| <b>Block 1</b>       |             |      |                  |         |                            |
| Age                  | -.12(.07)   | 2.63 | .11              | .89     | .065 <sup>*</sup>          |
| Gender               | .25(.65)    | .15  | .70              | 1.28    |                            |
| Race                 | .52(.38)    | 1.87 | .17              | 1.68    |                            |
| Education            | .16(.24)    | .47  | .49              | 1.18    |                            |
| Income               | -.06(.32)   | .03  | .86              | .95     |                            |
| Past colonoscopy     | -2.27(1.06) | 4.62 | .03 <sup>†</sup> | .10     |                            |
| <b>Block 2</b>       |             |      |                  |         |                            |
| Health motivation    | .16(.56)    | .08  | .78              | 1.17    | .104                       |
| Perc. benefits       | .03(.73)    | .00  | .97              | 1.03    |                            |
| Perc. barriers       | .30(.63)    | .22  | .64              | 1.35    |                            |
| Perc. susceptibility | -.47(.34)   | 1.90 | .17              | .63     |                            |
| Perc. severity       | -.19(.28)   | .43  | .51              | .83     |                            |
| Resp. efficacy       | -.10(.25)   | .17  | .68              | .90     |                            |
| Self-efficacy        | 2.68(1.60)  | 2.81 | .09 <sup>†</sup> | 14.62   |                            |
| <b>Block 3</b>       |             |      |                  |         |                            |
| CIO                  | -.99(.48)   | 4.20 | .04 <sup>*</sup> | .37     | .126 <sup>*</sup>          |

Note: Logistic regression predicting colonoscopy screening by demographics, past screening behavior, health motivation, health belief model variables, and CIO. All variables are reported by block.  $N = 191$  (18 missing cases).

\*  $p < .05$ .

†  $p < .10$ .

goodwill – and was assessed with measures developed by McCroskey and Teven [32].

5.3. Results

Approximately 1% of the data were missing and replaced using expectation maximization. As before, the CIO items exhibited significant multivariate abnormality, skewness = 15.51, Z-score = 14.21,  $p < .001$ , and kurtosis = 247.99, Z-score = 14.65,  $p < .001$ .

5.4. Confirmatory factor analysis – CIO

To test the model from Study 1, we correlated the same five error term pairings. The adjusted model suggested excellent fit, S–B  $\chi^2$  (15,  $N = 399$ ) = 35.70,  $p < .001$ ,  $\chi^2/df$  ratio = 2.38, CFI = .99, RMSEA = .05 (90% CI: .03, .08), SRMR = .06, Model AIC = 77.70 (see Fig. 2a). Thus, the factor structure identified in Study 1 was replicated. The final eight-item CIO scale proved reliable ( $M = 2.34$ ,  $SD = .41$ ,  $\alpha = .77$ , skewness =  $-.20$ , kurtosis = .12).

5.5. Confirmatory factor analysis – cancer fatalism

Powe’s cancer fatalism scale has not been evaluated using CFA. It is currently conceptualized as one latent variable with fifteen indicators. As with CIO, the fatalism items exhibited significant multivariate abnormality, skewness = 54.44, Z-score = 41.29,  $p < .001$ , and kurtosis = 371.63, Z-score = 20.75,  $p < .001$  (see Table 3).

Two questions about cancer fatalism need to be answered: (1) are CIO and cancer fatalism distinct constructs and (2) what is the underlying structure of Powe’s cancer fatalism inventory. These questions can be pursued simultaneously using CFA. Initially, a baseline model was constructed with one latent variable (cancer fatalism) and 23 indicators (15 fatalism items plus the 8 CIO items). The utility of the baseline model is that it will provide a baseline Model AIC; lower AIC scores indicate better model fit (in a comparative sense). The baseline model demonstrated poor fit, S–B

$\chi^2$  (230,  $N = 399$ ) = 1661.36,  $p < .001$ ,  $\chi^2/df$  ratio = 7.22, CFI = .81, RMSEA = .13 (90% CI: .12, .113), SRMR = .11, Model AIC = 1753.36.

A revised model was tested with two latent variables (CIO and cancer fatalism). CIO was modeled with five error terms correlated (as in Study 1). The two variable model was not a good fit for the data, but the Model AIC was significantly improved suggesting that the model was moving in the right direction: S–B  $\chi^2$  (229,  $N = 399$ ) = 1149.60,  $p < .001$ ,  $\chi^2/df$  ratio = 5.02, CFI = .88, RMSEA = .10 (90% CI: .09, .11), SRMR = .09, Model AIC = 1243.60.

An examination of the fatalism items reveals that seven items concern fatalistic beliefs about cancer prevention (items labeled CFP 1–7 in Table 3) and eight items concern fatalistic beliefs about cancer treatment (items labeled CFT 1– 8). An alternative model was constructed that separated fatalism into two latent variables: cancer fatalism prevention (CFP) and cancer fatalism treatment (CFT). The alternative model demonstrated good fit, S–B  $\chi^2$  (222,  $N = 399$ ) = 522.49,  $p < .001$ ,  $\chi^2/df$  ratio = 2.35, CFI = .96, RMSEA = .058 (90% CI: .05, .07), SRMR = .07, Model AIC = 630.49. An examination of the loadings revealed that two CFT items were low: CFT 4 loaded at .22 and CFT 5 loaded at .06. Both items are suboptimal measures of CFT because they address cancer detection rather than treatment. CFT 4 and 5 were removed, and the revised model was a good fit for the data, S–B  $\chi^2$  (181,  $N = 399$ ) = 403.01,  $p < .001$ ,  $\chi^2/df$  ratio = 2.23, CFI = .97, RMSEA = .056 (90% CI: .05, .06), SRMR = .06, Model AIC = 503.01 (see Fig. 2b).

Fornell and Larcker [33] provided a statistical formula for testing discriminant validity (i.e., whether constructs are significantly different). Discriminant validity is demonstrated if the average variance extracted (AVE) for each construct is greater than the square of the correlation ( $R^2$ ) between the two constructs. In all cases, AVEs (CIO = .31, CFP = .59, CFT = .43) are greater than the  $R^2$ s (see Fig. 2b for correlations). Thus, the results support that CIO, CFP, and CFT are distinct constructs. The resulting seven-item CFP measure exhibited excellent reliability ( $M = 2.37$ ,  $SD = .92$ ,  $\alpha = .91$ , skewness = .38, kurtosis =  $-.55$ ), as did the 6 item CFT measure ( $M = 1.80$ ,  $SD = .60$ ,  $\alpha = .80$ , skewness = .80, kurtosis = .77).

Discriminant validity is also demonstrated if constructs differ in their relationship to other variables, consistent with the

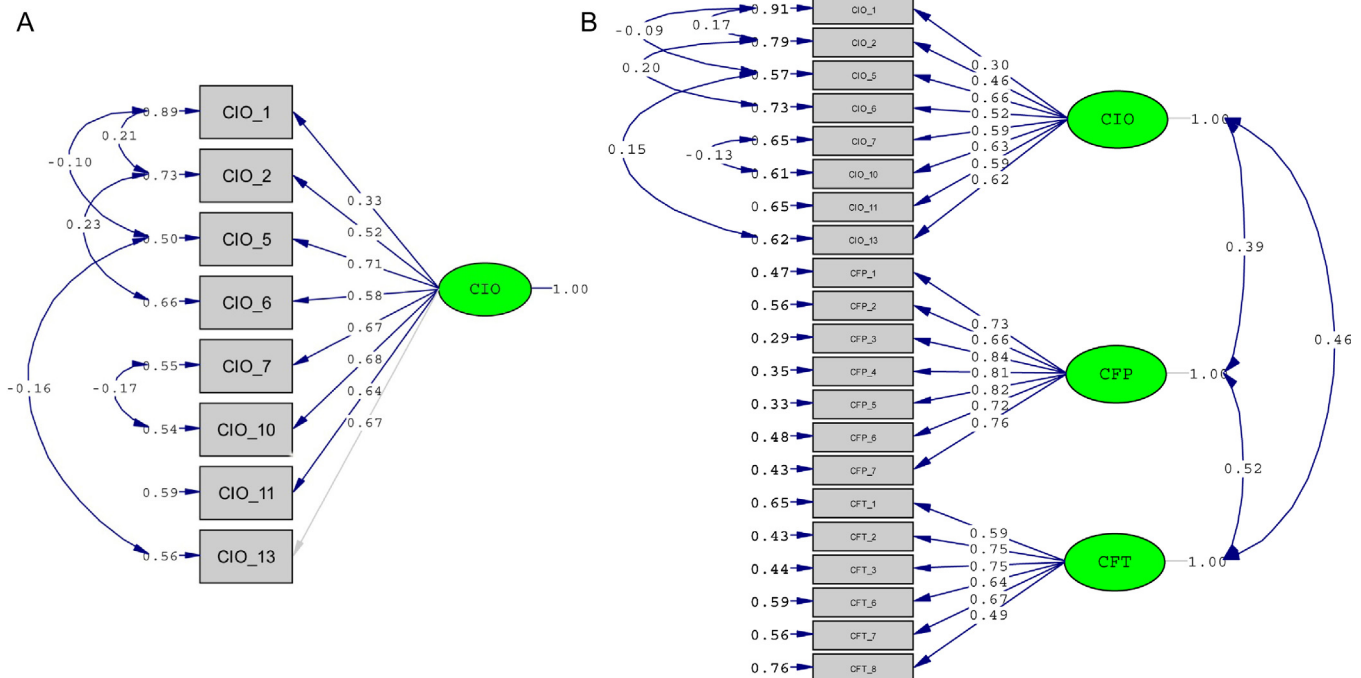


Fig. 2. Note. Confirmed CIO model and three-variable CIO, CFP, CFT model for Study 2.

**Table 3**  
Univariate summary statistics for cancer fatalism items, Study 2.

|        |  | M (SD)      | Skewness           | Kurtosis           |
|--------|--|-------------|--------------------|--------------------|
| CFP_1* | I believe that if someone is meant to have cancer it doesn't matter what they eat, they will get cancer anyway.                | 2.55 (1.19) | .32 <sup>+</sup>   | −1.04 <sup>+</sup> |
| CFP_2* | I believe someone can smoke all their life and if they are not meant to get cancer they won't get it.                          | 2.55 (1.24) | .24                | −1.23 <sup>+</sup> |
| CFP_3* | I believe if someone is meant to get cancer they will get it no matter what they do.   | 2.56 (1.22) | .31 <sup>+</sup>   | −1.08 <sup>+</sup> |
| CFP_4* | I believe if someone gets cancer it was meant to be.   | 2.38 (1.16) | .54 <sup>+</sup>   | −.70 <sup>+</sup>  |
| CFP_5* | I believe if someone is meant to have cancer they will have cancer.  | 2.34 (1.11) | .48 <sup>+</sup>   | −.72 <sup>+</sup>  |
| CFP_6* | I believe if someone was meant to have cancer it doesn't matter what the doctor tells them to do, they will get cancer anyway. | 2.06 (1.02) | .88 <sup>+</sup>   | .18                |
| CFP_7* | I believe if someone is meant to have cancer it doesn't matter if they eat healthy foods.                                      | 2.12 (1.07) | .82 <sup>+</sup>   | −.15               |
| CFT_1+ | I believe if someone has cancer it is already too late to do anything about it   | 1.59 (.69)  | 1.25 <sup>+</sup>  | 2.33 <sup>+</sup>  |
| CFT_2+ | I believe if someone gets cancer their time to die is near.  | 1.64 (.76)  | 1.35 <sup>+</sup>  | 2.39 <sup>+</sup>  |
| CFT_3+ | I believe if someone gets cancer that's the way they were meant to die.  | 1.70 (.85)  | 1.38 <sup>+</sup>  | 1.89 <sup>+</sup>  |
| CFT_4  | I believe getting checked for cancer makes people think about dying  | 2.65 (1.21) | .16                | −1.22 <sup>+</sup> |
| CFT_5  | I believe some people don't want to know if they have cancer because they don't want to know they are dying.                   | 3.62 (1.05) | −1.02 <sup>+</sup> | .46                |
| CFT_6+ | I believe if someone gets cancer it doesn't matter when they find out about it, they will still die.                           | 1.73 (.87)  | 1.37 <sup>+</sup>  | 2.04 <sup>+</sup>  |
| CFT_7+ | I believe if someone gets cancer a lot of different treatments won't make any difference.                                      | 1.73 (.78)  | 1.14 <sup>+</sup>  | 1.64 <sup>+</sup>  |
| CFT_8+ | I believe cancer kills most people who get it.   | 2.42 (1.07) | .42 <sup>+</sup>   | −.69 <sup>+</sup>  |

Note: Univariate summary statistics. Response options for all items are *strongly disagree, disagree, neutral, agree, strongly agree* (5 pt. scale). The 7 items used in the final CFP scale are marked with an asterisk (\*). The 6 items used in the final CFT are marked with a plus sign (+).  
\* p < .05.

underlying explication. All three constructs were negatively related to attention to health news, only CIO and CFT were negatively related to support for scientific research, and only CIO predicted the three dimensions of scientific credibility (Table 4). The results are consistent with the idea that CIO, CFP, and CFT differ as they relate to other variables in varying (and complex) ways. In particular, notice that CIO is negatively related to perceptions of scientific credibility whereas both CFP and CFT are not, presumably because neither perception directly relates back to the (perceived) source of cancer information.

5.6. Discussion and Conclusion

Results suggest re-consideration of one popular conceptualization of cancer fatalism from national survey data. It seems two items measure CFP (not much people can do and everything causes cancer) and one measures CIO (too many recommendations). Of these, CIO was the most widespread belief with 71.5% of the public holding this belief in 2003 and 74.9% in 2007 [30,34].

Many questions remain concerning CIO. First and foremost, researchers should consider message and environmental factors that serve to reduce or exacerbate CIO. For example, Jensen and colleagues have observed that including scientific uncertainty in news coverage about cancer researcher may decrease fatalism and perhaps overload [5,35]. Niederdeppe et al. [36] observed that the combination of two news stories describing uncertain cancer causes and preventive actions increased CIO, while pairing an uncertain cancer cause story with a summary of evidence-based cancer prevention recommendations reduced CIO. Other research-

ers have crafted effective messages by framing content to be concordant with dispositional motivations [37], a promising avenue of research as CIO is an aversive motivational disposition.

While national survey data suggests that CIO is common, these findings are based on a single item. The same question is included in the CIO scale (CIO 1), and it had the highest mean score (in both studies) among the 8 items included. Single items can misrepresent complex phenomena [15]; therefore, a national level survey with the CIO scale would provide a more comprehensive picture of this belief.

Finally, Shen et al. [38–40] are currently developing a multi-dimensional measure of health fatalism that is not disease specific and has three underlying dimensions: predestination, pessimism, and luck. Such a measure makes an important contribution to studying fatalism; still, the present study suggests cancer researchers should be aware that fatalism might vary along the cancer (or broader disease) continuum (e.g., CFP was more prevalent than CFT in Study 2).

Certain limitations of the current research merit discussion. Neither study randomly sampled from the U.S. population as a whole; thus, the results may not be nationally representative. For example, the majority of participants were Caucasian and this may bias the results in that ways the influence the underlying structure of the constructs. There are also important questions about CIO that still need to be answered. CIO is thought to be a disposition, but test–retest reliability has yet to be established. A state-based version of CIO could also be constructed and compared to the dispositional measure. Research on state-based CIO should consider earlier work from consumer contexts on general

**Table 4**  
Correlation matrix, Study 2.

|                         | 1 | 2                | 3                | 4                 | 5                 | 6                 | 7                 | 8                 | 9                | 10                | 11                |
|-------------------------|---|------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 1. CIO                  |   | .39 <sup>+</sup> | .46 <sup>+</sup> | −.26 <sup>+</sup> | −.15 <sup>+</sup> | −.17 <sup>+</sup> | −.15 <sup>+</sup> | −.15 <sup>+</sup> | −.04             | −.07              | −.12 <sup>+</sup> |
| 2. CFP                  |   |                  | .52 <sup>+</sup> | −.15 <sup>+</sup> | −.09              | .04               | .03               | .04               | .00              | .04               | −.08              |
| 3. CFT                  |   |                  |                  | −.14 <sup>+</sup> | −.21 <sup>+</sup> | .00               | −.05              | −.02              | .05              | −.11 <sup>+</sup> | −.10              |
| 4. Att. to health news  |   |                  |                  |                   | .16 <sup>+</sup>  | .11 <sup>+</sup>  | .08               | .09               | .23 <sup>+</sup> | .18 <sup>+</sup>  | .20 <sup>+</sup>  |
| 5. Support for SR       |   |                  |                  |                   |                   | .20 <sup>+</sup>  | .21 <sup>+</sup>  | .22 <sup>+</sup>  | −.02             | .08               | .05               |
| 6. SC – competence      |   |                  |                  |                   |                   |                   | .71 <sup>+</sup>  | .46 <sup>+</sup>  | −.05             | −.07              | .04               |
| 7. SC – trustworthiness |   |                  |                  |                   |                   |                   |                   | .62 <sup>+</sup>  | −.08             | .03               | −.01              |
| 8. SC – goodwill        |   |                  |                  |                   |                   |                   |                   |                   | −.06             | .14 <sup>+</sup>  | .07               |
| 9. Age                  |   |                  |                  |                   |                   |                   |                   |                   |                  | .07               | .18 <sup>+</sup>  |
| 10. Gender              |   |                  |                  |                   |                   |                   |                   |                   |                  |                   | .10               |
| 11. Education           |   |                  |                  |                   |                   |                   |                   |                   |                  |                   |                   |

Note: Bivariate correlations among variables in Study 2.  
\* p < .05.

information overload, which revealed that people often cease processing before reaching an overloaded state [41]. Of course, this behavioral response could cultivate dispositional CIO over time as consumers become frustrated with the strains of navigating the information environment. Within-factor correlated error terms need be viewed critically, as they suggest that individual items contain non-random error or “some unwanted component that is stable across measures” (p. 573) [42]. One way to address this issue is continued refinement of the items with correlated error terms so that each is unique and contains only random error.

### 5.7. Conclusion

U.S. adults have troubling beliefs about cancer. Understanding the origin and nature of those beliefs is a priority for researchers interested in improving cancer-related outcomes. The results of this study provide researchers with three valid measures (CIO, CFP, and CFT) designed to elucidate these complex perceptions.

### 5.8. Practice implications

Health care providers and public health professionals should be mindful of the fact that many adults have high CIO. Evidenced-based communication strategies that mitigate CIO are currently unavailable; however, practitioners could facilitate progress on this front by identifying and conveying best practices via case studies in research journals. We live in an information age, but too much information can be just as problematic as too little.

## References

- [1] Siegel R, Naishadham D, Jemal A. Cancer statistics, 2012. *CA Cancer J Clin* 2012;62:10–29.
- [2] Health Information National Trends Survey (HINTS). What does HINTS tell us about cancer perceptions and knowledge? 2007, Available from: <http://hints.cancer.gov/topic.aspx?section=Cancer+Perceptions+and+Knowledge> [accessed 23.12.12].
- [3] Niederdeppe J, Gurmankin Levy A. Fatalistic beliefs about cancer prevention and three prevention behaviors. *Cancer Epidemiol Biomarkers Prev* 2007;16:998–1002.
- [4] Powe BD, Finnie R. Cancer fatalism: the state of the science. *Cancer Nurs* 2003;26:454–67.
- [5] Jensen JD, Carcioppolo N, King AJ, Bernat JK, Davis LA, Yale R, et al. Including limitations in news coverage of cancer research: effects of news hedging on fatalism, medical skepticism, patient trust, and backlash. *J Health Commun* 2011;16:486–503.
- [6] Niederdeppe J, Fowler EF, Goldstein K, Pribble J. Does local television news coverage cultivate fatalistic beliefs about cancer prevention? *J Commun* 2010;60:230–53.
- [7] Reynolds T. News headlines feed on fear of cancer risk, experts say. *J Natl Cancer Inst Monogr* 2001;93:9–11.
- [8] Russell C. Living can be hazardous to your health: how the news media cover cancer risks. *J Natl Cancer Inst Monogr* 1999;25:167–70.
- [9] Elliot AJ. The hierarchical model of approach-avoidance motivation. *Motiv Emotion* 2006;30:111–6.
- [10] Elliot AJ, Thrash TM. Approach and avoidance temperament as basic dimensions of personality. *J Pers* 2010;78:865–906.
- [11] Lang A. Using the limited capacity model of motivated mediated message processing to design effective cancer communication messages. *J Commun* 2006;56:S57–80.
- [12] Champion V, Skinner CS. The health belief model. In: Glanz K, Rimer B, Viswanath K, editors. *Health behavior and health education*. 4th ed., San Francisco, CA: Jossey-Bass; 2008.
- [13] Elliot AJ. Approach and avoidance motivation and achievement goals. *Educ Psychol* 1999;34:169–89.
- [14] Witte K. Fear control and danger control: a test of the extended parallel process model (EPPM). *Commun Monogr* 1994;61:113–34.
- [15] DeVellis RF. *Scale development: theory and applications*. 2nd ed. Thousand Oaks, CA: Sage Publications; 2003.
- [16] Vidal L, LeBlanc WG, McCollister KE, Arheart KL, Chung-Bridges K, Christ S, et al. Cancer screening in US workers. *Am J Public Health* 2009;99:59–65.
- [17] Smith RA, Cokkinides V, Brawley OW. Cancer screening in the United States, 2008: a review of current American Cancer Society guidelines and cancer screening issues. 2008. *CA Cancer J Clin* 2008;58:161–79.
- [18] McQueen A, Tiro JA, Vernon SW. Construct validity and invariance of four factors associated with colorectal cancer screening across gender, race, and prior screening. *Cancer Epidemiol Biomarkers Prev* 2008;17:2231–7.
- [19] Tiro JA, Vernon SW, Hyslop T, Myers RE. Factorial validity and invariance of a survey measuring psychosocial correlates of colorectal cancer screening among African Americans and Caucasians. *Cancer Epidemiol Biomarkers Prev* 2005;14:2855–61.
- [20] Witte K, Cameron KA, McKeon JK, Berkowitz JM. Predicting risk behaviors: development and validation of a diagnostic scale. *J Health Commun* 1996;1:317–41.
- [21] Champion VL. Instrument refinement for breast cancer screening behaviors. *Nurs Res* 1993;42:139–43.
- [22] Schafer JL, Olsen MK. Multiple imputation for multivariate missing-data problems: a data analyst's perspective. *Multivar Behav Res* 1998;33:545–71.
- [23] Satorra A, Bentler PM. Ensuring positiveness of the scaled difference Chi-square test statistic. *Psychometrika* 2010;75:243–8.
- [24] Kline RB. *Principles and practice of structural equation modeling*. 2nd ed. New York, NY: Guilford; 2004.
- [25] Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Modeling* 1999;6:1–55.
- [26] Holbert RL, Stephenson MT. Commentary on the uses and misuses of structural equation modeling in communication research. In: Hayes AF, Slater MD, Snyder LB, editors. *The Sage handbook of advanced data analysis methods for communication research*. Thousand Oaks, CA: Sage; 2008. p. 185–218.
- [27] Akaike H. Factor analysis and AIC. *Psychometrika* 1987;52:317–32.
- [28] Byrne BM. *Structural equation modeling with AMOS: basic concepts, applications, and programming*. Mahwah, NJ: Lawrence Erlbaum Associates; 2001.
- [29] Bentler PM. SEM with simplicity and accuracy. *J Consum Psychol* 2010;20:215–20.
- [30] Arora NK, Hesse BW, Rimer BK, Viswanath K, Clayman ML, Croyle RT. Frustrated and confused: the American public rates its cancer-related information-seeking experiences. *J Gen Intern Med* 2008;23:223–8.
- [31] National Science Foundation. *Science and technology: public attitudes and understanding*; 2012, Retrieved from: <http://www.nsf.gov/statistics/seind12/c7/c7h.htm>.
- [32] McCroskey JC, Teven JJ. Goodwill: a reexamination of the construct and its measurement. *Commun Monogr* 1999;66:90–103.
- [33] Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Marketing Res* 1981;18:39–50.
- [34] Hesse B, Moser R. *Health Information National Trends Survey (HINTS), 2007*. ICPSR25262-v1. Ann Arbor, MI: Inter-University Consortium for Political and Social Research [distributor]; 2009.
- [35] Jensen JD. Scientific uncertainty in news coverage of cancer research: effects of hedging on scientists' and journalists' credibility. *Hum Commun Res* 2008;34:347–69.
- [36] J. Niederdeppe, T. Lee, H.K. Kim, R. Robbins, D. Kirshenblat, K. Standridge, et al. Content and effects of news stories about uncertain cancer causes and preventive behaviors. *Health Commun*, in press.
- [37] Mann T, Sherman D, Updegraff J. Dispositional motivations and message framing: a test of the congruency hypothesis in college students. *Health Psychol* 2004;23:330–4.
- [38] Condit CM. Public understanding of genetics and health. *Clin Genet* 2010;77:1–9.
- [39] Shen L, Condit CM. Addressing fatalism with health messages. In: Cho H, editor. *Health communication message design: theory and practice*. Thousand Oaks, CA: Sage; 2011. p. 191–208.
- [40] Shen L, Condit CM, Wright L. The psychometric property and validation of a fatalism scale. *Psychol Health* 2009;24:597–613.
- [41] Jacoby J. Perspectives on information overload. *J Consum Res* 1984;10:432–5.
- [42] Gerbing DW, Anderson JC. On the meaning of within-factor correlated measurement errors. *J Consum Res* 1984;11:572–80.