Report of empirical study

HEALTH PSYCHOLOGY OPEN

Health Psychology Open
July-December 2016: 1–11

DOI: 10.1177/2055102916657673
hpo.sagepub.com
SAGE

Heart disease and breast cancer perceptions: Ethnic differences and relationship to attentional bias

Tanya R Berry[1], Kimberley D Curtin[1], Kerry S Courneya[1], Kerry R McGannon[2], Colleen M Norris[1], Wendy M Rodgers[1] and John C Spence[1]

Abstract

Differences in perceptions of susceptibility, seriousness, and fear of heart disease and breast cancer were examined and related to attentional bias for disease-related words among Canadian women of various ethnic ancestry. Women ($n = 831$) completed an online survey, and 503, among them, also completed an attentional bias task. Perceived seriousness of breast cancer predicted attentional bias for breast cancer in women of South Asian ancestry. Lifestyle behaviors were related to breast cancer attentional bias in women with British ancestry. Understanding relationships between modifiable risk factors, disease risk perceptions, and attentional biases among different ethnic groups can help create targeted promotional campaigns.

Keywords

attentional bias, breast cancer, ethnicity, health psychology, heart disease

Differences exist between ethnic groups in the incidence and mortality rates of both heart disease and breast cancer.[1] In terms of heart disease, women of South Asian descent (i.e. Indian, Pakistani, Bangladeshi, Sri Lankan, and Nepalese) living in Canada have a greater risk compared to White populations (Rana et al., 2014). These authors attribute this difference to complex interactions between genetic and environmental factors. South Asians also suffer from higher mortality due to heart disease compared to Whites (Bainey et al., 2011). Conversely, although the incidence rate of breast cancer among Asian American women increased over the years 2000–2009 (Hou and Hou, 2013), women of Asian descent are at lower risk of breast cancer than are White women in the United States (Center for Disease Control and Prevention, 2015). Research from the United Kingdom indicated that lower risk of breast cancer in South Asian women can be largely attributed to lower rates of risk factors including body size, childbearing and breastfeeding history, alcohol consumption, and use of hormone therapy, when compared to White women (Gathani et al., 2014). In Canada, women of South Asian descent are diagnosed with breast cancer at a later stage than are the rest of the population possibly because they are less likely to be screened or have less exposure to health-promotion messaging (Ginsburg et al., 2015). These authors conclude that South Asian women could benefit from tailored breast cancer health-promotion programs, but what may contribute to a successful program remains understudied. This research addresses this question by examining differences in perceptions of heart disease compared to breast cancer between ethnic groups and if this is related to the automatic attention paid to disease-related stimuli.

Although there is research that examines risk perceptions of heart disease and breast cancer among women in general, there is less information regarding ethnic differences in perceptions of heart disease or breast cancer. For example, despite the relative risks of heart disease and breast cancer, many women feel at greater risk for, worry

[1]University of Alberta, Canada
[2]Laurentian University, Canada

Corresponding author:
Tanya R Berry, Faculty of Physical Education and Recreation, University of Alberta, 1-153 University Hall, Edmonton, AB T6G 2H9, Canada.
Email: tanya.berry@ualberta.ca

more, and are more concerned about breast cancer than heart disease (Wang et al., 2009). Women also often have inaccurate perceptions about breast cancer that tend to heighten their anxiety about cancer, whereas they believe heart disease can be overcome (Folta et al., 2008). Most of the research that examines differences between ethnic groups comes from the United States where studied groups tend to be Black and/or Hispanics compared to non-Hispanic Whites and has examined perceptions of breast cancer. For example, White women in the United States more often perceive themselves at a higher risk of breast cancer, and Black women are less likely to be aware that having a relative with the disease increases their chances of developing breast cancer (Katapodi et al., 2004). Research with other ethnic groups found South Asian women in the United States reported low susceptibility to breast cancer in the future (Poonawalla et al., 2013). However, others found that regardless of objective risk, African American and Asian/Pacific Islander women were more concerned about breast cancer compared to non-Latina or Latina women (Fehniger et al., 2014). In addition to the inconsistent findings, the study by Fehniger and colleagues highlights an issue pointed out by others (i.e. Ginsburg et al., 2015): researchers often group all Asian populations together and sometimes with Pacific Islanders, which could hide ethnic differences in health beliefs. Parenthetically, this could also apply to "Whites." In terms of heart disease, qualitative research indicated that Black and Hispanic women were most likely to mention fatalistic views (e.g. death and dying) in relation to heart disease (Arslanian-Engoren, 2007). Research that included more specific Asian groups found South Asian women believed heart attacks were not preventable (Kandula et al., 2010).

Racial/ethnic differences also exist in rates of modifiable risk factors that are related to both heart disease and breast cancer such as physical activity, smoking, diet, and obesity (Canadian Breast Cancer Foundation, 2015; Heart and Stroke Foundation of Canada, 2012). For example, the Public Health Agency of Canada (2009) reports that South Asians are less physically active and consume fewer fruit and vegetables, but also smoke less and are less likely to be obese, than Whites. Although motivation to take up positive health behaviors is related to personal risk factor knowledge, awareness, and worry about heart disease, women of Asian descent reported lower motivation to address modifiable risk factors, and non-White ethnicities reported less awareness and knowledge of personal risk factors (Galbraith et al., 2011). Others have also found a relationship between risk perceptions and health-protective behavior of African Americans living in poverty but not for Whites (Hovick et al., 2011). This relationship was mediated by a desire for more knowledge, which was related to more systematic processing of health messages.

Perceptions of diseases and associated risk factors may be related to whether messages that highlight risk perceptions and risk factors attract attention and are considered threatening. Health messages that emphasized physical activity and consuming fruit and vegetables to reduce cancer risk in middle-aged women were rated as moderately "threatening" and "scary" on a questionnaire (Iversen and Kraft, 2006). The level of perceived threat in a message may influence attentional bias, a cognitive process wherein orientation and attention is automatically allocated to cues that match one's mood or motivation (MacLeod et al., 1986). Attentional bias is important to consider in relation to health messaging given that attention allocated to messages is a factor in subsequent awareness and message effects (O'Cass and Griffin, 2006). For example, O'Cass and Griffin found attention paid to antismoking advertisements (measured by questionnaire) was related to their believability, which in turn was related to attitudes and intentions toward the behavior.

There is substantial evidence that anxiety and fear can affect attentional biases to threat-related stimuli, even in non-clinical samples (Bar-Haim et al., 2007). For example, if a woman finds information about breast cancer or heart disease highly threatening, she may automatically attend to information about the disease or she may avoid information because attending to the information can increase anxiety. Some researchers have examined attentional biases for disease threat words in persons with breast cancer or heart disease. For example, attentional bias toward heart disease threat words has been shown among individuals with coronary heart disease (Ginting et al., 2013). Attentional bias has also been demonstrated toward cancer-related words in women with breast cancer who had lower anxiety and showed greater signs of positive coping, which the authors argue is a positive, adaptive, response representing greater information seeking (Glinder et al., 2007). Cancer survivors also showed attentional bias toward cancer-related words, regardless of their level of fear of disease recurrence, compared to control participants (Custers et al., 2015). Others have found attentional bias away from cancer-related words among healthy women who were moderate alcohol drinkers after being informed that alcohol is a risk factor for breast cancer (Klein and Harris, 2009).

Given that previous research has shown ethnic differences in factors such as beliefs in the preventability of heart disease (e.g. Kandula et al., 2010) or concern about breast cancer (e.g. Fehniger et al., 2014), it is possible that attentional biases for disease-related stimuli are associated with different threat factors for different ethnic groups. Furthermore, variability exists among Western and other populations in cognitive processes such as attention allocation; this calls into question the presumption that inter-population variability in such processes is low (Henrich et al., 2010) and highlights the need to examine attentional bias between ethnicities for disease-related information.

The purpose of this research was to examine differences among women of diverse ethnic origins in perceptions of susceptibility, seriousness, and fear of heart disease and

breast cancer and to determine if these perceptions are related to attentional bias for disease-related words. The relationships of lifestyle behaviors (physical activity, fruit and vegetable consumption, smoking) to attentional bias were also examined. Based on the evidence that persons of Asian descent displayed less knowledge and awareness of personal risk of heart disease (Galbraith et al., 2011), and that White women tend to have higher perceived breast cancer risk compared to Asian women (e.g. Haas et al., 2005), it is hypothesized that

1. Perceptions of diseases will differ by ethnicity group with White women of European or British descent having higher perceived susceptibility, seriousness, and fear of heart disease and breast cancer than South Asian or East and Southeast Asian women.
2. Greater perceived susceptibility, seriousness, fear, more physical activity, fruit and vegetable consumption, and lower smoking will be related to greater attentional bias for heart disease–related words compared to control words and greater attentional bias for breast cancer–related words compared to control words. Differences between ethnic groups will be explored.

Method

Participants

Women ($N = 1101$) were recruited through an online survey ("I-Say" survey) by the global survey–based market research company Ipsos Reid. The women were from a panel of approximately 300,000 Canadians (aged 18–99 years), who had given prior consent to participate in survey research in exchange for the opportunity to gain points for small prizes. Women of South Asian ancestry were purposefully recruited. Personal communication with Ipsos Reid prior to starting the survey indicated that it would be realistic, based on their experience, to recruit a maximum of 200 women of South Asian ancestry from the panel with the remaining participants of various ethnicities.

Measures

Attentional bias. Attentional bias was measured with a visual probe task that included threatening words related to breast cancer and heart disease with neutral control words matched for length and language frequency. Totally, 10 pairs of breast cancer or heart disease words were selected based on previous research examining attentional bias for breast cancer (Klein and Harris, 2009) and heart disease (Glinder et al., 2007) and were piloted with nine women aged 33–71 years (ethnicity unknown). Final words selected for the task were those that all participants understood and rated between 4 and 5 on five-point scales of relatedness and threat relative to breast cancer or heart disease, indicating the words were highly related to the respective diseases and highly threatening.

Breast cancer words (e.g. metastasize, chemotherapy) were shown paired with control words, and heart disease words (e.g. cardiovascular, stroke) were shown paired with control words. An additional 10 neutral pairs were presented (e.g. bookcase, staircase). Words were presented one above the other, in a random order (once each with the target word on top and on the bottom). The word pairs were shown for 500 ms because of meta-analytic evidence that words presented for 500 ms can elicit bias effects in nonclinical participants with higher self-reported anxiety (Bar-Haim et al., 2007). After presentation of the word pairs, a probe replaced one of the words, and participants were instructed to indicate the location of the probe by pressing one of two keys marked "up" or "down" as quickly as possible. Congruent trials were when the probe appeared in the place of a target word (e.g. a heart disease or breast cancer–related word) and incongruent trials were those where the probe replaced the control word. Response time (RT) served as the measure of attentional bias with faster RT to congruent trials compared to incongruent trials indicating attentional bias for the congruent trial words. Data were collected using Inquisit4web (millisecond.com).

Demographic information. The I-Say survey collects information on age, education, work status, household income (in increments of CAD5000 from <CAD5000 to >CAD150,000), and region of data collection (British Columbia, Alberta, Saskatchewan/Manitoba, Ontario, Quebec, and Atlantic). Data on ethnicity were collected using the standard question for this survey: "As you know, we all live in Canada, but we come from many different ethnic backgrounds. What is your main ethnic background?" Options were South Asian (Punjabi, Indian, Tamil, Sri Lankan, Pakistani, Bangladeshi, Nepalese); East or Southeast Asian (China, Hong Kong, Japan, North or South Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, or other); British (English, Scottish, Welsh, Irish); Western European (Austria, Belgium, France, Germany, Netherlands, or other); Southern or Eastern European (Greece, Italy, Portugal, Spain, Bosnia, Croatia, Serbia, Czech Republic, Hungary, Poland, Slovakia, Ukraine, former Soviet Republics, or other); West Asian or Middle Eastern (Afghanistan, Iran, Iraq, Israel, Lebanon, Saudi Arabia, Syria, Turkey, or other); African, Central/South American, or Caribbean (Argentina, Brazil, Columbia, El Salvador, Guatemala, Mexico, Venezuela, Barbados, Jamaica, or other); Aboriginal/First Nations/Métis; or Other (please specify). Participants also self-reported height and weight, which was used to calculate body mass index (BMI). Finally, participants were asked if a doctor or nurse had ever told her she had (yes/no): high blood pressure, high cholesterol, heart disease, stroke, angina, diabetes, cancer (and if

so, what type), or other long-term health condition (and if so, what type).

Leisure-time physical activity. Information was gathered using a question validated for population-level research (Johansson and Westerterp, 2008): "Describe your physical activity at leisure time. If the activities vary between summer and winter, try to give an estimate for the average year round." Possible responses were as follows: very light (almost no activity at all), light (light activity approximately once a week—for example, walking, nonstrenuous cycling, or gardening), moderate (regular activity several times a week—for example, walking, bicycling, gardening, or walking to work 10–30 minutes a day), active (regular activities that cause you to breathe a bit more heavily more than once a week—for example, intense walking or cycling), or very active (strenuous activities several times a week—for example, running or sports).

Fruit and vegetable consumption. One question asked, "As you may know, the recommended number of servings of fruit and vegetables is 5 or more servings each day. How likely is it, that you will eat the recommended daily number of fruit and vegetables regularly over the next month?" rated on a scale of 1 (very unlikely) to 7 (very likely).

Smoking status. One question asked, "Which of the following best describes your current smoking status?" with the response options "never smoked," "ex-smoker," or "current smoker."

Susceptibility. Three items were used for each disease: (1) "How susceptible do you feel you are to developing heart disease/breast cancer at some point in your life?" rated from 1 (extremely low) to 7 (extremely high), (2) "I feel that my chance of developing heart disease/breast cancer at some point in my life is," rated from 1 (extremely low) to 7 (extremely high), and (3) "Compared to other women of your age, what do you believe are your chances of developing heart disease/breast cancer?" rated from 1 (much lower) to 7 (much higher). The internal reliability for the heart disease items ($\alpha = .94$) and the breast cancer items ($\alpha = .93$) was very high. Therefore, mean scores were created to represent perceived susceptibility for heart disease and breast cancer.

Seriousness. One item for each disease assessed perceptions of seriousness: "Heart disease/breast would be a very serious illness for me to develop," rated on a scale of 1 (strongly disagree) to 7 (strongly agree).

Fear. One item for each disease assessed fear: "The thought of getting heart disease/breast scares me," on a scale of 1 (strongly disagree) to 7 (strongly agree).

Procedures

Participants first completed informed consent procedures (as approved by a university human research ethics board) followed by a screening survey (standard with the I-say survey) which included the question "what is your gender" (screening for women) and ethnicity (initially screening for women of South Asian ancestry). Participants then completed demographic items before being directed to the attentional bias task, hosted online by Millisecond software. Each participant was provided a unique participant number to enter when starting the attentional bias task that matched their survey participant number. They then completed the remainder of the survey.

Data analysis

Work status was grouped as working full-time, student, or other (e.g. retired, home-maker, part-time work). Education was grouped as having completed high school or less, having some college or university education, or having completed a university or post-graduate degree. Income was grouped into less than CAD60,000, between CAD60,000 and CAD99,000, and greater than CAD100,000 net annual family income. A heart disease risk factor score was created by summing the number of risk factors reported (blood pressure, cholesterol, angina, and diabetes) for a possible range of 0–4. To determine differences in disease perceptions by ethnic groups, a series of analysis of variance (ANOVA) tests were conducted. Because multiple tests were conducted, a Bonferroni adjustment was applied such that alpha was set to .008 (.05/6). Cohen's *d* was used to evaluate the magnitude of the effect. It was also of interest if perceptions of susceptibility, seriousness, and fear of heart disease differed from breast cancer perceptions. Therefore, three repeated-measures analyses of variance (RM ANOVAs) were conducted comparing susceptibility, seriousness, or fear of heart disease and breast cancer as the within subjects factors and ethnicity as the between subjects factor in each test.

To determine if disease perceptions were related to attentional bias, attentional bias scores (RTs for target words subtracted from control word RTs; a higher score indicates attentional bias for the disease threat words) were regressed against the disease perception variables. Prior to running these analyses, relationships of demographic and lifestyle variables to attentional bias scores were explored as possible covariates using correlations for continuous variables and chi-square for categorical variables. *Z*-scores for the continuous and scale variables were used in the models. Separate regression analyses were conducted for each ethnicity group with large enough samples to conduct the models.

Results

In total, 1101 women completed the survey of whom, 665 also provided usable attentional bias data (screened for RTs

>250 ms and fewer than 10% errors, congruence of I-Say survey and Millisecond participant number and time logged in, an appropriate amount of time taken to complete attentional bias task). Data used in the hypothesis-testing analyses were from women of South Asian (survey $n=169$, usable attentional bias $n=85$), East or Southeast Asian (survey $n=178$, usable attentional bias $n=78$), British (survey $n=334$, usable attentional bias $n=238$), or Western European (survey $n=150$, usable attentional bias $n=102$) descent as these ethnicity groups had enough attentional bias data for the regression models. Ethnic groups not included in the analyses due to small sample sizes were South or Eastern European (survey $n=105$, only $n=61$ attentional bias), West Asian or Middle Eastern (survey $n=11$), African (survey $n=6$), Central/South American or Caribbean (survey $n=22$), Aboriginal or First Nations (survey $n=19$), or other (survey $n=107$). Participants classified as "other" cited their ethnicity as Canadian, mixed, or not sure. Half (49.9%) of the participants were from Ontario, 16 percent from British Columbia, 13.9 percent from Alberta, 8.8 percent from Saskatchewan/Manitoba, 8.8 percent from the Atlantic region, and 2.5 percent from Quebec.

A total of 831 participants from the four ethnic groups provided survey data and did not have breast cancer or heart disease (of whom, 503 had usable attentional bias tasks). Of these, 117 preferred not to report their annual income, therefore the mean income score was used to replace missing data (Fox-Wasylyshyn and El-Masri, 2005). Similarly, there were 77 missing BMI scores, for which the mean score was used. All continuous (age, BMI, attentional bias) and scale (fruit and vegetable consumption, susceptibility, seriousness, and fear for both diseases) scores were normally distributed; skewness range: −1.13 to 1.10, kurtosis range: –0.61 to 1.49. Differences among participants who provided usable attentional bias and those who did not were assessed using *t*-tests for continuous variables and chi-square for categorical variables. There were no significant differences in age, BMI, fruit and vegetable consumption, leisure-time physical activity (LTPA), education, or income (all $ps>.05$). There were significant differences in smoking status, $\chi^2=13.39$, $p=.004$; employment, $\chi^2=21.85$, $p=.005$; and number of risk factors for heart disease, $t(829)=2.62$, $p=.009$. Participants who provided usable attentional bias data were less likely to be smokers, more likely to be students, and had fewer risk factors for heart disease than those who did not provide usable attentional bias data.

Demographic information and differences by ethnicity group are shown in Table 1. The greater number of women reporting British ancestry, followed by Western European ancestry, reflects the general Canadian population. Statistics Canada Data (2011) show that after "Canadian" the highest cited ethnic origins (in order) are English, French, Scottish, Irish, and German. Over 1.5 million people in Canada are identified as South Asian and about 1.3 million as Chinese. Recall that South Asians were deliberately recruited for this study. In comparison with the Canadian population, this study sample was more educated (about 46% had a bachelor's degree or higher compared to about 28% for Canadian women aged 25–54 years; Statistics Canada, 2015a), but had approximately the same median household income (median for the current sample who reported was between CAD60,000 and CAD79,999 compared to a median of CAD65,500 for the Canadian population; Statistics Canada, 2015b). No significant differences existed in ethnicity groups in LTPA, fruit and vegetable consumption, number of heart disease risk factors, or income. South Asian and East or Southeast Asian ancestry participants were significantly younger and had lower BMI than British or Western European participants. Women with ancestry from the British Isles or Western Europe were more likely to be current smokers. South Asian and East or Southeast Asian participants were more educated but also more likely to be students, whereas British and Western European women were more likely to have "other" employment status.

Hypothesis 1 tests—differences in disease perceptions by ethnicity

Survey data were used for these analyses. Age and BMI were included as covariates in the ANOVA tests examining disease perception by ethnicity group, the results of which are shown in Table 2. South Asian participants had significantly lower perceptions of susceptibility to breast cancer compared to all other ethnic groups (Cohen's *d* ranged from .26 to .32, representing small effect sizes). Both Asian groups had lower perceptions of heart disease seriousness compared to the European groups (Cohen's *d* ranged from .33 to .59, representing small to medium effect sizes). Both Asian groups also had lower perceptions of breast cancer seriousness compared to the two European groups (Cohen's *d* ranged from .32 to .55, representing small to medium effect sizes). No substantive differences existed when these analyses were conducted including only the data from those with attentional bias scores, indicating that the two samples (i.e. those with and without attentional bias results) did not differ in disease risk perceptions.

Age and BMI were also included as covariates in the RM ANOVA tests. In terms of susceptibility, there was a significant effect by ethnicity, $F(3, 825)=5.34$, $p=.001$, $\eta^2=.02$. Follow-up tests showed women of South Asian, $F(1, 166)=4.67$, $p=.03$, Cohen's $d=.23$, and British ancestry, $F(1, 331)=37.78$, $p<.001$, Cohen's $d=.19$, felt significantly more susceptible to heart disease than breast cancer, but there were no differences for those with East and Southeast Asian or Western European ancestry. There was a main effect difference in perceptions of disease seriousness, $F(1, 825)=14.90$, $p<.001$, Cohen's $d=.19$, but no ethnic difference, $F(3, 825)=.85$, $p=.85$. All women felt breast cancer was more serious than heart disease. Fear of the diseases differed significantly by ethnicity, $F(3, 825)=3.92$, $p=.009$, $\eta^2=.01$. Follow-up tests showed that

Table 1. Study participant characteristics and differences between ethnic ancestry.

Demographic variable	South Asian, $n=169$	East/Southeast Asian, $n=178$	British, $n=334$	Western European, $n=150$	Differences by ethnicity group
Age, *M* (*SD*)	33.02 (12.86)	32.60 (11.14)	45.78 (16.15)	41.79 (16.43)	$F(3, 827)=46.06$, $p<.001$
BMI, *M* (*SD*)	24.69 (6.24)	23.38 (4.86)	27.87 (7.83)	26.59 (5.28)	$F(3, 827)=21.38$, $p<.001$
HD risk factors, *M* (*SD*)	.28 (.45)	.25 (.44)	.32 (.47)	.27 (.44)	$F(3, 827)=.94$, $p=.42$
Fruit and vegetable, *M* (*SD*)	4.44 (1.53)	4.72 (1.48)	4.43 (1.60)	4.61 (1.59)	$F(3, 827)=1.71$, $p=.16$
LTPA, *N* (%)					
Inactive	79 (46.7%)	80 (44.9%)	144 (43.1%)	50 (33.3%)	$\chi^2=10.84$, $p=.09$
Moderately active	68 (40.2%)	72 (40.4%)	144 (43.1%)	66 (44.0%)	
Active	22 (13.1%)	26 (14.7%)	46 (13.8%)	34 (22.7%)	
Smoking, *N* (%)					
Never smoked	142 (84.0%)	158 (88.8%)	189 (56.6%)	97 (64.7%)	$\chi^2=85.67$, $p<.001$
Ex-smoker	14 (8.3%)	9 (5.0%)	106 (31.7%)	32 (21.3%)	
Current smoker	13 (7.7%)	11 (6.2%)	39 (11.7%)	21 (14.0%)	
Education, *N* (%)					
⩾High school	34 (20.1%)	27 (15.2%)	61 (18.3%)	35 (23.3%)	$\chi^2=41.28$, $p<.001$
College or university	46 (27.2%)	45 (25.3%)	155 (56.4%)	57 (38.0%)	
⩾University	89 (52.7%)	106 (59.5%)	118 (35.3%)	58 (38.7%)	
Income, *N* (%)					
<CAD60,000	74 (43.8%)	53 (29.8%)	122 (36.5%)	49 (32.7%)	$\chi^2=12.26$, $p=.06$
CAD60,000–CAD99,000	82 (48.5%)	106 (59.5%)	167 (50.0%)	79 (52.7%)	
>CAD100,000	13 (7.7%)	19 (10.7%)	42 (12.6%)	22 (14.7%)	
Employment, *N* (%)					
Full-time	58 (34.3%)	92 (51.7%)	123 (36.8%)	54 (36.0%)	$\chi^2=58.08$, $p<.001$
Student	43 (25.5%)	38 (21.3%)	26 (7.8%)	24 (16.0%)	
Other	68 (40.2%)	48 (27.0%)	185 (55.4%)	72 (48.0%)	

HD: heart disease; BMI: body mass index; *M*: mean; *SD*: standard deviation; LTPA: leisure-time physical activity.

Table 2. Means (*SD*) of disease perceptions and differences by ethnic ancestry.

Disease perception	South Asian (SA)	East/Southeast Asian (EA)	British (B)	Western Europe (WE)	ANOVA tests and post hoc differences by ethnicity group
HD susceptibility	3.59 (1.53)	3.56 (1.34)	3.83 (1.32)	3.59 (1.30)	$F(3, 825)=.94$, $p=.42$
BC susceptibility	3.24 (1.47)	3.62 (1.31)	3.67 (1.21)	3.60 (1.27)	$F(3, 825)=4.45$, $p=.004$; SA < EA, B, WE
HD seriousness	5.17 (1.84)	5.02 (1.43)	5.85 (1.27)	5.69 (1.40)	$F(3, 825)=13.19$, $p<.001$; SA, EA < B, WE
BC seriousness	5.43 (1.83)	5.37 (1.49)	6.10 (1.14)	5.95 (1.35)	$F(3, 825)=64.79$, $p<.001$; SA, EA < B, WE
HD fear	5.47 (1.76)	5.44 (1.44)	5.36 (1.49)	5.27 (1.64)	$F(3, 825)=.40$, $p=.75$
BC fear	5.81 (1.74)	5.57 (1.48)	5.66 (1.47)	5.75 (1.48)	$F(3, 825)=3.03$, $p=.03$

HD: heart disease; BC: breast cancer; ANOVA: analysis of variance; *SD*: standard deviation.

South Asian ancestry, $F(1, 166)=3.84$, $p=.05$, Cohen's $d=.19$, and British ancestry, $F(1, 331)=23.48$, $p<.001$, Cohen's $d=.20$, feared breast cancer more than heart disease with no differences for women of East/Southeast Asian or Western European ancestry.

Hypothesis 2 tests—relationships of disease perceptions and lifestyle behaviors to attentional bias by ethnicity

The breast cancer models are shown in Table 3, and the heart disease models are shown in Table 4. The outcome variables are the standardized attentional bias scores. Multicollinearity was not a problem in any of the models with all variance inflation factors <1.79 and tolerance >.56. There were no significant predictors of heart disease attentional bias. Predictors of attentional bias for breast cancer words differed by ethnicity group models. For women of South Asian descent, the more serious they considered breast cancer, the greater their attentional bias for breast cancer words. Older women of western European descent showed greater attentional bias for breast cancer words. There were no significant predictors for women of Southeast or East Asian ancestry. For

Table 3. Regression model summaries and standardized β (step 3 βs reported for all predictors) for breast cancer attentional bias by ethnic ancestry.

	South Asian	East/Southeast Asian	British	Western European
Step 1 model summary	$R^2\Delta = .022$; $F = .91$	$R^2\Delta = .010$; $F = .38$	$R^2\Delta = .019$; $F = 2.25$	$R^2\Delta = .061$; $F = 3.21$*
Age	$\beta = -.014$	$\beta = .087$	$\beta = -.137$	$\beta = .238$*
BMI	$\beta = .142$	$\beta = .012$	$\beta = -.085$	$\beta = .007$
Step 2 model summary	$R^2\Delta = .018$; $F = .49$	$R^2\Delta = .018$; $F = .44$	$R^2\Delta = .038$; $F = 3.13$*	$R^2\Delta = .026$; $F = .89$
LTPA	$\beta = .035$	$\beta = -.054$	$\beta = -.177$**	$\beta = -.162$
FV consumption	$\beta = .059$	$\beta = .053$	$\beta = .167$*	$\beta = .101$
Smoking status	$\beta = .056$	$\beta = .140$	$\beta = .020$	$\beta = .063$
Step 3 model summary	$R^2\Delta = .109$; $F = 3.25$*	$R^2\Delta = .021$; $F = .49$	$R^2\Delta = .010$; $F = .80$	$R^2\Delta = .017$; $F = .60$
Susceptibility	$\beta = -.078$	$\beta = -.077$	$\beta = -.088$	$\beta = -.096$
Seriousness	$\beta = .400$**	$\beta = .044$	$\beta = -.058$	$\beta = -.123$
Fear	$\beta = -.125$	$\beta = -.151$	$\beta = .055$	$\beta = .138$

BMI: body mass index; LTPA: leisure-time physical activity; FV: fruit and vegetables.
*$p < .05$; **$p < .01$.

Table 4. Regression model summaries and standardized β (step 3 βs reported for all predictors) for heart disease attentional bias by ethnic ancestry.

	South Asian	East/Southeast Asian	British	Western European
Step 1 model summary	$R^2\Delta = .016$; $F = .66$	$R^2\Delta = .005$; $F = .19$	$R^2\Delta = .008$; $F = .91$	$R^2\Delta = .023$; $F = 1.17$
Age	$\beta = .010$	$\beta = .030$	$\beta = .026$	$\beta = .054$
BMI	$\beta = -.039$	$\beta = .063$	$\beta = -.043$	$\beta = .089$
Step 2 model summary	$R^2\Delta = .031$; $F = .86$	$R^2\Delta = .013$; $F = .32$	$R^2\Delta = .007$; $F = .58$	$R^2\Delta = .016$; $F = .52$
LTPA	$\beta = -.004$	$\beta = .130$	$\beta = -.002$	$\beta = -.001$
FV consumption	$\beta = .073$	$\beta = -.053$	$\beta = -.037$	$\beta = .130$
Smoking status	$\beta = .114$	$\beta = .060$	$\beta = -.084$	$\beta = -.018$
Step 3 model summary	$R^2\Delta = .036$; $F = .98$	$R^2\Delta = .016$; $F = .39$	$R^2\Delta = .010$; $F = .81$	$R^2\Delta = .013$; $F = .43$
Susceptibility	$\beta = -.140$	$\beta = -.075$	$\beta = .100$	$\beta = .097$
Seriousness	$\beta = .098$	$\beta = -.099$	$\beta = -.041$	$\beta = .084$
Fear	$\beta = -.163$	$\beta = -.011$	$\beta = -.050$	$\beta = -.054$

LTPA: leisure-time physical activity; FV: fruit and vegetables; BMI: body mass index.
*$p < .05$; **$p < .01$.

women of British Isles descent, LTPA and fruit and vegetable consumption predicted attentional bias, but in opposite directions. This finding is depicted in Figure 1. Inactive women who had the highest likelihood of consuming fruit and vegetables showed attentional bias for the breast cancer words compared to control words, active and moderately active participants with a very low likelihood of fruit and vegetable consumption showed a strong avoidance of breast cancer words. Western European women had similar results for LTPA and fruit and vegetable consumption, but the standardized β were not significant, likely due to a smaller sample size.

Discussion

This research examined differences among women living in Canada of South Asian, East or Southeast Asian, British, and Western European ancestry in perceptions of susceptibility, seriousness, and fear of heart disease and breast cancer, and examined if these perceptions were related to attentional bias for threatening disease-related words. Some differences were found in perceptions of the two diseases, which partially support the first hypothesis and provides more nuanced information regarding how certain diseases may be perceived by women of different ethnicities. South Asian women felt less susceptible to breast cancer compared to all other ethnic groups, which is consistent with previous research that also found low perceptions of susceptibility in South Asians (Poonawalla et al., 2013). This may be due to perceptions that breast cancer was not in their families, or it mostly affects White women (Bottorff et al., 1998).

In terms of heart disease perceptions, there were no differences among ethnic groups in perceived susceptibility for this disease, despite increased risk of heart disease among South Asians. Women with South Asian and British

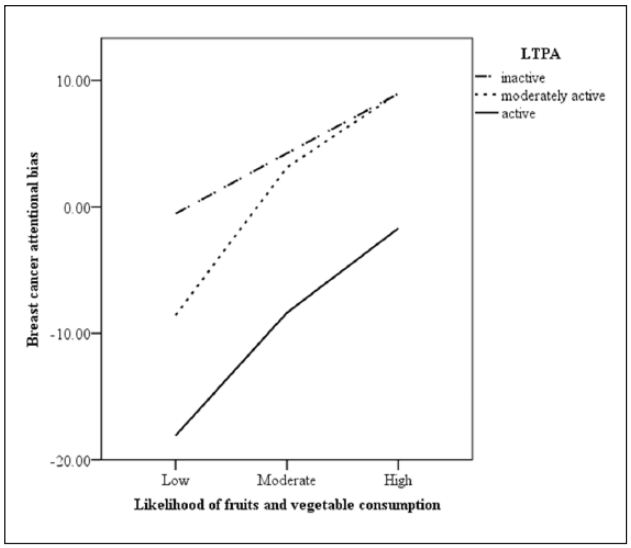

Figure 1. Breast cancer attentional bias by leisure-time physical activity (LTPA) and fruit and vegetable consumption for Canadian women with British ancestry.

ancestry felt more susceptible to heart disease than breast cancer, yet both groups of Asian women also considered heart disease to be less serious than did British or Western European ancestry women. This may be due to a lack of knowledge and awareness in ethnic minorities in terms of prevalence and risk factors for heart disease (Mosca et al., 2006). Specifically, South Asians have cited stress, aging, and lifestyle factors as contributors to heart disease, but failed to acknowledge their ancestry as a risk factor (Fernandez et al., 2014). Although existing heart disease prevention programs target South Asians in Canada (e.g. Heart and Stroke Foundation of Canada, 2015), the reach and influence of these programs, particularly among women, is not known.

It was also hypothesized that heightened perceptions of susceptibility, seriousness, and fear would be related to greater attentional biases. This hypothesis was partially supported for breast cancer, but not for heart disease; there were no significant predictors of attentional bias for heart disease words. The more South Asian women perceived breast cancer to be serious, the greater their attentional bias for related threat words. Thus, for South Asian women, the threat of breast cancer may have influenced attentional bias (Bar-Haim et al., 2007). This is important given risk perceptions can affect processing of health messages and subsequent health-protective behavior (Hovick et al., 2011). Increasing perceptions of the seriousness of breast cancer for some South Asian women may attract their attention to health-promotion campaigns. Whether this follows the path to more processing of health messages, as found by Hovick et al. (2011), remains to be determined. The lack of relationship between seriousness and attentional bias for women of British and Western European descent may be due to near ceiling scores for these two groups. There was greater variability in perceived seriousness for women of East or Southeast Asian descent.

For British women, significant predictors of attentional bias for breast cancer words were the health behaviors of LTPA and fruit and vegetable consumption. Women from Western Europe showed a similar (albeit not significant) pattern and older Western European women had increased attentional bias. The relationship of health behaviors to attentional bias for breast cancer words is intriguing. Participants who were active or moderately active and also reported low likelihood of consuming fruit and vegetables avoided breast cancer–related words. It may be that these women have associated fruit and vegetable consumption, and not physical activity, with decreased risk, and thus avoid breast cancer–related words to mitigate anxiety. Inactive or moderately active participants with high likelihood of consumption demonstrated attentional bias for breast cancer words. Rather than attract the attention of those who may feel threatened by cancer, the pattern of results from this research suggests that women of British descent who are unlikely to consume recommended amounts of fruit and vegetables may avoid breast cancer–related information. Health campaigns focusing on both diet and breast cancer prevention could benefit from additional information acknowledging the relationship between fruit and vegetable consumptions and breast cancer prevention, especially if those messages target those of British or Western European ancestry.

These results could be interpreted through the Extended Parallel Process Model, which includes perceptions of danger (a cognitive process) and fear (an emotional process) and posits that protective behavior stems from attempts to control danger (Witte, 1992). When perceptions of danger are stronger than fear (as in this research where British women's perceptions of the seriousness of breast cancer was greater than their fear of it), people respond to the danger and try to take preventive action, if they feel they can. This model also highlights how people may turn away from fearful messages when it is felt there is no way to control the danger by taking action. In this research, fruit and vegetable consumption may be the behavior most associated with prevention of breast cancer among British women. Consuming fruit and vegetables has received a large amount of attention as a positive health behavior in relation to cancer prevention. Furthermore, stories about breast cancer are more likely to depict White women (Champion et al., 2016), which may influence attentional bias because such women will feel represented in the images and may identify with the images of women used in the articles. These authors also found greater fruit and vegetable consumption was associated with greater perceived susceptibility for breast cancer in comparison

with heart disease, but physical activity was not related to susceptibility (Champion et al., 2016). A study with college-aged women in the United States showed a lack of knowledge that physical activity is related to a reduced risk of breast cancer (Bernat et al., 2015). Klein and Harris (2009) reported that women who were made aware of the relationship between alcohol consumption and breast cancer and were moderate drinkers demonstrated attentional bias away from breast cancer stimuli in women who did not self-affirm, a process that serves to offset threat to one's self-integrity. Among women with breast cancer, those who showed more positive affect and better coping strategies (e.g. problem solving, dealing with emotions) showed greater attention to cancer-related words (Glinder et al., 2007). Thus, it may be that fruit and vegetable consumption has a strong association with cancer prevention, and women of British descent with low consumption avoid breast cancer–related stimuli, even if they are active, due to low perceptions of control.

Several limitations to this study should be noted. First, data were not collected on where women were born, thus some participants may be new immigrants to Canada whereas others' families may have been in Canada for several generations. This is necessary to consider given there is evidence of greater risk of mortality from breast cancer for newly immigrated foreign-born compared to American-born women of Asian descent (Gomez et al., 2010). There may also be differences in attentional bias among these populations, although Henrich et al. (2010) provide evidence that perceptual judgments of Asian Americans are similar to those of East Asian, but differ from Americans of European descent (Figure 5, p. 74). The nature of inter-population variability in attentional processes remains to be determined. Second, this research does not allow for conclusions regarding the direction of relationships. Although, there is evidence that attentional bias precedes and is a causal contributor to fear because it creates a vulnerability toward being fearful while also contributing to the maintenance of fear (Van Bockstaele et al., 2014), future research should examine causal relationships with attentional biases toward disease-related information. It is also possible that social desirability may have influenced questionnaire responses; however, the anonymous panel somewhat mitigates this concern. Finally, it is possible that some of the differences found are due to cultural differences in how attention is allocated as there is evidence that Americans have a narrower attentional field than East Asians (Boduroglu et al., 2009). As already noted, length of residence in Canada was not collected. This may have limited the ability to account for the impact of acculturation on perceptions of risk. For example, lower perceived breast cancer risk among South Asians in Canada could be linked with lower cancer rates in their home countries (Poonawalla et al., 2013). Relatedly, ethnicity of the pilot sample was not collected.

This research highlights several important issues. First, fruit and vegetable consumption may be related to attentional biases to breast cancer–related words and may operate through perceptions of ability to control the threat (Witte, 1992). Further exploration of whether not engaging in preventive behaviors such as fruit and vegetable consumption results in avoidance of breast cancer–related information is needed. If the results of this research are replicated, greater care should be taken in the development of disease risk campaigns so that women who do not engage in healthy lifestyle behaviors will attend to, and subsequently process, information about reducing their risk of breast cancer. Examining attentional biases for disease-related information is a rich area for future inquiry that can serve to inform health-promotion campaigns, but there is a need for greater specification of racial/ethnic groups in research, including those of British and Western European descent who are almost always grouped into one large category (e.g. White). However, the research reported in this article still had broad ethnic groupings, especially for the East and South East Asian and Western European groups; greater attention to heterogeneity of ethnic groups is needed. Findings also highlight that women of South Asian and East or Southeast Asian descent do not perceive heart disease to be as serious as women of British or Western European self-reported ancestry. South Asian women also had lower perceptions of breast cancer seriousness, yet there was greater attentional bias for breast cancer words among those with heightened perceptions of seriousness. Further research is needed to understand relationships between modifiable risk factors, disease risk perceptions, and attentional biases. Basic awareness of disease is an important factor in health behavior (Van Stralen et al., 2010), and attention paid to health messages is related to cognitions such as attitudes (O'Cass and Griffin, 2006). Thus, highlighting the seriousness of breast cancer for South Asian women and profiling South Asian women in campaigns, and media stories about the diseases (Champion et al., 2016), may aid in attracting attention to the campaign and subsequent health behaviors. How women identify with, or feel represented by, disease risk campaigns is an important question that has implications for all women.

Declaration of conflicting interests

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

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by a grant from the Canadian Institutes of Health Research. Tanya R Berry and Kerry C Courneya are supported by the Canada Research Chairs Program.

Note

1. Descriptive terms comparing ethnic to "majority" groups can vary. Ethnicity (e.g. nationality, language, religion) and race (e.g. physical characteristics) are often used to categorize people as these are usually apparent and relatively easily evaluated (Taras et al., 2009). Throughout the literature review for this research, the term White is used to refer to those of European descent as it has been noted as socially recognized and historically stable despite the heterogeneity underlying the term (Bhopal and Donaldson, 1998).

References

Arslanian-Engoren C (2007) Black, Hispanic, and white women's perception of heart disease. *Progress in Cardiovascular Nursing* 22: 13–19.

Bainey KR, Norris CM, Gupta M, et al. (2011) Altered health status and quality of life in South Asians with coronary artery disease. *American Heart Journal* 162: 501–506.

Bar-Haim Y, Lamy D, Pergamin L, et al. (2007) Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin* 133: 1–24.

Bernat JK, Anderson LB, Parrish-Sprowl J, et al. (2015) Exploring the association between dispositional cancer worry, perceived risk, and physical activity among college women. *Journal of American College Health* 63: 216–220.

Bhopal R and Donaldson L (1998) White, European, Western, Caucasian, or what? Inappropriate labeling in research on race, ethnicity, and health. *American Journal of Public Health* 88(9): 1303–1307.

Boduroglu A, Shah P and Nisbett RE (2009) Cultural differences in allocation of attention in visual information processing. *Journal of Cross-Cultural Psychology* 40: 349–360.

Bottorff JL, Johnson JL, Bhagat R, et al. (1998) Beliefs related to breast health practices: The perceptions of South Asian women living in Canada. *Social Science & Medicine* 47(12): 2075–2085.

Canadian Breast Cancer Foundation (2015) Your lifestyle and environment. Available at: http://www.cbcf.org/ontario/AboutBreastHealth/KnowYourRisk/Pages/Lifestyle-Environment.aspx

Center for Disease Control and Prevention (2015) Breast cancer rates by race and ethnicity. Available at: http://www.cdc.gov/cancer/breast/statistics/race.htm (accessed 5 April 2016).

Champion C, Berry TR, Spence JC and Kingsley BK (2016) Pink Ribbons and Red Dresses: A mixed methods content analysis of media coverage of breast cancer and heart disease. *Health Communication*. E-pub ahead of print. DOI: 10.1080/10410236.2015.1050082

Custers JAE, Becker ES, Gielissen MFM, et al. (2015) Selective attention and fear of cancer recurrence in breast cancer survivors. *Annals of Behavioral Medicine* 49: 66–73.

Fehniger J, Livaudais-Toman J, Karliner L, et al. (2014) Perceived versus objective breast cancer risk in diverse women. *Journal of Women's Health* 23(5): 420–427.

Fernandez R, Davidson PM, Miranda C, et al. (2014) Attribution of risk for coronary heart disease in a vulnerable immigrant population: A survey study. *The Journal of Cardiovascular Nursing* 29(1): 48–54.

Folta SC, Goldberg JP, Lichtenstein AH, et al. (2008) Factors related to cardiovascular disease risk reduction in midlife and older women: A qualitative study. *Preventing Chronic Diseases* 5: 1–9.

Fox-Wasylyshyn SM and El-Masri MM (2005) Handling missing data in self-report measures. *Research in Nursing and Health* 28: 488–495.

Galbraith EM, Mehta PK, Veledar E, et al. (2011) Women and heart disease: Knowledge, worry, and motivation. *Journal of Women's Health* 20: 1529–1534.

Gathani T, Ali R, Balkwill A, et al. (2014) Ethnic differences in breast cancer incidence in England are due to differences in known risk factors for the disease: Prospective study. *British Journal of Cancer* 110: 224–229.

Ginsburg OM, Fischer HD, Shah BR, et al. (2015) A population-based study of ethnicity and breast cancer stage at diagnosis in Ontario. *Current Oncology* 22(2): 97–104.

Ginting H, Naring G and Becker ES (2013) Attentional bias and anxiety in individuals with coronary heart disease. *Psychology & Health* 28: 1306–1322.

Glinder JG, Beckjord E, Kaiser CR, et al. (2007) Psychological adjustment to breast cancer: Automatic and controlled responses to stress. *Psychology & Health* 22: 337–359.

Gomez SL, Clarke CA, Shema SJ, et al. (2010) Disparities in breast cancer survival among Asian women by ethnicity and immigrant status: A population-based study. *American Journal of Public Health* 100: 861–869.

Haas JS, Kaplan CP, Des Jarlais G, et al. (2005) Perceived risk of breast cancer among women at average and increased risk. *Journal of Women's Health* 14(9): 845–851.

Heart and Stroke Foundation of Canada (2012) Heart disease prevention. Available at: http://www.heartandstroke.com/site/c.ikIQLcMWJtE/b.3483919/k.EB14/Heart_disease__Prevention_and_risk_factors.htm

Heart and Stroke Foundation of Canada (2015) South Asian resources. Available at: http://www.heartandstroke.com/site/c.ikIQLcMWJtE/b.3479045/k.6516/South_Asian_Resources.htm (accessed 5 April 2016).

Henrich J, Heine SJ and Norenzayan A (2010) The weirdest people in the world? *Behaviorial and Brain Sciences* 33: 61–135.

Hou N and Hou D (2013) A trend analysis of breast cancer incidence rates in the United States from 2000 to 2009 shows a recent increase. *Breast Cancer Research and Treatment* 138: 633–641.

Hovick SR, Freimuth VS, Johsnon-Turbes A, et al. (2011) Multiple health risk perception and information processing among African Americans and Whites living in poverty. *Risk Analysis* 31: 1789–1799.

Iversen AC and Kraft P (2006) Does socio-economic status and health consciousness influence how women respond to health related messages in media? *Health Education Research* 21: 601–610.

Johansson G and Westerterp KR (2008) Assessment of the physical activity level with two questions: Validation with doubly labeled water. *International Journal of Obesity* 32: 1031–1033.

Kandula NR, Tirodkar MA, Lauderdale DS, et al. (2010) Knowledge gaps and misconceptions about coronary heart disease among US South Asians. *American Journal of Preventive Medicine* 38: 439–442.

Katapodi MC, Lee KA, Facione NC, et al. (2004) Predictors of perceived breast cancer risk and the relation between perceived risk and breast cancer screening: A meta-analytic review. *Preventive Medicine* 38: 388–402.

Klein WMP and Harris PR (2009) Self-affirmation enhances attentional bias toward threatening components of a persuasive message. *Psychological Science* 20: 1463–1467.

MacLeod C, Mathews A and Tata P (1986) Attentional bias in emotional disorders. *Journal of Abnormal Psychology* 95: 15–20.

Mosca L, Mochari H, Christian A, et al. (2006) National study of women's awareness, preventive action, and barriers to cardiovascular health. *Circulation* 113(4): 525–534.

O'Cass A and Griffin D (2006) Antecedents and consequences of social issue advertising believability. *Journal of Nonprofit & Public Sector Marketing* 15(1–2): 87–104.

Poonawalla IB, Goyal S, Mehrotra N, et al. (2013) Attitudes of South Asian women to breast health and breast cancer screening: Findings from a community based sample in the United States. *Asian Pacific Journal of Cancer Prevention* 15(20): 8719–8724.

Public Health Agency of Canada (2009) Tracking heart disease and stroke in Canada. Available at: http://www.phac-aspc.gc.ca/publicat/2009/cvd-avc/pdf/cvd-avs-2009-eng.pdf (accessed 5 April 2016).

Rana A, de Souza RJ, Kandasamy S, et al. (2014) Cardiovascular risk among South Asians living in Canada: A systematic review and meta-analysis. *Canadian Medical Association Journal* 22: E183–E191.

Statistics Canada (2011) Immigration and ethnocultural diversity in Canada. Available at: http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-010-x/99-010-x2011001-eng.cfm#a3 (accessed 20 May 2016).

Statistics Canada (2015a) Distribution of women and men aged 25 to 54, by province and highest level of educational attainment, 2009. Available at: http://www.statcan.gc.ca/pub/89-503-x/2010001/article/11542/tbl/tbl002-eng.htm (accessed 20 May 2016).

Statistics Canada (2015b) Income in Canada highlights. Available at: http://www.statcan.gc.ca/pub/75-202-x/2010000/hl-fs-eng.htm (accessed 20 May 2016).

Taras W, Rowney J and Steel P (2009) Half a century of measuring culture: Review of approaches, challenges, and limitations based on the analysis of 121 instruments for quantifying culture. *Journal of International Management* 15: 357–373.

Van Bockstaele B, Verschuere B, Tibboel H, et al. (2014) A review of current evidence for the causal impact of attentional bias on fear and anxiety. *Psychological Bulletin* 140: 682–721.

Van Stralen MM, Lechner L, Mudde AN, et al. (2010) Determinants of awareness, initiation and maintenance of physical activity among the over-fifties: A Delphi study. *Health Education Research* 25: 233–247.

Wang C, O'Neill SM, Rothrock N, et al. (2009) Comparison of risk perceptions and beliefs across common diseases. *Preventive Medicine* 48(2): 197–202.

Witte K (1992) Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs* 59(4): 329–349.