



Archived at the Flinders Academic Commons:

<http://dspace.flinders.edu.au/dspace/>

This is the authors' version of an article published in *Cancer Causes & Control*. The original publication is available by subscription at: <http://link.springer.com/journal/10552>

doi:10.1007/s10552-014-0377-3

The final publication is available at Springer via <http://dx.doi.org/10.1007/s10552-014-0377-3>.

Please cite this article as:

Dumalaon-Canaria, J.A., Hutchinson, A.D., Prichard, I. & Wilson, C. 'What causes breast cancer? A systematic review of causal attributions among breast cancer survivors and how these compare to expert endorsed risks'. *Cancer Causes and Control*, vol 25 (7) 2014, pp. 771-785.

Copyright (2014) Springer International Publishing Switzerland. All rights reserved. **Please note** that any alterations made during the publishing process may not appear in this version.

What causes breast cancer? A systematic review of causal attributions among breast cancer survivors and how these compare to expert endorsed risk factors

Authors: Jo Anne Dumalaon-Canaria^{a*} Amanda D. Hutchinson^{ab*} Ivanka Prichard^{abc} & Carlene Wilson^{ab}

a. Flinders Centre for Innovation in Cancer

GPO Box 2100

Flinders University

Adelaide, South Australia, 5001

AUSTRALIA

b. Cancer Council SA

PO Box 929

Unley BC, South Australia, 5061

AUSTRALIA

c. School of Health Sciences

Flinders University

GPO Box 2100

Adelaide, South Australia, 5001

AUSTRALIA

* Corresponding authors:

Jo Anne Dumalaon-Canaria
Flinders Centre for Innovation in Cancer
Flinders University
GPO Box 2100
Adelaide, SA, 5001
AUSTRALIA
Email: duma0005@flinders.edu.au
Phone: +61 8 7221 8473
Fax: +61 8 7221 8424

Amanda Hutchinson

School of Psychology, Social Work & Social Policy
University of South Australia
GPO Box 2471
Adelaide, SA, 5001
AUSTRALIA

Email: amanda.hutchinson@unisa.edu.au
Phone: +61 8 8302 4468
Fax: +61 8302 4377

Abstract

Purpose. The aim of this paper was to review published research that analyzed causal attributions for breast cancer among women previously diagnosed with breast cancer. These attributions were compared with risk factors identified by published scientific evidence in order to determine the level of agreement between cancer survivors' attributions and expert opinion.

Methods. A comprehensive search for articles, published between 1982 and 2012, reporting studies on causal attributions for breast cancer among patients and survivors was undertaken. Of 5,135 potentially relevant articles, 22 studies met the inclusion criteria. Two additional articles were sourced from reference lists of included studies.

Results. Results indicated a consistent belief among survivors that their own breast cancer could be attributed to family history, environmental factors, stress, fate or chance. Lifestyle factors were less frequently identified, despite expert health information highlighting the importance of these factors in controlling and modifying cancer risk. This review demonstrated that misperceptions about the contribution of modifiable lifestyle factors to the risk of breast cancer have remained largely unchanged over the past 30 years.

Conclusions. The findings of this review indicate that beliefs about the causes of breast cancer among affected women are not always consistent with the judgment of experts. Breast cancer survivors did not regularly identify causal factors supported by expert consensus such as age, physical inactivity, breast density, alcohol consumption and reproductive history. Further research examining psychological predictors of attributions and the impact of cancer prevention messages on adjustment and well-being of cancer survivors is warranted.

Keywords: breast cancer, attribution, cause, beliefs

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death in females. Worldwide, 1.39 million women were diagnosed with breast cancer in 2008 and 458,400 women died from the disease [1]. Women diagnosed with breast cancer not only have to cope with the physical burden of their condition, but also with psychological comorbidities common among breast cancer survivors such as depression and anxiety. For example, breast cancer patients have described feelings of helplessness and hopelessness, fears of death and dying, and concerns about how their illness would affect their families and their finances [2,3]. Being diagnosed with cancer is life-altering and it may lead people to question beliefs about themselves and the world which leads to a search for causes [4]. Asking questions such as "Why did I get this illness?" or "What caused this illness?", may provide a way for cancer patients to understand their situation and any accompanying symptomatology [5].

"Attribution theory" in psychology refers to the process by which people attempt to explain the causes of a particular outcome. Typical categories of causal attributions include the self, other people, heredity, the environment and chance [6]. Weiner [7,8] classified attributions according to three dimensions: locus, stability, and controllability. The locus dimension reflects whether the cause is within (internal) or outside (external) of the person. The stability dimension captures whether causes change over time (i.e., are stable or unstable) and controllability differentiates between causes that are volitional (modifiable) or non-volitional (fixed). In a National Institute of Health study of causal attributions among cancer survivors of the ten most common cancers, Ferrucci et al. [9] categorized individual causal attributions according to locus and controllability. Each response was condensed into nine broader categories based on the causal attribution literature. These categories were lifestyle, biological, environmental, smoking, chance/luck, stress, existential, prior health condition, and psychological. Lifestyle-related attributions such as physical inactivity were coded as internal to the individual and modifiable. By contrast, environmental attributions such as air pollution and occupational hazards were considered external to the individual and fixed or non-modifiable. These characteristics tended to correlate so that internal and unstable attributions such as lifestyle-related factors were considered controllable whereas external attributions were likely to stem from the environment and exhibited lower controllability.

Although causal attributions alone will not predict patients' behaviors and explain the complexity of human actions, attribution theory provides a framework for understanding the cognitions that influence health-related behaviors. Beliefs that people hold with regards to the cause of their own illness influence their decision to seek help, to adhere to medical treatment and their psychological adjustment, during and after treatment [6,10]. Attribution theory also helps explain affective responses to cancer and ways of coping. For example,

attributions that focus on uncontrollable causes are related to avoidance coping, whereas attributions that focus on modifiable or controllable causes tend to implicate approach and emotion-focused coping [5]. Lykins et al. [11] reported that, among cancer survivors, a reluctance to cite the influence of personal choices and behavior in cancer causation may serve a self-protective function, proving a way of maintaining self-esteem. This may create a health challenge: cancer patients are at a greater risk than the general population of developing cancer (i.e., secondary malignancies) [12] and if survivors do not recognize or act on controllable risk factors they may compromise their health risk. Costanzo, Lutgendorf and Roeder [13] demonstrated that cancer survivors' beliefs that lifestyle choice played a role in the development of their cancer appeared to motivate positive changes in health practices following cancer treatment. Since preventive health behaviors are, at least partly, determined by personal beliefs about illness causation (i.e., attributions), an understanding of these causal attributions, and factors that shape these beliefs, is important.

Thirty years ago, when women were asked what caused their own breast cancer, most women identified God, fate, chance, or stress, and exposure to carcinogenic substances [14,15]. Since then, a number of studies have been conducted on causal attributions for breast cancer among affected women. Results of these studies are less well synthesized but even recent studies indicate that women with a previous diagnosis of breast cancer continue to ascribe their own experience to forces outside of their volition [9,16]. In contrast, published scientific evidence on risk factors for breast cancer report the importance of modifiable lifestyle behaviors in controlling and modifying cancer risk. Parkin, Boyd, and Walker [17] estimated that 26.8% of all new cases of breast cancer diagnosed in the United Kingdom in 2010 could be attributed partly to lifestyle factors. Similarly, preventability estimates on breast cancer report that up to 23.0% of (post-menopausal) breast cancer cases can be accounted for by obesity. Physical inactivity accounts for up to 16.5% and alcohol use up to 7.0% of breast cancer cases. The World Health Organization stated that more than 30.0% of cancer deaths could be prevented by modifying or avoiding key behavioral or lifestyle-related risk factors [18].

This research suggests a mismatch between opinions of affected women as to what caused their own breast cancer and expert views of breast cancer causation, although direct evidence of this mismatch is limited. Documenting the extent of mismatch is important in order to inform prevention programs and to assist in understanding survivor support needs. Breast cancer was chosen as the prototypic cancer site to study because of its multi-factorial etiology, which is characterized by a well-documented hereditary component, and where modifiable lifestyle factors are reported by experts but may be less well understood in the general population [19]. Previous studies suggest that these distinct viewpoints may be supported by observations that, for affected

women, thinking about the possible causes of one's cancer may be driven by emotional processes as opposed to a logical or rational approach [20]. Some research suggests that breast cancer patients who attributed their cancer to behavioral choices experienced negative emotional states and poorer quality of life [21,22]. Furthermore, when the cause of one's cancer is associated with lifestyle choices, those affected reported feeling doubly stigmatized; they were stigmatized both by the experience of cancer and their own contribution to its causation [23]. To a certain extent, non-modifiable causal attributions among survivors can be seen as adaptive. Nonetheless, it is important to document the extent to which these deviate from currently accepted expert opinion. This is because tertiary prevention is at least partly dependent on the adoption of lifestyle choices validated in the scientific literature [13,24]. In addition, survivors' attributions may influence cancer prevention attitudes and behaviors among those in direct contact with them [16]. Etiological attributions and consequent response to cancer risk by female relatives are influenced by the subjective experience of breast cancer in the family [25,26].

In the broader population, the media is another factor that shapes understandings of breast cancer causation among women. For example, media coverage of celebrity diagnoses of breast cancer in young women may have led to underestimation of age as a risk factor [27]. Similarly, reports focused on personal accounts of affected women with a family history of breast cancer may have influenced views that breast cancer is a predominantly genetic disease [28]. Social media, particularly blog posts and discussion posts shared by breast cancer patients themselves, has also become an influential and credible forum for the promulgation of health information [29].

The following systematic review serves to comprehensively summarize literature on beliefs that affected women have about the cause of their own breast cancer and contrasts this with expert consensus derived from meta-analyses of various risk factors for breast cancer. Findings of this study may inform psycho-educational interventions which can help affected women develop accurate and adaptive beliefs about the cause of their breast cancer.

Methodology

Data Sources

The following PubMed, PsycINFO and Web of Knowledge search was conducted on January 25, 2013:
(breast cancer OR breast neoplasm) AND (caus*¹ OR attribute* OR belie* OR attitude OR illness

¹ *Search term and its derivatives were used (e.g., cause, causes, causal)

representation) AND (patient or surviv*). Papers published in English in the 30 years from January 1982 to December 31, 2012 were considered for inclusion.

Inclusion/Exclusion Criteria

Studies were included in the review if they reported causal attributions or beliefs of breast cancer patients or survivors. The search was limited to studies published in the English language involving women over 18 years of age. This review included both quantitative and qualitative studies conducted with inpatients, outpatients, or in community settings. Studies that had a mixed sample (i.e., samples which combined participants with other cancer diagnoses aside from breast cancer) were also eligible for this review provided that there was independent reporting of data for participants who had been diagnosed with breast cancer. Journal articles that did not involve a sample of women who identified causal attributions or beliefs about their breast cancer diagnosis were excluded. Editorials, reviews, opinion papers, and unpublished studies such as dissertation manuscripts were also excluded.

Study Selection

The studies were selected in two steps. Titles and abstracts of all citations identified by the search were screened using the inclusion and exclusion criteria. The full text of potentially relevant articles was then obtained, and reviewed independently by the first author. Reference lists of all included papers were also examined to identify studies not returned via the initial search. The initial search yielded 5,135 journal articles. Based on the titles and abstracts, 5,052 manuscripts were excluded. A total of 83 full text articles were screened and 61 were excluded; 22 studies met criteria for inclusion in this review and 2 relevant articles were sourced from the reference lists of included papers. In total, 24 papers met the inclusion criteria (see Figure 1).

Study Characteristics

Of the 24 included studies, four were conducted in Australia, nine in the USA, one in Canada, two in Israel, two in Hong Kong, and one each in Ethiopia, Greece, Japan, the Netherlands, Sweden, and the UK. The majority of papers meeting inclusion criteria were qualitative studies (n=15, see Table 1). Of these, four made use of mailed or researcher administered surveys with an open-ended question on attributions (i.e., "Why do you think you got your cancer?"). Eight studies utilized a semi-structured interview method and three studies used focus group discussions to elicit responses. Quantitative studies (n=9, see Table 2) asked participants to rate, or select, the cause of their breast cancer from a list of attributions provided by the researcher/s.

Results

A brief summary of published scientific evidence is presented for each risk factor associated with

breast cancer followed by the results from the systematic review on the extent to which breast cancer survivors attributed their cancer to the risk factor (including the percentage and corresponding number of women who identified a particular causal attribution in each study). The summaries of published scientific evidence are based on reports from the Australian Institute of Health and Welfare [30], the World Cancer Research Fund [31], the International Agency for Research on Cancer's review of human carcinogens and lifestyle factors [32], and the Breast Cancer: Risk Reduction and Early Detection Strategies report [33]. Risk factors or attributions are organized into the following categories: biological, environmental, reproductive history and hormones, and lifestyle. Other causal attributions identified, but not validated by expert consensus, such as stress, existential influences, and other health conditions are also reported. Results obtained from the qualitative and quantitative studies are summarized in Tables 1 and 2 respectively.

Biological Attributions

Family history/genetics. Based on established evidence it is estimated that those with a first-degree relative with a history of breast cancer have greater probability of developing breast cancer compared to women without such a history [33]. Risk varies according to the number of relatives with breast cancer and the age at which relatives were diagnosed [30]. Gene linkage studies estimate that the BRCA 1 and BRCA 2 genes, explain between 2.0 and 9.0% of all breast cancers [30-33].

In this review, a family history of breast cancer was one of the personal causes most cited by women. Fifteen of the 24 included studies found that most women with breast cancer attributed their own cancer, at least in part, to family history or genetics [9,13,15,16,24,34-43]. Across the quantitative studies reviewed, the proportion of the sample in each study who reported that family history was a leading or sole cause of breast cancer varied. For example, in Costanzo et al.'s, [13] study, 70.5% (n=56) of the sample agreed that genetics or heredity was a leading cause. In contrast, Arman et al., [40] found that only 4% (n=5) of participants believed that heredity was the sole genesis of their cancer. It is important to note that the qualitative studies reviewed also showed that women thought that genetics was a leading causal attribution but not the only cause. For example, when asked about the cause of her breast cancer, one participant said, "First, it may be due to genetics. Second the pressure from the company was too much...therefore they caused the cancer" [41 p.676]. A similar statement was made by a participant in Arman and colleague's [40] study, "...I have an aunt who also had breast cancer maybe there is something in my genes, but I am pretty sure that it is the contraceptive pill that played a role. It feels like it. ..." (p.145). Therefore, the presence of multiple risk factors may be perceived as significant.

Even though a large number of women identify genetics as a relevant determinant for their cancer,

empirical research indicates that less than 10% of cases are inherited [30,33]. This tendency to attribute causation to genetics and family history may be influenced by media reports surrounding genetic risk for breast cancer [28].

Age. Age is a strong risk factor for breast cancer in women [30]. Newcomb and Wernli [33] found that the greatest rate of increased risk for breast cancer occurs among post-menopausal women, where risk starts to double with each decade of life up to 80 years of age. In the current review, only two quantitative studies [13,24] reported age or aging attributions for breast cancer. Neither study reported that age was viewed as a leading cause. Interestingly, more than half of participants (n= 42) in Costanzo et al. [13] study identified aging as a cause. However, this is still a relatively small number of women given the strong link between age and breast cancer.

Breast conditions. High breast density as evident in a mammogram is considered to be one of the strongest risk factors for breast cancer [33]. It is estimated that for women with more than 75% breast density, the risk of breast cancer is four times greater than those with less dense breast tissue. Moreover, women with a history of benign breast disease, who have not been diagnosed with hyperplasia, have a 1.5 fold increased risk of breast cancer compared to women without benign breast disease [33]. Breast conditions were identified as a cause of breast cancer by participants in two studies included in the review, both of which made use of an open-ended survey question [38,42]. However, neither study specifically mentioned higher breast density as a cause of breast cancer. In Panjari et al., [38] breast issues were defined as trauma to breast, abscess, benign lumps, and breastfeeding practices and these factors were identified as causal by 1.7 % (n=26) of women. Lavery et al., [42] included past medical history of benign lumps, mastitis, and breast implants, and these were identified as the cause of breast cancer by 5.0% (n=12) of study participants.

Height. There is scientific evidence that taller height is associated with increased risk of breast cancer especially among post-menopausal women [30,31]. Height was not identified as a cause of breast cancer by any of the respondents in the studies reviewed.

Other demographic factors. Women may be at greater risk of breast cancer if they belong to higher socio-economic groups as indicated by level of income and education, as well as geographic locale. This association may also be attributable to the constellation of risk factors that are correlated with high socio-economic status. Caucasian white women have a higher risk for breast cancer, followed by African-American women, Hispanic women, and with the lowest rates in Asian women [33]. There were no studies reviewed which identified demographic factors such as socio-economic status, race, level of income and/or education as

risk factors for breast cancer.

Environmental Attributions

Environmental factors. Expert evidence suggests that the following environmental risk factors are associated with increased breast cancer risk: exposure to pesticide agents (e.g., dichlorodiphenyltrichloroethane [DDT] and dichlorodiphenyldichloroethylene [DDE]), heavy metal cadmium, and greater exposure to traffic emissions at the time of menarche for pre-menopausal women [33]. Radiation exposure is also classified as a carcinogenic agent with sufficient evidence in humans [32]. Expert guidelines indicate that many other aspects of the environment are still being tested.

The results of this systematic review show that causal beliefs relating to environmental factors are prevalent. Patients and survivors identify many different kinds of possible environmental causes for their breast cancer. A total of 15 of the 24 studies were reviewed and reported that women with breast cancer believed there was a connection between exposure to environmental toxins and their diagnosis [9,13-16,24,35-40,42-44]. In these studies, environmental toxins were defined as actions of other people (e.g., exposure to second-hand smoke), hazards found at the workplace, specific carcinogens, air pollution, exposure to chemical substances, toxic injury, and/or radiation. The number of women who identified environmental factors as a cause of their cancer varied ranged from 1.9% (n=28) [38] to 73.1% (n=58) [13]. In studies in which participants rated the strength of various attributions, environmental attributions were not highly rated [45,46]. For example, Kulik and colleagues [45] asked participants to rate separately “action of other people” and “occupation” as attributions for their cancer on a scale from 1, indicating little association, to 5, indicating strong causation. Neither was perceived to be strongly linked to breast cancer, with means of 1.84 (*SD*=1.07) and 1.49 (*SD*=0.92) for “action of other people” and “occupation” respectively. Environmental attributions may also be interpreted in accordance with one’s cultural background. Ethiopian women described their experience of “mich”, or a combination of bad air and sunlight, as a cause of their breast cancer. For example, “The temperature is hot in my village and I usually expose my breast to the sun. I think this is the cause.” [39 p.724].

Reproductive History, Breast Feeding, and Hormones

A number of factors affecting hormonal status have been associated with increased risk of breast cancer; lifetime exposure to estrogen influencing early menarche, having a late natural menopause, not bearing children, a late first pregnancy (over the age of 30), or not breastfeeding are all described by the WCRF/AICR as breast cancer risk factors with convincing evidence [31]. There is also convincing evidence that hormone replacement therapy increases the risk of breast cancer. Other data indicate oral contraceptives containing both

estrogen and progesterone cause a small, transient, increased risk of breast cancer. IARC [32] classified diethylstilbestrol, a synthetic nonsteroidal estrogen, and oral contraceptives, as carcinogenic agents with sufficient evidence in humans.

Even though scientific guidelines indicate convincing evidence that lifetime exposure to estrogen increases the risk of breast cancer, this was not widely acknowledged by participants in the studies included in this review. Early menarche was identified as causal by breast cancer survivors in three studies [24,35,38]. These three studies also identified the decision to delay or not to have children as a cause of breast cancer [24,35,38]. Oba et al., [35] found that Japanese women rated never having children more highly than any other cause ($M=2.90$, $SD=1.20$), with 70.0% ($n=44$) of participants attributing their illness to this factor. It is to be noted that Panjari et al., [38] grouped early menstruation with other factors such as age at menopause and not having children to form a causal category of reproductive cycle and age. Similarly, Oba et al.,[35] combined menstruation with issues regarding past child delivery. Four studies also identified lack of breastfeeding as a causal attribution for breast cancer in some populations [24,35, 38, 39]. Ethiopian cancer survivors defined the cause of breast cancer as accumulated milk in the breast, for example “I didn’t lactate after I birthed my first child so milk accumulated, I think this accumulated milk caused breast cancer”[39 p.725]. It is to be observed that Panjari et al.,[38] grouped breastfeeding with other factors such as trauma to breast, abscess, benign lumps to form the category of breast issues.

Two studies included in the review found that women identified hormones as a cause of their breast cancer [13,37]. Breast cancer patients in the Costanzo et al., [13] study rated hormones as a leading cause of cancer (84.5%, $n=67$). Five out of the 24 studies found that women identified hormone replacement therapy as a cause of their breast cancer [16,24,36,38,42]. In addition, breast cancer patients in six studies included in the review identified oral contraceptive pills as causal [16,24,36,38,40,42], which was identified by 1.5% ($n=23$) [38] to 20.9% ($n=87$) [36] of women. It is to be noted that Lavery and Clarke [42] combined oral contraceptive pill with hormone replacement therapy. Willcox et al., [16] combined hormonal replacement therapy, with vaccination, oral contraceptive, late detection/misdiagnosis, and medication to form the broad causal category of iatrogenic. In total, 13.2% ($n=103$) of participants attributed their cancer to this factor. It is also to be observed that in most of the studies in which women attributed the cause of their cancer to reproductive and hormonal factors provided participants with either a check-list or rating scale in which these risk factors were already listed.

Lifestyle

Physical activity. According to WCRF/AICR [31] there is convincing evidence that physical activity is protective against breast cancer for post-menopausal women. However, for pre-menopausal women there is limited evidence that it is protective against breast cancer. Physical inactivity has also been estimated to be responsible for approximately 10% of breast cancer mortality [31]. Women in four studies included in the review identified lack of exercise or physical activity as a causal factor [13,24,36,41]. The number of women attributing their cancer to a lack of physical activity ranged from 10.1% (n=42) [36] to 38.4% (n=30) [13].

Diet. Research has evaluated the relationship between dietary factors and breast cancer risk. According to the WCRF/AICR [31] only a high fat diet has been shown to play a causal role in increasing breast cancer risk among post-menopausal women, however, current evidence remains limited in this area. Eleven out of the 24 studies of women's perceptions identified diet as a causal factor [13,15,16,24,35-37,40-42,39]. In these studies, dietary factors included dietary choice or habit, lack of fruits and vegetables in the diet, or too much fat in the diet. Prevalence of attributions for diet as a cause of breast cancer ranged from 1.0% (n=2)[42] to 67.9% (n=54) [13].

Body size. Although evidence of a link between diet and breast cancer risk has not been consistent or strong [31] there is strong and convincing scientific evidence that weight gain in adulthood and abdominal body fat are associated with increased risk for breast cancer, particularly in post-menopausal women [30]. IARC [32] also state that overweight and obesity are responsible for 9.0% of breast-cancer related deaths. The strength of expert opinion contrasts with lay knowledge as represented in the review; only two studies suggested that weight or body size was viewed as causal for breast cancer with 15.9% (n=66)[36] and 16% (n=10)[35] of women partly attributing their breast cancer to being overweight or obese from a list of possible causes of cancer.

Alcohol. There is convincing evidence in humans that the consumption of alcoholic drinks or beverages is a carcinogenic agent that increases breast cancer risk [31]. The IARC [32] conclude that consumption of alcohol is responsible for 5.0% of breast cancer-related deaths. The use of alcohol or alcohol consumption was identified as a contributing cause of their breast cancer by women in five studies [13,24,35,36,40] with the prevalence of this attribution ranging between 6.7% (n=28) [36] and 25.0% (n=16) [35].

Lifestyle in general. Five studies in this review broadly identified lifestyle or behavioral choices as an attribution linked to cancer causation but did not report specific percentages for specific attributions that fall under this category [9,16,34,38,40]. Ferrucci et al., [9] found that lifestyle was reported by 49.5% (n=115) of

participants as the leading cause of their breast cancer. In contrast, only 0.9% (n=14) of participants in Panjari et al., [38] attributed their cancer to lifestyle factors. Both studies made use of a cross-sectional survey that posed an open-ended question about causal attributions. It is worth noting that the prevalence differences in these two studies cannot be explained by date (Ferrucci et al. was published in 2011 and Panjari et al. in 2012).

Causal Attributions Identified but Not Validated by Expert Consensus

Stress. There is no scientific evidence that stress is a cause of breast cancer [47-49]. The review suggests that many breast cancer survivors and patients believe that stress contributes to the development of breast cancer. Despite the lack of evidence that stress causes cancer, sixteen studies found that women attributed their breast cancer to their experience of stress [9,13,15,16,24,35-38,40-43,50-52]. Moreover, stress was identified as the leading cause of breast cancer in five studies [15,35,37,38,42]. In a study by Oba et al., [35] 70% (n=44) of the sample attributed their cancer to stress.

Four out of the sixteen studies which reported stress-related attributions for breast cancer, specifically defined stress as an inability to cope with a stressful situation, such as relationship conflicts, experience of trauma, dealing with loss or grief, and/or coping with a demanding environment [13,38,42,50]. Some women may rationalize stress as an attribution that is beyond their control. In a qualitative study by Lam and Fielding [51], a Hong Kong Chinese woman described how her separation from her husband led to her diagnosis of breast cancer, "I think that the separation with my husband caused me a lot of emotional distress, which triggered the development of cancer" (p.133). In a study by Kwok and White [50], a Chinese-Australian breast cancer patient described her belief about the cause of her breast cancer: "... life is more stressful here compared to living in China, because of the language problem and cultural differences. I believe that's why I got cancer" (p.89). Two studies included in the review found that those who attributed the cause of their breast cancer to stress also believed that a positive attitude was important in preventing a cancer recurrence [13] and were more likely to engage in activities such as yoga, meditation, and retreats [38].

Personality. A total of nine studies included in the review found that there were women who believed that their personality caused their breast cancer [9,13,34-36,40,43,44,52]. Estimates of the prevalence of this belief ranged from 2.6% (n=6) [9] to 35.0% (n=22) [35]. Unlike stress, which was viewed as external to the self, personality is likely to be seen as an internal characteristic. These women described their psychological disposition as their inability to cope with a stressful situation. They also believed that their internal mental state, such as having a negative mental attitude, feelings of anxiety and depression, or emotional suppression, caused their breast cancer. For example, in a qualitative study, an Asian American shared her views about why she and

other women got cancer, “I think that’s why we got the cancer. Holding things all the time, worry all the time, worry about many things, small things” [52 p.417].

Existential influences. There is no scientific evidence that existential influences (fate, chance, and/or God’s will) are causes of breast cancer. A total of 15 studies reported that breast cancer patients viewed these factors as causal to their own breast cancer [9,13,14,16,35,36,39-43,45,50,52,53]. In qualitative studies, participants from non-Western backgrounds were found to endorse fatalistic beliefs about their condition. For example, an Israeli women stated “I never ask any questions, it’s better not to know; I have to accept what life brings [14 p.142], and a Chinese-Australian woman stated “Life is life – if it [cancer] has to happen in your life, you cannot escape it. If it’s yours, it’s yours” [50 p.89]. Taken together, the studies suggest that fatalistic beliefs about the cause of cancer may serve as a coping mechanism. For breast cancer survivors, seeing their illness as outside their control may also be associated with the way that they accepted their illness.

Attributions may have also been influenced by an individual’s religious belief. For example, Baider and Sarell [14] indicated that those who described themselves as religious were more likely to view their illness as a punishment from God. In a focus group discussion with religious Punjabi women who live in Canada, Gurm et al., [53] discussed the different meanings associated with an attribution related to God’s will. For some women, a strong belief in God’s will is what helped them the most with their cancer and enabled positive coping behaviors such as prayers which brought relaxation, peace of mind and strength. However, for other women, attributing their cancer to God’s will meant a predetermined future in which cancer treatments would not be curative. They also expressed the stigma that they felt when a diagnosis of cancer was interpreted as “karma” or punishment for their sins by other people who live in their community. Conversely, Oba et al., [35] found that Japanese women who did not identify themselves with a particular religion, did not believe God’s will was a cause of their cancer.

Previous injury. In nine out of the 24 studies reviewed, participants cited a ‘blow’ to the breast or previous injury as a cause of their breast cancer [9,13,15,24,35-38,42]. The percentage of women who identified this cause of breast cancer was 10.0% or lower except in the case of Costanzo and colleagues who presented participants with a range of possible attributions (19.3%). It is to be noted that in Ferrucci et al., [9], trauma or injury was coded under the category of prior health condition. In Panjari et al.,[38] trauma to the breast was included under the broad category of breast issues.

Cancer germs. Despite no established evidence, two studies reported participants who considered cancer to be a germ or contagious virus [13,54]. South Asian women, who resided in the UK, described their

beliefs about cancer as a contagious disease, “we don’t even talk loudly about cancer; we whisper when cancer is mentioned or discussed. ... might catch it” [54 p.1622].

Unknown Origins (Don’t Know)

Despite the availability of information on breast cancer risk factors, eleven studies included in the review reported a number of women who indicated that they “don’t know” the cause of their cancer when asked [9,14,16,37-40,43,50,52]. It was found that 6- 57% of women said that they did not know the cause of their cancer or declined to give a reason for the development of their breast cancer. This finding may signify that a lack of awareness still exists about breast cancer risk factors, or it may also be possible that breast cancer survivors do not want to think about what may have caused their cancer. Alternatively, women may have knowledge about risk factors for breast cancer in general, but feel confused about the cause of their cancer specifically. For example, one woman was at a loss to explain why she got cancer because she followed healthy lifestyle recommendations, “I watched my food for many years, considered myself very fit, walked 4 miles every day.... I was somewhat angry because I had done all the right things with diet, I didn’t drink or smoke” [52 p.417].

Discussion

The findings of this review are consistent with previous literature that indicates beliefs about the causes of cancer may not always be consistent with the judgment of experts [9,16,55,56,36]. Results indicated that the most frequently identified causal attributions among women who have been previously diagnosed with breast cancer are family history, environment, stress, and fate/chance. Other risk factors with convincing evidence such as aging, reproductive history, and lifestyle factors were not as frequently mentioned, despite the availability of health information on the importance of these factors in reducing cancer risk. The studies in this review encompass a 30 year period and demonstrate that misperceptions about the comparative contribution of modifiable lifestyle factors to the risk of cancer are largely unchanged across this time period.

Results of this review are also consistent with psychometric theories that define aspects of hazards that increase fear [55,56]. This includes the controllability domain of a risk attribute whereby a risk variable is considered more significant if a person is unable to control their exposure to that risk (e.g., family history, environment, stress, or fate/chance). It also draws attention to the importance of affect and feelings in making personal judgments about the causes of breast cancer. For the breast cancer survivors in the included studies,

attributions may have been influenced by cognitive dissonance and the need to emotionally distance the self from recriminations and self-blame. Consequently, endorsed attributions would be those that served a protective function or a way to maintain their positive self-image or self-esteem. However, the extent to which lifestyle or modifiable causes of cancer are associated with self-blame remains unclear.

The observed variations in the findings of this review may have been influenced by the methods used to assess attributions across the studies. For example, studies which made use of a checklist of breast cancer risk factors were more likely to have women endorse causal attributions based on scientific evidence including age, reproductive choices, hormone therapy, lack of physical activity, and drinking alcohol. Moreover, these studies were also more likely to be published recently (between 2005 and 2012), by which time promotional information about these breast cancer risk factors had multiplied. However, it should be noted that in these studies, evidence-based modifiable factors were still endorsed less often than other non-modifiable factors such as family history or environmental toxins. On the other hand, most of the studies which had “don’t know” responses made use of surveys that included open-ended questions about causal attributions. Responses may have been influenced by variations in question wording, especially in qualitative studies which included an open-ended question on attributions. For example, questions asking respondents for events or circumstances which they believed may have contributed to the development of their breast cancer may have prompted stress-related attributions. A question such as “Have you ever thought ‘Why me?’” is likely to have encouraged metaphysical musings about causation.

Other factors, such as the socio-demographic background of participants in the included studies may have contributed to the variations in attribution prevalence observed. Affected women who are young and educated were found to be more likely to contemplate and search for causal explanations for their cancer [9, 13,38]. These individuals may have more access to and/or be aware of recent epidemiological studies of risk factors for cancer. Nonetheless, findings of the review suggest a bias for identifying non-modifiable causes even among young and educated participants. In addition, individual differences with regards to the experiences of affected women prior to being diagnosed need to be accounted for. For example, some breast cancer survivors who reported having a healthy lifestyle prior to diagnosis indicated that they “don’t know” the cause of their condition or relied upon attributions which have no expert consensus to explain their illness.

It is noteworthy that in studies in which the sample consisted of women from ethnic minorities living in western countries (e.g., Asian women living in Australia [50], or Canada [53]), beliefs in fatalistic influences as a cause of cancer were common. Some women also attributed their cancer to the stress and pressures of living in

a Western country [50]. Although existential attributions are at odds with expert opinion, these beliefs may provide an explanation that is acceptable to women. They may help women rationalize why a seemingly healthy woman gets sick with cancer and may serve as a psychological buffer that aids with life post cancer.

The generalizability of the results presented in this review is limited by the characteristics of the studies included. In Western studies, most participants were Caucasian and well-educated, therefore the attributions of women with less education remain largely unknown. Participants were also found to be similar in terms of breast cancer stage at diagnosis (i.e. stages I and II with no distant metastases) so views of affected women with poorer health status may have been missed. Most of the studies on causal attribution reported the percentage of women identifying or endorsing a particular attribution, and the large variation in sample size between studies included in the review means that proportions vary hugely. It is important to note that findings of quantitative studies included with relatively small sizes should be interpreted carefully, as this presents a small base when percentages are computed.

Notwithstanding these concerns, this review highlights the contrast between causal attributions that affected women have about their own breast cancer and published scientific evidence on breast cancer risk. Results indicated that, despite epidemiological findings on the importance of modifiable lifestyle behaviors in cancer causation, a significant percentage of women continue to ascribe causation to non-modifiable factors and factors with limited or no scientific evidence. This review highlights the need for health promotion and communication efforts to decrease the gap between lay and expert opinion on beliefs about the causes of cancer.

Summary and Recommendations for Future Research

This review revealed that, among breast cancer survivors, there is an awareness of lifestyle influences on breast cancer causation. However, non-modifiable attributions such as family history of cancer, as well as those with no or limited scientific support such as stress, continue to be given greater importance. A number of individuals also provide a “don’t know” response when asked about the cause of their cancer. Addressing possible confusion with regards to cancer causation and identifying the profile of individuals who may need additional support is an important area for future research.

Further studies on psychological predictors of attributions and beliefs about the causes of cancer may also help explain how risks are judged or interpreted. It is important to validate whether over-estimation of non-modifiable factors and/or attributions with limited or no scientific evidence is part of a coping strategy to avoid a sense of blame. The impact of cancer prevention messages on cancer survivors’ psychological well-being remains unclear.

The current review focused exclusively on causal attributions made by women with breast cancer; studying attributions made by men and/or people diagnosed with other cancers would indicate the extent to which these results are generalizable. A comparison of causal attributions and perceived risk factors among cancer survivors, those with a family history, and the general population may also warrant further study. Finally, most studies are either cross-sectional or qualitative in nature, and those that have a longitudinal study design have not examined whether attributions change throughout the cancer journey.

Conflict of Interest:

The authors declare that they have no conflict of interest.

References

1. Ferlay J, Shin HR, Bray F, Forman D, Mathers CD, Parkin D (2010) GLOBOCAN 2008, cancer incidence and mortality worldwide. <http://globocan.iarc.fr>. Accessed 11 January 2013
2. Barraclough J (1999) *Cancer and emotion: a practical guide to psycho-oncology*, 3rd edn. Wiley, Chichester
3. Hill J, Holcombe C, Clark L, Boothby MR, Hincks A, Fisher J, Tufail S, Salmon P (2011) Predictors of onset of depression and anxiety in the year after diagnosis of breast cancer. *Psychol Med*. doi:10.1017/S0033291710001868.
4. Janoff-Bulman R (1992) *Shattered assumptions*. Free Press, New York
5. Roesch SC, Weiner B (2001) A meta-analytic review of coping with illness: do causal attributions matter? *J Psychosom Res*.doi:S0022-3999(01)00188-X [pii]
6. Michela JL, Wood JV (1986) Causal attributions in health and illness. In: Kendall PC (ed) *Advances in cognitive behavioral research and therapy*, vol 5. Academic Press, New York, pp 179-235
7. Weiner B (1985) Spontaneous causal thinking. *Psychol. Bull.* doi:10.1037/0033-2909.97.1.74
8. Weiner B (1986) *An attributional theory of motivation and emotion*. Springer-Verlag, New York
9. Ferrucci LM, Cartmel B, Turkman YE, Murphy ME, Smith T, Stein KD, McCorkle R (2011) Causal attribution among cancer survivors of the 10 most common cancers. *J Psychosoc Oncol*. doi:10.1080/07347332.2010.548445
10. Shiloh S, Rashuk-Rosenthal DR, Benyamini Y (2002) Illness causal attributions: An exploratory study of their structure and association with other illness cognition and perceptions of control. *J Behav Med* 25: 379-394
11. Lykins EL, Graue LO, Brechting EH, Roach AR, Gochett CG, Andrykowski MA (2008) Beliefs about cancer causation and prevention as a function of personal and family history of cancer: a national, population-based study. *Psychooncology*. doi:10.1002/pon.1306
12. Rheingold S, Neugut A, Meadows A (2000) Secondary cancers: incidence, risk factors, and management. In: Bast R, Kufe D, RE. P, et al. (eds) *Holland-Frei Cancer Medicine*. 5th edn. Hamilton (ON):BC Decker. <http://www.ncbi.nlm.nih.gov/books/NBK20777/>. Accessed 12 March 2014
13. Costanzo ES, Lutgendorf SK, Roeder SL (2011) Common-sense beliefs about cancer and health practices among women completing treatment for breast cancer. *Psychooncology*. doi:10.1002/pon.1707
14. Baider L, Sarell M (1983) Perceptions and causal attributions of Israeli women with breast cancer concerning their illness: the effects of ethnicity and religiosity. *Psychother Psychosom* 39:136-143
15. Taylor SE, Lichtman RR, Wood JV (1984) Attributions, beliefs about control, and adjustment to breast cancer. *J Pers Soc Psychol* 46:489-502
16. Willcox SJ, Stewart BW, Sitas F (2011) What factors do cancer patients believe contribute to the development of their cancer? (New South Wales, Australia). *Cancer Causes Control*. doi:10.1007/s10552-011-9824-6
17. Parkin DM, Boyd L, Walker LC (2011) 16. The fraction of cancer attributable to lifestyle and environmental factors in the UK in 2010. *Br J Cancer*. doi:10.1038/bjc.2011.489
18. Bode AM, Dong Z (2009) Cancer prevention research - then and now. *Nat Rev Cancer*.doi:10.1038/nrc2646
19. Wang C, Miller SM, Egleston BL, Hay JL, Weinberg DS (2010) Beliefs about the causes of breast and colorectal cancer among women in the general population. *Cancer Causes Control*. doi:10.1007/s10552-009-9439-3
20. Epstein S (2000) The rationality debate from the perspective of cognitive-experiential self-theory. *Behav. Brain. Sci.* doi:10.1017/S0140525x0028343x
21. Friedman LC, Romero C, Elledge R, Chang J, Kalidas M, Dulay MF, Lynch GR, Osborne C (2007) Attribution of blame, self-forgiving attitude and psychological adjustment in women with breast cancer. *J. Behav. Med* 30:351-357
22. Bennett KK, Compas BE, Beckjord E, Glinder JG (2005) Self-blame and distress among women with newly diagnosed breast cancer. *J Behav Med*. doi:10.1007/s10865-005-9000-0
23. Lebel S, Devins GM (2008) Stigma in cancer patients whose behavior may have contributed to their disease. *Future Oncol*. doi:10.2217/14796694.4.5.717
24. Rabin C, Pinto B (2006) Cancer-related beliefs and health behavior change among breast cancer survivors and their first-degree relatives. *Psychooncology*. doi:10.1002/pon.1000
25. Rees G, Fry A, Cull A (2001) A family history of breast cancer: women's experiences from a theoretical perspective. *Soc Sci Med* 52:1433-1440
26. Lemon SC, Zapka JG, Clemow L (2004) Health behavior change among women with recent familial diagnosis of breast cancer. *Prev Med*. doi:10.1016/j.ypmed.2004.03.039
27. MacKenzie R, Chapman S, Holding S, Stiven A (2010) "No respecter of youth": Over-representation of young women in Australian television coverage of breast cancer. *J Canc Educ*. doi:10.1007/s13187-010-0083-0
28. Henderson L, Kitzinger J (1999) The human drama of genetics: 'hard' and 'soft' media representations of inherited breast cancer. *Sociol. Health. Ill.* doi:10.1111/1467-9566.00173

29. Quinn EM, Corrigan MA, McHugh SM, Murphy D, O'Mullane J, Hill AD, Redmond HP (2013) Who's talking about breast cancer? Analysis of daily breast cancer posts on the internet. *Breast*. doi:10.1016/j.breast.2012.05.001
30. AIHW (2012) Breast cancer in Australia: an overview (No. 71). AIHW, Canberra. <http://www.aihw.gov.au/publication-detail/?id=10737423008>. Accessed 11 January 2013
31. World Cancer Research Fund/American Institute for Cancer Research (2007) Food, nutrition, physical activity and the prevention of cancer: a global perspective. AICR, Washington DC
32. The International Agency for Research on Cancer (IARC) (2010) IARC monographs on the evaluation of carcinogenic risks to humans. <http://monographs.iarc.fr/>. Accessed 11 January 2013
33. Newcomb PA, Wernli KJ (2010) Risk Factors. In: Sauter E, Daly M (eds) *Breast cancer risk reduction and early detection*. Springer, New York, pp 3-22
34. Rozema H, Vollink T, Lechner L (2009) The role of illness representations in coping and health of patients treated for breast cancer. *Psychooncology*. doi:10.1002/pon.1488
35. Oba S, Takatsuka N, Nagata C, Nagao Y, Yamamoto S, Shibuya C, Kashiki Y, Shimizu H (2009) Causal attributions to epidemiological risk factors and their associations to later psychological adjustment among Japanese breast cancer patients. *Support Care Cancer*. doi:10.1007/s00520-008-0446-9
36. Wold KS, Byers T, Crane LA, Ahnen D (2005) What do cancer survivors believe causes cancer? (United States). *Cancer Causes Control*. doi:10.1007/s10552-004-2414-0
37. Stewart DE, Cheung AM, Duff S, Wong F, McQuestion M, Cheng T, Purdy L, Bunston T (2001) Attributions of cause and recurrence in long-term breast cancer survivors. *Psychooncology* doi:10.1002/pon.497
38. Panjari M, Davis SR, Fradkin P, Bell RJ (2012) Breast cancer survivors' beliefs about the causes of breast cancer. *Psychooncology*. doi:10.1002/pon.1949
39. De Ver Dye T, Bogale S, Hobden C, Tilahun Y, Hechter V, Deressa T, Bize M, Reeler A (2011) A mixed-method assessment of beliefs and practice around breast cancer in Ethiopia: implications for public health programming and cancer control. *Glob Public Health*. doi:10.1080/17441692.2010.510479
40. Arman M, Backman M, Carlsson M, Hamrin E (2006) Women's perceptions and beliefs about the genesis of their breast cancer. *Cancer Nurs*. doi:00002820-200603000-00010
41. Simpson P (2005) Hong Kong families and breast cancer: beliefs and adaptation strategies. *Psychooncology*. doi:10.1002/pon.893
42. Lavery JF, Clarke VA (1996) Causal attributions, coping strategies, and adjustment to breast cancer. *Cancer Nurs* 19:20-28
43. Lowery BJ, Jacobsen BS, Ducette J (1993) Causal attribution, control, and adjustment to breast cancer. *J Psychosoc Oncol* 10:37-53
44. Anagnostopoulos F, Spanea E (2005) Assessing illness representations of breast cancer: a comparison of patients with healthy and benign controls. *J Psychosom Res*. doi:10.1016/j.jpsychores.2004.09.011
45. Kulik L, Kronfeld M (2005) Adjustment to breast cancer: the contribution of resources and causal attributions regarding the illness. *Soc Work Health Care*. doi:10.1300/J010v41n02_03
46. Timko C, Janoff-Bulman R (1985) Attributions, vulnerability, and psychological adjustment: the case of breast cancer. *Health Psychol* 4:521-544
47. Surtees PG, Wainwright NW, Luben RN, Khaw KT, Bingham SA (2010) No evidence that social stress is associated with breast cancer incidence. *Breast Cancer Res Treat* 120. doi:10.1007/s10549-009-0454-6
48. Michael YL, Carlson NE, Chlebowski RT, Aickin M, Weihs KL, Ockene JK, Bowen DJ, Ritenbaugh C (2009) Influence of stressors on breast cancer incidence in the Women's Health Initiative. *Health Psychol*. doi:10.1037/a0012982
49. Nielsen NR, Gronbaek M (2006) Stress and breast cancer: a systematic update on the current knowledge. *Nat Clin Pract Oncol*. doi:10.1038/nponc0652
50. Kwok C, White K (2011) Cultural and linguistic isolation: the breast cancer experience of Chinese-Australian women - a qualitative study. *Contemp Nurse*. doi:10.5172/conu.2011.39.1.85
51. Lam WW, Fielding R (2003) The evolving experience of illness for Chinese women with breast cancer: a qualitative study. *Psychooncology*. doi:10.1002/pon.621
52. Ashing-Giwa KT, Padilla G, Tejero J, Kraemer J, Wright K, Coscarelli A, Clayton S, Williams I, Hills D (2004) Understanding the breast cancer experience of women: a qualitative study of African American, Asian American, Latina and Caucasian cancer survivors. *Psychooncology*. doi:10.1002/pon.750
53. Gurm BK, Stephen J, MacKenzie G, Doll R, Barroetavena MC, Cadell S (2008) Understanding Canadian Punjabi-speaking South Asian women's experience of breast cancer: a qualitative study. *Int J Nurs Stud*. doi:10.1016/j.ijnurstu.2006.08.023
54. Karbani G, Lim JN, Hewison J, Atkin K, Horgan K, Lansdown M, Chu CE (2011) Culture, attitude and knowledge about breast cancer and preventive measures: a qualitative study of South Asian breast cancer patients in the UK. *Asian Pac J Cancer Prev* 12:1619-1626
55. Slovic P (1987) Perception of risk. *Science*. doi:10.1126/science.3563507

56. Slovic P (2010) The psychology of risk. Saude E Sociedade. doi:10.1590/S0104-12902010000400002

Figure 1. Search results and inclusion and exclusion of studies

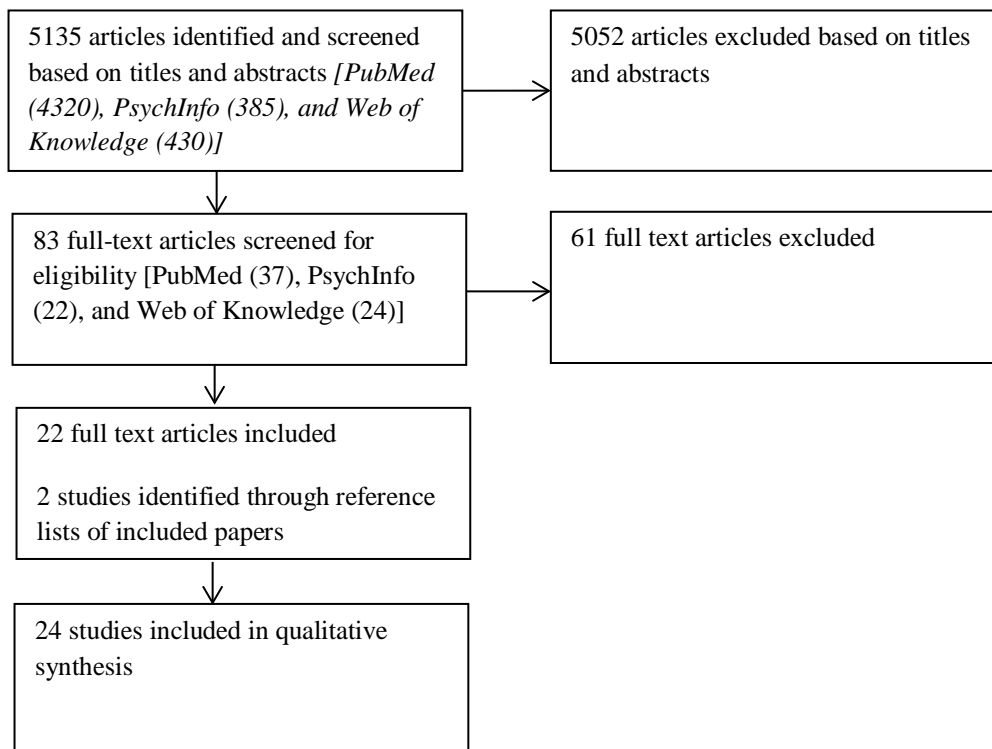


Table 1

Summary of qualitative articles on causal attributions among breast cancer survivors (by year)

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
Ferrucci, [9] (2011, USA)	Survey with open-ended question	n ^a = 232 ^b ; age: 55 years and older	ACS-SCS-1: 1. “Why do you think you got your cancer?”	<p>Biological attributions: biological (30.6%)</p> <p>Environmental attributions: environmental (18.6%)</p> <p>Lifestyle attributions: lifestyle (49.5%); smoking (1.3%)</p> <p>Other attributions^c: stress (11.6%); existential (8.2%), chance/luck (5.6%); prior health condition (3.0%); psychological (2.6%)</p> <p>Don’t Know^d: did not identify a specific attribution (18.5%)</p>
Panjari, [38] (2011, Australia)	Survey with open-ended question	N = 1496 ^b ; age: 25-74 years	BUPA Study: 1. “Do you believe anything in particular may have contributed to you developing BC?” and 2. “Please tell us which event(s) or underlying circumstance(s) you believe may have contributed to the development of your BC”	<p>Biological attributions: family history/genetic (4.4 %);</p> <p>Environmental attributions: environmental exposure (1.9%)</p> <p>Reproductive history: reproductive cycle/age (1.3%); hormone therapy (5.9%); oral contraceptive pill (1.5%); breast issues (which included trauma to breast, abscess, benign lumps, breastfeeding or not) (1.7%)</p> <p>Lifestyle attributions: lifestyle (0.9%)</p> <p>Other attributions: stressful life events (25.1%); prior</p>

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
				illness/disability (0.3%) Don't Know: did not believe that anything in particular contributed to their breast cancer (56.9%)
Willcox [16] (2011, Australia)	Survey with open-ended question	n ^a = 779 ^b ; age: 18+ years	CLEAR questionnaire: "What factors do you believe or suspect contributed to your or your partner's development of cancer, if any?"	Biological attributions: non-modifiable risk factors (27.5%); biological factors (4.9%) Environmental attributions: involuntary toxic injury (7.8%); radiation (3.6%); domestic exposures (1.5%) Reproductive history: iatrogenic (13.2%) Lifestyle attributions: behavior choices (16.9%); active tobacco smoking (2.6%) Other attributions: stress (26.4%); non-material influences (3.3%) Don't Know: did not identify a contributing factor (41.5%)
De ver Dye [39] (2011, Ethiopia)	Semi- structured interviews	N = 69 (55 patients and 14 proxies); age: mean not	Asked what they feel causes BC	Biological attributions: biomedical causes ^e (27.5%); genetics/heredity (14.5%) Environmental attributions: mich ^f or bad air (21.70%); sunlight (11.6%); cold exposure (5.8%); heat exposure (4.3%)

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
		specified		<p>Reproductive history: breastfeeding problem (17.40%)</p> <p>Lifestyle attributions: ethnomedical cause^g (55.1%) poor diet (11.60%)</p> <p>Other attributions: curse (5.8%)</p> <p>Don't Know: answered "don't know" (30.4%)</p>
Karbani [54] (2011, UK)	Semi- structured interviews	N = 24; age: mean = 58 years	Lay understanding and beliefs about BC	<p>Other attributions: cultural practices and beliefs about breast cancer include the perception that cancer was contagious (e.g. talking about cancer or using careless words could put one at risk); cancer germs can be spread through sharing of personal items with a cancer patient.</p>
Kwok [50] (2011, Australia)	Focus group interviews	N = 23; age: 40-69 years	"What did/does BC mean to you?"	<p>Other attributions: believed mammography was a preventive rather than a diagnostic measure; fatalism; stress and grief</p> <p>Don't Know: women who emphasized their healthy lifestyles, could not explain why they got BC</p>
Gurm [53] (2008, Canada)	Focus group interviews	N = 20; age: mean =	Questions on personal beliefs and understanding about BC	<p>Other attributions: spiritual beliefs provided context for understanding their cancer experience (themes included a</p>

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
Arman [40] (2006, Sweden)	Semi- structured interviews	53 years N = 118; age: mean = 49 years	“Do you think that there is a connection between the life you live and the diseases you get?”	positive framework of meaning; passive fatalism; karma) Biological attributions: “the body itself, with heredity and disposition in combination with external and inner aspects of life.” ^h Environmental attributions: external factors: environmental toxins Reproductive history: endocrine drugs (oral contraceptives; estrogen) Lifestyle attributions: diet; tobacco; alcohol Other attributions: inner and psychosocial factors; statement of pure chance Don’t Know: “no connection”- rejection of belief in a link; Reflection about possible causes but rejection in own case
Simpson [41] (2005, Hong Kong)	Semi- structured interviews	N = 20 ⁱ ; age: 35-58 years	Asked where their illness came from	Biological attributions: genetics Lifestyle attributions: diet patterns; lack of exercise and rest Other attributions: stress and emotion; fate
Ashing-Giwa [52]	Focus group	N = 102;	Groups discussed attitudes,	Other attributions: stress

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
(2004, USA)	interviews	age: 31-79 years	beliefs, and knowledge about BC	Don't Know: women who emphasized their healthy lifestyles, and have no family history of cancer could not explain why they got BC
Lam [51] (2003, Hong Kong)	Semi- structured interviews	N = 17 age: 30-65 years	“Please tell me what it was like for you to have BC.”	Other attributions: stress Don't Know: women who emphasized their healthy lifestyles, and did not experience distress could not explain why they got BC
Lavery [42] (1996, Australia)	Survey with open-ended question	N = 244; age: mean = 56 years	A question relating to whether a causal attribution had been made regarding BC. If causal attribution(s) were made, respondents were then invited to indicate the nature of these beliefs.	Biological attributions: family history (13.0%) Environmental attributions: environment (2.0%) Reproductive history pill and hormone replacement therapy (6.0%) Lifestyle attributions: diet (1.0%) Other attributions: stress (34.0%); injury (5.0%); past medical history of benign lumps, mastitis, breast implants (5.0%); chance, luck, God's will (2.0%) Don't know: did not make a causal attribution (30.0%)
Lowery [43]	Semi-	N = 195 ^b ;	“Have you ever asked, ‘Why me?’	Biological attributions: heredity (13.6%)

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
(1993, USA)	structured interviews	age: mean = 53 years	about your BC?" If yes, "How have you answered that question?"	Environmental attributions: specific carcinogen (5.6%) Other attributions: chance (33.6%); God (10.4%); stress (4.0%); something about me (3.2%) Don't Know: answered "don't know" (9.2%); did not give a causal attribution (11.5%)
Taylor [15] (1984, USA)	Structured interviews	N = 78 ^l ; age: 29-78 years	Participants asked about their hunch or theory about why they have BC	Biological attributions: heredity (26.0%) Environmental attributions: specific carcinogen (32.0%); Lifestyle attributions: diet (17.0%) Other attributions: stress (41.0%); blow to the breast (10.0%); unspecified other (28.0%) Don't Know: did not give an attribution (5.0%)
Baider [14] (1983, Israel)	Semi- structured interviews	N = 33; age: mean = 51 years	"What do you think is the cause of your illness?"	Environmental attributions: others (6%) Internal/Modifiable: yourself (24.0%) Other attributions: fate (70.0%); God (60.6%); illness as a punishment (12.1%) Don't Know: answered "don't know" (6.0%)

Note. Percentages enclosed in parentheses represent the percentage of women identifying or endorsing each attribution

ACS-SCS-I = American Cancer Society's Study of Cancer Survivors-I; *BUPA Study* = BUPA Health Foundation Health and Well-being after Breast Cancer Study; BC: breast cancer; *CLEAR* = Cancer Lifestyle and Evaluation of Risk Study.

^a Small n indicates reporting of data for BC patients only but total sample included other cancer types

^b Percentages were re-calculated to report the entire sample of women with breast cancer who participated in the study

^c Causal attributions identified but not validated by expert consensus

^d Don't Know includes participants who did not specify a specific causal attribution for their breast cancer (i.e., those that said "I don't know"; those who declined or did not give a response to the open-ended question on what caused their breast cancer or left the open-ended question on what caused their breast cancer blank)

^e Biomedical cause is a combination of heredity, diet and environment

^f mich (an Ethiopian ethnomedical category roughly equivalent to bad air)

^g Ethnomedical cause is a combination of breastfeeding, exposure to cold, sunlight, heat, mich and symptoms acquired through work in the workplace

^h Involves a combination of biological and other factors

ⁱ Interviews included family members resulting in a total sample size of 59

^j Paper does not explicitly state whether percentages report for the whole sample or the 95% of women who made attributions

Table 2

Summary of *Quantitative* Articles on Causal Attributions among Breast Cancer Survivors (by Year)

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
Costanzo [13] (2011, USA)	Longitudinal	N = 79; age: mean = 55 years	IPQ –R: with an additional section on causal attributions. Participants rated the importance of factors in causing their cancer on a 5-point scale (responses ranged from not at all important to very important)	Biological attributions: genetics or heredity (70.5%); aging (53.3%) Environmental attributions: environmental toxins or hazards (73.1%) Reproductive history: hormones (84.5%) Lifestyle attributions: diet or eating habits (67.9%); lack of exercise (38.4%); alcohol use (20.6%) Other attributions^a: stress or worry (54.6%); God’s will (43.4%); chance or bad luck (36.8%); mental attitude (28.6%); injury (19.3%); germ or virus (17.1%)
Rozema [34] (2009, Netherlands)	Cross-sectional	N = 119; age: mean = 46.8 years	IPQ-R: 19 items assessed causal attributions and these were subjected to a principal components analysis	Biological attributions: biological cause ^b Lifestyle attributions: behavioral cause Other attributions: psychological cause
Oba, [35]	Cross-sectional	N = 63;	Checklist: Participants were	Biological attributions^c: heredity (46%)

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
(2009, Japan)		age: 25-77 years	Asked whether they thought any of the items were the cause of their BC, response scale ranged from 1 (do not think so) to 4 (strongly think so).	<p>Environmental attributions^c: occupation (43%); exposure to chemical substance (10%); air pollution (10%)</p> <p>Reproductive history^c: never having children (70%); never breast-feeding (16%); issues regarding past child delivery or menstruation (21%)</p> <p>Lifestyle attributions^c: dietary habit (57%); alcohol consumption (25%); body size (16%); tobacco (10%)</p> <p>Other attributions^c: stress (70%); chance (59%); fate (56%); physical fragility (41%); personality traits (35%); God's will (16%); had blow to the breast or got hurt the breast (10%)</p>
Rabin [24] (2006, USA)	Longitudinal	n ^e = 61; age: mean = 56 years	Checklist: Participants were asked to select the factors they perceived as having caused their BC	<p>Biological attributions: heredity (47.5%); old age (14.8%);</p> <p>Environmental attributions: pollution in the environment (41.0%); second hand smoke (16.4%)</p> <p>Reproductive history: use of HRT (24.6%); use of birth control (16.4%); delayed childbirth (9.8%); early menarche (9.8%); late menopause (8.2%); history of breastfeeding (1.6%)</p> <p>Lifestyle attributions: unhealthy diet (32.8%); smoking</p>

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
				(16.4%); not enough exercise (23.0 %); alcohol consumption (11.5%) Other attributions: stress (45.9%); physical characteristics of body (14.8%); constipation (6.6%); physical injury (4.9%); restrictive clothing (1.6%)
Kulik [45] (Israel, 2005)	Cross-sectional	N = 60; age: not specified	Causal Attribution Questionnaire: 23 statements about the causes of BC rated on a scale ranging from 1 = not true at all, to 5 = very true	Other attributions: external fate ^d
Anagnostopoulous [44] (2005, Greece)	Cross-sectional	n ^e = 102; age: mean = 55.9 years	IPQ: Participants rated statements on a five-point Likert scale ranging from strongly agree (1) to strongly disagree (5)	Environmental attributions: environmental (such as radiation exposure and chemical substances) ^f Other attributions: internal causal attributions (such as personality characteristics and suppression of emotions) ^f
Wold [36] (2005, USA)	Cross-sectional	n ^e = 416 age: not specified	Opinion survey: 19 causes rated in terms their own cancer on a scale from (1) definitely causes	Biological attributions: genetic factors (53.1%); family history (46.6%) Environmental attributions: environmental pollutants

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
			cancer to (5) definitely does not cause cancer	<p>(40.6%); food additives (31.5%); occupation or type of work (10.8%); medical x-rays (8.9%); power lines (3.6%)</p> <p>Reproductive history: hormone replacements (40.1%); oral contraceptives (20.9%)</p> <p>Lifestyle attributions: too much fat in diet (20.7%); lack of fruits and vegetables in diet (16.6%); obesity or being overweight (15.9%); smoking (12.0%); lack of exercise (10.1%); drinking alcohol (6.7%)</p> <p>Other attributions: stress (39.7%); personality (8.7%); God's will (8.4%); physical injury to cancer area (7.2%); bad luck (6.0%); infection (5.1%)</p>
Stewart [37] (2001, USA)	Cross-sectional	N = 378 ^g ; age: mean = 61 years	Questionnaire: Included specific questions about breast cancer cause (questions not provided)	<p>Biological attributions: genetics (22.8%)</p> <p>Environmental attributions: environment (21.7%)</p> <p>Reproductive history hormones (20.4%)</p> <p>Lifestyle attributions: diet (13.2%)</p> <p>Other attributions: stress (36.0%); breast trauma (2.4%)</p> <p>Don't know: answered "don't know" (14.0%); did not respond</p>

First author (Year, Country)	Study design	Sample characteristics	Attribution Measure	Summary of Findings
				to question about the cause of breast cancer (14.8%)
Timko [46] (1985, USA)	Cross-sectional	N = 42; age: mean = 53 years	Structured measure: Participants indicated the extent to which factors were a cause of her BC on an 11-point scale (1 = not at all a cause, to 11 = completely a cause)	No attributions had mean rating of 6 or above (indicating endorsement)

Note. Percentages enclosed in parentheses represent the percentage of women identifying or endorsing each attribution

IPQ-R = Illness Perception Questionnaire-Revised; *BC*: Breast Cancer; *IPQ* = Illness Perception Questionnaire.

^a Causal attributions identified but not validated by expert consensus

^b Only causal dimensions with sufficient alpha were reported

^c Percentages reflect the number of participants who rated the attribution as 3 or 4 (strongly think so) on a 4 point scale

^d Only factors with a mean rating of 3 or higher (indicating endorsement of the attribution) reported

^e Small n indicates reporting of data for BC patients only but total sample included other cancer types or family members

^f Only factors with a mean rating of 3 or less (indicating endorsement of the attribution) reported

^g Percentages were re-calculated to report the entire sample of women with breast cancer who participated in the study

