PSYCHOMETRIC PROPERTIES OF THE ENGLISH AND SPANISH VERSIONS OF THE CANCER WORRY SCALE IN HISPANIC-AMERICAN WOMEN

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Psychometric Properties of the English and the Spanish Versions of the Cancer Worry Scale in Hispanic-American Women

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ABSTRACT OF THE THESIS

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Breast cancer is one of the most common malignancies in the United States, and as a result, has become a significant public health problem for women in this country. Among ethnic minorities in the United States, breast cancer is the leading cause of cancer death(s) in Hispanic-American women. Cancer worry, a woman’s level of worry about her risk of getting breast cancer, has been implicated as a determinant of preventive screening and psychological adjustment for women at breast cancer risk. The Cancer Worry Scale (CWS) is a four-item self-report questionnaire developed for use in men and women to measure frequency of worry about cancer risk and the impact of cancer worry on daily activities. The aim of the research study was to investigate the psychometric properties of the CWS in Hispanic-American women to determine its utility in this population.

Multiple group confirmatory factor analysis (CFA) was utilized to examine the equivalence of the CWS in Hispanic-American women across the two language preference sub-groups. Multiple group CFA did not provide support for a one-factor structure model in the overall group, nor did it provide support for a one-factor structure model in the English or Spanish language preference sub-groups. Due to the lack of model fit, an exploratory factor analysis (EFA) was conducted as a follow-up to explore the dimensionality of the four items of the CWS for the overall group and the English and the Spanish language preference sub-groups. EFA suggested a one-factor structure/solution for worry in which the four items loaded well for the solution in the overall group and in each language preference sub-group.

Convergent and discriminant validity were assessed between the CWS and each of the following measures: CWC, PHQ-9, and the MacArthur Scale of Subjective Status. There was a positive correlation between the CWS and the CWC, which was statistically significant. In this same assessment, there was a positive correlation between the CWS and the PHQ-9, which was also statistically significant. Lastly, there were no significant correlations between the CWS and the two ladders of the MacArthur Scale of Subjective Social Status.
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CHAPTER 1
INTRODUCTION

A 2009 issue of Psycho-Oncology cited several women, who were participating in a study of women at intermediate risk for breast cancer, discussing their experiences following risk assessment. These women were specifically discussing factors that contributed to their distress and use of medical resources (Bennett, Parsons, Brain & Hood, 2009). Here is what some of them had to say:

I thought I was at higher risk; going to [get assessed] put it all into perspective. They gave me lots of advice about how to self-exam. [Case 1511]

I would go for my mammogram and then I would think, right, I am all right now, for another 12 months … [Case 0505]

I would know if something had changed in my breasts … The thing is I am now older than my mother was when she had it so it becomes less of a worry. [Case 0146]

Ask a woman and there is bound to be a consensus that for some individuals worrying about breast cancer is unavoidable, considering the attention devoted to the disease by advocacy groups, celebrities, and the media (Blanchard, Erblich, Montgomery, & Bovbjerg, 2002). This worry is true for women who are at high risk for breast cancer due to a family history (Lerman & Schwartz, 1993) or previous abnormal mammography results (Lerman, Trock, Rimer, Jepson, et al., 1991). Cancer worry may be of particular importance because researchers have suggested that worrying about breast cancer to be problematic. It causes a woman distress and may prompt her to avoid breast cancer screening (for example, avoid participation in mammography screening; Hay, McCaul, & Magnan, 2006; Kash, 1995; Lerman, Kash, & Stefanek, 1994). Currently, there is burgeoning literature on cancer worry impeding screening behaviors in high risk populations (i.e., those with increased genetic risk) (Hay, Buckley, & Ostroff, 2005).

This research study examined the psychometric properties of a particular domain-specific measure, the Cancer Worry Scale (CWS), which is utilized in the literature as a
measure of cancer-related worry. The goal of this research study is to provide an assessment of the CWS among the Hispanic-American women in the United States. To date, few studies have completed psychometric evaluations of the CWS among this population.

**Cancer Prevalence and Screening Patterns of Hispanic Individuals**

In 2012 the American Cancer Society estimated that 1.6 million new cancer cases were diagnosed. Of those cases, 790,740 affected the female population, with breast cancer being the most frequently diagnosed among American women (American Cancer Society [ACS], 2012). In addition, a number of observations have been noted in the cancer prevalence of Hispanic Americans in the United States. It is estimated that about 59,200 Hispanic-American women living in the U.S. are affected by the disease, with an estimated 17,100 of these women specifically diagnosed with breast cancer (Siegal, Cokkinides, & Jemal, 2012).

Trends in cancer incidence among this target population are evident by the aforementioned statistics but the death rate is just as alarming. A breast cancer diagnosis is the leading cause of cancer death among Hispanic-American women living in the United States (Kapp, Ryerson, Coughlin, & Thompson, 2009; Tejeda, Thompson, Coronado, Martin, & Heagerty, 2009). Although the incidence and mortality rates are lower for Hispanic-American women in comparison to non Hispanic-American white women, breast cancer is often diagnosed at an advance stage (Li, Malone, & Daling, 2003; Tejeda et al., 2009).

One way to address the cancer burden involves increasing the use of regular screening for early detection of breast cancer (Hay et al., 2005). However, to date, the majority of the literature has indicated that Hispanic-American women, in comparison to other ethnic groups, differ in their knowledge about breast cancer and screening practices (Chavez, Hubbell, McMullin, Martinez, & Mishra, 1995; Hubbell, Chavez, Mishra, & Valdez, 1996; Michielutte & Diesker, 1982). For instance, findings from a cultural analysis of ethnographic data suggested that for less acculturated Hispanic-American women, beliefs about breast cancer risks emphasized on breast trauma and bad behaviors, whereas, white non Hispanic-American women emphasized on risk factors such as family history and age (Chavez et al., 1995; Mishra et al., 1998). Mishra et al. (1998) reported that less acculturated women were non-U.S. born, had less than 13 years of education and were not in the
workforce. Hubbell et al. (1996) conducted a random telephone survey that concluded that, in comparison to non Hispanic-American women, Hispanic-American women preferred not to know if they currently had breast cancer, and if in a hypothetical scenario of having breast cancer one day, would prefer not to tell their spouses for fear that their relationship might change. In addition, some literature suggested that Hispanic-American women were three times more likely to believe that a mammogram was only required when a breast lump was discovered (Tejeda et al., 2009).

Preventative health screening practices in the Hispanic-American population are also variant. Again, in comparison to other ethnic groups, Hispanic-American women are less likely to practice/utilize appropriate cancer screening examinations such as the breast self-examination (BSE), detection techniques of mammography, and the clinical breast exam (CBE) (Mishra et al., 1998; Vernon et al., 1992). Furthermore, it is less likely for a Hispanic-American woman to report the regular practice of a BSE, and when a self-breast exam is performed, it is likely to be sub-par in desired efficiency (Coe et al., 1994; Mishra et al., 1998).

In addition to the inadequate use of screening practices such as BSE, Hispanic-American women under-utilize mammography services. The Center for Disease Control and Prevention and the National Center for Health Statistics reported in 2005 that Hispanic-American women were less likely than other ethnic populations to undergo recommended mammography screening practices. More specifically, 30.3% of Hispanic-American women have never had a mammogram in comparison to 27.2% non Hispanic American counterpart (Tejeda et al., 2009).

The literature has provided information regarding Hispanic-American women’s breast cancer-related knowledge and practices. Inadequate knowledge and sub-par screening practices are of concern because there is growing evidence that cancer screening methods can reduce mortality (Hay et al., 2005; Hendrick, Smith, Rutledge, & Smart, 1997). In order to change trends of a late diagnosis and decrease cancer deaths in this population, it is imperative that those involved in the psycho-oncology field explore factors that influence breast cancer screening behaviors.
Researchers have observed (DuBard & Gizlice, 2008; McGarvey et al., 2003; Michielutta & Diesker, 1982; Wells & Roetzheim, 2007) that although cancer screening behaviors are complex, the reasons for low screening, especially in the area of mammography use, include but are not limited to, limited knowledge about cancer-related risk factors and screening procedures, socioeconomic factors such as poverty, deterrence to participate due to lack of financial ability to pay for out of pocket medical procedure expense, and lack of health insurance. While such factors are well established in the literature, a current alternative view is to focus on health cognitions and emotions (Hay et al., 2005).

The cancer prevention literature explained that cancer worry was one example of an emotion interfering with preventative health screening behaviors. Cancer worry is defined as an emotional reaction to the threat of cancer (Bowen et al., 2003; Hay et al., 2005; McCaul, Branstetter, Schroeder, & Glasgow, 1996). More specifically, breast cancer-specific worry, refers to the undesired and uncontrollable thoughts about the threat of developing breast cancer (McQueen, Vernon, Meissner, & Rakowski, 2008).

Currently, the literature suggests a link between cancer-specific worry and cancer screening practices such as mammography use, but according to McCaul, Reid, Rathge, and Martinson (1996), whether cancer worry facilitates or deters screening is “a murky state of affairs” (p. 183). While some studies have suggested that the psychological distress of worry has predicted lower screening rates and overall screening avoidance (Alagna, Morokoff, Bevett, & Reddy, 1987; Bowen et al., 2003; Kash, 1995; Kash, Holland, Halper, & Miller, 1992; Lerman, Trock, Rimer, Jepson, et al., 1991; Rimer, Keintz, Kessler, Engstrom, & Rosan, 1989), some researchers contended that higher levels of cancer worry prompted women to perform hyper vigilant behaviors, (Brain, Norman, Gray, & Mansel, 1999; Diefenbach, Miller, & Daly, 1999; McCaul, Reid, et al., 1996; McCaul, Schroeder, & Reid, 1996).

Studies have established that cancer worry either facilitates or deters cancer screening practices, however, an overall consensus has yet to be achieved. What is of concern is the limited research that applies to the Hispanic-American population. To date, the majority of
research regarding cancer worry has focused on the non Hispanic-American population. This is of concern because primary focus on a non Hispanic-American population makes it impossible to generalize across a heterogeneous population like that of the United States (Bowen et al., 2003). Additionally, there is developing concern about the negative outcomes cancer worry might have on racial or cultural groups (Aiken, Gerend, & Jackson, 2001). The present study contributes to the line of research that calls for further exploration of cancer-specific worry in the Hispanic-American population in the United States.

**Cancer Worry: A Possible Psychological Determinant of Adherence?**

Several psychological factors have been implicated as to why women do not partake in regular screening practices. One such factor/barrier is the emotional reaction of worry to the threat of cancer (McCaul, Branstetter, et al., 1996). In research related to health cognitions and emotions, Lerman, Trock, Rimer, Jepson, et al. (1991) observed that women had emotional distress when undergoing a preventive health exam/screening. More specifically, Lerman, Trock, Rimer, Jepson, et al. (1991) noted that in the process of having a routine mammogram, as recommended by the National Cancer Institute, the probability of having a mammogram result as inconclusive or abnormal could be as high as 20% (p. 259). Lerman and colleagues further stated that an abnormal or inconclusive result, which they noted as risk notification, could produce an after effect of psychological morbidity. Lerman and colleagues defined psychological morbidity as the affect health distress can put on an individual. Additionally, they noted that it was important to further produce studies that “identify potential psychological consequences of this experience and to evaluate the impact these psychological factors have on continued adherence to breast cancer screening” (Lerman, Trock, Rimer, Jepson, et al., 1991, p. 266).

Lerman, Trock, Rimer, Jepson, et al. were the first group of researchers to give importance to the impact of worry on continued adherence to cancer screening. Lerman et al. (1991) stated “to date, however, there have been no published studies on the relationships among women’s cognition, affect and screening patterns subsequent to routine mammograms” (p. 260). This continues to be true, especially when examining this in diverse ethnic or cultural groups in the United States. Lerman, Trock, Rimer, Jepson, et al. (1991)
questioned whether distress, as a result of a potential abnormal or inconclusive mammogram, would interfere with succeeding breast cancer screening behaviors.

In a study that examined extreme levels of distress interfering with adherence behaviors, Alagna et al. (1987) noted that high levels of anxiety and worry were associated with low levels of breast self-examinations. In this study, two groups of women (high risk for breast cancer compared to low risk for breast cancer) were evaluated in terms of frequency of breast self-examination (BSE) and knowledge about BSE. The women at high risk, when compared to the low risk cohort, were much more knowledgeable about BSE and breast cancer overall. In terms of the frequency of BSE, both groups of women had low screening behaviors. Similarly, Lerman, Trock, Rimer, Jepson, et al. (1991) noted that when measuring distress (i.e., breast cancer worry) in their cohort of women, their breast cancer worries exhibited a curvilinear relationship with BSE frequency. For this study, the women with high and low levels of breast cancer worry were less likely to practice the recommended monthly BSE.

In a similar line of research, Lerman, Rimer, Trock, Balshem, and Engstrom (1990) examined overall barriers and facilitators to repeated mammography and BSE participation. Factors such as physician recommendation, perceived risk of breast cancer, family history of breast cancer, and anxiety about getting a mammogram were examined in relation to women who had repeat mammograms (the study did not inform if this cohort of women had a breast cancer diagnosis or not). In this study, women with continued adherence to breast cancer screening were more likely to do so based on a recommendation by a physician, family history of breast cancer, and perceived risk to breast cancer. Not surprisingly, in this same cohort of women, anxiety reduced the likelihood of repeat mammograms. Anxiety, however, was not a significant predictor in a cohort of women who were getting a first time mammogram, suggesting, “that some aspect of the mammogram process may generate anxiety, which interferes with repeat participation” (Lerman et al., 1990, p. 288).

The latter result is consistent with some of the literature regarding emotional distress associated with first time breast cancer screening. Emotional reactions to mammography screening may suggest that psychological distress is produced, and as a result, may predict lower screening behaviors (Alagna et al., 1987; Dean, Roberts, French, & Robinson, 1986;
Kash et al., 1992) and as Lerman, Trock, Rimer, Jepson, et al. (1991) have suggested, may also affect repeat screening intentions when faced with abnormal mammograms\(^1\).

In regards to the importance of breast cancer screening adherence, Lerman, Rimer, and Engstrom (1989) contended that, “measurement of adherence is essential in understanding the efficacy of regimens being recommended to the public and to high-risk target populations” (p. 4958). When Lerman, Trock, Rimer, Jepson, et al. (1991) developed the Cancer Worry Scale (CWS), they emphasized on measuring continued adherence to breast cancer screening, while challenging medical personnel to improve their responses to patient distress.

**DEVELOPMENT OF THE CANCER WORRY SCALE**

The Cancer Worry Scale (Lerman, Trock, Rimer, Jepson, et al., 1991) is one of the earlier scales developed in the psycho-oncology literature as a measure of cancer-specific worry. It is a self-report measure meant to assess subjective distress in relation to a specific life stressor (e.g., emotional impact of receiving an abnormal mammogram result after a subsequent routine check-up). Lerman and colleagues assessed cancer worry with structured questions that described the frequency of psychological distress of three kinds: current levels of breast cancer worry, impact of worry on mood and functioning, and anxiety about future mammogram results.

Lerman, Trock, Rimer, Jepson, et al. (1991) developed the CWS when they attempted to define the distress that resulted from a negative outcome of a preventative health screening procedure, such as an abnormal mammogram result. In a previous study (Lerman et al., 1990; Lerman, Trock, Rimer, Boyce, et al., 1991), Lerman sought to evaluate the psychological impact mammography results had on women’s anxiety and cancer worry. At the time of developing the CWS, Lerman and colleagues used the term “cancer worry,” but they

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\(^1\) Women with abnormal mammograms did report a significantly stronger intention to adhere to continuous screenings when compared to woman with normal mammograms. Interestingly, BSE frequency was not related to either abnormal or normal mammogram results.
produced no direct definition of the term. The closest Lerman, Trock, Rimer, Jepson, et al. (1991) came to a definition of cancer worry was calling it “psychological distress” (p. 260).

The original CWS in Lerman, Trock, Rimer, Jepson, et al. (1991) is four-item measure on a Likert-scale. Lerman and colleagues divided the first three items into two parts: frequency of worry and the impact of worry. The fourth item rated current level of anxiety about future mammogram results. Details of the measure as it appeared in Lerman, Trock, Rimer, Jepson, et al. (1991) is as follows:

For breast cancer worry, women rated their current levels of worry about getting breast cancer some day on a 5-point scale with points labeled not at all (1), rarely (2), sometimes (3), often (4), and almost all the time (5). For impact of worry on mood and on functioning, women who reported experiencing breast cancer worries rated the current impact of such worries on their moods and on their ability to perform their daily activities using a 4-point scale with points labeled not at all (1), a little (2), somewhat (3), and a lot (4). For anxiety about getting mammograms, women rated their current level of anxiety about the results of future mammograms on a four-point scale with points labeled none (1), a little (2), somewhat (3), and a lot (4). (p. 260-261)

The research Lerman, Trock, Rimer, Jepson, et al. (1991) utilized for the development of the CWS stemmed from research in screening and risk notification. For example, Lerman and colleagues discussed a study by Reelick, De Haes, and Schuurman (1984) in which women who were notified of abnormal Pap smears exhibited significant tension and depression. In such a manner, Lerman and colleagues were curious about the implication distress had on subsequent screening practices. Lerman and colleagues wrote, “The potential of risk notification to produce psychological sequelae is of particular concern because of the possible effects of such a sequelae on subsequent screening and treatment behaviors” (Lerman, Trock, Rimer, Jepson, et al., 1991, p. 260).

**Variants and Inconsistencies of the CWS**

Lerman and colleagues noted the importance of developing the CWS, however, in the process of this development, Lerman, Trock, Rimer, Jepson, et al. (1991) failed to consider the importance of standardizing and validating the CWS. When Lerman and colleagues developed the CWS, they failed to provide an exact wording of the measure. That is, they never pre-determined the measure’s closed-ended questions. As a result, variants of this measure exist in the literature. The CWS has been modified (McCaul, Branstetter, O’Donnell, Jacobson, & Quinlan, 1998), has had questions added or omitted, and has been
adapted to oncology research outside of breast cancer research (Cohen et al., 2003; Sweetman et al., 2006). Overall, it is difficult to follow the evolution of the CWS as it appears in the cancer literature. As a result, the present study seeks to contribute to the history and the development of the CWS.

A pattern that is noted in some studies that utilize the CWS is the addition of two items to the four items of the measure. Through an exhaustive literature search, three studies reported the CWS as a six-item measure (Brain et al., 2002; Hopwood, Shenton, Laloo, Evans, & Howell, 2001; Rhee et al., 2006). Again, this is inconsistent with Lerman, Trock, Rimer, Jepson, et al. (1991), as the original CWS only reported a four-item measure. Given the studies mentioned, little can be said about the details of the two additional items. That is, the studies that report a six-item CWS never inform the reader what the two addition questions are. The following is the only information available about the six-item CWS, “the CWS is a six-item (originally four-item) scale designed to measure worry about the risk of developing cancer and the impact of worry on daily functioning” (Hopwood et al., 2001, p. 2); and “The Breast Cancer Worry Scale is a six-item scale that assesses frequency of concerns about developing breast cancer and impact of cancer worry on mood and daily functioning” (Brain et al., 2002, p. 234). What is more inconsistent is that Hopwood et al. (2001) and Brain et al. (2002) cited Lerman, Trock, Rimer, Boyce, et al. (1991) and Lerman, Trock, Rimer, Jepson, et al. (1991) as their sources of information for the CWS.

Bowen, Christensen, Powers, Graves, & Anderson (1998) reported a four-item CWS but made minor adjustments to one of the item questions. In this study, the CWS continued to assess the frequency of worry about cancer risk and the impact this worry had on daily functioning, but unlike the original CWS, it did not address a woman’s anxiety about a future mammogram exam. In lieu of addressing a participant’s anxiety about a pending mammogram, as it appeared in the original Lerman, Trock, Rimer, Jepson, et al. (1991) CWS, the adjusted item questioned if women had ever thought about developing breast cancer. Another example of a modified CWS appeared in McCaul et al. (1998). McCaul and colleagues modified the wording of one of the items by asking, “How many days, of the last seven, did you worry about breast cancer?” (p. 569).

Sweetman et al. (2006) illustrated an example of a reference inconsistency. Sweetman and colleagues sought to address psychological morbidity and screening adherence in first-
degree relatives of prostate cancer patients by utilizing the CWS, however, Sweetman and colleagues referred to the measure as the Cancer Worry Scale Revised (CWS-R). Furthermore, they sourced it back to Lerman and Schwartz (1993) not Lerman, Trock, Rimer, Jepson, et al. (1991). An examination of Lerman and Schwartz (1993) revealed that this research article was a review of the literature on adherence and psychological adjustment for women at high risk for breast cancer. Although this study (Lerman & Schwartz, 1993) discussed breast cancer concerns in relation to preventative health care practices, the CWS was not acknowledged in this review paper. Further assessment of the literature on the CWS revealed that the CWS-R did not derive from Lerman and colleagues but instead originated from a study by Watson et al. (1999). Watson et al. (1999) labeled it CWS-R because their study incorporated the four items of the CWS plus two additional items that inquired about the frequency of worry and the problem aspect of that worry.

**Psychometric Evaluations of the Cancer Worry Scale**

Reliability is a characteristic of a set of test scores. It is information that tells researchers and educators how consistent test scores are. More specifically, it reflects factors that contribute to consistency and factors that contribute to inconsistency (i.e., error). Murphy and Davidshofer (2005) inform that there are four methods of establishing reliability: test-re-test, alternate form, split-half, and internal consistency.

The CWS as a measure of cancer-specific worry reports acceptable to good reliability for two of the four methods of establishing reliability. As per the cancer worry literature, internal consistency appears to be widely used in establishing reliability of the CWS. Two studies reported good internal consistency for the CWS. Brain et al. (1999) reported a Cronbach’s $\alpha$ of 0.86 for a population of women at high risk and low risk for familial breast cancer. McCaul et al., (1998) reported a similar Cronbach’s $\alpha$ of 0.85 for the four items of the CWS. Other studies reported an acceptable internal consistency for the CWS in varying populations. Bowen et al. (1998) reported a Cronbach’s $\alpha$ of 0.76 in a study that looked at the relationship between the effects of breast cancer risk counseling on perceived risk and cancer worry in a cohort of African American women. Cohen et al. (2003) reported an adequate internal reliability (Cronbach’s $\alpha = 0.71$) in a population of prostate cancer-specific worry.
McCaul et al. (1998) was the only study that investigated test-retest reliability. McCaul and colleagues sought to investigate the day-to-day thoughts and worries about women with and without a family history of breast cancer. McCaul et al. (1998) reported a test-retest of \( r = 0.61 \) across a one month interval and a test-retest of \( r = 0.58 \) across one year (p. 569). McCaul and colleagues made note that the test-retest reliability difference between the one month interval and one year interval was expected since the one year follow-ups were conducted via phone interviews. For the sake of efficiency, the CWS was converted to a three-item measure in the one year phone interview follow-ups.

Validity is the extent to which a test measure addresses what it is intended to measure. Specifically, validity is evidence for an inference made about a test score and it is a scientific inquiry into test scores (Murphy & Davidshofer, 2005). Murphy and Davidshofer (2005) recognized numerous ways of classifying validity. Researchers classify validity as content validity, construct validity, predictive validity, and concurrent validity.

In assessing the construct validity of cancer worry, it was important to determine whether test scores for the CWS provide a good measure of the cancer worry construct based on its hypothesized relationship and lack of relationship with test scores derived from measures of other constructs. In operationalizing a variety of cancer worry related constructs, Murphy and Davidshofer (2005) noted the importance of identifying (a) behaviors that relate to cancer worry and (b) constructs related to (i.e., convergent validity) and not related to (i.e., discriminant validity) the construct of interest.

Currently, there is little research on the CWS as it relates to other measures. Rhee et al. (2006) incorporated the CWS in validating the Skin Cancer Index (SCI), a disease specific quality of life (QoL) measure. In this study, convergent validity was observed with a significant correlation between the SCI measure and the CWS (\( r = -0.531, p < .001 \)). These results demonstrated that the better their QoL, the less worry participants had about cancer. At the most basic level, researchers need to correlate the CWS test scores with test scores from other measures of theoretically related and theoretically unrelated constructs in order to assess the measure’s validity.

Another important aspect to take into consideration is the lack of literature on the factor analysis of the CWS for English and Spanish speaking Hispanic Americans. In applied research, factor analysis is most commonly used in psychometric evaluations of item testing.
instruments (Brown, 2006). The two main types of analyses based on the common factor model (concepts of factor analysis originate from common factor model) are exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). There is currently little to no literature that investigates the factor analysis of the CWS in the Hispanic-American population. This research study adds to the literature on the CWS in this population.

Confirmatory factor analysis (CFA) represents a theory-driven approach to testing the a priori factor structure and goodness-of-fit between competing models. However, more robust investigations of measurement properties involve making comparisons across demographic groups. This ensures that, regardless of group characteristics, these properties are retained (Byrne, 2006). The statistical method used to test measurement and structural invariance across groups is multi-group CFA. Byrne (2006) noted that “in seeking evidence of multi-group invariance, researchers are typically interested in finding the answer to the following question(s): do the items composing a particular measuring instrument operate equivalently across different populations (e.g., gender, age, ability, culture)? In order words, is the measurement model group-invariant?” (p. 225). In order to investigate the invariance of the CWS across the English and Spanish versions, this study performed multi-group confirmatory analysis (CFA) to determine if the measurement model of one factor structure held for the English and the Spanish versions of the CWS.

The objective of exploratory factor analysis (EFA) is to evaluate the dimensionality of a set of indicators (e.g., items in a questionnaire) by revealing the smallest of factors and establishing their correlations (Brown, 2006). The researcher/investigator has no expectation of the nature or number of variables/factors involved. It allows the investigator the opportunity to explore the dimension(s) of a set of indicators in order to generate a model from latent constructs often represented in the items of the questionnaire (Williams, Brown, & Onsman, 2010). This research study performed an EFA of the CWS in a group of English or Spanish speaking Hispanic-American women in order to confirm the factor structure of the measurement model established in previous samples of the CWS.

**Summation Scores of the CWS**

As previously stated, the CWS was first informally introduced when Lerman and colleagues assessed the psychological and behavioral implications of abnormal mammogram
results. According to Lerman and colleagues, the measure items “were forced-choice, with responses given on three- to five-point Likert scales – for example, ranging from strongly agree to strongly disagree” (Lerman, Trock, Rimer, Jepson, et al., 1991, p. 260).

The exact wording of the CWS, as it currently exists in the psycho-oncology literature, is as follows:

During the past month, how often have you thought about your own chances of developing breast cancer?, During the past month, how often have you worried about your own chances of developing breast cancer?, During the past month, how often have thoughts about getting breast cancer affected your mood?, and During the past month, how often have thoughts about getting breast cancer affected your ability to perform your daily activities? (Lerman, Trock, Rimer, Jepson, et al., 1991, p. 260).

For each of the four-items, participants use a four-point response scale: 1= not at all, or rarely, 2= sometimes, 3= often and 4= almost all the time. The four items yield a score ranging from four to sixteen. The CWS range can be indicative of excessive breast cancer worry. However, no clinical cutoff points are currently available (Sweetman et al., 2006).

**Current Uses of the CWS in the Psycho-Oncology Literature**

In empirical studies that examine breast cancer worry and screening utilization, the primary method of assessment is the Cancer Worry Scale (CWS). The CWS was initially used to evaluate a woman’s psychological response to abnormal mammogram results and to note the effect on subsequent adherence (Lerman, Trock, Rimer, Boyce, et al., 1991). The CWS (Anderson, Smith, Meischke, Bowen, & Urban, 2003; Quillin, Bodurtha, McClish, & Wilson, 2011) has been utilized to assess risk notification in populations at high risk for cancer (e.g., a cohort of individuals undergoing genetic assessment due to family history of breast cancer). Andersen et al. (2003) used the CWS to assess worry about breast cancer risk and mammography use in a population of women with and without a family history. Cancer worry research has recently directed attention to worry related to cancer reoccurrence in cancer survivors. For example, Burriss, Jacobsen, Loftus, and Andrykowski (2012) attempted to identify the relationship between performances of potential breast cancer recurrence risk reduction behaviors, breast cancer recurrence risk reduction beliefs and worry about breast cancer recurrence.
Use of the Cancer Worry Scale in Heterogeneous Populations

Despite the use of the CWS in genetic counseling research, cancer screening behavior, cancer risks communication approaches, and cancer survivors post-treatment, it is a concern that to date, very few studies have examined the CWS’s psychometric properties in more heterogeneous populations (Andersen et al., 2003; Hopwood et al., 2001). More specifically, there are few studies that utilize the CWS to systematically examine breast cancer worry in Hispanic Americans. Furthermore, the literature reveals that there are few studies that assess the psychometric properties of the CWS in this minority group. The lack of proper psychometric evaluations of the CWS is also evident in the English and the Spanish versions of the measure.

This issue is important to evaluate when one considers the Spanish speaking community that exists in the United States. Language is an important and necessary part of patient communication within the healthcare system. In hopes of decreasing language barriers, the research community is now utilizing translated and adapted measures such as the CWS. When assessing a translated measure, it is necessary to consider some important information. This information includes ensuring that the measure continues to assess the same emotional construct or characteristic, and that the test content remains the same - all while being vigilant of culture and language sensitivity. Lastly, the translated measure has to have continued validity and usefulness in the new community (Geisinger, 1994). A valid measure for this population is important for health and psycho-oncology research as it helps evaluate Hispanic-American women’s psychological responses to breast cancer worry and subsequent adherence to screening.

The Spanish version of the CWS necessitates the re-establishment of reliability and validity. Geisinger (1994) reported that any time a test is altered and adapted for use in a culturally and linguistically different population, the “test adapter needs to demonstrate that the instrument continues to assess the same qualities with the same degree of [consistency] in the new population” (p. 308).

Earlier one established that the CWS, as a measure of cancer-specific worry, reported acceptable to good reliability (Brain et al., 1999). Additionally, an exhaustive search of the cancer worry literature yielded several studies that reported acceptable to good reliability for
the Spanish version of the CWS. For example, Cabrera, Blanco, Yague, and Zabalegui (2010) reported an internal consistency Cronbach’s $\alpha$ of .84 for the total scale and test-retest reliability, $r = 0.75, p < .001$. Two additional studies from a cohort of Spaniard women reported similar internal consistencies with a Cronbach’s $\alpha$ of .84 (Costa-Requena, Rodriguez, Fernandez, Palomera, & Gil, 2011) and a Cronbach’s $\alpha$ of .84 (Cabrera, Zabalegui, & Blanco, 2011). Furthermore, Cabrera and colleagues also reported a test-retest reliability, $r = .77$.

Despite the reliability findings for the Spanish version of the CWS, no validity analyses were reported in the aforementioned studies (Cabrera et al., 2010; Cabrera et al., 2011; Costa-Requena et al., 2011). Additionally, there were no CWS studies that utilize the Spanish version of the measure in the Hispanic-American population. In a heterogeneous group such as the United States, cross-cultural application (e.g., cultures within the United States and language preferences within the United States) invariance of the measure is needed.
CHAPTER 2

METHOD

This section describes the number and type of individuals that participated in the study. It also describes the materials used and measures that were included, as well as the procedure that was used.

PARTICIPANTS

A total of 503 Hispanic-American women were recruited from San Diego County during the time-span of October 2007 to February 2008. Participants were recruited from various community-based sites such as churches, health-fairs, PTAs, post-office branches, and through word of mouth by recruitment staff and students. In order to participate in the study a woman had to be at least 18 years of age, self-identify as Hispanic-American, be a resident of San Diego, speak English and/or Spanish, and be competent to give informed consent.

Of the 503 women, 59% ($n = 297$) emigrated from Mexico, 34% ($n = 171$) were born in the United States and 7% ($n = 20$) emigrated from different parts of Latin American, including Colombia, Ecuador, El Salvador, Nicaragua, Honduras, and Puerto Rico. These women were between 18-80 years of age ($M = 38.2$). Half of the women ($n = 252$) reported a preference for materials and questionnaires in English, while the other half ($n = 251$) reported a Spanish-language preference and completed questionnaires in Spanish.

MEASURES

All participants completed a battery of self-report questionnaires. A total of 14 measures were included in the packet, but only the following were relevant for this study: (a) The Cancer Worry Chart was administered in either English or Spanish language. It is a single-item measure that assesses a participant’s concern for cancer. (b) The CWS was administered in either English or Spanish. It is a four-item self-report measure used to assess
the frequency of worry about cancer risk and the impact of cancer worry on daily activities.
(c) The MacArthur Scale of Subjective Social Status was administered in either English or Spanish. It is a two-part pictorial format measure that reflects social standing in the community and the United States. (d) The Patient Health Questionnaire-9 (PHQ-9) was administered in either English or Spanish. It is a nine-item self-report measure that assesses depression on a four-point scale (from 0 = not at all to 3 = nearly every day). Total scores range from 0-27 with higher scores denoting a greater endorsement of depressive symptoms and scores ≥ 10 indicating that the respondent may be depressed. (e) The Personal Health Survey was administered in either English or Spanish. It is a survey that inquires about a participant’s demographic information including personal and family health.

PROCEDURES

Seven bilingual women (four Mexican-American, two White-American and one African-American) collected the data from October 2007 through February 2008. All data collectors were IRB- and HIPAA-certified through the University of California, San Diego (UCSD) online tutorials. The UCSD research team trained the data collectors in survey data collection methods (e.g., practices, procedures, protocol for screening for eligibility, confidentiality, informed consent procedures, reliable and thorough data collection, and reading of standardized scales to participants if needed).

Recruiters invited participants to partake in the study by explaining that it involved completing surveys that were frequently used in clinical health and research settings. Each participant was given the option of having the surveys and consent forms read to them in English or Spanish, or they could fill out the forms themselves. The welcome form, consent form, data collection, and subsequent questions took approximately one hour to complete. The process took about two hours to complete for participants who elected to have the interviewer read the materials aloud. Each participant was offered refreshments and compensated with twenty dollars ($20.00) for her contribution and time. Additionally, the interviews took place at a convenient location, (e.g., homes, community center, place of worship, or work environment).
DATA ANALYSES OBJECTIVES AND OVERVIEW

Objective 1: Examine the Reliability of the CWS in a Hispanic-American Population

Reliability was established for the CWS in a group of Hispanic-American women with either an English language preference or a Spanish language preference. The internal consistency method estimated the reliability of the CWS based on the four items of the measure and the average inter-correlation among the four items. These two factors are combined in the following formula to determine the reliability of a measure (Murphy & Davidshofer, 2005):

\[ R_{xx} = \frac{k(r_{ij})}{1 + (k-1)(r_{ij})} \]

Objective 2: Examine the Invariance of the CWS in a Hispanic-American Population

In order to investigate the equivalence of the CWS across English and Spanish speaking Hispanic-American women in the United States, (i.e., does the CWS measure operate the same across different language preference groups?) a multiple group confirmatory factor analysis (CFA) was conducted.

A multiple group CFA entailed a series of steps that began with a baseline model. Byrne (2008) described this process as the “determination of a well-fit multiple group baseline model for which sets of parameters are put to the test of equality in a logically ordered and increasingly restrictive fashion” (p. 872). The first step in examining configural invariance was to fit the factor solution to the data for the English and Spanish language preference sub-groups. This model was set at “equal form,” meaning that the factor parameters and pattern of indicator-factor loadings were the same across groups. In other words, testing for cross-group equivalence required that the factor loadings be freely estimated such that no equality constraints were imposed on the parameter. The configural invariance model, which was the least restrictive, tested whether English and Spanish language preference sub-groups had the same factor structure across groups. If the data supported the same factor loading pattern across the groups, then the baseline model was compared to a more constrained model, the metric invariance model.
The metric invariance model, which was more restrictive, tested whether each item on the CWS loaded equally on the same factor for both English and Spanish language preference sub-groups. Should the metric invariance model fit well, then regardless of language, the associations between each item and the overall worry factor were considered the same. The metric invariance model would then be compared to the baseline model. If this comparison demonstrated improved fit, then it was determined that the metric invariance model fit the data best, and one would proceed with a further restrictive model.

The factor variance invariance model, which was the most restrictive, tested whether the English and Spanish preference sub-groups had equivalent factor variability. If through the process of the $\chi^2$ difference test, one determined that the factor variance invariance model fit the data better than the metric invariance model, this would indicate that each language sub-group has the same range of scores.

Since the interpretation of model fit in SEM is not without some level of controversy, several indices of fit were also utilized. It was important to review Mardia’s coefficient as it provided information regarding multivariate non-normality. Data that departs from multivariate normality can inflate the $\chi^2$ maximum likelihood ratio. Tanaka (1993) determined that chi-square ($\chi^2$) may be insufficient in establishing model fit for numerous reasons, one of the reasons being that $\chi^2$ was heavily influenced by sample size. Due to these limitations, many researchers (Hoyle, 2000; Tanaka, 1993) have suggested using multiple measures of model fit. In this research study, model fit for the data was determined by the use of both statistical $\chi^2$ difference and the following descriptive indices: (a) The Comparative Fit Index (CFI) in which values greater than .93 indicated reasonable model fit (Bentler, 1990). (b) The Root Mean Square Error of Approximation RMSEA (Steiger, 1990) in which values less than .08 indicated reasonable model fit. (c) Standardized Root Mean Square Residual SRMR (Hu & Bentler, 1999) in which values less than .05 indicated reasonable model fit. A model was determined to fit well if two of the three criteria were met.

Exploratory factor analysis (EFA) was utilized as a follow-up to the CFA of the CWS in a group English and Spanish speaking Hispanic-American women. Typically, EFA is used early in the process of scale development and construct validation as a means to establish the number of latent constructs and the underlying factor structure of a measure. For this
research study, it was important to reassess the EFA of the CWS to confirm the replication of a one-factor structure in the English and Spanish speaking Hispanic-American female sample. Brown (2006) explained EFA as “a way to evaluate the dimensionality of a set of multiple indicators (e.g., items from the questionnaire) by uncovering the smallest number of interpretable factors needed to explain the correlation among them” (p. 20). In other words, EFA allows the researcher the ability to explore the main dimension(s) in order to generate a theory or model from a set of latent constructs often represented by a set of indicators/observed measures (Williams et al., 2010). Additionally, no a priori restrictions are placed on the patterns of relationships between the indicators/observed measures and latent variables.

The procedural aspects of EFA included: (a) Utilization of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett’s Test of Sphericity to assess the suitability of the respondent data for factor analysis. (b) Use of estimation methods such as principal axis factoring (PFA) to estimate the common factor model. PFA accounts for the maximum available covariance among variables. The results of this initial analysis were used to determine the appropriate number of factors to be extracted (Brown, 2006). (c) Once the number of factors were determined, the extracted factors were rotated - via oblique rotation - to foster their interpretability (i.e., the rotation allowed the researcher the ability to note the correlation between each observed measure/variable and factor). Note that the rotation(s) did not apply to the CWS as this measure is a one-factor solution (Brown, 2006; Williams et al., 2010).

Objective 3: Examine Convergent Validity of the CWS in a Hispanic-American Population

Convergent validity (sub-set of construct validity) of the English and the Spanish language preference sub-groups of the CWS in a Hispanic-American female population was established. First it was examined for the overall group and then separately for each language sub-group. A significant association between constructs and construct behaviors support convergent validity because measures of constructs that theoretically should be related to each other are in fact, observed to be related to each other (Trochim & Donnelly, 2008). In order to assess the degree in which two measures are related to each other, the statistical measure of correlation coefficient was utilized. The first pattern of correlation assessed was
between the CWS and the Cancer Worry Chart (CWC). The CWC is a one-item measure that assessed concern about cancer. Previous research indicated a moderate significant correlation between the two measures (Gramling, Anthony, Frierson, & Bowen, 2007). This research study assessed whether a similar correlation existed in a Hispanic-American population female population.

Literature on cancer-related constructs suggested that the Self-Regulation Model of Health Behavior was important in understanding breast cancer screening behaviors. In this model, cancer worry was viewed as the emotional aspect to screening, similar to depression or anxiety. A correlation of the CWS and the Patient Health Questionnaire-9 (PHQ-9), a measure for depression was assessed. Furthermore, the correlation of the (PHQ-9) minus the item that assessed death or harm to oneself was assessed for this Hispanic-American population.

Objective 4: Examine Discriminant Validity of the CWS in a Hispanic-American Population

Discriminant validity (sub-set of construct validity) of the English and Spanish versions of the CWS in a Hispanic-American population was established. First it was examined for the overall group and then separately for each language sub-group. Discriminant validity finds little to no relationship to measures of theoretically unrelated constructs. A correlation of the CWS and the MacArthur Scale of Subjective Social Status (SSS) was assessed. The MacArthur Scale of Subjective Social Status was developed to capture a sense of social status across socioeconomic indicators. In a pictorial format, the measure is represented in the “social ladder” in which a participant placed an “X” on the ladder rung that he or she felt they stood (Adler, Epel, Castellazzon, & Ickovics, 2000). Although there is growing literature that links socioeconomic status and health, discriminant validity was hypothesized to be present (no significant correlation), as cancer worry alone is unrelated to social status (as measured in the MacArthur Scale of Subjective Social Status).

Objective 5: Provide Summary Statistics of the CWS in a Hispanic-American Population

Summary statistics such as means, standard deviations, and ranges for the English and the Spanish language preference sub-groups of the CWS in a population of Hispanic-
American women were examined using IBM SPSS Statistics 22. Summary statistics of the two language sub-groups were compared.
CHAPTER 3

RESULTS

OBJECTIVE 1: EXAMINE THE RELIABILITY OF THE CWS IN A HISPANIC-AMERICAN POPULATION

Cronbach’s alphas were calculated for the CWS in a sample of Hispanic-American women for the overall group and for its English and Spanish language preference sub-groups. The measure yield an acceptable level of internal consistency for the overall group as determined by a Cronbach’s alpha of .83. Additionally, the CWS in this sample yield a strong correlation as determined by Cronbach’s alpha of .80 for the English language preference sub-group and Cronbach’s alpha of .84 for the Spanish language preference sub-group of the CWS.

OBJECTIVE 2: EXAMINE THE INVARIANCE OF THE CWS IN A HISPANIC-AMERICAN POPULATION

The adequacy of the one-factor solution for the CWS in Hispanic-American women in the overall group and each language preference sub-group was tested via a multiple group confirmatory factor analysis (CFA). A multiple group CFA was performed to test a one-factor measurement model of the CWS in the multivariate software, EQS. In this model, the latent variable of worry was indicated by four observed variables (i.e., the responses to the four items on the CWS).

A one-factor baseline model for Hispanic-American women in the overall group was tested using CFA. This one-factor model did not fit statistically $\chi^2 [2, N = 495] = 161.23, p < .001$, and it did not fit well descriptively (CFI = .84, RMSEA = .40, SRMR = .11). Furthermore, multivariate kurtosis was found with Mardia’s Coefficient estimate to be 25.53. Standardized factor loadings were moderate to large and statistically significant for worry (with values ranging from .51 to .94).
A one-factor baseline model for Hispanic-American women with an English language preference was tested using CFA. Data from the English language preference sub-group did not fit the one-factor model statistically $\chi^2 [2, N = 248] = 74.78, p < .001$, and did not fit well descriptively (CFI = .86, RMSEA = .38, SRMR = .13). Multivariate kurtosis was found with Mardia’s Coefficient estimate to be 29.08. Standardized factor loadings were moderate to large and statistically significant for worry (with values ranging from .32 to .96).

Furthermore, a one-factor baseline model for Hispanic-American women with a Spanish language preference showed similar results. Data from the Spanish language preference sub-group did not fit the one-factor model statistically $\chi^2 [2, N = 247] = 61.59, p < .001$, and it did not fit well descriptively (CFI = 0.87, RMSEA = 0.35, SRMR = 0.08). Furthermore, multivariate kurtosis was found with Mardia’s Coefficient estimate to be 29.08. Standardized factor loadings were large and statistically significant for worry (with values ranging from .65 to .89).

The aforementioned results did not establish configural invariance across Hispanic-American women in the overall group nor did they establish configural invariance for Hispanic-American women with either an English or Spanish language preference. For this reason evaluation of more restrictive models was discontinued. Tables 2 and 3 contain a summary of the CFA results.

An Exploratory Factor Analysis (EFA) using principal axis factoring was conducted to explore the dimensionality of the four-item CWS for Hispanic-American women in the overall group and each language preference sub-group. The variance accounted for by the solution and the interpretability of the factor was evaluated to determine the plausibility of the factor structure.

An EFA of the CWS suggested that a one-factor solution best explained the data for the Hispanic-American women in the overall group (i.e., women with an English and Spanish language preference). The variance explained by the solution was 56.09%. Using the factor matrix for interpretation, the four items of the CWS loaded on the component (values ranged from .63 to .87).

A one-factor solution best explained the data for each language preference sub-group. Hispanic-American women with an English language preference accounted for 53.66% of the explained variance. Using the factor matrix for interpretation, the four items of the CWS
loaded on the component (values ranged from .44 to .90). Additionally, a one-factor solution best explained the data for Hispanic-American women with a Spanish language preference. The variance explained by the solution was 57.92%. Using the factor matrix for interpretation, the four items of the CWS loaded on the component (values ranged from .72 to .85). Table 4 contains a summary of the EFA results.

**OBJECTIVE 3: EXAMINE CONVERGENT VALIDITY OF THE CWS IN A HISPANIC-AMERICAN POPULATION**

Convergent validity (sub-set of construct validity) of the CWS in Hispanic-American women was assessed with other measurements for the overall group, as well as assessed for the English and the Spanish language sub-groups. Spearman’s rank-order correlation was utilized to calculate associations between the CWS and the Cancer Worry Chart (CWC). A preliminary analysis showed the relationship was monotonic, as assessed by visual inspection of a scatterplot. There was a positive significant correlation between the CWS and the CWC for the overall group, \( r_s (500) = .61, p < .001 \), as well as for the English language version, \( r_s (249) = .64, p < .001 \), and for the Spanish language version, \( r_s (249) = .60, p < .001 \).

Spearman’s rank correlation coefficient was utilized to calculate associations between the CWS and the Patient Health Questionnaire (PHQ-9). There was a significant, yet low correlation between the CWS and PHQ-9 for the overall group, \( r_s (499) = .20, p < .001 \), as well as for the English language version, \( r_s (249) = .23, p < .001 \), and for the Spanish language version, \( r_s (248) = .18, p < .05 \).

Spearman’s rank correlation coefficient was utilized to analyze the correlation between the CWS and the Patient Health Questionnaire (PHQ-9) minus the item that assessed death or harm to oneself. There was a significant, yet low correlation between the CWS and PHQ-9 for the overall group, \( r_s (478) = .17, p < .001 \), as well as for the English language version, \( r_s (242) = .22, p < .001 \), and for the Spanish language version, \( r_s (234) = .18, p < .05 \).

**OBJECTIVE 4: EXAMINE DISCRIMINANT VALIDITY OF THE CWS IN A HISPANIC-AMERICAN POPULATION**

Discriminant validity (sub-set of construct validity) of the CWS in Hispanic-American women was assessed for the overall group, as well as assessed for the English and
the Spanish language preference sub-groups. Spearman’s rank correlation was utilized to calculate associations between the CWS and the two ladders of MacArthur Scale of Subjective Social Status. One ladder was linked to one’s standing in the community (SSS1), and the other ladder was linked to socioeconomic status indicators (SSS2). There was no significant correlation between CWS and SSS1 for the overall group \( r_s(502) = -0.04, p = .42 \), as well as for the English language version, \( r_s(251) = 0.04, p = .52 \), and for the Spanish language version, \( r_s(251) = -0.10, p = 0.14 \). In addition, there was no significant correlation between CWS and SSS2 for the overall group \( r_s(503) = -0.06, p = .18 \), as well as for the English language version, \( r_s(251) = 0.04, p = .58 \), and for the Spanish language version, \( r_s(251) = -0.12, p = .07 \).

**OBJECTIVE 5: PROVIDE DESCRIPTIVE STATISTICS AND COMPARE CWS SCORES ACROSS SUB-GROUPS**

The mean and standard deviation for each item of the English and the Spanish language preference sub-group of the CWS are reported in Table 1. The sample characteristics including socio-economic indicators of the English and the Spanish language preference sub-groups of the CWS are reported in Table 7.

The Mann-Whitney U test (also called the Wilcoxon-Mann-Whitney test) was utilized as a non-parametric alternative to independent-samples t-test because this sample failed assumptions of the t-test. The Mann-Whitney U test was run to determine if there was a difference in the CWS scores of the English and the Spanish language preferences sub-groups. Distributions of the CWS scores for the English and the Spanish language preference sub-groups were not normally distributed, as assessed by visual inspection. The CWS score was statistically significant and higher for the Spanish language preference sub-group (mean rank = 276.61) than in the English language preference sub-group (mean rank = 226.39), \( U = 25199.00, z = -3.98, p < .001 \).
CHAPTER 4

DISCUSSION

The CWS is utilized in research related to cancer screening behaviors, cancer risk counseling research, and cancer survivor post-treatment. However, few studies have applied the CWS to systematically examine cancer worry in the Hispanic-American population. Moreover, fewer studies have examined the CWS’s reliability and validity in this population. Overall, the CWS in this research study had good internal consistency for all the Hispanic-American women surveyed and for those with either an English or Spanish language preference. Additionally, internal consistency coefficients yielded similar results for the English and the Spanish groups. To date, only three other studies have examined the psychometrics properties of the CWS in a Spanish speaking population. Results from this study remained consistent with those studies (Cabrera et al., 2010; Cabrera et al., 2011; Costa-Requena et al., 2011).

In applied research, factor analysis is commonly used in psychometric evaluations. Brown (2006) informed that factor analysis includes construct validation and data reduction. Additionally, Brown (2006) stated that such statistical procedures emerged from common factor model which proposed “that each indicator/observed variable in a set of observed measures is a linear function of one or more common factors and one unique factor. Thus factor analysis partitions the variance of each indicator/observed variable into two parts, common variance and unique variance” (p. 13). Two types of analyses based on the common factor model are exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Presently, this research study was the first to address EFA and CFA in the CWS. Furthermore, this research study was the first to extend factor analysis of the CWS in the Hispanic-American female population.

Confirmatory factor analysis (CFA) was utilized to examine the invariance/equivalence of the CWS in Hispanic-American women with either an English or
Spanish language preference. Brown (2006) stated, “a key strength of CFA is the ability to determine how well measurement models generalize across groups of individuals. Measurement invariance evaluation is an important aspect of test development if it is intended to be administered to heterogeneous populations” (p. 4). This said, multiple group CFA is a widely use method to test measurement invariance and extends its utility to detect invariance for test items (French & Finch, 2008).

On account of the CFA results, which indicated little support for a one-factor structure of the CWS in Hispanic-American women with English language preference, EFA was utilized to explore the dimensionality of the measure and to identify the nature of the worry construct as it was represented in this CWS population sample. EFA allows the researcher the opportunity to see the magnitude of the factor loadings that cannot be seen in CFA, and as a result, one is able to assess what factor structure emerged from the Hispanic-American sample utilized in this research study.

EFA analyses did provide support for a one-factor structure/solution for the overall group and for the English and the Spanish language preference sub-groups. The one-factor structure/solution extracted for the overall group and for each language preference sub-group explained more than half (50%) of the variance in the model(s) containing the observed variables represented in the CWS. Some researchers (Velicer, Peacock, & Jackson, 1982) have recommended that, in order to deem a variable salient for use in EFA, the item factor loadings need to be greater than .45. Guadagnoli and Velicer (1988) augmented the aforementioned recommendation by informing that variable saturation with the factors, indicated by the size of the factor loadings, along with the total sample size and the number of observed indicator variables (i.e., items of a measure) per factor were important in determining the stability of the factor solution (p. 271). Per the recommendations of Guadagnoli and Velicer (1988), each item of the CWS loaded well on the worry component for the overall group and for each language preference sub-group. This is particularly true for the Spanish language preference sub-group. Table 4 contains a summary of the results from this analysis. Presently, this portion of the research study was the first to address the structure and potential utility of the worry factor underlying the CWS in a Hispanic-American population.
Literature on psychometric evaluation informed that there have been examples of *exploratively* obtained factor structures that could not be confirmed by CFA (Borkenau & Ostendorf, 1990; Church & Burke, 1994; Vassend & Skondal, 1997). One explanation for this discrepancy was presented by Van de Vijver & Leung (1997) in which they informed that the measurement structure of psychological scales/tests have been changed through translation. However, this discrepancy is applicable to cross-cultural studies in which there are cultural differences between studies. For this reason, the translation argument is not plausible for this sample.

Another possible reason for the statistical discrepancy between CFA results and EFA results in the CWS for Hispanic-American women is the difference in conservatism of the two factor analyses. CFA has more stringent criterion than EFA. To reiterate, EFA is primarily a data-driven technique and thus allows the researcher the freedom to dictate the number of factors he/she wishes to keep in the model. Conversely, CFA is theory-driven and the researcher has to specify the number of factors in advance. The lack of model fit of an EFA-based model in the CFA seems to suggest that CFA may be too conservative (Van Prooijen & Van Der Kloot, 2001). Relatively small deviations from the model can lead to model rejection. Additionally, it is important to note that EFA does not give an indication of overall model fit like CFA. In this sample, the one-factor structure/model in EFA appeared permissible given that in EFA there are no descriptive indices for overall model fit. The four observed indicator variables (i.e., the items of the CWS) were correlated enough to suggest a one-factor solution in EFA, but there is still some correlation among the items that the factor cannot explain.

The CWS is a four-item measure that reported good reliability in this sample of Hispanic-American women. When a multiple group CFA was conducted, poor model fit was encountered in this sample. There could be some extra correlation between sub-sets of these items that could indicate that the CWS is not a single-factor model. In factor analysis each observed indicator variable has an error term or residual associated with it that expresses the proportion of variance in the variable that is not explained by the factor(s). Some researchers suggest correlating error terms (to account for more co-variation among the items) in factor analysis when there is little to no support for overall model fit. Additionally, correlated error terms in measurement models represent the hypothesis that the unique variances of the
associated indicators overlap. However, this is not feasible for the CWS because it is a simple four-item measure – if the measure had more items, one could end up with multiple factors.

Despite the differential CFA and EFA results for the CWS in this sample of Hispanic-American women, this research study provides some factor analytic perspective. The EFA provides a direct picture of dimensionality and confirms the adequacy of the CWS items for the overall group and for each language preference sub-group. Furthermore, review of the CFA results informs that model fit for the CWS in this sample of Hispanic-American women was statistically rejected for the overall group and each language preference sub-group, but leniency on some of the thresholds for the descriptive indices allowed the sub-group data to be permissible for model fit. The CFA for Spanish language preference sub-group has a CFI and SRMR of .87 and .08, respectively. Earlier it was mentioned that several researchers (Hoyle, 2000; Tanaka, 1993) suggested the following information for the descriptive indices: (a) a CFI in which values greater than .90 indicated plausible model fit and (b) SRMR (Hu & Bentler, 1999) in which values less than .08 indicated plausible model fit. A model was determined to fit well if two of three criteria were met. Following these “liberal” thresholds allows for plausible model fit for the Spanish language preference sub-group. This means that the one-factor model structure of the CWS in this sample of Hispanic-American women may be plausible.

Construct validity was assessed for cancer worry to determine whether the test scores of the CWS provided an accurate representation of the construct of worry. DeVellis (2012) proposed that both new and existing measures should be subject to various validity tests including construct validity (and its sub-sets of convergent validity and discriminant validity). In this research study, convergent validity was supported for the CWS. The CWS and the CWC were significantly and moderately correlated for Hispanic-American women in the overall group and for each language preference sub-group. Previous research revealed a similar correlation between the CWS and CWC (Gramling et al., 2007). As previously mentioned, evidence for convergent validity is demonstrated when measures of theoretically similar constructs are found to be significant and correlated at a higher magnitude than the discriminant validity correlations. This is true for the CWC and the CWS as both are measures for the cancer worry construct. Table 5 contains a correlation(s) summary of these
results. Further review of the relationship between the CWC and each item of the CWS revealed a moderate correlation for two of the items of the CWS in the overall group and in each language preference sub-group. Table 6 contains a summary of these results.

Since the CWS and the CWC were significantly and moderately correlated, one could argue that using both measures in a clinical/medical setting is redundant – which begs the question, can you utilize the CWC in lieu of the CWS? The CWC has its advantages. It is known for its brevity and ease of use in a medical provider’s office environment, however, unlike the CWS, it does not assess the affect cancer worry has on health-related functioning. Although both measures assess cancer worry, the CWS takes into account a person’s emotional and daily functioning. The additional information acquired from utilizing the CWS allows for a medical provider to link an individual to additional support.

Additionally, a correlation of the CWS and the PHQ-9 (with and without the item that assessed suicidality) was assessed for convergent validity. These correlations also showed a significant yet low correlation for Hispanic-American women in the overall group and for each language sub-group. Worry and depression, as measured by the CWS and PHQ-9, are instinctive states of emotion that derive from an individual’s circumstance(s) and mood. A significant correlation was expected since constructs of worry and depression contribute to an individual’s emotional functioning and psychological distress.

Additionally, this study was able to find support for discriminant validity. The CWS, a measure of worry about cancer risk was hypothesized to have low relatability to the MacArthur Scale of Subjective Social Status since this measure reflects social standing in an individual’s community and the United States. More specifically, this measure was developed to capture a sense of social status across socioeconomic (SES) indicators (e.g., income, occupation, and education). Although there is literature that links socioeconomic status and health indicators (e.g., higher mortality, poor self-rated health, and emotional distress) (Adler et al., 2000), the MacArthur Scale of Subjective Social Status and the CWS assess two distinct constructs. In other words, because the constructs of worry and social status are, in theory, unrelated, low correlations between measures of these two constructs provide evidence for discriminant validity. There was a low non-significant correlation between the two measures for Hispanic-American women in the overall group and for each language preference sub-group.
In this sample, mean and standard deviation for each item of the CWS for the overall group and the English and Spanish language sub-groups were reported in Table 1. CWS scores revealed a full range of possible scores for each item. Hispanic-American women with a Spanish language preference had higher mean scores with less variance. A Mann-Whitney U test informed that for this group, Hispanic-American women with a Spanish language preference have a higher CWS score than the English language preference counterpart. This suggested that Hispanic-American women with a Spanish language preference had higher cancer worry than the English language counterpart.

This study had limitations. All participants surveyed were from San Diego County and the majority of the participants were of Mexican descent (59% were born in Mexico). This limited the ability to generalize the findings to Hispanic individuals of other ethnicities and cultures. Additionally, all participants surveyed were women. This further limited the generality of these finding. In order to maintain certainty of the psychometric properties and clinical implications of the CWS in Hispanic-American populations, future research is needed. It is important to further assess the CWS’s factor structure with Hispanic-American men (as the CWS is applicable to both sexes) and women of other ethnicities and countries of origin.

Overall, this study contributes to the literature on the development of the CWS, as well as sheds light on the measure’s psychometric properties among a Hispanic-American female population. Furthermore, this research study was the first to address CFA and EFA of the CWS in this population, of which provided some perspective on the measure’s factor-analytic status. Lastly, as with any analyses that rely on inferences drawn from statistical results, the CFA factor structure models did not provide an adequate fit in the English language preference sub-group, and thus the implication of this finding is to use caution when utilizing the CWS. Further statistical review of the CWS is required in order to establish a theoretically suitable and reliable method of measuring the construct of worry in a population of Hispanic-American women.
REFERENCES


Li, C. I., Malone, K. E., & Daling, J. R. (2003). Differences in breast cancer stage, treatment, and survival by race and ethnicity. *Archives of Internal Medicine, 1*, 49-56.


APPENDIX

TABLES AND FIGURE
| CWS item | Total Sample  
| (N = 495) | English  
| (n = 248) | Spanish  
| (n = 247) |
| --- | --- | --- | --- |
| Factor loadings | M (SD) | Factor loadings | M (SD) | Factor loadings | M (SD) |
| 1. During the past month, how often have you thought about your own chances of developing breast cancer? | .83 | 1.74 (.76) | .89 | 1.72 (.73) | .80 | 1.77 (.78) |
| 2. During the past month, how often have you worried about your own chances of developing breast cancer? | .94 | 1.75 (.79) | .96 | 1.63 (.72) | .89 | 1.86 (.85) |
| 3. During the past month, how often have thoughts about your chances of getting breast cancer affected your mood? | .61 | 1.42 (.70) | .56 | 1.23 (.53) | .67 | 1.60 (.80) |
| 4. During the past month, how often have thoughts about your chances of getting breast cancer affected your ability to perform daily activities? | .59 | 1.28 (.60) | .32 | 1.15 (.47) | .65 | 1.41 (.69) |
Table 2. Test Statistics from the Configural Invariance Models of the CWS in a Sample of Hispanic-American Women and for the English and the Spanish Language Sub-Groups

<table>
<thead>
<tr>
<th></th>
<th>Average Standardized Residual</th>
<th>$\chi^2$ (df)</th>
<th>p value of $\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sample</td>
<td>.049</td>
<td>161.23 (2)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>(N = 495)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>.047</td>
<td>74.78 (2)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>(n = 248)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td>.046</td>
<td>61.59 (2)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>(n = 247)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Goodness of Fit Indices for the CWS in a Sample of Hispanic-American Women and for the English and the Spanish Language Sub-Groups

<table>
<thead>
<tr>
<th></th>
<th>CFI</th>
<th>RMSEA (90% CI)</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sample</td>
<td>.84</td>
<td>.40 (.35-.45)</td>
<td>.11</td>
</tr>
<tr>
<td>(N = 495)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>.86</td>
<td>.38 (.31-.46)</td>
<td>.13</td>
</tr>
<tr>
<td>(n = 248)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td>.87</td>
<td>.35 (.28-.42)</td>
<td>.08</td>
</tr>
<tr>
<td>(n = 247)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. CFI = robust comparative fit index; SRMR = standardized root mean square residual; RMSEA = robust root mean square error of approximation.
Table 4. Summary of Exploratory Factor Analysis Results for the CWS in a Sample of Hispanic-American Women and for the English and the Spanish Language Sub-Groups

<table>
<thead>
<tr>
<th>CWS item</th>
<th>Total Sample (N = 495)</th>
<th>English (n = 248)</th>
<th>Spanish (n = 247)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor loadings</td>
<td>Factor loadings</td>
<td>Factor loadings</td>
</tr>
<tr>
<td>1. During the past month, how often have you thought about your own</td>
<td>.75</td>
<td>.83</td>
<td>.74</td>
</tr>
<tr>
<td>chances of developing breast cancer?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. During the past month, how often have you worried about your own</td>
<td>.87</td>
<td>.90</td>
<td>.85</td>
</tr>
<tr>
<td>chances of developing breast cancer?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. During the past month, how often have thoughts about your chances of</td>
<td>.73</td>
<td>.67</td>
<td>.74</td>
</tr>
<tr>
<td>getting breast cancer affected you mood?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. During the past month, how often have thoughts about your chances of</td>
<td>.63</td>
<td>.44</td>
<td>.72</td>
</tr>
<tr>
<td>getting breast cancer affected your ability to perform daily activities?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of Variance</td>
<td>56.09</td>
<td>53.66</td>
<td>57.92</td>
</tr>
</tbody>
</table>

Figure 1. One-factor model of cancer worry for the CWS.
### Table 5. Spearman’s Rank-Order Correlations ($r_s$) in a Sample of Hispanic-American Women and for the English and the Spanish Sub-Groups

<table>
<thead>
<tr>
<th>Total Sample</th>
<th>CWS Total Score</th>
<th>Cancer Worry Chart (CWC)</th>
<th>Patient Health Questionnaire (PHQ-9)</th>
<th>Patient Health Questionnaire minus the suicidality item (PHQ-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWS Total Score</td>
<td>1.00</td>
<td>.61**</td>
<td>.20**</td>
<td>.17**</td>
</tr>
<tr>
<td>English</td>
<td>CWS Total Score</td>
<td>1.00</td>
<td>.64**</td>
<td>.23**</td>
</tr>
<tr>
<td></td>
<td>Cancer Worry Chart (CWC)</td>
<td>.64**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patient Health Questionnaire (PHQ-9)</td>
<td>.23**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patient Health Questionnaire minus the suicidality item (PHQ-8)</td>
<td>.22**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td>CWS Total Score</td>
<td>1.00</td>
<td>.60**</td>
<td>.18*</td>
</tr>
<tr>
<td></td>
<td>Cancer Worry Chart (CWC)</td>
<td>.60**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patient Health Questionnaire (PHQ-9)</td>
<td>.18*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patient Health Questionnaire minus the suicidality item (PHQ-8)</td>
<td>.18*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: *p < .05  **p < .001*
Table 6. Spearman’s Rank-Order Correlations (rs) Between the CWS and the CWC in a Sample of Hispanic-American Women and for the English and the Spanish Sub-groups

<table>
<thead>
<tr>
<th>Cancer Worry Chart (CWC)</th>
<th>Total Sample</th>
<th>English</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. During the past month, how often have you thought about your own chances of developing breast cancer?</td>
<td>.59*</td>
<td>.60*</td>
<td>.58*</td>
</tr>
<tr>
<td>2. During the past month, how often have you worried about your own chances of developing breast cancer?</td>
<td>.60*</td>
<td>.63*</td>
<td>.57*</td>
</tr>
<tr>
<td>3. During the past month, how often have thoughts about your chances of getting breast cancer affected you mood?</td>
<td>.42*</td>
<td>.42*</td>
<td>.44*</td>
</tr>
<tr>
<td>4. During the past month, how often have thoughts about your chances of getting breast cancer affected your ability to perform daily activities?</td>
<td>.30*</td>
<td>.27*</td>
<td>.34*</td>
</tr>
</tbody>
</table>

Note: *p < .001
Table 7. Sample Characteristics

<table>
<thead>
<tr>
<th></th>
<th>English (n = 252)</th>
<th>Spanish (n = 251)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>36.22 (13.82)</td>
<td>40.17 (12.34)</td>
</tr>
<tr>
<td><strong>Education</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>32 (12.7%)</td>
<td>183 (73.0%)</td>
</tr>
<tr>
<td>High school/trade school</td>
<td>90 (35.7%)</td>
<td>43 (17.2%)</td>
</tr>
<tr>
<td>Some college/Associates degree</td>
<td>102 (40.4%)</td>
<td>13 (5.2%)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>23 (9.1%)</td>
<td>8 (3.2%)</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>5 (2.0%)</td>
<td>3 (1.2%)</td>
</tr>
<tr>
<td><strong>Employment Status</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>191 (75.8%)</td>
<td>102 (40.7%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>6 (2.4%)</td>
<td>22 (8.8%)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>16 (6.3%)</td>
<td>101 (40.2%)</td>
</tr>
<tr>
<td>Student/retired/disabled</td>
<td>39 (15.5%)</td>
<td>26 (10.4%)</td>
</tr>
<tr>
<td><strong>Marital Status</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>129 (51.2%)</td>
<td>136 (54.2%)</td>
</tr>
<tr>
<td>Divorced</td>
<td>23 (9.1%)</td>
<td>16 (6.4%)</td>
</tr>
<tr>
<td>Single</td>
<td>100 (39.8%)</td>
<td>99 (39.4%)</td>
</tr>
<tr>
<td><strong>Country of birth</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>161 (63.9%)</td>
<td>10 (4.0%)</td>
</tr>
<tr>
<td>Mexico</td>
<td>76 (30.2%)</td>
<td>221 (88.0%)</td>
</tr>
<tr>
<td>Other</td>
<td>15 (5.9%)</td>
<td>20 (8.0%)</td>
</tr>
</tbody>
</table>

*Note: *<sup>1</sup>*M (SD), *<sup>2</sup>*n (p)