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Cancer Health Literacy Test-30-Spanish (CHLT-30-DKspa), a new Spanish- language version of the Cancer Health Literacy Test (CHLT-30) for Spanish-speaking Latinos

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Abstract

Objective—Describe adaptation and initial validation of the Cancer Health Literacy Test (CHLT) for Spanish-speakers.

Methods—Cross-sectional field test of the CHLT Spanish version (CHLT-30-DKspa) among healthy Latinos in Louisiana. Diagonally Weighted Least Squares were used to confirm the factor structure. Item-Response Analysis using 2-parameter logistic estimates were used to identify questions that may require modification to avoid bias. Cronbach's alpha coefficients estimated scale internal consistency reliability. Analysis of variance was used to test for significant differences in CHLT-30-DKspa scores by gender, origin, age and education.

Results—Mean CHLT-30-DKspa score (N=400) was 17.13 (range 0 to 30; SD 6.65). Results confirmed a unidimensional structure ($X^2[405] = 461.55$, $p = .027$, CFI=.993; TLI=.992, RMSEA=.0180). Cronbach's alpha was 0.88. Items **Q1-High calorie** and **Q15-Tumor spread** had the lowest item-scale correlations (.148 and .288) and standardized factor loadings (.152 and .302). Items **Q1-High Calories**, **Q8-Palliative Care**, and **Q19-Smoking Risk** had the highest item-difficulty parameters (diff=1.12, 1.21, and 2.40).

Conclusions—Results generally supported the applicability of the CHLT-30-DKspa for Spanish-speaking healthy populations, with the exception of four items that need to be deleted or revised and further studied (Q1, Q8, Q15, and Q19).

Practical Implications—The CHLT-30-DKspa can be used to assess cancer health literacy among Spanish-speaking populations to advance research on cancer health literacy and outcomes.

Keywords

cancer health literacy; Latinos; Hispanics; psychometric evaluation; Spanish

Introduction

Latinos and Cancer Disparities

Latinos are the largest and fastest-growing minority population in the United States (U.S. Census Bureau, 2012) and the only population group with cancer as the leading cause of death, accounting for 21% of overall deaths (American Cancer Society-ACS-, 2012). Although prostate and breast cancer are the most commonly diagnosed cancers in U.S. Latinos, lung, colorectal, liver, and breast cancer are their leading causes of cancer death. Compared to non-Hispanic whites, Latinos, especially first-generation immigrants, have the highest incidence and mortality rates for gallbladder and liver (two-fold), stomach (more than double for women and 70% higher for men), and cervical (50% to 70% higher) cancers (ACS, 2012). These disparities are most likely the result of the higher prevalence of infectious agents, namely, hepatitis B virus, the bacterium *H. pylori*, and human papillomavirus (HPV). Furthermore, evidence suggests that increased acculturation is associated with higher cancer mortality rates (ACS, 2012); for example, cancer death rates during 1993-2003 were 22% higher among US-born Latinos than foreign-born Latinos (Singh & Hiatt, 2006).

Measures of Health Literacy and Cancer Health Literacy among Latinos

Health literacy is known to impact health behaviors, patient and provider rapport, patient compliance, and health outcomes. Specifically, low health literacy is associated with poorer health status, lower treatment compliance, increased visits to emergency rooms, and a decreased ability for the patient to understand their treatment and participate in decision making (U.S. Department of Health and Human Services, 2010; Berkman, Sheridan, Donahue, Halpern & Crotty, 2011; Sentell & Braun, 2012). A systematic review of research on health literacy among U.S. Latinos concluded that, in general, Spanish-speaking, less educated, and foreign-born Latinos had lower levels of health literacy when compared to Whites, African Americans, and English-speaking Latinos (Koskan, Friedman, Hilfinger & DeAnne, 2010). Furthermore, they found that Spanish-language instruments were rarely used; the most widely used measures of health literacy in Latino populations were the *Test of Functional Health Literacy in Adults* (TOFHLA) and its short version (S-TOFHLA) (Parker, Baker, Williams & Nurss, 1995), and the *Rapid Estimate of Adult Literacy in Medicine* (REALM) (Davis et al., 1991).

In addition to the need for further studies that explore the validity of health literacy measures among Spanish-speaking populations, other limitations of generic measures of health literacy, such as the TOFHLA and REALM have been found when applied to the assessment of disease-specific literacy. These generic measures tend to be less specific and fail to capture the breadth of disease-specific literacy for some diseases. For example, in the case of

cancer, one study found that although the S-TOFHLA measure indicated that participants demonstrated “adequate” comprehension of prostate cancer prevention, more in-depth discussions revealed participants’ limited understanding and literacy skills related to prostate cancer (Fridman & Dominick, 2009). Furthermore, a recent study of more than 1,000 cancer patients found that the REALM can be used as a measure of reading and pronunciation ability, but should not be used to make inferences about a person's level of health literacy because of the lack of coverage of important health literacy domains such as comprehension of printed materials, numeracy, and information seeking/navigation (Dumenci, Matsuyama, Kuhn, Perera & Siminoff, 2013). There is substantial evidence that health literacy has many domains that are disease-specific and that we need to assess patients’ management of specific chronic diseases (Gazmararian, Williams, Peel & Baker, 2003; Shaw, Armin, Torres, Orzech & Vivian, 2012; Heijmans, Waverijn, Rademakers, Van der Vaart & Rijken, 2015).

Thus, there is a need to develop disease-specific health literacy measures that account for differences in patients’ experiences with various health conditions and life circumstances that affect these illnesses (Berkman, Davis & McCormack, 2010). An individual's health literacy can vary, depending on the health condition for which it is assessed. For example “an individual may be health literate about diabetes, but health illiterate about cervical cancer.” (Helitzer, Hollis, Sanders & Roybal, 2012, p.2). In particular, cancer-specific health literacy instruments are lacking (William & Templin, 2013, p. 740).

We could find no definition of cancer health literacy (CHL) in the literature. Based on widely accepted definitions of health literacy (American Medical Association, 1999; Institute of Medicine, 2004; Zarcadoolas, Greer & Pleasant, 2006), we define CHL as the individual's capacity to seek out, comprehend, evaluate, and use basic information and services needed to make appropriate decisions regarding cancer prevention, diagnosis and treatment.

Even though, limited research has examined the intersection of health literacy and cancer (Evans et al., 2012), tools designed to measure CHL and related constructs are emerging. We identified eight CHL measures in the literature, three of which have been tested in Spanish-speaking women; five are specific to breast and/or cervical cancer.

The *Cancer Health Literacy Test* (CHLT) was developed to measure CHL and validated with non-Latino English-speaking cancer patients. The *Cancer Literacy Measure* (CLM-BCC) was developed to measure Latina women's knowledge, beliefs, attitudes, and emotions about breast and cervical cancer (BCC); the tool has been adapted for use with Mexican, Filipino, Uruguayan, and Navajo women (Buki, Yee, Weiterschan & Lehardy, in preparation). A version of the CLM-BCC in English was recently validated with African American women, resulting in a new tool, the *Cancer Literacy Measure for African Americans* (CLM-AA), which includes 60 items classified into 10 dimensions: breast/cervical cancer diagnosis, breast cancer screening embarrassing, protecting ones’ health, cancer burden, physician trust, cancer education interest, cancer risk perceptions, feeling healthy, breast cancer knowledge, and cervical cancer knowledge (Mayfield, 2014). The *Awareness and Beliefs about Cancer* measure (ABC) assesses awareness of symptoms and risks, perceived barriers to symptomatic presentation, and beliefs about cancer outcomes; it was applied and

validated with participants from six countries (Australia, Canada, Denmark, Norway, Sweden and the UK) (Simon et al., 2012). The *Cancer Message Literacy Test* (CMLT) includes two scales to assess comprehension of health messages related to cancer prevention and screening: the CMLT-*Listening* scale includes videos to assess understanding of spoken messages and the CMLT-*Reading* scale includes reading passages to assess understanding of written messages; validation of this measure included only English-speaking Latinos (Mazor, Roblin, Williams, Greene, et al., 2012). The *Cultural Cancer Screening Scale* (CCSS) includes 20 items measuring five factors associated with the following breast/cervical cancer screening behaviors and emotions: cancer screening fatalism, negative beliefs about health professionals, catastrophic disease expectations, and symptomatic and sociocultural deterrents; it has been validated for Anglo, African American and Latina women and is available in English and Spanish (Betancourt, Flynn, Riggs & Garberoglio, 2010). The *TALKDOC* assessment includes 109 items measuring three domains (knowledge, dispositions and communication skills) related to cervical cancer; the validation process included Latinos who were English-speaking (Helitzer, Hollis, Sanders & Roybal, 2012). The *Cervical Cancer Literacy Assessment Tool* (C-CLAT) includes 16 items measuring three domains (awareness, knowledge, and prevention/control) related to cervical cancer; it was validated with Latinas and is available in Spanish (William & Templin, 2013).

Limitations of these measures are that their testing has been restricted to English language versions only (CHLT, CMLT, CLM-AA, and the TALKDOC Assessment) or to a specific type of cancer and not cancer in general (CLM-BCC, CLM-AA, CCSS, C-CLAT, and the TALKDOC Assessment). Another limitation is that these measures focus on beliefs rather than health literacy (ABC, CLM-BCC, CLM-AA, CCSS, C-CLAT and the TALKDOC Assessment). Given these limitations, there is a need to identify a valid CHL measure for use among Spanish-speaking Latinos that can be applied with various types of cancers. Consequently, the primary objective of this study was to develop and test a tool to assess CHL among Latino Spanish speakers that is not restricted to a specific cancer (breast, colon, etc.) or a specific population (e.g., cancer patients, women). This study reports on the adaptation of the Cancer Health Literacy Tool-30 (CHLT-30) to create a new and adapted Spanish-language version of the instrument called the Cancer Health Literacy Survey-30 Spanish (CHLT-30-DKspa), and its initial validation among a general population of Spanish-speaking Latinos from New Orleans, LA.

Methods

We reviewed CHL tools described above and selected the one that had the most potential for successful adaptation among Spanish-speakers. We selected the CHLT-30 because of its broad content coverage; focus on measuring CHL; ease of administration (10-15 minutes) and scoring (total number of correct answers); reliability of its constructs (Cronbach's alpha internal consistency reliability of .88, McDonald's omega reliability of .89, 2-week test-retest reliability of .90, and 6-month test-retest reliability of .92), and its strong theoretical foundation and adaptability. The CHLT-30 is targeted to non-Latino cancer patients. We sought to assess its validity with a general population (not cancer patients) of Latino Spanish-speakers. Permission was requested and granted from the authors to use the CHLT-30, translate it into Spanish, and culturally adapt it. Although both scales of the

Cancer Message Literacy Test (CMLT-Listening and the CMLT-Reading) appeared appropriate, we decided against it because of limitations in study resources to translate the videos and reading passages to Spanish and the need for a computer and Internet connection for administration of this tool.

Instrument Translation and Pretesting

The CHLT-30 is a unidimensional 30-item instrument developed to measure CHL of cancer patients. It was validated with 1,306 non-Latino White (61.7%) and non-Latino Black (37.7%) English-speaking cancer patients, age 18 years or older (Dumenci et al., 2014). The CHLT-30 can be found as an appendix in Dumenci's publication. For this study, CHLT-30 items were translated into Spanish and back-translated, names of individuals (doctors, patients) included in the questions were substituted for common names in Spanish (e.g. patient Shirley B. Edward in item 2 was changed to Maria Hernandez), and all measures were converted to the metric system. In this report, we use the same item number and condensed label from the original study to refer to each item.

Two pretests were conducted before the field test of the CHLT-30, Spanish version (CHLT-30-DKspa) in the target population. First, the tool was translated to Spanish and pretested with five members of the Community Advisory Board (CAB) created for this project, who, after completing the tool, gave feedback question by question, about their understanding, answer choices and difficulties. The tool was then revised and the revised version was pretested with 15 Latino Spanish-speaking adult volunteers of different ages and educational levels. In this step, we identified and discussed with the respondents additional issues with the tool such as the organization of questions, font size, and questions/concepts that were difficult to understand.

Applying the same item numbers and labels used by Dumenci, the following changes were made to the CHLT-30 items based on the pretest results: 1) for all items, graphs, tables and additional content were included after the question and before the answer choices so that respondents knew the context of the question; 2) key words in items were included in quotes (such as “biopsy” in Q9-*Biopsy*, “stage 1” in Q12-*Stage 1 Cancer*, “survival” in Q17-*Survival Rate*, “metastasized” in Q23-*Metastasized*, and “benign” in Q24-*Benign Tumor*) to focus the attention of respondents; 3) in Q7-*Complication Risk*, “treatment A and B” where changed to “treatment #1 and #2” to avoid confusion introduced by the use of letters; 4) in Q22-*High Fiber Food*, a brief explanation of “curry” was added because respondents were unfamiliar with this food; and 5) we added a “Don't know” option for all items because many respondents did not feel comfortable guessing and preferred to indicate they did not know. Because of this last change, we added the “DK” (don't know) to the name of the new tool.

Participants and Data Collection

We conducted a cross-sectional survey between November 2014 and February 2015 to field test the Spanish version of the CHLT-30-DKspa among Spanish speaking Latinos. After approval of the protocol by the Institutional Review Board, self-identified Latinos who met the inclusion criteria (being primarily Spanish speakers, 25 + years old, and Louisiana

residents) were registered to complete the CHLT-30-DKspa. The study was announced through radio, newspapers and flyers distributed by members of the CAB, who completed the screening and registration process at community events scheduled during the data collection period. No specific exclusion criterion was applied.

The mode of administration varied to accommodate participants' unique needs. Participants with less than a high school education, visual impairments and/or those older than 70 completed an interviewer-administrated survey conducted by Spanish-speaking interviewers; those with a high school diploma or some college education completed an interviewer-administered or self-administered survey depending on their preference; and those with bachelor degrees or higher education completed a self-administered questionnaire. Because the option "Don't know" was included in each question, participants were clearly instructed to not guess the answer but choose this option if they did not know or were not sure about the correct answer.

Statistical Analyses

The analyses followed commonly used psychometric procedures, which were also used in the validation process of the original CHLT-30 (Dumenci et al., 2014). The total score on the CHLT-30-DKspa was calculated as the number of correct answers (range 0 to 30), counting "don't know" responses as incorrect answers. Item-level and total score frequencies and summary statistics were calculated. Item-scale correlations for each item were calculated corrected for overlap (the correlation of that item to the scale score calculated without that item). Item-scale correlations are used to test for scale homogeneity. High values (over 0.8) can indicate a problem with multicollinearity or redundancy of items, while low values (under 0.3) could mean that the item is not measuring the same construct and does not correlate very well with the overall scale so it may be best to drop it (Field, 2005; Nunnally & Bernstein, 1994; Hair, Black, Babin, & Anderson, 2010).

Analyses of variance (ANOVA) was used to identify statistically significant differences on CHLT-30-DKspa Score by gender (male or female), national origin (country of birth), age (25+), and education level (primary education or below, some high school, high school diploma, some college or vocational studies, bachelor or advanced degree).

Item-response theory analysis using 2-parameter logistic estimates (discrimination and difficulty) was used to identify questions that may require modification to avoid bias or confusion. "Don't know" answers were scored as incorrect answers; therefore, a pseudo-chance (guessing) parameter was not needed in the model (Hambleton and Ronald, 1982).

Confirmatory factor analysis using diagonally weighted least squares (DWLS) models was used to explore the validity of the hypothesized CHLT-30-DKspa unidimensional factor structure. DWLS has several advantages: it is robust against non-normality and works better with categorical and ordinal data than maximum likelihood methods (Mindrila, 2010). Cronbach's alpha coefficients estimated the internal consistency reliability of the scale. Data were analyzed using SPSS, R (R) statistical packages (R Development Core Team, 2011), the ltm package (Rizopoulos, 2006), and the Lavaan package (Rosseel, 2012).

Results

A total of 400 self-identified Latinos, half women, completed the CHLT-30-DKspa (Table 1). In summary, the majority of participants was from Central America (80.3%), between 25-55 years old (72.8%), and had a high school diploma or higher (61.8%).

The mean CHLT-30-DKspa total score was 17.13 (range 0 to 30; SD 6.65). While only one person (0.25%) had the maximum score of 30 points, 3 participants (0.75%) had the minimum score of 0 points; thus, the entire range was observed. Based on the histogram of CHLT-30-DKspa total scores (Figure 1), it was reasonable to classify scores into three levels: low (10 or lower), intermediate (11 to 26), and high scores (27 to 30). In our study, 17.5% of participants were in the low range, 73.8% were in the intermediate range, and 8.8% were in the high range.

No significant differences were found in CHLT-30-DKspa total score by age ($p = .175$) or gender ($p = .081$). Educational level was positively associated with CHLT-Score ($p < .0001$). There were significant differences ($p < .05$, Holm correction used for multiple comparisons) between all five categories: participants with primary education or below ($M = 10.57$), participants with some high school studies ($M = 15.33$), participants with high school diploma ($M = 18.04$), participants with some college or vocational studies ($M = 20.57$) and participants with bachelor or advanced degrees ($M = 22.46$). Controlling for education, there was no significant difference in the total score by mode of administration (interviewer vs. self-administered; $p = .023$).

Total score differed by region of origin. Participants from South America had significantly higher total scores than those born in Central America, controlling for education ($p < .0001$).

CHLT-30-DKspa Factor Structure

Confirmatory factor analysis with DWLS found a model with one underlying factor to be a good fit to the data ($X^2[405] = 461.55$, $p = .027$, CFI = .993; TLI = .992, RMSEA = .0180). Cronbach's alpha internal consistency reliability of the CHLT-30-DKspa was the same (.88) as that obtained in the original CHLT-30 validation study (Dumenci et al., 2014).

Item-scale correlations ranged from a low of .148 for the Q1-*High calorie* item to a high of .547 for the Q21-*Inoperable tumor* item ($M = .42$). Although DWLS results confirmed the hypothesized unidimensional model of the CHLT-30-DKspa, some items had marginal factor loadings and/or item-scale correlations. CHLT-30-DKspa factor loadings ranged from 0.152 to 0.585 ($M = .41$) with the Q1-*High calorie* item having the lowest factor loading (.152) and eight additional items (Q8-*Palliative care*; Q10-*Appointment location*; Q12-*Stage 1 cancer*; Q13-*Direction*; Q15-*Tumor spread*; Q16-*Generic drugs*; Q27-*Double dose*; and Q29-*Dose time*) having factor loadings lower than 0.4 (Table 2). Items Q1-*High calorie* and Q15-*Tumor spread*, which had the lowest item-scale correlations (.148 and .288) also had the lowest factor loadings (.152 and .302).

Item Parameter Estimates for the CHLT-30-DKspa

The item-level correct responses ranged from .24 to .86 (Mean .57) with the most correct responses observed on the *Q2-Next Pill* item and the fewest correct responses on the *Q19-Smoking Risk* item (Table 2). Item difficulty parameter estimates ranged from -1.4 to 2.40 (mean = -0.24) with 19 questions having negative values (easy questions) and three questions having values over +1.0 (difficult questions). Consistent with the percent of correct-item responses, the easiest questions were *Q2-Next Pill* and *Q27-Double Dose* (diff = -1.40 and -1.35) and *Q19-Smoking Risk*, *Q08-Palliative Care*, and *Q1-High Calorie* were the most difficult ones (diff=1.12, 1.21, and 2.40).

Item discrimination parameter estimates ranged from 0.35 to 2.04 (mean=1.27). While nine questions had low discrimination values (<1.0), 21 questions had good discrimination values (>1.0) meaning that these questions are better able to discriminate between groups with different cancer health literacy levels. The item with the lowest discrimination value was *Q1-High Calorie* (disc=0.35), while the one with highest value was *Q2-Next Pill* (disc=2.04).

The percent correct item responses were higher in the CHLT-30 when compared to the CHLT-30-DKspa, while discrimination parameters in the CHLT-30 were lower than in the CHLT-30-DKspa with mean differences of 0.43 between both (Table 3). While in the original CHLT-30 all the item difficulty estimates were negative, indicating that the questions were relatively easy to answer, in this study item difficulty was higher overall (Tables 2 and 3).

While in the original CHLT-30 validation study standardized factor loadings were considered adequate for all items, the CHLT-30-DKspa factor loadings were lower (Table 3), with *Q1-High Calorie* having an unacceptable factor loading of 0.15 (Table 2).

Analysis of the “Don't know” (DK) option

Means, frequencies, standard deviations and ANOVAs of number of DK responses were calculated to analyze the impact of the DK option on CHLT scores. The distribution of DK responses (Figure 2) was heavily skewed to the right [min. 0.00, median 4.0, mean 5.66, max. 30.0, SD 5.68]. While 50 participants (12.5%) had no DK answers, 202 participants (50.5%) had low numbers of DK answers (between 1 and 5), and only two participants (0.5%) answered all questions as DK.

ANOVA (Model: $\text{Sqrt}(\text{DK}) = \text{Education} + \text{Age} + \text{Education}:\text{Age}$) conducted on the squared root of the number of DK responses to adjust for skew, found that respondents with higher levels of education tended to have fewer DK responses ($p < .0001$) and that there was a significant education-age interaction ($p = .043$). As seen in Figure 3, older respondents (56+years old) with less than high school diploma tended to have a high number of DK answers. Differences in the number of DK responses by region of origin were not significant once education was taken into account.

Analysis of the Impact of Numeracy Skills

We defined numeracy as “the ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage mathematical demands of a

range of situations in adult life” (Goodman, Finnegan, Mohadjer, et al, 2013). Considering that respondents may have a particular challenge with questions related to numeracy, we identified 11 of the 30 questions that required numeracy skills. While items Q2-*Next pill*, Q4-*Hemoglobin range*, Q7-*Risk of complication*, Q11-*Body temperature*, Q18-*Fasting*, Q25-*Radiation treatment*, and Q29-*Dose time*, required simple arithmetic operations (add, subtract, multiply, or compare ranges), results show that these items were, in general, considered easy questions (item-difficulty values from -0.23 to -1.40). However Q18-*Fasting* and Q29-*Dose time* had lower percentage-correct answers (0.55) than the other items in this group. In contrast, Q5-*Oral cancer*, Q17-*Survival rate*, Q19-*Smoking risk*, and Q26-*Complication rate*, required respondents to understand and interpret percentage ranges—a higher level of numeracy skills (Goodman et al, 2013, exhibit B-3). Although item-difficulty was higher in this second group of numeracy items (positive values from 0.09 to 1.12), significant differences by education were found on all the numeracy items except in Q19-*Smoking risk*.

Discussion

We conducted a field test among 400 Spanish-speaking Latinos to assess the reliability and validity of the CHLT-30-DKspa, an adapted Spanish version of the CHLT-30, in a healthy Spanish-speaking Latino sample. The CHLT-30 is a measure of cancer health literacy previously validated in a white English-speaking cancer patient sample. In general, the CHLT-30-DKspa demonstrated good psychometric properties in our sample. Our results were very consistent with those obtained in the original validation study (Dumenci et al, 2014). Consistent with the original study, our study confirmed a uni-dimensional factor structure of the measure, obtained similar internal consistency reliability estimates, and found significant differences in total scores by educational level.

There were some notable differences between results from our study and the original validation study. Overall, our participants obtained lower scores than those observed in the original study. Our respondents were provided with a “don't know” (DK) response option that was not a part of the original validation study, which may have reduced respondent guessing and may explain the lower scores observed in our study. However, the ability to select a DK response also may have increased the accuracy of the results by making it impossible to inflate scores based on guesses. Even with just four DK responses (the median), replacing the DK with guesses would likely increase the total score. , Based on our results, items on the CHLT-30-DKspa appeared to be more difficult for respondents than in the original study, which might be due to differences across studies in participants' educational levels. In Dumenci's study, 30% of participants had a high school education or less while in our study, 60% of respondents had this level of education. Caution should be exercised though when comparing our scores with those obtained in the original instrument validation study because the response formats and several items differed across studies.

In our study, 4 of the 30 items on the CHLT-30-DKspa exhibited marginal psychometric properties (low item-scale correlations, low factor loadings, and/or high difficulty parameter estimates). These items were Q1-*High Calories* (“Doctors often recommend high calorie and high protein foods for cancer patients in treatment. Which is the highest in calories and

protein?"); Q8-*Palliative Care* ("The purpose of palliative care is to cure cancer"); Q15-*Tumor Spread* ("Exposing a tumor to air during surgery causes the tumor to spread") and Q19-*Smoking Risk* ("Scientists estimate that smoking is responsible for 85% to 90% of lung cancer deaths. This means that 85% to 90% of smokers will get lung cancer"). Based on our findings, these items should be revised and further tested or deleted from the questionnaire (Costello & Osborne, 2005; Hair, Black, Babin, & Anderson, 2010).

Respondents' comments during the survey administration also support dropping or revising these items. Several participants indicated that they would answer Q1-*High Calories* differently, depending on whether they were thinking of calories or protein. This item also performed poorly in the original validation study relative to the other items. The Q8-*Palliative Care* item was difficult because of the lack of familiarity with the term "palliative", regardless of educational level. Translation of this item to Spanish was difficult. While participants in the pilot test were familiar with the concept of "tratamiento para pacientes terminales o desahuciados" (treatment for terminal/hopeless patients), they were not familiar with the term "cuidado paliativo" (palliative care), which is the correct Spanish translation. We found that language barriers may also have an impact. For example, the term "hospice" is very similar to the Spanish word "hospicio," which is known as a place for poor, old or disabled people and for those who are ill and have no family to take care of them (Kreling, Selsky, Perret-Gentil, Huerta, Mandelblatt, et al, 2010).

Q19-*Smoking Risk* was considered by respondents to be especially difficult. This item had the highest difficulty value (1.12) and the lowest percentage-correct value (24%) among all the numeracy items in the tool. The fact that this item was the only numeracy item with no significant differences by education level, may indicate that the problem was not in the respondents numeracy skills but in the item-difficulty. Based on participants' comments during administration of the survey, it became obvious that many equated smoking with lung cancer death and thus answered the item incorrectly because they assumed the correct answer should be 100%. Some of them began to tell histories about family/friends who smoked and died of lung cancer. It might help to revise the item including an introductory statement such as "Although not all smokers get lung cancer, ..."

Although Q15-*Tumor Spread* was not considered of high difficulty (diff=0.56), participants' comments during the application of the survey indicated that their experiences with families/friends who died of cancer were influencing their answers. Some of them talked about people they knew who had cancer and after the surgery to "cut" the cancer, it was instead spread into the blood contaminating all the body. Although it could be argued that answers to this item are affected by low literacy level of respondents, this issue is commonly considered in the literature as a "myth" or "belief" that is generally based on individuals experiences and that may be reinforced by conflicting information sources (American Cancer Society, 2014; Goldfarb & Ben-Eliyahu, 2006-2007; CANCERactive.com; Scutti, 2015) The strength of the belief that cancer can be spread by surgery and its influence in treatment decisions have been reported in several studies (Dumenci et al, 2014; James, Daley & Greiner, 2011; Luo, Spolverato, Johnston, Haider, & Pawlik, 2015; Carrion, Nedjat-Haiem & Marquez, 2013; DeLisser, Keirns, Clinton & Margolis, 2009), and is well

documented in the application of the Health Belief Model to study cancer screening behaviors (Champion & Skinner, 2008).

We found that participants from South America had significantly higher total scores than those from Central America, even after controlling for education. These results are of special interest when considering that Central American immigrants were the fastest growing segment of U.S. Latinos and made up over 35% of all foreign born immigrants in the New Orleans metro area with higher percentages of non-English speakers coming from Mexico and Central American countries, such as Honduras, El Salvador and Guatemala (USA.com, 2012). A low level of health literacy combined with limited English skills and lack of professional interpreter services may affect Latinos' understanding of cancer-related terms, communication with healthcare providers, understanding of medical instructions, as well as their decisions related to cancer screening and treatment.

Limitations of our study include that the results may not be generalizable to the immigrant Latino population of Louisiana or other areas of the U.S. However, results provide support for further exploration of the CHLT-30-DKspa more broadly in Louisiana and in other Latino populations. The high growth rate of the Latino population in New Orleans, compared to the nation's rate (57% vs 43%), suggests that the New Orleans metro area may be emerging as an important gateway for Latino immigrants (Plyer, 2011), making this topic of high relevance.

Conclusions

Our study is the first to assess the CHLT-30 in a healthy Spanish-speaking sample of Latinos. With the exception of four items, our results support the applicability of the CHLT-30-DKspa for healthy Spanish-speaking Latinos. This study advances research on measures of cancer health literacy among minority non-English speaking populations and helps address the need for linguistically and culturally sensitive health literacy assessment tools (Koshan 2010). Addressing cancer health disparities among U.S. Latinos requires parsing out the unique contributions of health literacy, language barriers, immigration status, cultural views regarding health, and lack of access to health care (CDC, 2015; McGill, 2013; Diaz et al., 2013; Perez, 2014) to develop appropriate interventions. This study represents an important contribution toward that goal.

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Figure 1.

Cancer Health Literacy Test-30- Spanish version (CHLT-30-DKspa): Total Scores (N=400, Mean =17.13, SD=6.649)

Figure 2.
Histogram of Don't Know (DK) Responses. (N=400, min. 0.00, median 4.0, mean 5.66, max. 30.0, SD 5.68)

Figure 3.
Don't Know Answers (DK): Interaction Plot Education-Age

Table 1

Demographics of Participants

Demographics	Male		Female		Total	
	n	%	n	%	N	%
Total Participants	200	50.0	200	50.0	400	100.0
Education						
Primary education or below	54	27.0	41	20.5	95	23.8
Some high school	31	15.5	27	13.5	58	14.5
High school diploma	39	19.5	51	25.5	90	22.5
Some college or vocational studies	55	27.5	52	26.0	107	26.8
Bachelor or advanced degree	21	10.5	29	14.5	50	12.5
Age						
25-40	92	46.0	75	37.5	167	41.8
41-55	61	30.5	63	31.5	124	31.0
55+	47	23.5	62	31.0	109	27.3
Origin / immigration						
Central American countries (1 st generation)	161	80.5	160	80.0	321	80.3
South American countries (1 st generation)	23	11.5	31	15.5	54	13.5
U.S.-born (2 nd generation) *	16	8.0	9	4.5	25	6.3

* U.S.-born Latinos were bilingual but spoke Spanish at home

Table 2

Item Parameter Estimates for the Spanish Version of the Cancer Health Literacy Test (CHLT-30-DKspa)
(N=400)

<u>Item⁽¹⁾</u>	<u>Correct (%)</u>	<u>Item-Total Correlation⁽²⁾</u>	<u>Factor loading DWLS⁽³⁾</u>	<u>Item Difficulty</u>	<u>Item Discrimination</u>
Q01 High calorie	30.5	0.148	0.152	2.40	0.35
Q02 Next pill	85.5	0.466	0.482	-1.40	2.04
Q03 Chemotherapy	60.3	0.477	0.513	-0.42	1.38
Q04 Hemoglobin range	75.0	0.474	0.504	-1.02	1.55
Q05 Oral cancer	47.8	0.420	0.453	0.09	1.15
Q06 Side effects	53.8	0.508	0.551	-0.15	1.54
Q07 Risk of complication	65.8	0.469	0.505	-0.65	1.39
Q08 Palliative care	27.8	0.342	0.343	1.21	0.92
Q09 Biopsy	76.8	0.424	0.448	-1.18	1.37
Q10 Appointment location	57.5	0.370	0.394	-0.39	0.97
Q11 Body temperature	75.5	0.501	0.522	-0.99	1.73
Q12 Stage 1 cancer	68.8	0.324	0.344	-1.11	0.82
Q13 Direction	49.8	0.321	0.333	0.00	0.77
Q14 Efficacy	75.3	0.533	0.558	-0.93	1.90
Q15 Tumor spread	41.8	0.288	0.302	0.56	0.64
Q16 Generic drugs	36.8	0.352	0.373	0.31	0.87
Q17 Survival rate	45.8	0.424	0.452	0.17	1.16
Q18 Fasting	55.0	0.432	0.471	-0.23	1.19
Q19 Smoking risk	24.0	0.397	0.426	1.12	1.36
Q20 Physical therapist	47.8	0.524	0.556	0.07	1.62
Q21 Inoperable tumor	53.5	0.547	0.585	-0.14	1.78
Q22 High fiber food	71.8	0.375	0.403	-1.10	1.05
Q23 Metastasized	37.0	0.384	0.403	0.61	1.04
Q24 Benign tumor	62.5	0.489	0.523	-0.50	1.45
Q25 Radiation treatment	76.8	0.502	0.534	-1.02	1.82
Q26 Complication rate	45.3	0.404	0.430	0.20	1.09
Q27 Double dose	75.3	0.357	0.377	-1.35	0.99
Q28 Book chapter	50.8	0.517	0.563	-0.04	1.63
Q29 Dose time	55.5	0.314	0.335	-0.34	0.77
Q30 Map reading	76.8	0.470	0.515	-1.05	1.69

⁽¹⁾ Stem for all of the items = Question # + abbreviated description used in Dumenci et al., (2014)

⁽²⁾ Corrected for overlap, e.g. item correlation with total score calculated omitting that item

⁽³⁾ DWLS = Diagonally Weighted Least Squares

Table 3

Comparison of Main Parameter Estimates among CHLT-30 and CHLT-30-DKspa

Item Parameter Estimates	CHLT-30 ^(a)			CHLT-30-DKspa		
	Range	Range size	Mean	Range	Range size	Mean
Standardized factor loadings	0.44 to 0.81	0.37	0.63	0.15 to 0.59	0.44	0.41
Corrected Item-Total Correlations	0.31 to 0.54	0.23	0.42	0.15 to 0.55	0.40	0.42
Percent correct-item responses	0.56 to 0.93	0.37	0.81	0.24 to 0.86	0.62	0.57
Item difficulty	-2.13 to -0.36	1.77	-1.43	-1.40 to 2.40	3.80	-0.24
Item discrimination	0.49 to 1.36	0.87	0.84	0.35 to 2.04	1.69	1.27

Abbreviations: CHLT = Cancer Health Literacy Test; CHLT-DKspa = Cancer Health Literacy Test, Spanish version

^(a)Dumenci, L., Matsumaya, R.K., Riddle, D.L., Cartwright, L.A., Perera, R.A., Chung, H., Siminoff, L.A. (2014). Measurement of Cancer Health Literacy and Identification of Patients with Limited Cancer Health Literacy. *Journal of Health Communication: International Perspectives*, 19:sup2, 205-224