Development and validation of the biobanking attitudes and knowledge survey-Spanish (BANKS-SP)

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Received: 15 October 2015 / Accepted: 22 August 2016 / Published online: 15 September 2016
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Abstract Few research studies with non-English-speaking audiences have been conducted to explore community members' views on biospecimen donation and banking, and no validated Spanish-language multi-scale instruments exist to measure community perspectives on biobanking. This study describes the development and psychometric properties of the *Biobanking Attitudes and Knowledge Survey-Spanish* (BANKS-SP). The BANKS was translated into Spanish using the Brislin method of translation. Draft BANKS-SP items were refined through cognitive interviews, and psychometric properties were assessed in a sample of 85 Spanish-speaking individuals recruited at various community events in a three county area in central west Florida, USA. The final BANKS-SP includes three scales: attitudes, knowledge, and self-efficacy; as well as three single items, which evaluated receptivity and intention to donate a biospecimen for research. The final Cronbach's alpha coefficients for the two scales that use a Likert response format indicated adequate internal consistency (attitudes, $\alpha = .79$; self-efficacy, $\alpha = .91$). Intention to

donate blood and intention to donate urine were positively correlated with attitudes, self-efficacy, and receptivity to learning more about biobanking (all p 's < .001). BANKS-SP-Knowledge was not statistically significantly correlated with other BANKS-SP scales or single items measuring intention to donate a biospecimen for research and receptivity for learning more about biospecimen research. The BANKS-SP attitudes and self-efficacy scales show evidence of satisfactory reliability and validity. Additional research should be conducted with larger samples to assess the BANKS-SP instrument's reliability and validity. A valid and reliable Spanish-language instrument measuring Spanish-speaking community members' views about biobanking may help researchers evaluate relevant communication interventions to enhance understanding, intention, and actual biospecimen donation among this population.

Keywords Biospecimen · Tissue banking · Reliability · Validity · Questionnaire · Self-efficacy

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Introduction

The science of oncology is undergoing a transformation, whereby biospecimen research is an increasingly important tool to develop new ways to prevent, detect, and treat cancer (Baer et al. 2010). As such, participation in biobanks by large numbers of individuals with diverse backgrounds is important. Recently, findings from a survey of repository facilities, in the Midwest and Northwest USA, indicated that only 1.3 % of collected biospecimens were from Hispanic participants, compared to 89 % of biospecimens from White participants, and that about half of the surveyed facilities had made efforts to collect biospecimens in their communities (Simon et al. 2014). There is an expanding body of literature that

documents the significant efforts to engage ethnically and racially diverse communities in biospecimen research across the US (Braun et al. 2014; Cohn et al. 2014; Dang et al. 2014; Dash et al. 2014; Erwin et al. 2013; Lopez et al. 2014; Luque et al. 2012; Rodriguez et al. 2013). To date, only a few studies have explored biobanking awareness, perceptions, beliefs (Hohl et al. 2014; Luque et al. 2012; Rodriguez et al. 2013), willingness to donate biospecimens (Hohl et al. 2014; Lopez et al. 2014), and attitudes toward biobanking (Hohl et al. 2014) among Hispanic populations in the US. Two of these qualitative studies found low awareness of biobanking initiatives and uncertainty about the process (Luque et al. 2012; Rodriguez et al. 2013). Quantitative studies which have been conducted with Hispanic participants have explored the influence of acculturation on willingness and donation of biospecimens for research (Lopez et al. 2014), misconceptions about receiving personal health information as part of participation (Knerr and Ceballos 2015), and factors associated with prior knowledge of biospecimen research (Loffredo et al. 2013). However, published research is hampered by a lack of valid and reliable quantitative surveys in Spanish that evaluate constructs which can predict biospecimen donation or evaluate interventions aimed at improving understanding of biospecimen research.

Until recently, there were no known validated measures to evaluate knowledge about and attitudes towards biospecimen donation and biobanking. To address this gap, the Biobanking Attitudes and Knowledge Survey (BANKS) (Wells et al. 2014) was developed in English based on the knowledge-attitudes-behavior (KAB) approach (Schrader and Lawless 2004). The BANKS development used an iterative and community-engaged process including a review of existing related measures; a review of focus group data conducted with English and Spanish-speaking participants (Luque et al. 2012) and the development and revision of an item pool using cognitive interviews, content validity assessment by an expert panel, and pilot testing (Wells et al. 2014). The final version of the BANKS includes three multiple-item scales measuring knowledge ($n = 16$ items), attitudes ($n = 14$ items), and self-efficacy ($n = 12$ items), as well as three single items measuring intention to donate a biospecimen for research and receptivity to learning more about biospecimen research. The BANKS-attitudes and BANKS-self-efficacy scales demonstrated high internal consistency (attitudes, $\alpha = .88$; self-efficacy, $\alpha = .95$). Content validity indices were moderate, ranging from 0.69 to 0.89. The BANKS measures also demonstrated construct validity as intention to donate blood and intention to donate urine were significantly positively correlated with attitudes, knowledge, self-efficacy, and receptivity to learning more about biobanking (Wells et al. 2014).

Currently, there are no known published Spanish language multiple-item scales to evaluate knowledge regarding, attitudes toward, or self-efficacy for biospecimen donation

and biobanking that have been validated in populations in the USA who prefer to receive written information in Spanish. The objectives of this paper are to (1) describe development of an instrument containing three multiple-item Spanish-language scales, respectively, evaluating knowledge of, attitudes towards, and self-efficacy related to biospecimen donation; and (2) provide preliminary evidence of psychometric properties of the BANKS-SP scales. In addition, this paper reports the development of three single Spanish-language items measuring receptivity to learning more about biobanking and intention to donate a biospecimen (one item for blood and one item for urine) to a biobank.

Materials and methods

This project was approved by the University of South Florida Institutional Review Board and conducted as a pilot project of the Tampa Bay Community Cancer Network (TBCCN; U54 CA153509), a National Cancer Institute Community Network Program Center. TBCCN aims to reduce cancer health disparities by conducting evidence-based research projects based on community-based participatory research (CBPR) principles, health promotion outreach, and capacity-building and training activities in a tri-county area of Tampa Bay, Florida in the USA (Meade et al. 2011). TBCCN is a collaboration of 22 community and academic partners including local community-based health centers, social service agencies, faith-based groups, adult education organizations, as well as a cancer center. Together, this collaboration addresses critical cancer access, prevention, and control issues that impact medically underserved, low-literacy, and low-income populations. A Biobanking Community Advisory Board (B-CAB) provided guidance on the development and refinement of items for both the BANKS and the BANKS-SP (Wells et al. 2014). Members of the B-CAB were ethnically and linguistically diverse. Three out of five B-CAB members self-identified as Hispanic, were fluent Spanish/English speakers, and had ethnic origins from Mexico (1) and Puerto Rico (2). The other two members self-identified as African American and were monolingual English speakers. All members had strong ties to our target community.

Development and translation of the BANKS-SP items

The BANKS-SP development process occurred simultaneously with the BANKS development. Similar to the development of the BANKS (Wells et al. 2014), the development of the BANKS-SP also used an iterative and community-engaged process including a review of existing related measures and a review of focus group data conducted with English and Spanish-speaking participants (Luque et al. 2012). Translation of the BANKS from English to Spanish

was conducted based on the Brislin Model of Translation (Brislin 1970; Jones et al. 2001). The translation team consisted of four Spanish-English bilingual research staff members from various countries (i.e., Guatemala, Puerto Rico, Colombia, and the USA) in order to capture the various dialects spoken by the Tampa Bay area Spanish-speaking community. First, two bilingual translators independently translated the BANKS from the source language (English) to the target language (Spanish). Then, two different bilingual translators blindly back-translated the BANKS from Spanish to English. Next, in an iterative process, (1) the Spanish-language translations were compared to each other, (2) the Spanish-language translations were compared to the original BANKS, and (3) the back-translated versions of the BANKS-SP were compared to the original BANKS. During this iterative process, all four translators met with the research team to discuss any semantic differences or inconsistencies identified through the translation and back-translation processes. As a group, and through consensus, changes were made to the BANKS-SP draft items to ensure that the translated BANKS-SP was consistent with the BANKS. As a last step before pilot testing the measures, the BANKS-SP final draft was reviewed by a certified translator.

Instrument refinement

Cognitive interviews

A trained, bilingual (Spanish and English) research coordinator conducted 10 cognitive interviews with 10 community members identified through the assistance of the B-CAB to evaluate readability, language and wording, understanding, and cultural appropriateness of BANKS-SP draft items and instructions. Participants in the cognitive interviews were (1) receiving health care, educational, or social services from a TBCCN community partner organization; (2) spoke and read Spanish; (3) 18 years or older; (4) lived in the Tampa Bay area of Florida; and (5) provided informed consent. Community members were excluded from cognitive interviews if they had previously participated in the *TBCCN Community Perceptions on Biobanking Project* (Luque et al. 2012).

The research coordinator conducted the interviews with a cognitive interview guide developed by the research team. Using this guide, the coordinator asked participants to read the survey instructions and items, and to respond to each item using each instrument's response scale. The coordinator observed and recorded if participants had difficulty understanding instrument instructions, understanding or interpreting survey items, and/or providing an appropriate response to the question. After participants provided an answer to each item, the coordinator asked a series of specific questions to identify if participants understood the question, comprehended the terminology, and if the wording and words

were culturally appropriate. After three cognitive interviews, results were summarized, and changes were made to items and the survey instructions. The revised items and instructions were subsequently reviewed by new cognitive interview participants. This process was repeated until no additional changes were suggested, and all participants stated they understood each item and the wording was appropriate. The survey cover page was also refined during this process. Participants were provided a \$20 incentive for participating in a cognitive interview.

Pilot testing

After the research team completed the iterative process of translation and cognitive interviewing, the refined BANKS-SP items were pilot tested in a sample of 85 participants (see power analysis below). Pilot test participants were recruited from health fairs and community events. For inclusion in the pilot test, participants were required to (1) have received health care, educational, or social services from a TBCCN partner; (2) speak and read Spanish; (3) be 18 years or older; (4) live in the Tampa Bay area of Florida; and (5) provide informed consent. Participants were excluded if they had participated in the prior *TBCCN Community Perceptions on Biobanking Project* (Luque et al. 2012) or cognitive interviews for the BANKS-SP.

After obtaining written consent, the coordinator asked each participant to manually complete the pilot version of the BANKS-SP, which included a cover page with instructions for completing the BANKS-SP and definitions of biospecimen and biobanking. Research staff assisted participants who had difficulty completing the survey. After completing the BANKS-SP instrument, participants completed a brief demographic questionnaire (gender, age, race, ethnicity, marital status, education, employment, income, place of birth). Participants were provided a \$10 incentive for completing the pilot test survey.

Data management and psychometric analyses

All pilot test data were entered into an SPSS (IBM Corp. 2012) data file for analysis and screened for missing data through an evaluation of frequencies and out of range values. Preliminary analyses examined the distribution of data on each scale and on each single item measure (mean, standard deviation, range, skewness). Missing data were minimal but in these instances data were imputed using the mean of each variable. After imputing missing data, the BANKS-SP-Intention and BANKS-SP-Receptivity, as well as the positively worded items on the BANKS-SP-Attitudes scale, were reverse coded so that higher scores indicated more positive responses. Items on the BANKS-SP-Attitudes and BANKS-SP-Self-efficacy were summed to indicate a total scale score.

Internal consistency was evaluated for the BANKS-SP-Attitudes and Self-efficacy scales using Cronbach's alpha and a review of item-to-total correlations. Items found to have poor internal consistency, as indicated by an increase in Cronbach's alpha if deleted or an item-to-total correlation under .30, were reviewed to determine if they should be included in the final scale. For the BANKS-SP-Knowledge scale, items that were answered correctly were summed to calculate a total number of correct items ("don't know" responses were coded as having answered the item incorrectly).

Construct validity was assessed by the known-groups method using several hypotheses (DeVellis 2003). It was anticipated that people who indicated they intended to donate blood or urine to a biobank would have: greater receptivity to learning more about biospecimen donation and biobanking; more positive attitudes towards biospecimen donation and biobanking; higher self-efficacy for donating a biospecimen; and more knowledge of biospecimen donation and biobanking. In addition, it was anticipated that people with more knowledge of biospecimen donation and biobanking would have more positive attitudes and higher self-efficacy related to biospecimen donation and biobanking. All known group hypotheses were tested using Pearson correlations. A sample size of 85 participants was selected to detect a Pearson correlation with a medium effect size (.5) at $\alpha = .05$, and with 80 % power (Cohen 1988).

Results

Cognitive interviews

Ten cognitive interviews were conducted with Spanish-speaking participants. Despite multiple attempts to recruit both males and females, only female participants provided consent and ultimately participated in cognitive interviews. On average, cognitive interview participants were 38.5 years of age (standard deviation [SD]: 9.8 years). Table 1 presents demographics of participants who took part in cognitive interviews. Nine BANKS-SP items were modified to improve the translation to match the English BANKS. Table 2 provides descriptive details on the changes made to the instrument items during cognitive interviewing.

Pilot testing

One hundred and one participants were approached to take part in the pilot testing of the BANKS-SP, and 85 (84.2 %) met inclusion criteria. Eighty-five participants provided informed consent and completed the BANKS-SP. Most participants were female (70.6 %), White (62.4 %), self-identified as Hispanic (96.5 %), married (56.5 %), and employed (71.4 %; Table 3). The mean age was 46.3 years (SD: 13.4 years).

Table 1 Demographic characteristics of cognitive interview participants ($n = 10$)

Characteristic	<i>N</i>	%
Gender		
Female	10	100
Male	0	0
Ethnicity		
Hispanic	10	100
Not Hispanic	0	0
Race		
White	6	60.0
Multiple races	2	20.0
Other	2	20.0
Origin of Birth		
Colombia	3	30.0
Dominican Republic	1	10.0
Honduras	1	10.0
Mexico	4	40.0
Puerto Rico	1	10.0
Marital Status		
Currently married	4	40.0
Single	3	30.0
Separated/Divorced	3	30.0
Employment		
Full-time (32 or more hours per week)	3	30.0
Part-time (less than 32 hours per week)	4	40.0
Homemaker	3	30.0
Annual household income		
Less than \$10,000	3	30.0
\$10,000–\$19,999	0	0
\$20,000–\$39,999	5	50.0
\$40,000–\$59,999	0	0
\$60,000–\$100,000	0	0
Greater than \$100,000	0	0
Do not know/refused to answer	2	20.0
Education		
Less than high school	3	30.0
High school	2	20.0
College or vocational school	4	40.0
Graduate degree	1	10.0

There was wide variation in the number of years of completed education across the pilot test participants, with most having completed between 1 and 3 years of college.

There were minimal missing data (no item had more than 2.4 % missing data), so no item was deleted or revised based on tendency for missing data, but was instead imputed using the mean of the item. A review of the frequency of correct responses on the BANKS-SP-Knowledge revealed there was a range of item difficulty. The percent of correct answers

Table 2 Item wording modifications obtained through cognitive interview (CI) testing

BANKS Spanish—Attitudes scale		
Original item	Modifications based on participant comments	Final item
1. <i>Personas que dan muestras biológicas ayudan a prevenir enfermedades</i>	Participants indicated that a “the” was needed at the beginning of this sentence, so the word “las (the)” was added to this item.	1. <i>Las personas que dan muestras biológicas ayudan a prevenir enfermedades</i>
2. <i>Personas que dan muestras biológicas ayudan a curar enfermedades</i>	Participants indicated that a “the” was needed at the beginning of this sentence, so the word “las (the)” was added to this item.	2. <i>Las personas que dan muestras biológicas ayudan a curar enfermedades</i>
3. <i>Dar una muestra biológica interfiere con los cuidados médicos de una persona</i>	Some participants preferred the word “cuidados de salud (health care)” than “cuidados médicos (medical care),” so this term was replaced in the final item.	3. <i>Dar una muestra biológica interfiere con los cuidados de salud de una persona</i>
4. <i>El historial familiar médico de una persona está segura en un biobanco</i>	“Historial familiar médico (medical family history)” was not widely understood by participants, so it was changed to a term that was easier to understand by participants.	4. <i>La información médica familiar de una persona está segura en un biobanco</i>
5. <i>Las muestras biológicas pueden ser usadas de una forma en que la persona que las dona no desea</i>	Participants indicated that this statement was hard to understand, so the wording was changed based on their suggestions.	5. <i>Las muestras biológicas pueden ser usadas para un propósito distinto a lo que quiere el donador</i>
6. <i>Una persona no debería dar muestras biológicas porque podrían identificar problemas de salud</i>	This statement was not clear to some participants. A participant said: “Whose health does it refer to?” so the wording was changed to be more specific about whose health it was.	6. <i>Una persona no debería dar muestras biológicas porque podrían identificar problemas en su salud</i>
BANKS Spanish—Knowledge Scale		
Original item	Modifications based on participant comments	Final item
1. <i>Las muestras biológicas que la gente da pueden ser</i>	Some participants had difficulty understanding this item, especially the	1. <i>Las muestras biológicas que la gente da no pueden ser compartidas con</i>

Table 2 (continued)

<i>enviadas a otras organizaciones</i>	phrase “sent to other organizations.” Therefore, item was reworded to be a negative item and phrase was replaced with a low-literacy alternative	<i>otras organizaciones que las pidan</i>
BANKS Spanish—Self-efficacy scale		
Original item	Modifications based on participant comments	Final item
1. <i>Creo que yo podría dar una muestra biológica a un biobanco aunque tuviera que viajar lejos para hacerlo.</i>	One participant said: “what do you mean by ‘travel far [viajar lejos].’... Do I need to travel by plane? How far is it?...” so rewording for this item was tested until the meaning was clear to most participants.	1. <i>Creo que yo podría dar una muestra biológica a un biobanco aunque tuviera que ir lejos para hacerlo.</i>
2. <i>Creo que yo podría dar una muestra biológica a un biobanco aunque tenga que pasar más tiempo en la oficina del doctor.</i>	Many participants did not understand the wording “pasar más tiempo (spend more time)” so it was reworded to “demore más (wait longer)”	2. <i>Creo que yo podría dar una muestra biológica a un biobanco aunque me demore más en la oficina del doctor.</i>

provided on BANKS-SP-Knowledge items ranged from 10.6 to 90.6 %. On average, participants answered 7.0 out of 16 BANKS-SP-Knowledge questions correctly (Table 4).

There was variability in the item measuring receptivity to learning more regarding biospecimen donation and biobanking and the two items measuring intention to donate blood and urine. Both items evaluating intention to donate blood (*Si le pidieran que donara una muestra de sangre para fines de investigación, estaría dispuesto(a) a hacerlo?*; If you were asked to give a blood sample for research, would you agree to do it?) and urine (*Si le pidieran que donara una muestra de orina para fines de investigación, ¿estaría dispuesto(a) a hacerlo?*; If you were asked to give a urine sample for research, would you agree to do it?) were significantly positively skewed as indicated by a skewness value greater than 1. The skewness suggests that participants were likely to state that they would donate a blood or urine biospecimen if asked.

A review of the distribution of responses on BANKS-SP-Attitudes items revealed variation in responses to most items. Two items showed significant skewness, as indicated by a skewness value greater than 1 or less than −1. Item 9 (*Dar sangre a un biobanco es una buena forma de ayudar a la*

Table 3 Demographic characteristics of pilot test participants ($n = 85$)

Characteristic	N	%
Gender ($n = 85$)		
Female	60	70.6
Male	25	29.4
Ethnicity ($n = 84$)		
Hispanic	82	96.5
Not Hispanic	2	2.4
Race ($n = 80$)		
African American or Black	4	4.7
White	53	62.4
Multiple races	9	10.6
Other	12	14.1
American Indian	2	2.4
Marital Status ($n = 85$)		
Currently married	48	56.5
Never married	22	25.9
Divorced	15	17.6
Employment ($n = 84$)		
Full-time (32 or more hours per week)	38	44.7
Part-time (31 or fewer hours per week)	6	7.1
Retired	7	8.2
Student	13	15.3
Disabled	4	4.7
Self-employed	16	18.8
Annual household income ($n = 83$)		
Less than \$10,000	15	17.6
\$10,000–\$19,999	16	18.8
\$20,000–\$39,999	30	35.3
\$40,000–\$59,999	8	9.4
\$60,000–\$100,000	6	7.1
Greater than \$100,000	1	1.2
Education ($n = 79$)		
Less than 8th grade	11	13.9
High school or high school graduate	13	16.5
Some college (1 to 3 years) or vocational/technical school	37	46.8
4 years of college or college graduate	14	17.7
Graduate or professional degree (masters, doctoral)	4	5.1
Yes		
Had ever heard of biospecimens		

investigación del cáncer; Giving blood to a biobank is a good way to help cancer research) was positively skewed, indicating that participants were likely to agree with the item. Item 4, (*Dar una muestra biológica es una pérdida de tiempo para la persona*; Giving a biospecimen is a waste of a person's time) was negatively skewed, indicating participants were likely to disagree with the item. The distribution of responses on BANKS-SP-Self-efficacy items also

revealed variation in responses, but there were no significantly positively or negatively skewed items on the BANKS-SP-Self-efficacy scale.

Internal consistency

Initial versions of the BANKS-SP-Attitudes and BANKS-SP-Self-efficacy scales demonstrated adequate internal consistency (Cronbach's $\alpha = .77$ and $.91$, respectively). When the 14 individual items on the BANKS-SP-Attitudes were examined, four items demonstrated negative inter-item correlations. All four of the items had positive item-to-total correlations, but three of these same items also had an item-to-total correlation less than $.3$ (see Table 5). Two of the three BANKS-SP-Attitudes items with negative inter-item correlations, *La información médica familiar de una persona está segura en un biobanco* (A person's family medical information is safe in a biobank) and *Las muestras biológicas pueden ser usadas para un propósito distinto a lo que quiere el donador* (Biospecimens that people donate might be used for purposes they do not want), were deleted from the final scale because removing them increased the BANKS-SP-Attitudes scale's internal consistency (Cronbach's α after deletion of the two items = $.79$). The third item with an item-to-total correlation less than $.3$, *Dar una muestra biológica interfiere con los cuidados de salud de una persona* (Giving a biospecimen gets in the way of a person's medical care) was not deleted from the final scale because removing this item did not increase the BANKS-SP-Attitudes scale's internal consistency. Deletion of the two BANKS-SP-Attitudes items left 12 items in the final BANKS-SP-Attitudes scale, which was used to evaluate construct validity (see below). With respect to the BANKS-SP-Self-Efficacy scale, all inter-item correlations were positive, and all item-to-total correlations were above $r = .48$. Therefore, all 12 BANKS-SP-Self-Efficacy items were retained.

Construct validity

As anticipated, participants who indicated they were more likely to agree to donate urine or blood to a biobank had: more receptivity to learning about biospecimen donation ($r = .61$, $p < .001$ [urine]; $r = .75$, $p < .001$ [blood]); more positive attitudes towards biospecimen donation and biobanking ($r = .36$, $p = .001$ [urine]; $r = .47$, $p < .001$ [blood]); and higher self-efficacy for donating a biospecimen ($r = .47$, $p < .001$ [urine]; $r = .56$, $p < .001$ [blood]). Contrary to the hypotheses, there were no statistically significant correlations between knowledge of biospecimen donation and biobanking and measures of receptivity to learning more about biospecimen donation and biobanking ($r = .11$, $p = .32$), intention to donate urine ($r = .05$, $p = .63$), intention to donate blood ($r = -.04$, $p = .74$),

Table 4 Numbers and percentages of people who endorsed each response on knowledge items

BANKS-SP Knowledge scale	Sí (Yes) <i>N</i> (%)	No (No) <i>N</i> (%)	No sé (Do not Know) <i>N</i> (%)
1. Una persona tiene que gastar dinero para dar una muestra biológica (A person has to spend money to give a biospecimen)	6 (7.1)	55 (64.7)	24 (28.2)
2. Cualquiera tiene acceso a las muestras biológicas que la gente da (Anyone can access the biospecimens a person gets)	5 (5.9)	58 (68.2)	22 (25.9)
3. Los resultados de las investigaciones con las muestras biológicas serán incluidos en los expedientes médicos (Research results from biospecimens will show up in medical records)	21 (25.3)	21 (25.3)	41 (49.4)
4. Las muestras biológicas que se dan a los biobancos serán vendidas a compañías farmacéuticas (Biospecimens given to a biobank will be sold to drug companies)	4 (4.7)	40 (47.1)	41 (48.2)
5. Un investigador debe de guardar en privado la información de una persona cuando hace estudios de investigación (A scientist must keep a person's information private when doing research)	77 (90.6)	2 (2.4)	6 (7.1)
6. Las muestras biológicas que la gente da no pueden ser compartidas con otras organizaciones que las pidan (The biospecimens people give can be sent to any organization that requests them)	31 (36.5)	30 (35.3)	24 (28.2)
7. Los departamentos de la policía pueden obtener legalmente las muestras biológicas que la gente da (Police departments can legally get the biospecimens a person gives)	21 (24.7)	26 (30.6)	38 (44.7)
8. Las muestras biológicas que se dan a los biobancos pueden ser vendidas a cualquiera (Biospecimens given to a biobank can be sold to anyone)	2 (2.4)	59 (69.4)	24 (28.2)
9. Las compañías de seguro pueden obtener legalmente las muestras biológicas que una persona da (Insurance companies can legally get the biospecimens a person gives)	15 (17.9)	40 (47.6)	29 (34.5)
10. Los investigadores siempre contactarán a las personas si sus muestras biológicas muestran riesgo de alguna enfermedad (Researchers will always contact people if their biospecimens show risk for disease)	57 (67.1)	9 (10.6)	19 (22.4)
11. La familia de una persona puede obtener información acerca de las muestras biológicas que la persona da (A person's family can get information about the biospecimens a person gives)	28 (32.9)	27 (31.8)	30 (35.3)
12. Pueden haber personas que ganen dinero de muestras biológicas donadas (People can make money from donated biospecimens)	28 (32.9)	18 (21.2)	39 (45.9)
13. Las muestras biológicas ya no le pertenecen a la persona después de que las dona (People no longer own their biospecimens after they give them to a biobank)	34 (40.0)	17 (20.0)	34 (40.0)
14. Después que una persona da una muestra biológica a un biobanco la puede recuperar (After a person gives a biospecimen to a biobank, she/he can get it back)	11 (12.9)	34 (40.0)	40 (47.1)
15. Una persona puede ser clonada si dona una muestra biológica a un biobanco (A person might be cloned if he/she donates a biospecimen to a biobank)	8 (9.4)	25 (29.4)	52 (61.2)
16. Una persona puede dejar de participar en un estudio después de haber donado una muestra biológica (A person can stop being in a research study after giving a biospecimen)	29 (34.1)	15 (17.6)	41 (48.2)

attitudes towards biospecimen donation and biobanking ($r = .20$, $p = .07$), and self-efficacy ($r = .11$, $p = .31$). Participants who had more positive attitudes towards biospecimen donation and biobanking had higher self-efficacy for donating a biospecimen to a biobank ($r = .43$, $p < .001$).

Discussion

The development of the BANKS-SP instrument addresses a significant gap in biospecimen science by enabling researchers to assess biospecimen donation knowledge, attitudes, self-efficacy, intention, and receptivity among Spanish-speaking community members in the Tampa Bay area. Further, it is anticipated that a Spanish-language biobanking instrument can be used to evaluate

the efficacy of Spanish-language biobanking educational materials or interventions. To our knowledge, the BANKS-SP is the first Spanish-language instrument measuring constructs related to biospecimen donation and biobanking. The final BANKS-SP instrument includes three scales which measure biobanking attitudes (12 items), biobanking knowledge (16 items), and self-efficacy for donating a biospecimen (12 items) as well as three single-item measures of intention to donate a biospecimen and receptivity to learning more about biospecimen donation and biobanking (total of 43 items; see Online Resource 1 for items in the order in which they were administered).

Pilot testing of the BANKS-SP indicated the measures were easy-to-administer and participants could complete them with little missing data. A number of different psychometric properties of items were reviewed to obtain the final scale for

Table 5 Scale and item means, standard deviations, and item-to-total correlations

Item	Mean	Standard deviation	Item to total correlation
BANKS-SP Attitudes scale (total score range for 12-item scale: 35–60)	46.9	6.13	
Response scale: <i>Muy de acuerdo, De acuerdo, Ni de acuerdo ni en desacuerdo, En desacuerdo, Muy en desacuerdo.</i>			
(<i>Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree</i>)			
1. Dar muestras biológicas es para el bien de todos (Giving a biospecimen is for the greater good of society)	4.35	0.70	0.40
2. Las personas que dan muestras biológicas ayudan a prevenir enfermedades (People who give biospecimens help prevent diseases)	4.39	0.64	0.55
3. Las personas que dan muestras biológicas ayudan a curar enfermedades (People who give biospecimens help cure diseases)	4.27	0.79	0.45
4. Dar una muestra biológica es una pérdida de tiempo para la persona (Giving a biospecimen is a waste of a person's time)	3.94	1.08	0.49
5. Dar muestras biológicas ayuda a futuras generaciones (Giving a biospecimen will help future generations)	4.51	0.63	0.45
6. Dar una muestra biológica interfiere con los cuidados de salud de una persona (Giving a biospecimen gets in the way of a person's medical care)	3.52	1.33	0.27
7. Dar una muestra biológica ayudará a la familia de una persona (Giving a biospecimen will help a person's family)	4.18	0.83	0.33
8. No es probable que la información médica de una persona sea robada de un biobanco (Medical information is unlikely to be stolen from a biobank)	3.25	1.22	0.37
9. Dar sangre a un biobanco es una buena forma de ayudar a la investigación del cáncer (Giving blood to a biobank is a good way to help cancer research)	4.31	0.76	0.39
10. No es probable que la información personal de una persona sea robada de un biobanco (Personal information is unlikely to be stolen from a biobank)	3.13	1.20	0.32
11. La información médica familiar de una persona está segura en un biobanco ^a (A person's family medical information is safe in a biobank)	3.74	0.94	0.16
12. Las muestras biológicas pueden ser usadas para un propósito distinto a lo que quiere el donador ^a (Biospecimens that people donate might be used for purposes they do not want)	2.92	1.14	0.12
13. Una persona no debería dar muestras biológicas porque podrían identificar problemas en su salud (A person should not donate biospecimens because it might identify health problems)	3.59	1.19	0.41
14. Dar muestras biológicas a un biobanco podría ocasionar más gastos médicos (Giving biospecimens to a biobank may lead to more health care costs)	3.49	1.05	0.52
BANKS-SP Knowledge scale (range: 0–13)	6.64	4.25	
Response scale: Sí, No, No sé (Yes, no, do not know)			
BANKS-SP Self-efficacy scale (total score range: 0–110)	55.75	28.54	
Response scale: 0 = <i>No Podría</i> 10 = <i>Muy seguro que podría</i> (0 = Cannot do 10 = Highly certain I can do)			
1. Creo que yo podría dar una muestra biológica a un biobanco aunque nunca antes lo haya hecho (I think I could give a biospecimen to a biobank even if I have not donated a biospecimen before)	6.08	3.31	
2. Creo que yo podría dar una muestra biológica a un biobanco aunque tuviera que ir lejos para hacerlo. (I think I could give a biospecimen to a biobank even if I had to travel far to do so)	3.95	3.38	
3. Creo que yo podría dar una muestra biológica a un biobanco aunque me duela. (I think I could give a biospecimen to a biobank even if it hurts)	3.65	3.12	
4. Creo que yo podría dar sangre a un biobanco aunque me sienta débil. (I think I could give blood to a biobank even if I feel weak)	3.69	3.10	

Table 5 (continued)

Item	Mean	Standard deviation	Item to total correlation
5. Creo que yo podría dar una muestra biológica a un biobanco aunque mi familia no quiera que lo haga (I think I could give a biospecimen to a biobank even if my family does not want me to)	5.48	3.60	
6. Creo que yo podría dar una muestra biológica a un biobanco aunque vaya en contra de mis creencias culturales. (I think I could give a biospecimen to a biobank even if it is against my cultural beliefs)	4.61	3.73	
7. Creo que yo podría dar una muestra de sangre a un biobanco aunque me duela (I think I could give blood to a biobank even if it hurts)	4.42	3.49	
8. Creo que yo podría dar una muestra biológica a un biobanco aunque esté preocupado(a) acerca de cómo será utilizada (I think I could give a biospecimen to a biobank even if I am worried about how it will be used)	4.66	3.10	
9. Creo que yo podría dar una muestra biológica a un biobanco aunque no me sienta bien (I think I could give a biospecimen even if I am not feeling well)	2.95	3.01	
10. Creo que yo podría dar una muestra biológica a un biobanco aunque le tenga miedo a las agujas (I think I could give a biospecimen to a biobank even if I am afraid of needles)	5.60	3.37	
11. Creo que yo podría dar una muestra biológica a un biobanco aunque vaya en contra de mis creencias religiosas (I think I could give a biospecimen to a biobank even if it is against my religious beliefs)	4.56	3.81	
12. Creo que yo podría dar una muestra biológica a un biobanco aunque me demore más en la oficina del doctor (I think I could give a biospecimen to a biobank even if I have to spend more time at a doctor's office)	6.08	3.10	
BANKS Intention (range 1–5: for both items)			
Response scale: Definitivamente sí, Probablemente sí, No está seguro(a), Probablemente no, Definitivamente no.			
(Definitely yes, Probably yes, Unsure, Probably no, Definitely no)			
Si le pidieran que donara una muestra de orina para fines de investigación, ¿estaría dispuesto(a) a hacerlo? (If you were asked to give a urine sample for research, would you agree to do it?)	4.39	0.91	
Si le pidieran que donara una muestra de sangre para fines de investigación, ¿estaría dispuesto(a) a hacerlo? (If you were asked to give a blood sample for research, would you agree to do it?)	4.26	1.04	
BANKS receptivity (range: 1–5)			
Response scale: Definitivamente sí, Probablemente sí, No está seguro(a), Probablemente no, Definitivamente no.			
(Definitely yes, Probably yes, Unsure, Probably no, Definitely no)			
Si le pidieran que donara una muestra biológica para fines de investigación, ¿estaría dispuesto(a) a escuchar más información al respecto? (If you were asked to give a biospecimen for research, would you be willing to hear more information about it?)	3.99	1.09	

^a Item was removed from final version of the scale

the BANKS-SP-Attitudes and the BANKS-SP-Self-efficacy scales, including the distribution of responses to the items, the item-to-total correlations, and Cronbach's alpha if a particular item was removed from a scale. In general, all items on the BANKS-SP-Self-efficacy scale appeared to be internally consistent. When the 14 individual items on the BANKS-SP-Attitudes were examined for internal consistency, there were four items which demonstrated negative inter-item correlations. In addition, while all item-to-total correlations were

positive, three of these same four items also had an item-to-total correlation less than .3. However, upon further examination, the internal consistency of the BANKS-SP-Attitudes scale was strengthened with the removal of only two of these items. The removal of the third item did not change Cronbach's alpha, and therefore, that item was retained, leaving a total of 12 items in the final BANKS-SP-Attitudes scale. The two items which were removed were initially difficult to translate and were refined in cognitive interviewing.

Analyses of pilot data indicated the final 12 item BANKS-SP-Attitudes and BANKS-SP-Self-efficacy scales demonstrated evidence of construct validity. While the level of difficulty of individual BANKS-SP-Knowledge items, and the mean number of BANKS-SP-Knowledge items answered correctly were both similar to the English language BANKS (Wells et al. 2014), the summed BANKS-SP-Knowledge scale was not statistically significantly associated with intention to donate a biospecimen, attitudes towards biospecimen donation and biobanking, or biobanking self-efficacy. The sample size of 85 participants in the pilot test was selected to detect correlations with a medium effect size. It is possible that some of the relationships between these variables exist in the same direction hypothesized (i.e., positive correlations between the variables) as was found in the English BANKS (Wells et al. 2014), but that the relationship is weaker than hypothesized, and therefore, these correlations were not statistically significant in the BANKS-SP. However, caution should be taken in comparing the BANKS-SP and BANKS, as the populations from which participants were sampled were different.

On the other hand, differential responses to questions on the knowledge scale may point to actual differences in knowledge between English and Spanish speakers based on the availability of information in each language. A comparison of the pattern of responding to items on the BANKS-Knowledge and the BANKS-SP-Knowledge indicates that for six BANKS-Knowledge questions, BANKS-SP pilot test participants were less likely to use the “don’t know” response than BANKS pilot test participants who completed the BANKS in English (Wells et al. 2014). In contrast, for one item, *Una persona puede ser clonada si dona una muestra biológica a un biobanco* (A person might be cloned if he/she donates a biospecimen to a biobank), BANKS-SP pilot test participants were more likely to answer “don’t know” when compared to those who completed the BANKS-Knowledge in English (Wells et al. 2014). A closer examination of BANKS-SP-Knowledge responses indicated that using the more definitive “yes” or “no” response was associated with both increased incorrect answers and increased correct answers, depending on the item.

Additional research should be conducted to further evaluate the psychometric properties of the BANKS-SP-Knowledge scale and may include drafting additional items or evaluating the psychometric properties of the scale in a larger sample. Furthermore, it is important to note that responses observed in individual BANKS-SP-Knowledge items suggest that participants had limited knowledge about certain aspects of the biobanking process. Similarly, a recent study found that participants lacked knowledge about biobanking and biospecimens, particularly in items relating to participants’ rights (Tham et al. 2016). In our study, for example, 67.1 % of respondents believed that researchers will always

contact people if their biospecimens show risk for disease. Incorrect responses to individual items can help identify topic areas that can potentially be addressed in educational materials and community outreach efforts. In turn, increasing knowledge of biobanking could help increase biospecimen donations from minority individuals (Tham et al. 2016).

Although careful and systematic steps were taken to create the BANKS-SP, there are some limitations to the research. First, we did not assess cognitive interview or pilot test participants’ prior knowledge of biobanking or biospecimen donation. Our intent was not to exclude community members who had previous knowledge about biobanking, and our formative research efforts with our target population suggested that community members had insufficient biobanking knowledge and awareness (Luque et al. 2012). This is consistent with another study with Hispanics which found that three fourths of their respondents were not familiar with a local biorepository (Rodriguez et al. 2013). Nonetheless, we acknowledge that this could be a limitation to our study. Second, the initial pilot testing of the BANKS-SP was conducted in a small sample of Spanish-speaking community members in central west Florida who were not being asked to donate a biospecimen for research at that time. Thus, it is possible that intentions would not match actual behaviors. The samples for both the cognitive interviews and pilot testing were predominately female, which reflects the attendance of events and health care services provided by TBCCN partners and is similar to the psychometric testing of the English BANKS (Wells et al. 2014). However, it is possible that findings from this initial pilot testing of the BANKS-SP may be different from a sample that includes more male participants. The next steps for this line of research include the collection of additional data from a larger, more diverse sample of people being asked to donate a biospecimen to further assess the reliability and validity of the measures by correlating scores with actual donation rather than intent.

Another limitation of our study is that socioeconomic factors may influence participants’ responses about their attitudes, knowledge, self-efficacy, intentions, and receptivity to donate biospecimens to a biobank; thus, we recommend that future studies assess the influence of these factors on participants’ responses. Future research should also examine measurement invariance by language of administration and potential underlying constructs within the scales. Measurement of these constructs may or may not vary across different languages, and it is important to ascertain that our instruments measure the same constructs across populations who speak different languages. Similarly, future studies should examine the underlying structure of our BANKS-SP-Attitudes scale and assess potential sub-scales within this latent construct. Lastly, we also recommend further testing of the BANKS-SP instruments with other Spanish-speaking community samples. While our translation decisions were selected to enhance

the reach of a wider Spanish-speaking audience, we are cognizant that Spanish language has a diverse range of dialects and our word selections may not have been inclusive of all dialects or expressions that could vary by geographical location. Thus, we recommend that additional data be collected in other Spanish-reading populations and Hispanic heritage groups to further examine the psychometric characteristics of the BANKS-SP. Other researchers who use the BANKS-SP instruments may need to pre-test and adapt them to their target audiences, as needed.

In conclusion, the BANKS-SP is a valid and reliable set of measures of intention, receptivity, attitudes, and self-efficacy related to biospecimen donation and biobanking. Future research should further assess reliability and validity of the BANKS-SP measures, especially among individuals who are approached to donate a biospecimen to a biobank.

Acknowledgments This project was supported by a grant (U54 CA153509) from the National Cancer Institute (Cathy D. Meade PhD RN FAAN & Clement K. Gwede PhD MPH [MPHs]) and represents a pilot project conducted in Tampa Florida as part of the Tampa Bay Community Cancer Network for which Kristen Wells, PhD, MPH was the Project Leader. Between 2013 and 2014, the effort of Dr. Kristen Wells was supported by the National Cancer Institute of the National Institutes of Health under award numbers U54 CA132384 and U54 CA132379 following her relocation to San Diego State University. The content of the manuscript is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute. Between 2015 and 2016, the effort of Ms. Mariana Arevalo was supported by a pre-doctoral fellowship at the University of Texas Health Science Center at Houston, School of Public Health, Susan G. Komen Traineeship in Breast Cancer Disparities (GTDR14300827). The authors acknowledge the valuable time contributions and feedback from the TBCCN Biobanking Community Advisory Board members (Ms. Carmen Reyes, Ms. Gloria San Miguel, Ms. Margarita Romo, Mr. Jim West, Ms. Dale Watson, and Ms. Rebecca Phillips). The authors would like to thank the many people who reviewed drafts of the BANKS-SP, especially those who participated in cognitive interviews and in the pilot study. The authors would like to thank Ms. Megan Lombard for her assistance in editing this manuscript.

Compliance with ethical standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5).

Conflict of interest The authors declare that they have no conflict of interest.

Informed consent Written informed consent was obtained from all pilot test and cognitive interview participants included in the study.

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