

# UCSF

## UC San Francisco Previously Published Works

### Title

Linguistic and Cultural Acceptability of a Spanish Translation of the Ohio State University Traumatic Brain Injury Identification Method Among Community-Dwelling Spanish-Dominant Older Adults

### Permalink

<https://escholarship.org/uc/item/3d56132k>

### Journal

Archives of Rehabilitation Research and Clinical Translation, 1(3-4)

### ISSN

2590-1095

### Authors

Hufstedler, Heather C  
Dorsman, Karen A  
Rivera, Ernesto J  
[et al.](#)

### Publication Date

2019-12-01

### DOI

10.1016/j.arrct.2019.100020

Peer reviewed



Original Research

# Linguistic and Cultural Acceptability of a Spanish Translation of the Ohio State University Traumatic Brain Injury Identification Method Among Community-Dwelling Spanish-Dominant Older Adults



Heather C. Hufstedler, MSc <sup>a</sup>, Karen A. Dorsman, BA <sup>b,c</sup>,  
Ernesto J. Rivera, BA <sup>d</sup>, Sergio C. Lanata, MD, MSc <sup>b,c</sup>,  
Jennifer A. Bogner, PhD, ABPP, FACRM <sup>e</sup>,  
John D. Corrigan, PhD, ABPP <sup>e</sup>, Shannon M. Fuller, MSc <sup>a</sup>,  
Xochilt R. Borja, MSc <sup>a</sup>, Fiona Wilson, BSc, MSc, PhD <sup>f</sup>,  
Raquel C. Gardner, MD <sup>a,g</sup>

<sup>a</sup> Institute for Global Health Sciences, University of California, San Francisco, California

<sup>b</sup> Memory and Aging Center, Department of Neurology, University of California, San Francisco, California

<sup>c</sup> Global Brain Health Institute, San Francisco, California

<sup>d</sup> Department of Neurosurgery, University of California, San Francisco, California

<sup>e</sup> Department of Physical Medicine and Rehabilitation, College of Medicine, Ohio State University, Columbus, Ohio

<sup>f</sup> Discipline of Physiotherapy, School of Medicine Trinity College Dublin, University of Dublin, Dublin, Ireland

<sup>g</sup> San Francisco Veterans Affairs Medical Center, San Francisco, California

## KEYWORDS

Hispanic Americans;  
Latinos;  
Rehabilitation;

**Abstract Objective:** Our objective was to (1) evaluate the linguistic and cultural acceptability of a Spanish translation of the Ohio State University traumatic brain injury identification method (OSU TBI-ID) and (2) to assess the usability and acceptability of a tablet-based version of this instrument in a cohort of Spanish-dominant older adults.

*List of abbreviations:* MoCA, Montreal Cognitive Assessment; OSU TBI-ID, Ohio State University traumatic brain injury identification; TBI, traumatic brain injury.

Supported by the Global Brain Health Institute (to R.C.G. and F.W.), the American Federation for Aging Research (to R.C.G.), and the National Institute of Neurological Disorders and Stroke (award no. K23 NS095755 to R.C.G.).

Disclosures: none.

Cite this article as: Arch Rehabil Res Clin Transl. 2019;1:100020.

<https://doi.org/10.1016/j.arrct.2019.100020>

2590-1095/© 2019 The Authors. Published by Elsevier Inc. on behalf of the American Congress of Rehabilitation Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Traumatic brain injuries

**Setting:** University clinical research center and local community center.

**Participants:** Community-dwelling Spanish-dominant adults age 50 years or older without dementia residing in the Bay Area of California (N=22).

**Design:** Cross-sectional cohort study.

**Main Outcome Measures:** Qualitative assessment of linguistic or cultural acceptability of a Spanish translation of the OSU TBI-ID as well as usability or acceptability of a tablet-based self-administered version of this instrument.

**Results:** The Spanish translation had high linguistic and cultural acceptability and was further optimized based on participant feedback. Cognitive interviews to review survey wording revealed high levels of homogeneity in the clinical definitions and synonyms given by participants—for example, results for the clinical term “*Quedó Inconsciente/Pérdida (temporal) de la conciencia*” (To be unconscious/[Temporary] loss of consciousness) used in the survey included “*perder el conocimiento*” (loss of consciousness), “*knockeado*” (knocked out), “*No es que esté dormida, porque está inconsciente, pero su corazón está todavía palpitando*” (it’s not that they’re sleeping, because they’re unconscious, but their heart is still palpitating). The tablet interface had low observer-based usability, revealing that participants with <13 years of education (n=6) had more difficulty using the tablet which could be improved with minor changes to the coding of the application and minimal in-person technology support. Acceptability of the tool was low among all but 1 participant.

**Conclusion:** This linguistically optimized Spanish translation of the OSU TBI-ID is recommended for use as a semistructured interview among Spanish-dominant older adults. Although the tablet-based instrument may be used by interviewers as an efficient electronic case report form among older adults, further research is needed, particularly among older adults with varying levels of education, to validate this instrument as a self-administered survey.

© 2019 The Authors. Published by Elsevier Inc. on behalf of the American Congress of Rehabilitation Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Traumatic brain injury (TBI) is a global health issue, with more than 27 million people dying from or being hospitalized due to TBI annually.<sup>1</sup> TBI leads to substantial cognitive, behavioral, and physical disability.<sup>1,2</sup> Some studies have shown that individuals with TBI exposure are at elevated risk for dementia, and this risk may be especially high when TBI is sustained in later life.<sup>3</sup> It is currently unknown why some older adults who have sustained TBI develop dementia while others remain resilient.<sup>3-6</sup> Thus, there are no available interventions to prevent or delay post-TBI dementia.

One of the major barriers to studying mechanisms and developing interventions for post-TBI dementia and other TBI-related disabilities in high-risk older adults is the complexity of measuring lifetime exposure to TBI in large, diverse, aging populations. In the United States and several other developed countries, older adults have the highest and fastest rising incidence of TBI of any other age group, primarily due to ground-level falls.<sup>7-9</sup> However, >40% of adults who reported a history of TBI did not seek medical attention for their injury, meaning that hospital incidence records underestimate true population incidence and prevalence.<sup>10</sup> Thus, self-report of TBI exposure is necessary to capture the magnitude of the public health burden of TBI.<sup>11</sup> Because brief TBI screens may miss up to 35% of exposures, comprehensive screens are preferable.<sup>12,13</sup>

The Ohio State University TBI identification method (OSU TBI-ID) is a validated semistructured English language interview that comprehensively captures lifetime history of TBI,<sup>14,15</sup> which has also been validated for online use in at least 1 study.<sup>16</sup> Using this instrument, several studies have

identified substantial disabilities associated with history of TBI in military<sup>17,18</sup> and civilian populations.<sup>19</sup> At least 1 prior population-based study in Colorado used a computer-assisted telephone administered version of the OSU TBI-ID, including an unvalidated Spanish translation of this instrument, and identified substantial negative outcomes associated with history of TBI in both English and Spanish speakers.<sup>19</sup> No prior study, however, has formally evaluated the linguistic and cultural acceptability of a Spanish translation of the OSU TBI-ID. Thus, it is unknown whether currently available unvalidated translations of this instrument adequately capture lifetime history of TBI in Spanish speakers.

Our primary aim in this study was to examine the linguistic and cultural acceptability of a Spanish translation of the OSU TBI-ID for measuring lifetime TBI exposure among community-dwelling Spanish-speaking older adults in an effort to facilitate prospective research on post-TBI disability and dementia. Our secondary aim was to assess the acceptability and usability of implementing this Spanish translation of the OSU TBI-ID as a self-administered, tablet-based survey in order to increase efficiency and scalability of this instrument in research settings.

## Methods

### Selection and description of participants

Participants were recruited from the University of California, San Francisco’s Memory and Aging Center and through

the Mission Neighborhood Centers in San Francisco. Participants were considered eligible for the study if they were (1) Spanish-dominant and could read and write in Spanish; (2) were 50 years or older; (3) scored 16 or above on the Spanish language Montreal Cognitive Assessment [MoCA]); and (4) were able to provide written consent. Participants who were unable to understand the consent process or who scored <16 on the MoCA<sup>20,21</sup> were excluded due to cognitive impairment. All contact with patients took place in Spanish with either a native or fluent Spanish speaker. The study was approved by the University of California, San Francisco's Committee for Human Research and all participants provided written informed consent.

### Adaptation of the OSU TBI-ID

An unvalidated Spanish translation of the OSU TBI-ID was provided by the developers of the original English-language OSU TBI-ID. This translation was reviewed by bilingual research staff and investigators and experts in aging research. Questions in Step 1 were modified by cutting into 2 or 3 shorter questions instead of a single longer question and more examples of types of falls were provided. In addition, structured survey questions were created to replace the semistructured components of the interview (appendix 1). The translation was back-translated by 2 bilingual researchers external to the study. The Spanish language OSU TBI-ID survey was coded in to REDCap,<sup>22</sup> an online data-management system with web and tablet-based survey capability.

### Qualitative data collection

#### Individual think-aloud and cognitive interviews

In the first session, participants were paired with a research assistant who provided 1-on-1 instruction on how to use the tablet. After this informal tutorial, each participant began to complete the Spanish language, tablet-based OSU TBI-ID survey while engaging in unstructured conversation (the think-aloud method). Researchers remained seated next to their participants to take field notes. After participants completed the survey, researchers conducted semi-structured cognitive interviews to evaluate the linguistic accuracy and cultural acceptability of the Spanish translation as well as the usability and acceptability of the tablet interface (appendix 2). Both the think-aloud method and the cognitive interviews were audio recorded.

#### Focus groups

Within 1-6 weeks of the individual assessments, participants took part in focus groups comprising 3-7 participants, depending on the availability of the participants. Groups were asked to discuss similar topics and questions or discuss points of confusion that arose from the one-on-one semi-structured cognitive interviews (eg, whether the face is considered part of the head (appendix 3). In addition, groups viewed and were asked to describe in their own words 4 video clips of people sustaining TBIs and experiencing posttraumatic symptoms in order to create a list of typical or spontaneous descriptive terms for specific post-traumatic symptoms. To eliminate influence over word selection, audio was omitted and subtitles were removed.

Videos 1a and b were used to target vocabulary for the Spanish equivalents for English terms "dazed"; Video 2a, "posttraumatic amnesia"; Video 2b, "knocked out" or "unconscious." All focus groups were also audio recorded.

#### Field notes

Researchers wrote field notes during each phase of the data collection process. These notes included observations made by the researchers, as well as comments and questions made by participants.

### Data transcription, coding, and analysis

Audio recorded materials from the think-aloud method and cognitive interviews were transcribed by a single researcher. Audio materials from the focus groups were translated by both a third-party transcription company TranscribeMe! and a researcher. The interviews were then uploaded to Dedoose,<sup>a</sup> a qualitative software program, to be coded.

A codebook (see appendix 5) was developed using closed codes, which are codes developed based on preconceived themes and hypotheses. Emergent codes, codes developed during the analysis of the data, were also added to the codebook during the data analysis period. Coding of the transcripts was then completed by 2 researchers, 1 fluent and 1 native Spanish speaker.

## Results

### Characteristics of the study populations

Twenty-two participants met enrollment criteria, completed all components of the study, and had their data recorded, transcribed, coded, and analyzed. Participant demographics and MoCA scores are shown in table 1. Most participants were female, in the seventh decade of life, and had ≤12 years education.

**Table 1** Participant characteristics

Demographics	N
Age (y)	
61-70	6
71-80	14
81+	2
Sex	
Male	3
Female	19
Education (y)	
0-6	8
7-12	8
13+	6
Cognitive screen	
MoCA score	
16-25 (mild cognitive impairment) <sup>20,21</sup>	18
26-30 (normal cognition)	4

**Table 2** Linguistic acceptability

Terms	Respondents' Synonyms	Quotes (translated by researcher)	Original Quotes
<p><i>Lesión</i> "Le voy a preguntar sobre lesiones en su cabeza o cuello..."</p>	<p>In cognitive interviews, many respondents said that "lesión" (<i>injury</i>) was something "grave" (<i>serious</i>)—more serious than a "golpe" (<i>blow or hit</i>) to the head or neck. In focus groups, respondents stated that "lesiones" (<i>injuries</i>) were more serious than "golpes" (<i>hits</i>) and could include internal or external bleeding, while "golpes" (<i>hits</i>) would not. With this understanding of the term "lesión" used in the assessment, they explained that they would not have anything to report because they believed their traumatic experience would be considered a "golpe" (<i>hit</i>) and not an "injury" (<i>lesión</i>).</p>	<p>"Well, I can tell them, about the fall and that, the fall, the consequences that can sometimes befall someone with those hits(golpes), because, after time, problems can arise, when there is not an opening in the head. When they open one, then air enters the head, and there comes blood sometimes, and everything. But when it's a hit (golpe), one can get tumors. [Then, there are injuries (lesiones), and], injuries (lesiones) are very... over time, it's what you lose someone to. See you later! - #12</p>	<p>"Pues, puedo decirles, sobre la caída y eso la caída, las consecuencias que a veces le caen a uno con esos golpes, porque a través del tiempo pueden surgir los problemas, cuando no hay abierta a la cabeza que es, cuando le abren a uno le entra a uno aire a la cabeza, de ahí sale sangre a veces y todo. Pero cuando es golpe, se pueden hacer tumores. Después son lesiones muy...a lo largo, es lo que pierde uno ¡hasta la vista!" - #12</p>
<p><i>Quedó Inconsciente/Pérdida (temporal) de la conciencia</i></p>	<p>Many respondents provided "inconsciente" (<i>unconscious</i>) or "noqueado" (<i>knocked out</i>) as acceptable synonyms. When asked which of the 2 terms would be the best to describe this posttraumatic symptom, several people said that they preferred "perder el conocimiento" (<i>loss of consciousness</i>) to "quedar inconsciente" (<i>to be unconscious</i>). No reason was given for the preference other than it was more often used among their peers.</p>	<p>But the person is awake, or? No, it's not that they're sleeping, because they're unconscious, but their heart is still palpitating. - Second focus group</p>	<p>¿Pero la persona está despierta o-? No es que esté dormida, porque está inconsciente, pero su corazón está todavía palpitando. -2º Grupo Focal</p>
<p><i>Pérdida de la memoria</i> ¿se sintió aturdido(a) o tuvo pérdida de memoria debido a, o después de la lesión?</p>	<p>Of the respondents in cognitive interviews who answered, the terms "inconsciente" (<i>unconscious</i>) and "noqueado" (<i>knocked out</i>) were offered. One focus group said it was perdida de la memoria (<i>a loss of memory</i>) of the events preceding and surrounding the event; another group offered the term "no en mis cinco sentidos" (<i>not in my five senses</i>) as a synonym.</p>	<p>"Memory loss? Well, unconscious for minutes, for seconds, for an hour, right?" -Participant #17 Participant A: "A loss of memory, like in those moments, because you don't remember anything." ... Interviewer: "And what is it called when a person can answer [questions], but after a few hours,</p>	<p>"Perdió la memoria? Pues, que quedó inconsciente (unconscious) por minutos, por segundos, por una hora, ¿verdad?" -Participante #17 Participante A: "Pérdida de la memoria ya en eso momentos, porque no se recuerda de nada." ... Entrevistadora: "¿Y qué pasa cuando esa persona contesta, pero después</p>

*Aturdido(a)/ Aturdimiento*  
¿se sintió aturdido(a) o tuvo pérdida de memoria debido a, o después de la lesión?

In the individual cognitive interviews, participants reported a high level of acceptability with the use of the word “aturdido” (*dazed*). Through individual interviews and focus groups, a low level of variability was seen regarding descriptions or synonyms that participants used to describe this term. The majority of participants provided “confundido(a),” (*confused*), as an appropriate description. Other descriptions given by participants were “quedarse en el aire” (*to stay in the air*) or “quedarse en la luna” (*to stay on the moon*). In focus groups, there was a high level of acceptability for the synonym “atarantado” (*dazed, stunned or dopey* in English)

Visually Presented Posttraumatic Symptoms  
Videos 1a and b (target: “dazed”)

Video 2a (target: “knocked out”)

Video 2b (target: “knocked out”)

*they don't remember what they actually said?”*  
Participant A: “That’s the memory gap (*laguna*).”

-Third focus group

*Dazed, confused, stunned, it’s the same?*

*It’s the same.*

*It’s the same meaning.*

*It has the same meaning.*

*They all three mean the same thing?*  
[inaudible]

*They’re in the same vein.*

*Exactly.*

*Because one could say—it depends on the person, who says “he’s stunned,” “he’s confused”; it comes from the same.*

- First focus group

*de unas horas no se acuerda en realidad de lo que contestó?”*  
Participante A: “Esa es la laguna.”  
- 3r Grupo Focal

*Aturdido, confundido, atarantado, ¿es lo mismo?*

*Es lo mismo.*

*Eso mismo significan.*

*Los tres tienen el mismo significado.*

*¿Significan lo mismo las tres cosas?*

*Lo mismo, sí. [diafonía]*

*Dan el mismo sentido.*

*Exactamente.*

*Porque uno puede decir- depende de qué persona, puede decir: “está atarantado,” “está confundido”; viene siendo el mismo.*

- Primer Grupo Focal

Descriptions of Posttraumatic Symptoms

The majority of participants used *mareado* (*dizzy, queasy*) and *aturdido(a)* (*dazed*) to describe Video 1a and used other terms for Video 1b such as *inconsciente* (*unconscious*) and *desmayado* (*unconscious*).

Responses included *atarantado* (*stunned*), *desorientado* (*disoriented*), *perder la memoria*, *noqueado* (*loss of memory*), and *perdió el conocimiento* (*loss of consciousness*).

Dominant word used in 2 of the focus groups was *noqueado* (*knocked out*) and the dominant term in the other 2 groups was *inconsciente* (*unconscious*). A minority of participants used *loss of consciousness* (*perdió la conciencia*) (Video 2b).

## Spanish-language OSU TBI-ID: linguistic and cultural acceptability

### Perceived linguistic acceptability of Spanish-language OSU TBI-ID

During both the individual cognitive interviews and the focus groups, participants overwhelmingly reported that the language and dialect used in the interview were acceptable—meaning the participants understood terms used and acknowledged that they understood what was being asked regarding phrasing and direction. In both individual cognitive interviews and focus groups, there was a low level of variability in the descriptions, definitions, or synonyms provided by participants for terms present in the Spanish language OSU TBI-ID: *lesión* (*injury*), *pérdida de la memoria* (*loss of memory*), *quedó inconsciente* (*unconscious*)/*pérdida temporal de la memoria* (*temporary loss of memory/consciousness*), *aturdido(a)/aturdimiento* (*dazed*) (table 2).

### Descriptions of visually presented posttraumatic symptoms

Similar low levels of variability were seen in the responses to visually presented TBI symptoms presented in the focus groups (see table 2).

### Unexpected results: “Face as a part of the head”

During all 3 phases of data collection, an unforeseen issue arose involving the question of whether or not the face constituted part of the head, and, thus, whether or not injuries to the face should be reported in the assessment (table 3). During focus groups, the respondents said that, because some participants will include an injury to the face as an injury to the head while others will not, that the interview should specify whether or not the assessment considers injuries to the face to also constitute as injuries to the head.

## Cultural acceptability of the Spanish-language OSU TBI-ID

There was a high level of self-reported cultural acceptability of the Spanish language OSU TBI-ID tool among participants. In addition, no respondent reported an instance in which they felt that the Spanish language adaptation of the tool was culturally inadequate. Researchers provided participants with the example of the tool’s use of “soccer” instead of “fútbol” as a possible cultural pitfall, but every participant said they felt this term was culturally acceptable.

## Tablet-based tool: usability and acceptability

### Usability of the tablet-based tool

After completing the tablet-based survey, participants participated in face-to-face cognitive interviews where they reported high levels of usability. Only 2 people stated that they had difficulty navigating the tool. Field observations made by each researcher, however, noted a low level of usability of the tool among most participants, with the exception of those with  $\geq 13$  years of education ( $n=6$ ), who reported and were observed to have higher levels of usability.

In contrast to the reports made by participants in the cognitive interviews, field observations made by each researcher noted that most participants with  $< 13$  years of education had trouble navigating the interface in several basic facets of the tablet, including the touchscreen interface and using the scroll feature, as well as difficulty discerning between drop-down menus versus text boxes and how to use either. Most participants struggled with minor issues like determining what level of pressure was required to have the tablet mark an answer bubble. A small number of participants did not list all symptoms in the second section associated with the injuries they listed in the first section without prompting from a researcher.

**Table 3** Illustrative quotes regarding “face as a part of the head”

Spanish	English Translation
¿Describe una lesión a la cara como una lesión de la cabeza?	Would you describe an injury to the face included as an injury to the head?
Participant A: <i>No, la cara no tiene que ver nada con la cabeza, son dos cosas muy diferentes; tú te golpeas la cara.</i>	Participant A: <i>No, the face has nothing to do with the head. They’re two very different things. You hit your head—</i>
Participant B: <i>Pero la cara está en la cabeza.</i>	Participant B: <i>But the face is in the head.</i>
Participant A: <i>Sí, pero no te golpeas la cabeza, porque las lesiones de la cabeza son más graves.</i>	Participant A: <i>Yes, but you don’t hit (te golpeas) your head, because the injuries (lesiones) [the injuries to the head] are more serious (grave).</i>
...	...
Participant A: <i>Sería mejor, entonces, especificar. Porque alguna gente entiende por cabeza todo y otra gente, cree que es diferente. Porque otra señora nos decía que se había golpeado, y me dice: “ah, pero es que yo no le dije porque yo lo que me golpeé, fue la cara; me caí de frente,” y le digo: “pero eso fue la cabeza, también,” “no, fue la cara,” me dice.</i>	Participant A: <i>It would be best, then, to specify. Because some people would understand that head is everything [including the face] and some would believe that it’s different. Because another woman told us that she was hit, and she told me: “ah, but I didn’t tell you because the place that I got hit was the face; I fell forward.” And I said to her, “but that’s the head, too.” And she told me, “no, it was the face.”</i>
-3r Grupo Focal	-Third focus group



### Acceptability of tablet-based tool

Most participants expressed a low level of acceptability of the tablet-based tool. When asked which they would choose if given the option between a self-administered tablet-based tool or a researcher-administered interview, only 1 of the 22 participants stated that they would choose the tablet-based tool (table 4).

## Discussion and Implications

In this qualitative cross-sectional cohort study of 22 community-dwelling, Spanish-dominant older adults, we identified high linguistic accuracy and cultural acceptability of a Spanish translation of the OSU TBI-ID, but low usability and acceptability of a self-administered tablet-based version of this instrument. Based on our qualitative findings, we recommend the following minor linguistic changes to the Spanish translation used in our study in order to minimize confusion and optimize collection of a comprehensive TBI history: (1) clarify during Part 1 that the face is considered part of the head; (2) use both the terms “golpe” (hit) and “lesión” (injury) when asking about injuries to the head or neck (eg, “Durante su vida, ¿Ha sido hospitalizado(a) o atendido(a) en una sala/clínica de emergencia por lesiones/golpes en su cabeza o cuello?”); (3) add “atarantado” (stunned) alongside the current symptom “aturdido(a)” (dazed); (4) include the term “laguna” (gap in memory) alongside “pérdida de la memoria” (memory lapse; eg, “¿Se sintió aturdido(a), o tuvo lagunas/pérdida de su memoria debido a, o después de la lesión?”); and (5) include “noqueado” (knocked out)

alongside “inconsciente” (unconscious) in order to avoid confusion. We also recommend that questions in Step 1 remain in their modified form for the targeted test participants (older Spanish-speaking adults) as described in the Methods (adaptation of the OSU TBI-ID). Specifically, the questions from the original English version were cut into 2 or 3 shorter questions instead of a single longer question, and more examples of types of falls were provided, because this is the most common mechanism of injury among older adults. This final linguistically optimized Spanish translation of the OSU TBI-ID is recommended for use as a semi-structured interview among Spanish-dominant individuals and can be found in appendix 4.

Although the low observed usability of the self-administered tablet-based survey was likely mediated by low education and likely low associated technology literacy, all but 1 participant would have preferred to engage in a verbal interview with the examiner, suggesting that the low levels of acceptability were not entirely due to low education or technology literacy. In addition, our study highlights the importance of gathering data on both self-reported (how the participant reports on their experience) and observer-reported usability (researchers’ observations of the participant’s experience) in older adults because usability may have been falsely high in our study if only reported usability was considered. Of note, however, all usability issues were remedied via minor technological assistance, suggesting that minor improvements in the interface or instructions could substantially improve usability and acceptability of the tablet-based survey, even among those with low education. Further research would then be needed to validate the modified tablet-based self-administered OSU TBI-ID survey against the gold standard semi-structured OSU TBI-ID survey prior to recommending it for use in clinical research. Based on our experience, the instrument will likely take up to 15 minutes when used as a self-administered tool. At present, however, due to the low usability or acceptability of this tablet-based self-administered survey, we recommend that the tablet-based interface be used as an efficient electronic case report form by interviewers administering the Spanish OSU TBI-ID as a semistructured interview. We have included an updated version of the Spanish language interview incorporating the above suggested linguistic edits (see appendix 4).

### Study limitations

Strengths of this study include the rigorous qualitative design and analysis that included multiple approaches to the assessment of linguistic accuracy and cultural acceptability, including speak-aloud, cognitive interviews, and focus groups including spontaneous verbal descriptions of videos of TBI. Limitations of this study include the small sample size, narrow age range, and restriction to Spanish-dominant adults residing in the Bay Area of California which may not represent the full spectrum of Spanish dialects spoken in other regions in the United States or worldwide. Although theoretical saturation is widely accepted to occur in qualitative studies with smaller sample sizes of 6-20,<sup>23-25</sup> we did identify potentially important subgroups (eg,

**Table 4** Illustrative quotes regarding acceptability

Spanish	English Translation
Participante A: Que la haga una persona.	Participant A: That another person does it.
Participante B: Es personalmente, ¿verdad? Más confianza.	Participant B: It’s personal, right? More confidence.
Participante A: Porque con la tableta no podemos conversar [risas].	Participant A: Because with the tablet, we can’t converse. [laughs].
Participante C: Y si hay una confusión, ahí nos quedamos; y aquí por lo menos tenemos más comunicación.	Participant C: And if there’s confusion [with the self-administered Tablet], we’ll just sit there. And here [with the interviewer-administered tool], at the very least we have more communication.
Participante B: Sí. Si uno no ha entendido, pues, pregunta para que le expliquen; y a la tableta, ¿cómo le vamos a preguntar? [risas]	Participant B: Yes. If some didn’t understand, well, they can ask [the researcher] so that they can explain. And with the [self-administered] tablet, how are we going to ask you? [laughs]
- 3r Grupo Focal	-Third focus group



participants with high vs low education) who could benefit from further study.

## Conclusions

This Spanish language TBI exposure instrument has high linguistic and cultural acceptability. With our recommended linguistic clarifications, it is appropriate for use as a semistructured interview in clinical research studies seeking to comprehensively measure lifetime exposure to TBI among Spanish-speaking community-dwelling older adults. Further modification and validation are needed before this instrument can be recommended for use as a tablet-based self-administered survey.

## Supplier

a. Dedoose version 7.5.9; SocioCultural Research Consultants.

## Corresponding author

Raquel C. Gardner, MD, San Francisco Veterans Affairs Medical Center, 4150 Clement St., Neurology 127, San Francisco, CA 94121. *E-mail address:* [Raquel.gardner@ucsf.edu](mailto:Raquel.gardner@ucsf.edu).

## References

- GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators. Global, regional, and national burden of traumatic brain injury and spinal cord injury, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol* 2019;18:56-87.
- Langlois JA, Rutland-Brown W, Wald MM. The epidemiology and impact of traumatic brain injury: a brief overview. *J Head Trauma Rehabil* 2006;21:375-8.
- Gardner RC, Burke JF, Nettiksimmons J, Kaup A, Barnes DE, Yaffe K. Dementia risk after traumatic brain injury vs nonbrain trauma: the role of age and severity. *JAMA Neurol* 2014;71:1490-7.
- Plassman BL, Havlik RJ, Steffens DC, et al. Documented head injury in early adulthood and risk of Alzheimer's disease and other dementias. *Neurology* 2000;55:1158-66.
- Lee YK, Hou SW, Lee CC, Hsu CY, Huang YS, Su YC. Increased risk of dementia in patients with mild traumatic brain injury: a nationwide cohort study. *PLoS One* 2013;8:e62422.
- Nordstrom P, Michaelsson K, Gustafson Y, Nordstrom A. Traumatic brain injury and young onset dementia: a nationwide cohort study. *Ann Neurol* 2014;75:374-81.
- Gardner RC, Dams-O'Connor K, Morrissey MR, Manley GT. Geriatric traumatic brain injury: epidemiology, outcomes, knowledge gaps, and future directions. *J Neurotrauma* 2018 Feb 15 [Epub ahead of print].
- Thompson HJ, McCormick WC, Kagan SH. Traumatic brain injury in older adults: epidemiology, outcomes, and future implications. *J Am Geriatr Soc* 2006;54:1590-5.
- Taylor CA, Bell JM, Breiding MJ, Xu L. Traumatic brain injury-related emergency department visits, hospitalizations, and deaths - United States, 2007 and 2013. *MMWR Surveill Summ* 2017;66:1-16.
- Setnik L, Bazarian JJ. The characteristics of patients who do not seek medical treatment for traumatic brain injury. *Brain Inj* 2007;21:1-9.
- Whiteneck GG, Cuthbert JP, Corrigan JD, Bogner JA. Prevalence of self-reported lifetime history of traumatic brain injury and associated disability: a statewide population-based survey. *J Head Trauma Rehabil* 2016;31:E55-62.
- Diamond PM, Harzke AJ, Magaletta PR, Cummins AG, Frankowski R. Screening for traumatic brain injury in an offender sample: a first look at the reliability and validity of the Traumatic Brain Injury Questionnaire. *J Head Trauma Rehabil* 2007;22:330-8.
- Russell LM, Devore MD, Barnes SM, et al. Challenges associated with screening for traumatic brain injury among US veterans seeking homeless services. *Am J Public Health* 2013;103(Suppl 2):S211-2.
- Corrigan JD, Bogner J. Initial reliability and validity of the Ohio State University TBI identification method. *J Head Trauma Rehabil* 2007;22:318-29.
- Bogner J, Corrigan JD. Reliability and predictive validity of the Ohio State University TBI identification method with prisoners. *J Head Trauma Rehabil* 2009;24:279-91.
- Lequerica AH, Lucca C, Chiaravalloti ND, Ward I, Corrigan JD. Feasibility and preliminary validation of an online version of the Ohio State University traumatic brain injury identification method. *Arch Phys Med Rehabil* 2018;99:1811-7.
- Peltz CB, Gardner RC, Kenney K, Diaz-Arrastia R, Kramer JH, Yaffe K. Neurobehavioral characteristics of older veterans with remote traumatic brain injury. *J Head Trauma Rehabil* 2017;32:E8-15.
- Gardner RC, Peltz CB, Kenney K, Covinsky KE, Diaz-Arrastia R, Yaffe K. Remote traumatic brain injury is associated with motor dysfunction in older military veterans. *J Gerontol A Biol Sci Med Sci* 2017;72:1233-8.
- Whiteneck GG, Cuthbert JP, Corrigan JD, Bogner JA. Risk of negative outcomes after traumatic brain injury: a statewide population-based survey. *J Head Trauma Rehabil* 2016;31:E43-54.
- Pedraza OL, Salazar AM, Sierra FA, et al. Reliability, criterion and discriminant validity of the Montreal Cognitive Assessment Test (MoCA) in a group of adults from Bogotá. *Acta Medica Colombiana* 2016;41:221-8.
- Zhou Y, Ortiz F, Nunez C, et al. Use of the MoCA in detecting early Alzheimer's disease in a Spanish-speaking population with varied levels of education. *Dement Geriatr Cogn Dis Extra* 2015;5:85-95.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research Electronic Data Capture (REDCap)-a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-81.
- Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods* 2005;18:59-82.
- Jette D, Grover L, Keck CP. A qualitative study of clinical decision making in recommending discharge placement from the acute care setting. *Phys Ther* 2003;83:224-36.
- Kuzel AJ. Sampling in qualitative inquiry. In: Crabtree BF, Miles MB, editors. *Doing qualitative research*. 2nd ed. Thousand Oaks, CA: Sage; 1999. p 33-45.