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Evaluation of the psychometric properties of the Oral Health Behavior Social Support (OHBSS) Scales in English and Spanish for Mexican-origin young adults

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Abstract

Background Valid, reliable measures of psychosocial constructs are needed in oral health research. This study quantitatively evaluated the psychometric properties of nine new Oral Health Behavior Social Support (OHBSS) scales, which measured support for three oral health behaviors (brushing, flossing, dental care), queried for each of three sources (family, health providers, others/friends).

Methods Young Mexican-origin adults in the southwestern United States-Mexico border region completed an online survey, in English or Spanish ($N=502$). Survey items included: OHBSS scales, general social support scales, oral health behaviors, self-rated oral health status, dental anxiety, acculturation and socio-demographics. Subsample 1 participants also completed a dental exam ($N=41$). Subsample 2 participants also completed a repeat OHBSS survey two-to-six weeks later ($N=56$).

Psychometric properties were tabulated, overall and by language preference (English or Spanish). Convergent and divergent validity were evaluated via correlations between the dental-specific OHBSS social support scales, scores from three validated general social support scales, and scales expected to be largely unrelated (acculturation, dental anxiety). Correlations examined predictive validity between the OHBSS scales and oral health behaviors, and self-reported and clinical outcomes. Test–retest reliability was assessed via intraclass correlation coefficients in Subsample 2.

Results Of 502 participants, 60% preferred speaking English, 37% were single, and 21% were male. OHBSS scores indicated that health providers then family provided the most support for all three oral health behaviors, while others/friends did not provide much support. Spanish speakers tended to have higher OHBSS scores than English speakers.

Correlations followed expected patterns and supported convergent and divergent validity, in the full sample and across languages. OHBSS scales exhibited many significant weak-moderate positive correlations ($r=0.10–0.38$) with general social support scales. Few (11/108) significant correlations (<-0.16) were observed between OHBSS scales, acculturation, and dental anxiety. OHBSS scales exhibited some significant weak-moderate positive correlations

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with oral health-promoting behaviors. OHBSS scales were not associated with clinical outcomes. OHBSS scales exhibited good test–retest reliability overall and in Spanish.

Conclusion Psychometric properties for the OHBSS scales were acceptable in both English and Spanish versions. The scales are valid and reliable tools for assessing social support for oral health-promoting behaviors from family, health providers, and others/friends.

Trial registration Not applicable.

Keywords Psychometric properties, Social support, Oral health, Toothbrushing, Flossing, Dental utilization, Dental caries, Periodontal disease, Mexican–American

Introduction

Hispanic/Latino adults living in the United States (US) suffer disproportionately from oral health disparities [1]. Within the diversity of Hispanic/Latino ethnic groups, there are subgroups that experience worse oral health status. The 2008–2011 Hispanic Community Health Study/Study of Latinos (HCHS/SOL) assessed clinical oral health status of adults from six different Hispanic/Latino subgroups, and found that Mexican-origin adults had the highest periodontal probing depth severity [2]. In the HCHS/SOL, Mexican-origin and Central American-origin adults also had the most untreated decayed surfaces (1.4 vs. 0.8–0.9 for other groups); Mexican-origin men and women ages 18–44 had high means of 1.8 and 1.3, respectively [3]. Mexican-origin adults experience a high burden of oral diseases. In the 2009–2014 National Health and Nutrition Examination Survey (NHANES), Mexican–American adults had the highest periodontal disease prevalence compared to non-Hispanic White and non-Hispanic Black adults [4]. Adults' self-rated oral health status was similar during this NHANES period, and Mexican–American adults were less likely to indicate they had excellent or very good oral health compared to non-Hispanic Whites [5]. In the most current 2017–2020 NHANES, dental caries prevalence estimates were available for children and adolescents, and were highest among Hispanics (about 55%) compared to their non-Hispanic counterparts (range: 42%-47%) [6]. This higher burden of disease in early life extends into young adulthood; thus, factors influencing poor oral health outcomes among Mexican-origin young adults warrant closer investigation.

Social determinants of oral health and markers of social disadvantage are increasingly included in assessments of oral conditions, attempting to contextualize the mechanisms underlying such conditions [7]. One important social determinant is social support. Social support includes help and assistance perceived or received from other people and can be an important potential resource and source of influence over health behaviors [8], including oral health-related behaviors like oral hygiene practices and seeking dental care. Two prominent social support theories posit that social support and social relationships can influence health through direct or indirect pathways [8–13]. Direct pathways have been proposed, suggesting psychological mechanisms linking social support to physical and biological aspects of health [11]. Indirect pathways suggest social support operating through health behaviors, which in turn affects physiology and health status. Additionally, the unifying oral health disparities framework advanced by Lee and Divaris [14] was adapted and referenced as a conceptual framework for exploring the indirect role of social support on oral health-related behaviors. Oral hygiene and dental utilization were selected as the most proximal oral health-related behaviors influencing oral health status. Brushing, flossing, and seeking dental care were also selected as health behaviors to target in the development of future interventions to improve oral health.

The development of this oral health social support scale focused on brushing, flossing and seeking dental care behaviors based on the Lee and Divaris framework [14] and the small but growing existing body of research exploring the role of social support and oral health. Positive associations have been found between general social support and clinical oral health outcomes, such as fewer missing teeth or lower caries experience [15–19]. Dahlan and colleagues [20] reviewed 26 studies that examined the associations between social support and oral health among ethnic minority groups, and immigrants in particular, and concluded that social support was positively associated with a range of oral health clinical and self-rated outcomes and dental behaviors. National data from 2005–2008 NHANES of adults ages 40 and older, including Mexican–American adults and other racial/ethnic groups, showed that those with low social support had 1.48 odds of untreated caries and 1.23 odds of severe tooth loss [19]. In other recent studies, higher levels of social support among immigrant parents were associated with their children's toothbrushing frequency, but not associated with children's caries experience [21]. Among Hispanic/Latino parents in Colorado, children were

more likely to have dental caries if their parents lacked social support across four different types of support [22]. Among recent and established adult Mexican immigrants in Indiana, social support was positively associated with improved flossing behavior [23]. While most of the literature is focused on children or parents of children, the limited evidence about adults of Mexican-origin also suggest the importance of social support for oral health. Quantifying the strength of association between social support and oral health behaviors among Mexican-origin young adults is one strategy for acquiring more precise information; generally speaking, we have lacked validated instruments directly usable in a dental context. There is a need for valid, reliable measurement instruments to advance behavioral oral health intervention research [7], and especially instruments that are appropriate and validated for diverse sociocultural groups. Evaluating multiple aspects of validity and reliability is critical for developing new measurement instruments in the social sciences [24]. Our team developed nine Oral Health Behavior Social Support (OHBSS) scales with large samples of Mexican-Americans in both English and Spanish, resulting in a series of scales with 37 required items [25]. The new scales query social support for three oral health behaviors (brushing, flossing, and accessing dental care) from three different sources of social support (family, health providers, others/friends). The co-creation, refinement, and structural validity of these scales in both English and Spanish are reported elsewhere [25]. The purpose of this study is to evaluate the OHBSS scales' psychometric properties, including convergent and divergent validity, predictive validity, and test–retest reliability, overall and by English and Spanish language groups, in a large sample of Mexican-origin adult men and women between 21–40 years of age.

Methods

Study design

This cross-sectional observational study's data collection occurred in the southwestern US-Mexico border region from April 2022 to February 2023. An online survey was the primary data collection mode used for validating the newly developed items in the nine OHBSS scales (participants who completed the online survey will be hereafter referred to as the Full Sample). There were two convenience subsamples who participated in follow-up study activities, as outlined in Fig. 1: Study Design. In Subsample 1, participants also completed standardized study dental exams, and in Subsample 2, participants also completed a repeat OHBSS survey two to six weeks after completing the survey the first time.

This study was conducted in partnership with three federally qualified health centers (FQHCs): Vista Community Clinic (VCC), Innercare, and El Rio Health. Two FQHCs, VCC and Innercare, were subcontracted partners on this research study and hosted Subsample 1 dental exams. VCC operates multiple clinic sites in northern San Diego County, Orange County, and Riverside County, CA. One VCC San Diego site hosted the dental exams. Innercare operates several sites in Imperial and Riverside Counties, CA, and one Imperial County site hosted dental exams. El Rio Health, with multiple clinic sites in Tucson, AZ, promoted the research study, and participants in all four Arizona counties were eligible to participate in the Full Sample and Subsample 2.

The study design intentionally supported the co-creation and validation of the new scales in both English and Spanish simultaneously. Details of all phases of the scale development approach are described elsewhere [25]. The study team referred to scale development best practices [26], social support theory and measurement [9] and adapted an approach for bilingual scale development from Erkut and colleagues [27, 28] in designing this study.

Setting and participants

Details about the study settings and participant eligibility criteria, recruitment, and data collection efforts have been reported elsewhere [25]. Briefly, eligible participants were young adult Mexican-origin men and women, between the ages of 21–40 years old, fluent in either English or Spanish, and lived in one of eight counties: San Diego, Imperial, Riverside, or Orange County, California (CA); or Pima, Cochise, Santa Cruz, or Yuma County, Arizona (AZ). These eight counties were selected to include the two CA counties (San Diego and Imperial) and all four AZ counties along the US-Mexico border, along with two additional counties (Riverside and Orange Counties) where our CA clinical partners provide dental care services. Women who were pregnant were temporarily ineligible but could be waitlisted to participate later. Participants who were edentulous, could not provide written informed consent, or required pre-medication before dental procedures were excluded. Language preference (English/Spanish), sex (male/female), and marital status (single/married or partnered and living as married) were monitored throughout recruitment to enroll a balanced sample. Balance by language was a top priority in order to support examining psychometric properties for the new scales overall, and by language group.

After study staff confirmed eligibility and interest and obtained written informed consent, participants were first invited to complete a one-time, approximately one-hour online survey, in either English or Spanish ($N=502$). Separate informed consent forms were obtained before participation in either subsample. The San Diego State

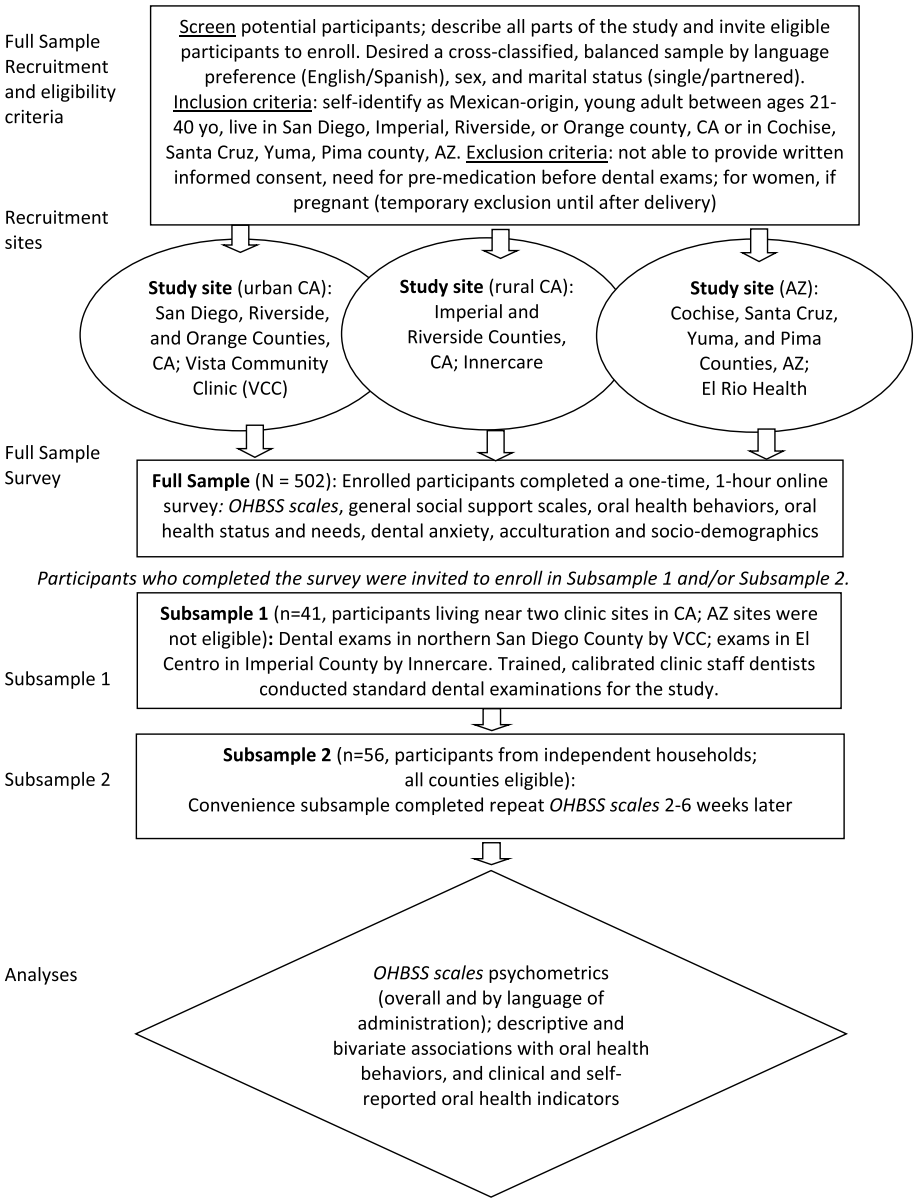

Fig. 1 Study design

University (SDSU) Institutional Review Board (IRB) and a clinical study oversight committee appointed by the National Institutes of Dental and Craniofacial Research (NIDCR) reviewed and approved this study's protocols and materials prior to data collection. Clinic partners relied on the SDSU IRB.

Survey measures

Several survey measures were administered to all participants in the Full Sample: the new OHBSS scales, three validated general social support scales, and validated dental anxiety and acculturation scales; self-reported oral health behaviors; and self-reported oral health status measures. These measures were selected to examine the psychometric properties of the new OHBSS scales.

Social Support

New OHBSS scales

The nine OHBSS scales assessed brushing social support from family (BF), health providers (BP), and others/friends (BO); flossing social support from family (FF), health providers (FP), and others/friends (FO); and dental care social support from family (DF), health

providers (DP), and others/friends (DO). There were 37 required items to compute each of the nine scale scores (see Additional File 1: OHBSS scales; Additional File 2: REDCap template for OHBSS scales). Possible response options were: *0 = never,1 = rarely, 2 = sometimes, 3 = often, and 4 = always*. Scale scores reflect the average of twelve brushing items, twelve flossing items (one item is scored in both the brushing and flossing scales, but only asked once), and fourteen dental care items. All nine scales had Cronbach's alphas above 0.95, overall in the full sample and in both languages [25].

Existing general social support scales

Three validated general social support scales were selected for this study. The 12-item Interpersonal Support Evaluation List (ISEL-12) was selected given its use in the HCHS/SOL Socio-Cultural Ancillary Study. ISEL-12 assesses perceived availability of different types of functional social support, and has been validated in English [29] and Spanish [30–33]. The scale is scored overall, and also has three subscales (appraisal, belonging, tangible). Response options included *definitely false, probably false, probably true,* or *definitely true*. After reverse scoring six items accordingly, scores were summed, and higher total scores indicated greater perceived social support. In this sample, the overall ISEL-12 Cronbach's alpha was 0.86 (English = 0.87, Spanish = 0.84). The Cronbach's alpha for the appraisal subscale was 0.66 (English = 0.69; Spanish = 0.61), belonging subscale was 0.70 (English = 0.75; Spanish = 0.59), and the tangible subscale was 0.62 (English = 0.68; Spanish = 0.52).

The 12-item Multidimensional Scale of Perceived Social Support (MSPSS) was selected as it has been used in oral health research [17, 18, 34]. The MSPSS assesses perceived available emotional social support from three sources (family, friend, and significant other), and has been validated in both English [35–37] and Spanish [38]. The response options range from 1 = *very strongly disagree* to 7 = *very strongly agree*. An overall sum score and subscale scores for each of the three sources of support were computed, with higher scores indicating greater perceived social support. In this sample, the overall MSPSS Cronbach's alpha was 0.96 (English = 0.95, Spanish = 0.96). The Cronbach's alphas for the MSPSS-family subscale was 0.95 (English = 0.95; Spanish = 0.95), MSPSS-friend subscale was 0.94 (English = 0.96; Spanish = 0.95), and the MSPSS-significant other subscale was 0.95 (English = 0.96; Spanish = 0.94).

The modified Medical Outcomes Study Social Support Survey (mMOS) was selected as it is a brief, validated, widely-used general measure in large US health studies, including the All of Us Research Program Social Determinants of Health survey [39, 40], and RAND Medical Outcomes Study for patients with chronic health conditions [41]. The mMOS is a shorter eight-item version of the MOS social support survey, which assesses companionship types of support. The mMOS has been validated in English [42, 43] and Spanish [44]. An overall average score, and two subscale scores (emotional and instrumental/tangible) were tabulated. The five-point response options range from 1 = *none of the time* to 5 = *all of the time*, with higher scores indicating more frequent receipt of social support. In this sample, the overall mMOS scale Cronbach's alpha was 0.96 (English = 0.96, Spanish = 0.96). The Cronbach's alpha for the mMOS-emotional subscale was 0.94 (English = 0.93; Spanish = 0.95), and the mMOS-tangible subscale was 0.93 (English = 0.95; Spanish = 0.91).

Other validated survey measures

Two validated scales that did not assess social support but were relevant to the study population and dental context, were selected for study inclusion. The 10-item Short Acculturation Scale for Hispanics (SASH) assesses acculturation by language use and social interaction preferences. Two different five-point response options were used, ranging from 1 to 5 (e.g., 1 = *Only Spanish* to 5 = *Only English*, or 1 = *All Hispanic/Latino* to 5 = *All non-Hispanic/Latino*). A total SASH score and subscale scores for language use and social interactions were computed. Sample items include "*in which language do you usually think*" and "*you prefer going to social gatherings/parties at which people are*" members of this group. The SASH has been validated in both English and Spanish [45–47]. In this sample, the overall SASH Cronbach's alpha was 0.89 (English = 0.83, Spanish = 0.83). The Cronbach's alphas for the SASH-language use subscale was 0.94 (English = 0.86; Spanish = 0.86), and the SASH-social interaction subscale was 0.80 (English = 0.79; Spanish = 0.78).

The Modified Dental Anxiety Scale (MDAS) queries how anxious one feels at a dental visit in five different scenarios (sample items include *if you were sitting in the waiting room,* or *about to have teeth scaled and polished*). Responses are made on a five-point scale ranging from 1 = *not anxious* to *5 = extremely anxious*. An average score was computed with higher scores indicating greater levels of dental anxiety. The MDAS has been validated in English [48] and Spanish [49]. In this sample, the overall MDAS Cronbach's alpha = 0.78 (English = 0.85; Spanish = 0.74).

Oral health behaviors

Three oral health behaviors were the focus of this study and were assessed via self-report. Weekly frequency of

brushing and flossing were each assessed by single questions: "*how many times did you brush/floss your teeth in the last week?*" Frequencies were retained as continuous counts for analyses.

Recent dental visit was determined by reported length of time since last dental visit, and recoded to reflect whether or not an individual had a dental visit within the last 12 months.

Self-reported oral health indicators

Self-reported periodontal disease status was obtained using the first of eight NHANES survey questions [50, 51], which asked whether or not they thought they might have gum disease. Responses were recoded as *yes* versus *no/don't know/prefer not to answer*.

Participants reported the number of missing teeth due to disease as *none, one to five, six or more but not all*, or *all*. These responses were collapsed as a dichotomy of *one or more but not all* versus *none* (no one reported "all"; that was an exclusion criterion).

Self-rated oral health status (overall health of teeth and gums) was assessed as *poor, fair, good, very good,* or *excellent*, then was recoded into *poor/fair* versus *good/very good/excellent*, a frequently employed dichotomy [52–55].

Subsample 1: Study dental exam training, calibration and data collection

Standardized study dental exams were conducted by trained and calibrated dental staff in two partner clinics (two dentists and three registered dental assistants (RDA) at Innercare; one dentist, one RDA and one trained backup recorder at VCC). The clinics identified which dental staff should be trained, determined which clinic sites would be involved, and provided input on the development of a detailed manual of procedures for the study dental exams. As part of compliance documentation, copies of all dental providers' current licenses were requested and kept on file.

The dental teams' training is summarized in Table 1, and included a total of at least 36 h of training for the study. There were about 24 h of human subject ethical trainings to complete four required online modules. While these modules could be started/stopped several times until finished, were not timed and self-paced, the estimated 24 h to finish all four was reported by the dental team feedback as an accurate approximation of the required time commitment. There were also 12 h of project-specific trainings on study procedures, and didactic and hands-on clinical trainings to ensure consistency in implementing the study dental exams and recording data.

Calibration day exercises were conducted in-person on-site at each clinic by the study co-investigator/Calibration Examiner dentist (MIR) for the assessment and calibration of caries detection, gingival index, probing depths and position of gingival margin [57, 58]. The techniques to examine oral soft tissues, detect and record decayed, missing and filled teeth and measure plaque index, gingival index, periodontal probing, bleeding on probing, and gingival margin levels relative to the cementoenamel junction were reviewed [57, 58]. The detection of coronal caries was conducted by visual inspection only, per the International Caries Detection and Assessment System (ICDAS) criteria whereby an explorer could only be used to scrape away plaque to better visualize the tooth surface, but was not used to physically detect catches in suspected carious lesions [56]. A coronal carious lesion was determined if there was a visible break in the enamel surrounded by decalcified enamel with visible underlying dentin for interproximal carious lesions by transillumination. See Additional File 3: Calibration Forms.

Three live calibration participants were available during each of the three on-site training visits; one participated in two different trainings, for a total of eight calibration participants (see Additional File 4: Calibration Participant Characteristics). There was no racial/ethnic background inclusion criterion, and calibration participants could be clinic staff or other established clinic patients. Calibration participants provided written informed consent before participation, completed a brief demographic survey, and received a $50 gift card for their participation.

The Calibration Examiner first demonstrated standardized techniques to the examiner(s) on one participant in the order that they would be performed in the study dental exam. The Calibration Examiner then conducted a full mouth examination on the second calibration participant. Calibrations were completed on the maxillary arch with one examiner and mandibular arch with the second examiner for the first calibration. If there was not sufficient agreement between the Calibration Examiner and the Study Dental Examiner(s), discrepancies were discussed, and the third calibration participant was selected to repeat parts of the exercise where there was not agreement. Successful agreement between the Calibration Dentist and the Study Dental Examiner(s) were defined for three parameter in Table 2. All Study Dental Examiners met minimum concordance levels prior to examining any Subsample 1 study participants (see Additional File 5. Study Dentist Examiner Agreement Levels).

Study dental exams followed an approved detailed clinical protocol (NIDCR Protocol #17–051-E; see Additional File 6: REDCap template for the OHBSS study dental exam form, and Additional File 7: OHBSS study dental exam data collection forms, and Additional File 8: REDCap study dental form manual). All dental exam

Table 1 Dental Examiner and Recorder Trainings

Purpose	Time Commitment (Completion Dates[a])	Training Description	Relevant Materials
Human Subjects Research Ethics Trainings	Varies; approx. 24 h total (2020–2022)	Four required online, self-paced CITI[b] modules on topics related to ethical research conduct: 1) Human Subjects Research – Social-Behavioral basic course (HSR) 2) Information Privacy and Security (IPS) 3) Responsible Conduct of Research (RCR) involving human subjects 4) Good Clinical Practice (GCP) – Social and Behavioral Research Best Practices for Clinical Research	Modules accessible on the CITI program website: https://www.citiprogram.org/ Copies of all current CITI certifications (valid for three years) were kept on file in all study offices, clinic sites, with SDSU IRB, and NIDCR
Project Orientation	1 h (December 2021—February 2022)	Project overview presented by the study Principal Investigator (PI; TLF) to introduce the dental team to the study and review their roles, all training requirements, expectations, timeline, and to answer any questions	Project-specific powerpoint and recording
Dental Exam Manual of Procedures (MOP) and REDCap Orientation	2 h material review prior to 2 h training, must be done before in-person Calibration Day (February 2022)	The Dental Exam MOP and all appendices were provided to the dental team to review in advance of the training session with the study PI (TLF) and other study staff. This training provided step-by-step instructions for conducting the dental exam, and accessing and recording data in the REDCap Academic project database	Project-specific powerpoint and recording; OHBSS Dental Exam Manual of Procedures[c], study dental exam forms[d], REDCap template for study dental exam[e]
Didactic Dental Exam Training	2 h, done within two weeks before in-person Calibration Day (February 2022)	The co-investigator/Calibration Examiner dentist (MIR) presented the process of conducting the study dental exams, discussed identifying major oral tissue abnormalities, and provided several visual examples of dental caries and gingival index scoring criteria. He provided an overview of the calibration day exercise expectations, and answered clinical questions. The study PI (TLF) was available to answer study procedure-related questions	Project-specific powerpoint and recording
Clinic Orientation and Calibration	4 h (February and April 2022)	The Calibration Examiner (MIR) conducted a half-day, hands-on, in-person, on-site calibration exercises with three calibration participants (live patients) at the clinic to ensure that the study dental examiners were consistent in visually assessing, scoring, and recording all clinical oral health indices for the study according to all protocols	Dental Exam Calibration Forms[f]

Table 1 (continued)

Purpose	Time Commitment (Completion Dates[a])	Training Description	Relevant Materials
Consultations	1 h (June 2022)	Consultation and support was available from the PI (TLF) and/or the Calibration Examiner (MIR) and other study staff, just prior to seeing the first scheduled study participants. A "Frequently Asked Questions (FAQ) and Answers" sheet was developed and shared, along with links to all materials from prior study dental exam trainings. Clinical data from the first participants seen at each clinic were reviewed, and feedback solicited. Additional consultations to answer questions and review any/all of the study dental exam procedures were available as needed as the study progressed	Project-specific FAQ sheet
TOTAL HOURS TRAINING	≥ 36 total hours (at least 24 h online CITI certifications + 12 h study-specific trainings)		

[a] Training completion was documented through attendance records and updated on a Training Tracking Sheet

[b] CITI = Collaborative Institutional Training Initiative

[c] Additional File 8: REDCap study dental exam form manual (excerpted section from the Manual of Procedures);

[d] Additional File 7: OHBSS study dental exam collection forms;

[e] Additional File 6: REDCap template for OHBSS study dental exam forms;

[f] Additional File 3: Calibration Forms

Table 2 Calibration minimum concordance levels

Parameter	Concordance level
Decayed surfaces	A minimal level of concordance of 90%
Pocket depths	A minimum level of concordance of 90% for these measures ± 1 mm
Position of Gingival Margin	A minimum level of concordance of 90% for these measures ± 1 mm

data were recorded electronically in REDCap Academic, hosted by the University of California San Francisco School of Dentistry's Data Coordinating Center. Comprehensive oral health exams are the gold standard objective measure of oral health status. Study dental exams were primarily visual, along with periodontal probing. First, each tooth was assessed as present or absent, then each tooth was evaluated. Dental caries burden was assessed using the number of Decayed, Missing, and Filled permanent tooth Surfaces Index (DMFS, specifying M missing due to caries) [57]), five clinical periodontal indices (Gingival Index, Gingival Margin (GM), pocket depth (PD), plaque index, bleeding on probing (BOP)), and presence of oral soft tissue lesions and sealants. Determination of overall tooth status, classification of DMFS for each tooth and each of the periodontal indices followed the protocol modifications used in the oral Pediatric HIV/AIDS Cohort Study [58, 59].

Overall burden and history of dental disease was derived from the DMFS score. The following clinical oral health indicators were also tabulated, based on 28 teeth (excluding third molars): extent of tooth loss; Decayed, Missing, and Filled permanent Teeth (DMFT) and untreated decay (D component); and percentage of sites with BOP. Clinical attachment levels (CAL) were derived from PD and GM scores and used to calculate periodontal disease status based on the Centers for Disease Control and Prevention and American Academy of Periodontology (CDC/AAP) case definition [50, 51].

Dental exams were conducted in full for 41 participants who also had complete surveys between June and November 2022 at two California partner clinic sites only. Participants had to register with the clinic if they were not already an established patient of record there. Participants received a $20 Amazon gift card, dental kit, summary of any findings and local resources, and referral support if needed.

Subsample 2: Repeat survey data collection

All participants were invited to complete the OHBSS scale a second time, followed by an interview to probe further about actual sources of support for the target oral health behaviors and for social support generally. These repeat surveys were conducted two to six weeks after completing the survey the first time. Participants received a $20 Amazon gift card after completing the repeat survey and the interview, which lasted about one hour ($N=56$).

Analysis

Descriptive characteristics were tabulated for the full sample and both subsamples, and chi-square tests conducted to check for differences across samples by age group, language preference, sex, and marital status. The means and standard deviations for the OHBSS scales and other continuous measures, and the distributions and percentages of categorical variables of interest, were tabulated for the full sample and by language group. Differences by language group were assessed.

Psychometric properties for the nine OHBSS scales were tabulated, overall and by language; details about the development, structural fit, and internal consistency of the new OHBSS scales were reported elsewhere [25]. Spearman correlations were calculated for continuous measures to examine convergent validity and divergent validity in the full sample and by language group. Differences by language group were assessed.

For convergent validity, we examined Spearman correlations between OHBSS scales with three validated general social support scales (ISEL-12, MSPSS, and mMOS), overall and by language. We expected significant, positive moderate correlations (0.30–0.50 range) between the OHBSS scales and the ISEL-12, MSPSS, and mMOS scales and their subscales to indicate adequate convergent validity [60]. For MSPSS subscales that differentiated by sources of support, we expected sources to strongly correlate to the corresponding OHBSS source groups. Specifically, we expected to observe significant higher positive correlations between the MSPSS-family subscale and the OHBSS family social support scales (BF, FF, DF), and MSPSS-friends subscale with the OHBSS others/friends social support scales (BO, FO, DO).

For divergent validity, we examined Spearman correlations between the OHBSS scales with two other validated scales, the SASH scale and SASH subscales, and the MDAS. We expected either no significant correlation, or significant but weak correlations (0.10–0.30 range) between the OHBSS scales and SASH [60]. We expected that the SASH would be largely independent of OHBSS scale scores. We expected either no significant correlation, or significant but weak correlations (0.10–0.30 range) between the OHBSS scales and MDAS. We expected that MDAS scores would be largely

independent of OHBSS scale scores, but that they would be most strongly related to social support scores from dental providers (BP, FP, DP), given the overlapping dental visit context of both scales. We expected health providers to provide the most social support (and have higher scores compared to other sources of social support) and be related to the MDAS.

Correlations were calculated to explore potential predictive validity of the OHBSS scales to the self-reported oral health behaviors and select oral health status outcomes (self-reported in the full sample, and clinically-determined oral health in Subsample 1). We expected OHBSS brushing and flossing social support scales (BF, BP, BO and FF, FP, FO) to be significantly positively correlated with more frequent toothbrushing and flossing in the last week. We expected the OHBSS dental care social support scales (DF, DP, DO) to be associated with having had a dental visit in the past year. We expected significant, positive correlations (0.10–0.30 range) between the OHBSS scales and the corresponding target oral health behaviors. We calculated ANOVAs to compare OHBSS scale scores across categorical variables, including self-reported oral health status indicators. Next, correlations and ANOVAs were tabulated for OHBSS scale scores and several clinical oral health status indicators among Subsample 1 participants. We expected significant, weak correlations (0.10–0.30 range) between the OHBSS scales and oral health status indicators. OHBSS scales were expected to be more strongly positively correlated with oral health behaviors than oral health status indicators, as the behaviors were more proximal than oral health status outcomes.

All correlations and ANOVAs were also calculated for English and Spanish language groups separately. Full sample and Subsample 1 data analyses were conducted in SAS (v9.4, SAS Institute, Cary, NC).

Test–retest reliability was assessed with Subsample 2 data using R studio (v4.0.3 (2020–10-10), Boston, MA) to calculate intraclass correlation coefficients (ICC) estimates and their 95% confident intervals (CI) based on a single measure, absolute agreement, and a two-way mixed-effects model [61]. This type of ICC model is used to assess test–retest reliability if measurements cannot be regarded as randomized samples, represent a single score rather than an aggregation of multiple scores, and the aim is to examine if participants scored the same at different time points. In line with these characteristics, this psychometric evaluation of the OHBSS scales had a non-randomized, repeated-measures design and aimed to assess the similarity between single scores across two time points (time intervals between two to six weeks). Test–retest reliability was examined overall and by language. Cicchetti [62] defined ICCs from 0.60 to 0.74 as "good" reliability, and above 0.75 as "excellent".

Results

Table 3 reports the demographic characteristics for the Full Sample and both Subsample 1 and 2. The Full Sample and both subsamples were evenly split by age, and nearly evenly split by language of survey administration and marital status, per study design. There was an imbalance in composition by sex, with all the samples skewing female. In the Full Sample, there were significant differences by language group, sex, and marital status. In Subsample 1, there were significant differences by sex, and in Subsample 2, there were significant differences by language group and sex.

Table 4 presents the OHBSS scale scores, by language. Five of the nine OHBSS scales' mean scores were higher among Spanish versus English speakers: brushing social support from family (BF), brushing social support from health providers (BP), flossing social support from family (FF), dental care social support from family (DF), and dental care social support from health providers (DP). For all three oral health behaviors, OHBSS scores were higher for social support from health providers and family, and they were much lower for support from others/friends.

Table 5 summarizes the distribution of the three general social support scales and their subscales, the SASH and MDAS, and self-reported oral health behaviors and oral health status. There were significant differences by language group for the SASH and MDAS scales. As expected, English-speakers had higher SASH scores

Table 3 Full Sample and Subsample Characteristics

	Full Sample[a] *N* = 502	Subsample 1 Dental Exams[b] *N* = 41	Subsample 2 Repeat Surveys[c] *N* = 56
Age in years			
21–30	267 (53%)	21 (51%)	21 (37%)
31–40	235 (47%)	20 (49%)	35 (63%)
Language			
Spanish	199 (40%)	20 (49%)	21 (37%)
English	303 (60%)	21 (51%)	35 (63%)
Sex			
Female	397 (79%)	34 (83%)	49 (87%)
Male	105 (21%)	7 (17%)	7 (13%)
Marital Status			
Married	188 (37%)	19 (46%)	23 (41%)
Single	314 (63%)	22 (54%)	33 (59%)

[a] Significant differences by language, sex, marital status ($p < 0.05$)

[b] Significant differences by sex ($p < 0.05$)

[c] Significant differences by language, sex ($p < 0.05$)

(overall and in the language and social interaction subscales) than Spanish-speakers. English-speakers also had higher MDAS scores than Spanish-speakers.

Participants reported toothbrushing an average of 12.20 ± 6.78 times in the past week, flossing 5.88 ± 6.18 times in the past week, and 53% had a past year dental visit. About half (53%) rated themselves as having fair/poor oral health status, one-quarter (25%) indicated they had gum disease, and about one-third (37%) were missing at least one tooth due to disease.

Convergent and divergent validity

Overall, nearly all OHBSS scales were positively and significantly correlated with the three general social support scales (Table 6). The patterns of correlations for convergent validity were generally consistent with expectations, though significant correlations observed were of a smaller magnitude than hypothesized. Many weak to moderate positive correlations ranging 0.10–0.38 were observed.

The OHBSS scales' family and health provider sources of support (BF, BP, FF, FP, DF, DP) were significantly weakly positively correlated with the overall ISEL-12 score and its subscale scores, in the full sample (r = 0.152–0.236) and in both languages (r = 0.113–0.301). All OHBSS scales were significantly weakly positively correlated with the MSPSS-Total score, in the full sample (r = 0.095–0.243) and in the English-speaking sample (r = 0.123–0.278). Several OHBSS scales were significantly weakly positively correlated with the MSPSS-Total score in the Spanish-speaking sample (r = 0.150–0.229). The patterns of correlations for the MSPSS subscales generally aligned with expectations by source of support. Significant positive correlations were observed for OHBSS family source of support scales; BF, FF and DF scales weakly correlated with MSPSS-Family, in the full sample (r = 0.227–0.292) and were weak-to-moderately correlated in both languages (r = 0.263–0.332). OHBSS family social support scales also significantly weakly positively correlated with many of the MSPSS-Significant other subscale scores, in the full sample (r = 0.126–0.170) and English-speaking sample (r = 0.165–0.207); these correlations were not significant in the Spanish-speaking sample. Significant, weak, positive correlations were observed for all OHBSS scales assessing social support from others/friends and the MSPSS-Friends subscale, in the full sample (r = 0.149–0.199) and in the English-speaking sample (r = 0.177–0.242). Few OHBSS scales (FP, DF, DP and DO) were significantly weakly correlated with the MSPSS-Friends subscale in the Spanish-speaking sample (r = 0.135–0.207). Most OHBSS scales (except FO in the full sample, BO and FO in English, and BO, FO, DO in Spanish) were significantly weak-to-moderate positively correlated with the mMOS and most of the mMOS subscales (r = 0.089–0.384).

Overall, the patterns of findings for divergent validity between the OHBSS scales and the SASH and MDAS scales were consistent with expectations in the full sample and by language. Very few (11 of 108 correlations) between OHBSS scale scores had significant weak negative correlations (r < -0.16) with the acculturation and dental anxiety scales (Table 7). BF and FF were significantly weakly negatively correlated with the SASH in the full sample; BF, FF, DF and DP were significantly weakly negatively correlated with the SASH-Language subscale in the full sample. Only BF was significantly weakly negatively correlated with the SASH-Language subscale in the English-speaking sample. Only DP was significantly weakly negatively correlated with the MDAS in the full sample. A few OHBSS scales (BF, BP, FP, DP) were weakly negatively correlated with the MDAS in the English-speaking sample.

Predictive validity

OHBSS scales exhibited some significant weak positive correlations with oral hygiene behaviors (Table 8). Most OHBSS scales (BF, BP, FF, and FP) exhibited significant weak positive correlations with weekly brushing frequency in the full sample (r = 0.105–0.142); BF and FF exhibited significant weak positive correlations with weekly brushing frequency in the Spanish-speaking sample (r = 0.156–0.205). Most OHBSS scales (BF, BP, FF, FP and FO) exhibited significant weak positive correlations with weekly flossing frequency in the full sample (r = 0.134–0.256); BF, BP, FF and FP were significantly weakly positively correlated in the English-speaking sample (r = 0.136–0.189), and FF, FP and FO were significantly weak-to-moderately positively correlated in the Spanish-speaking sample (r = 0.196–0.342).

Dental care social support scores were significantly higher in the Spanish-speaking sample than in the English-speaking sample (Table 9). Among participants with a recent dental visit in the last year, dental care social support from health providers (DP) was significantly higher in the full sample and English-speaking sample, compared to those without a recent dental visit.

Overall, the findings examining the association between the OHBSS scales and self-reported oral health status show patterns in expected directions. Adults with better oral health status (no periodontal disease, good/very good/excellent oral health, and not missing any teeth due to disease) reported higher social support on the OHBSS scale of dental care social support.

There were significant differences in OHBSS scores for periodontal disease status by language, with higher social

Table 4 OHBSS social support scale scores, by language

	Full Sample *N* = 502 mean ± SD	English *N* = 303 mean ± SD	Spanish *N* = 199 mean ± SD
Brushing_Family (BF)*	2.22 ± 1.28	2.06 ± 1.28	2.46 ± 1.24
Brushing_Providers (BP)*	2.80 ± 1.13	2.71 ± 1.18	2.93 ± 1.03
Brushing_Others (BO)	0.92 ± 1.14	0.90 ± 1.17	0.95 ± 1.08
Flossing_Family (FF)*	1.81 ± 1.32	1.69 ± 1.32	1.99 ± 1.31
Flossing_Providers (FP)	2.71 ± 1.22	2.67 ± 1.23	2.78 ± 1.19
Flossing_Others (FO)	0.74 ± 1.10	0.75 ± 1.14	0.73 ± 1.05
Dental Care_Family (DF)*	2.10 ± 1.23	2.00 ± 1.23	2.24 ± 1.22
Dental Care_Providers (DP)*	2.85 ± 1.10	2.74 ± 1.12	3.01 ± 1.06
Dental Care_Others (DO)	0.98 ± 1.12	0.94 ± 1.15	1.03 ± 1.09

* significant differences by language at $p < 0.05$ level

Table 5 Distribution of survey measures, overall and by language

	Full Sample *N* = 502	English *N* = 303	Spanish *N* = 199
General social support scales and subscales, mean ± SD			
Interpersonal Support Evaluation List (ISEL-12)	24.69 ± 7.35	24.56 ± 7.69	24.88 ± 6.82
ISEL-appraisal	8.72 ± 2.67	8.70 ± 2.79	8.74 ± 2.50
ISEL-belonging	7.91 ± 2.89	7.74 ± 3.05	8.17 ± 2.60
ISEL-tangible	8.06 ± 2.76	8.11 ± 2.85	7.97 ± 2.62
Multidimensional Scale of Perceived Social Support (MSPSS) Total	5.79 ± 1.66	5.84 ± 1.63	5.70 ± 1.71
MSPSS-Family	5.33 ± 1.75	5.32 ± 1.76	5.34 ± 1.75
MSPSS-Friends	5.06 ± 1.76	5.14 ± 1.79	4.93 ± 1.72
MSPSS-Significant Other	5.65 ± 1.72	5.74 ± 1.69	5.51 ± 1.75
Modified Medical Outcomes Study Social Support Survey (mMOS) total	3.89 ± 1.05	3.86 ± 1.09	3.94 ± 0.98
mMOS-emotional	3.62 ± 1.00	3.70 ± 1.01	3.49 ± 0.99
mMOS-tangible	3.71 ± 0.98	3.76 ± 0.94	3.63 ± 1.08
Other measures, mean ± SD			
Short Acculturation Scale for Hispanics (SASH)*	2.55 ± 0.87	3.08 ± 0.60	1.73 ± 0.49
SASH-Language*	2.66 ± 1.21	3.45 ± 0.83	1.47 ± 0.56
SASH-Social Interactions*	2.26 ± 0.68	2.43 ± 0.66	2.01 ± 0.62
Modified Dental Anxiety Scale (MDAS)*	13.06 ± 6.03	13.77 ± 6.13	11.98 ± 5.71
Oral health behaviors			
Brushing, times in past week, mean ± SD	12.20 ± 6.78	11.90 ± 5.64	12.64 ± 8.00
Flossing, times in past week, mean ± SD	5.88 ± 6.18	5.56 ± 5.34	6.36 ± 7.27
Dental visit in last year, *n*(%)	266 (53%)	172 (57%)	94 (47%)
Self-reported oral health status, *n*(%)			
Fair/Poor self-rated oral health	266 (53%)	156 (51%)	110 (55%)
Periodontal disease	125 (25%)	76 (25%)	49 (25%)
Missing ≥ 1 teeth due to disease	184 (37%)	91 (30%)	93 (47%)

* Significant differences by language at $p < 0.05$ level

support scores in the Spanish-speaking sample than the English-speaking sample (Table 10). In the full sample, dental care social support from family (DF) and health providers (DP) were each significantly higher for those who did not have periodontal disease compared to those with periodontal disease.

There were some significant differences in OHBSS scores for oral health status by language (Table 11). In the full sample, dental care social support from all sources (DF, DP, and DO) were each significantly higher for those who had good/very good/excellent oral health compared to those who had fair/poor oral health.

Table 6 Spearman correlation coefficients for assessing OHBSS scales' convergent validity with general social support scales

	ISEL_all	ISEL_app	ISEL_bel	ISEL_ tang	MSPSS Total	MSPSS Sig	MSPSS Fam	MSPSSFr	mMOS	mMOS tang	mMOS emot
Full Sample (*N* = 502)											
Brush_Family (BF)	0.177**	0.136**	0.168**	0.166**	0.180**	0.126**	0.237**	0.124**	0.219**	0.210**	0.209**
Brush_Provider (BP)	0.152**	0.145**	0.124**	0.136**	0.136**	0.080	0.147**	0.132**	0.156**	0.144**	0.148**
Brush_Others (BO)	0.020	-0.035	0.069	0.015	0.095*	0.020	0.064	0.151**	0.089*	0.087	0.076
Floss_Family (FF)	0.164**	0.122**	0.163**	0.148**	0.182**	0.127**	0.227**	0.133**	0.214**	0.212**	0.194**
Floss_Providers (FP)	0.205**	0.177**	0.170**	0.196**	0.169**	0.083	0.169**	0.188**	0.209**	0.199**	0.187**
Floss_Others (FO)	0.026	-0.034	0.087	0.013	0.096*	0.019	0.068	0.149**	0.082	0.087	0.064
Dental_Family (DF)	0.236**	0.202**	0.214**	0.208**	0.243**	0.170**	0.292**	0.185**	0.283**	0.278**	0.271**
Dental_Provider (DP)	0.222**	0.222**	0.181**	0.188**	0.184**	0.112*	0.171**	0.196**	0.264**	0.258**	0.258**
Dental_Others (DO)	0.087	0.047	0.134**	0.046	0.154**	0.056	0.122**	0.199**	0.134**	0.125**	0.130**
English (*N* = 303)											
Brush_Family (BF)	0.195**	0.130*	0.192**	0.193**	0.222**	0.171**	0.285**	0.140*	0.210**	0.211**	0.185**
Brush_Provider (BP)	0.146*	0.113*	0.126*	0.148**	0.135*	0.056	0.135*	0.154**	0.113*	0.109	0.093
Brush_Others (BO)	0.086	0.016	0.139*	0.068	0.131*	0.046	0.081	0.200**	0.092	0.104	0.055
Floss_Family (FF)	0.165**	0.099	0.183**	0.153**	0.214**	0.165**	0.263**	0.142*	0.196**	0.203**	0.164**
Floss_Providers (FP)	0.217**	0.169**	0.187**	0.220**	0.164**	0.061	0.136*	0.216**	0.173**	0.167**	0.144*
Floss_Others (FO)	0.083	0.001	0.163**	0.049	0.123*	0.043	0.090	0.177**	0.079	0.093	0.043
Dental_Family (DF)	0.210**	0.172**	0.194**	0.189**	0.278**	0.207**	0.332**	0.200**	0.256**	0.266**	0.233**
Dental_Provider (DP)	0.178**	0.170**	0.132*	0.172**	0.167**	0.088	0.134*	0.203**	0.194**	0.200**	0.179**
Dental_Others (DO)	0.128*	0.071	0.174**	0.090	0.193**	0.097	0.151**	0.242**	0.131*	0.139*	0.101
Spanish (*N* = 199)											
Brush_Family (BF)	0.144*	0.150*	0.099	0.134	0.139	0.087	0.166*	0.125	0.225**	0.203**	0.238**
Brush_Provider (BP)	0.161*	0.207**	0.101	0.122	0.153*	0.138	0.169*	0.109	0.231**	0.207**	0.239**
Brush_Others (BO)	-0.105	-0.130	-0.072	-0.079	0.041	-0.019	0.035	0.071	0.083	0.053	0.109
Floss_Family (FF)	0.158*	0.162*	0.109	0.150*	0.150*	0.090	0.174*	0.136	0.238**	0.225**	0.234**
Floss_Providers (FP)	0.181*	0.193**	0.131	0.159*	0.183**	0.126	0.222**	0.150*	0.267**	0.253**	0.256**
Floss_Others (FO)	-0.079	-0.099	-0.059	-0.054	0.052	-0.022	0.031	0.100	0.090	0.077	0.101
Dental_Family (DF)	0.279**	0.254**	0.238**	0.249**	0.205**	0.132	0.232**	0.179*	0.322**	0.295**	0.328**
Dental_Provider (DP)	0.301**	0.318**	0.254**	0.230**	0.229**	0.173*	0.235**	0.207**	0.382**	0.359**	0.384**
Dental_Others (DO)	0.012	0.004	0.054	-0.027	0.097	0.020	0.077	0.135*	0.137	0.096	0.176*

ISEL = Interpersonal Support Evaluation List-12 item social support scale and subscales for appraisal (app), belonging (bel), and tangible (tang) support

MSPSS Multidimensional Scale of Perceived Social Support scale and subscales for support from significant other (Sig), family (Fam), and friends (Fr)

mMOS modified Medical Outcomes Study social support scale and subscales for tangible (tang) and emotional (emot) support

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)

There were significant differences in OHBSS scores for missing teeth due to disease by language, with higher scores among the Spanish-speaking sample than in the English-speaking sample (Table 12).

Subsample 1: dental exams

Among the 41 Subsample 1 participants, four (10%) were identified to have an unusual oral lesion and were referred for follow-up care. About one-quarter (24%) had missing teeth due to disease. Participants' DMFT scores revealed a history of dental caries experience. Half (52%) had some untreated caries (DT > 0), reflecting unmet needs. In terms of periodontal disease status indicators, the majority (80%) had mild gingivitis, and 20% had moderate gingivitis. The proportion of sites bleeding on probing ranged from 0.05 to 0.88. All participants had at least one tooth with a plaque index of one or greater. Subsample 1 participants' clinical oral health status indicators are summarized in Table 13. There were no significant correlations between the OHBSS scale scores and the clinical indices. Subsample 1 participants' OHBSS scale scores are summarized in Additional File 9.

Subsample 2 repeat survey: test–retest reliability

Subsample 2 participants' original and repeat OHBSS scores are summarized in Additional File 10. Overall, average OHBSS scores appeared consistent across the two time points (for example, BF initial average score: 2.22 vs. repeat BF average score: 2.14). The stability in these scores suggests the scales are reproducible, and yield consistent results over a short time period, when scores should be generally stable. OHBSS scales exhibited high test–retest reliability in both languages, with seven of the nine intra-class correlation coefficients (ICCs) greater than 0.60 in the full sample. The scales exhibited lower ICCs in the English-speaking sample, with only four of the nine scale ICCs in the "good" range. In the Spanish-speaking subsample, all nine ICCs were above 0.75, and in the "excellent" range. See all ICCs in Table 14.

Table 7 Spearman correlation coefficients for assessing OHBSS scales' divergent validity with SASH and MDAS

Full Sample (*N* = 502)	SASH	SASH_Lang	SASH_SOC	MDAS
Brush_Family (BF)	-0.141**	-0.161**	-0.024	-0.069
Brush_Provider (BP)	-0.058	-0.074	0.016	-0.075
Brush_Others (BO)	-0.014	-0.021	0.022	0.018
Floss_Family (FF)	-0.091*	-0.106*	-0.004	-0.030
Floss_Provider (FP)	-0.008	-0.015	0.015	-0.073
Floss_Others (FO)	0.011	0.006	0.026	0.014
Dental care_Family (DF)	-0.073	-0.095*	0.015	-0.054
Dental care_Providers (DP)	-0.072	-0.090*	0.013	-0.099*
Dental care_Others (DO)	-0.008	-0.024	0.043	0.003
English (*N* = 303)				
Brush_Family (BF)	-0.098	-0.129*	0.007	-0.114*
Brush_Provider (BP)	-0.030	-0.043	0.019	-0.121*
Brush_Others (BO)	-0.017	-0.020	0.022	-0.039
Floss_Family (FF)	-0.052	-0.070	0.023	-0.034
Floss_Provider (FP)	0.004	-0.002	0.029	-0.131*
Floss_Others (FO)	-0.029	-0.024	0.010	-0.026
Dental care_Family (DF)	-0.039	-0.059	0.012	-0.075
Dental care_Providers (DP)	-0.002	-0.027	0.052	-0.142*
Dental care_Others (DO)	-0.003	-0.040	0.016	-0.016
Spanish (*N* = 199)				
Brush_Family (BF)	0.077	0.075	0.049	0.068
Brush_Provider (BP)	0.131	0.117	0.097	0.052
Brush_Others (BO)	0.040	0.023	0.041	0.132
Floss_Family (FF)	0.058	0.047	0.040	0.022
Floss_Provider (FP)	0.119	0.132	0.034	0.045
Floss_Others (FO)	0.071	0.045	0.048	0.086
Dental care_Family (DF)	0.069	0.024	0.101	0.022
Dental care_Providers (DP)	0.096	0.094	0.052	0.031
Dental care_Others (DO)	0.100	0.034	0.130	0.055

SASH Short Acculturation Scale for Hispanics, and subscales for language (lang) and social interactions (soc)

MDAS Modified Dental Anxiety Scale

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Discussion

The psychometric properties of the new OHBSS scales exhibited acceptable validity, in the full sample of Mexican-origin adults, and in both English and Spanish. Test–retest reliability was adequate; ICCs were better in the full sample and in the Spanish-speaking sample than in the English-speaking sample. These new scales measure social support for brushing, flossing, and dental care utilization from family, health providers, and others/friends. Evidence for OHBSS scales' adequate structural validity and internal consistency (Cronbach's alphas and McDonald's omegas) is reported elsewhere [25]. Overall, patterns of findings from this study support these scales have adequate convergent validity, divergent validity, and test–retest reliability. In terms of predictive validity, findings were mixed. The OHBSS scales demonstrated adequate predictive validity for the three oral health behaviors, and most of the self-reported oral health status indicators. However, there was no evidence of predictive validity

Table 8 Correlations between brushing and flossing social support with self-reported oral hygiene behaviors, by language

	Weekly Brushing			Weekly Flossing		
	Full Sample	**English**	**Spanish**	**Full Sample**	**English**	**Spanish**
Brush_Family (BF)	0.126**	0.087	0.156*	0.140**	0.136*	0.116
Brush_Provider (BP)	0.105*	0.082	0.125	0.160**	0.117*	0.214
Brush_Others (BO)	-0.007	-0.035	0.024	0.055	0.026	0.095
Floss_Family (FF)	0.142**	0.085	0.205**	0.254**	0.189**	0.342**
Floss_Provider (FP)	0.105*	0.085	0.124	0.217**	0.144*	0.315**
Floss_Others (FO)	0.033	0.041	0.018	0.134**	0.094	0.196**

* Correlation is significant at the < 0.05 level (2-tailed)

** Correlation is significant at the < 0.01 level (2-tailed)

of the OHBSS scales and the clinically-determined oral health status indicators in Subsample 1. The lack of predictive validity for the clinical indices may be due to the very small subsample size, and that these outcomes are more distal than the oral health behaviors.

The OHBSS scores indicated that health providers were the most significant source of social support across all three oral health behaviors among our large sample of Mexican-origin young adults, as evidenced by higher mean social support scores for this source group compared to family or others/friends. This is not surprising given the dental health context of the OHBSS scales, and it is a very notable finding. Other social support measures are not designed to capture social support from health providers. OHBSS scales will be helpful, as it specifically queries the source of support most commonly reported as providing social support among Mexican-origin young adults. This finding has important implications for potential future interventions that target improving social support from health providers for patients. Dental and other healthcare professionals are often seen as trusted sources of information [63, 64]. However, racism and discrimination could be diluting the potential benefits of social support from health providers for the Mexican-origin population [65–67].

OHBSS scores indicated family members also provide social support for engaging in oral health behaviors. Family members are often involved in teaching and facilitating oral hygiene behaviors at home and facilitating dental care utilization in multiple ways. Family structures may change in young adulthood as individuals may or may not live independently or start their own families. "Family" is a broad group that can encompass parents, spouses, children and others, and the OHBSS scale defined "family" to include any family member, whether they resided with the participant or not. Supplemental OHBSS analyses investigated the social networks of participants and is reported elsewhere [68]. The category of "others/friends" did not provide much support for engaging in oral health behaviors. The patterns observed for the different sources of support groups were as expected, with health providers providing the most social support, followed by family, then others/friends. It is possible that others/friends may be a potential untapped source of social support.

Table 9 Dental care social support scale scores and recent dental utilization, by language

	Full Sample *N* = 502 mean ± SD	**English *N* = 303 mean ± SD**	**Spanish *N* = 199 mean ± SD**
DENTAL VISIT IN LAST YEAR	***N* = 266**	***N* = 172**	***N* = 94**
Dental care_Family (DF)*	2.10 ± 1.23	2.04 ± 1.22	2.22 ± 1.26
Dental care_Providers (DP)*	3.03 ± 0.94[a]	2.98 ± 0.93[a]	3.11 ± 0.96
Dental care_Others (DO)*	0.96 ± 1.15	0.95 ± 1.18	1.00 ± 1.10
NO DENTAL VISIT IN LAST YEAR	***N* = 236**	***N* = 131**	***N* = 105**
Dental care_Family (DF)*	2.09 ± 1.23	1.95 ± 1.25	2.26 ± 1.20
Dental care_Providers (DP)*	2.65 ± 1.23[a]	2.42 ± 1.26[a]	2.93 ± 1.13
Dental care_Others (DO)*	0.99 ± 1.09	0.94 ± 1.10	1.06 ± 1.08

* significant difference in dental care social support scale scores by language, $p < 0.05$

[a] significant difference in dental care social support scale scores by dental visit, $p < 0.05$

Table 10 Dental care social support scale scores for self-reported periodontal disease status, by language

	Full Sample *N* = 502 mean ± SD	English *N* = 303 mean ± SD	Spanish *N* = 199 mean ± SD
NO PERIODONTAL DISEASE	***N* = 377**	***N* = 227**	***N* = 150**
Dental care_Family (DF)*	2.16 ± 1.24[a]	2.05 ± 1.24	2.33 ± 1.21
Dental care_Providers (DP)*	2.91 ± 1.05[a]	2.81 ± 1.08	3.08 ± 0.97
Dental care_Others (DO)*	1.00 ± 1.16	0.95 ± 1.16	1.09 ± 1.15
PERIODONTAL DISEASE	***N* = 125**	***N* = 76**	***N* = 49**
Dental care_Family (DF)*	1.89 ± 1.20[a]	1.85 ± 1.16	1.96 ± 1.22
Dental care_Providers (DP)*	2.64 ± 1.22[a]	2.54 ± 1.19	2.79 ± 1.26
Dental care_Others (DO)*	0.89 ± 1.08	0.92 ± 1.11	0.84 ± 0.85

* significant difference in dental care social support scale scores by language, $p < 0.05$

[a] significant difference in dental care social support scale scores by dental visit, $p < 0.05$

Table 11 Dental care social support scale scores for self-reported oral health status, by language

	Full Sample *N* = 502 mean ± SD	English *N* = 303 mean ± SD	Spanish *N* = 199 mean ± SD
GOOD/VERY GOOD/EXCELLENT SELF-RATED ORAL HEALTH	***N* = 236**	***N* = 147**	***N* = 89**
Dental care_Family (DF)*	2.38 ± 1.15[a]	2.56 ± 1.15[a]	2.57 ± 1.11[a]
Dental care_Providers (DP)	3.05 ± 0.95[a]	3.05 ± 0.90[a]	3.05 ± 1.03
Dental care_Others (DO)*	1.18 ± 1.21[a]	1.11 ± 1.20[a]	1.30 ± 1.23[a]
FAIR/POOR SELF-RATED ORAL HEALTH	***N* = 266**	***N* = 156**	***N* = 110**
Dental care_Family (DF)*	1.85 ± 1.27[a]	1.76 ± 1.26[a]	1.97 ± 1.25[a]
Dental care_Providers (DP)*	2.67 ± 1.19[a]	2.46 ± 1.22[a]	2.98 ± 1.08
Dental care_Others (DO)	0.80 ± 1.01[a]	0.79 ± 1.08[a]	0.81 ± 0.91[a]

* significant difference in dental care social support scale scores by language, $p < 0.05$

[a] significant difference in dental care social support scale scores by dental visit, $p < 0.05$

Table 12 Dental care social support scale scores for self-reported missing teeth, by language

	Full Sample *N* = 502 mean ± SD	English *N* = 303 mean ± SD	Spanish *N* = 199 mean ± SD
NO MISSING TEETH DUE TO DISEASE	***N* = 318**	***N* = 212**	***N* = 106**
Dental care_Family (DF)*	2.07 ± 1.25	1.94 ± 1.22	2.31 ± 1.30
Dental care_Providers (DP)*	2.81 ± 1.16	2.72 ± 1.13	2.97 ± 1.19
Dental care_Others (DO)*	0.95 ± 1.11	0.87 ± 1.08	1.11 ± 1.15
MISSING TEETH DUE TO DISEASE	***N* = 184**	***N* = 91**	***N* = 93**
Dental care_Family (DF)*	2.14 ± 1.20	2.12 ± 1.27	2.15 ± 1.13
Dental care_Providers (DP)*	2.92 ± 0.99	2.77 ± 1.09	3.06 ± 0.88
Dental care_Others (DO)*	1.02 ± 1.15	1.11 ± 1.27	0.94 ± 1.01

* significant difference in dental care social support scale scores by language, $p < 0.05$

"Others" can include a wide array of potential sources of support, such as community health workers or health navigators or home visitors who could facilitate navigating barriers to engaging in oral health-promoting behaviors.

In terms of language differences, Spanish speakers tended to report higher OHBSS scores (reflecting greater

Table 13 Clinically-determined oral health status in Subsample 1, overall and by language (*N* = 41)

	Subsample 1 *N* = 41 *n*(%)/ mean ± SD	English *N* = 21 *n*(%), mean ± SD	Spanish *N* = 20 *n*(%), mean ± SD
Oral health status[a]			
Extent of tooth loss			
Any missing teeth due to disease	10 (24%)	5 (23%)	5 (25%)
Dental Caries			
Any untreated decayed tooth	22 (52%)	14 (64%)	8 (40%)
No untreated decayed teeth (DT = 0)	20 (48%)	8 (36%)	12 (60%)
DMFT	9.19 ± 5.43	9.27 ± 5.81	9.10 ± 5.14
DT	1.95 ± 2.93	2.59 ± 3.48	1.25 ± 2.02
FT	6.52 ± 4.85	6.09 ± 4.87	7.00 ± 4.92
MT	0.71 ± 1.45	0.59 ± 1.30	0.85 ± 1.63
Periodontal Disease			
Proportion of sites BOP	0.39 ± 0.24	0.36 ± 0.23	0.43 ± 0.24
CDC/AAP case definition			
None	8 (20%)	6 (29%)	2 (10%)
Mild	15 (36%)	9 (43%)	6 (30%)
Moderate	13 (32%)	3 (14%)	10 (50%)
Severe	5 (12%)	3 (14%)	2 (10%)

DMFT Decayed Missing Filled Teeth, *DT* Decayed Teeth, *FT* Filled Teeth, *MT* Missing Teeth, *BOP* Bleeding on probing, *CDC/AAP* Centers for Disease Control and Prevention / American Academy of Periodontology

[a] Based on 28 teeth, third molars excluded

social support) than English speakers. Further, Spanish speakers tended to have higher OHBSS scores when the source of social support was a family member. *Familismo*, a culturally-derived concept that considers both family obligations and family connections [69, 70], can shape health norms and beliefs. In an oral health social network study of Mexican-origin adults in the midwestern US, *familismo* played a role, and family members were frequently sought to discuss dental problems [71]. In the present study, it is possible that *familismo* may be stronger among Spanish-speaking participants, who may have stronger retention of cultural norms and behaviors consistent with their country of origin. Findings showed that OHBSS scales were correlated with their respective oral health behaviors, with some weak positive correlations. Spanish speakers appeared to have more brushing and flossing social support from family members, and generally higher scores than English speakers. This could again be tied to *familismo*. If participants live with family members, those family members may have more opportunities to interact with participants at home during the times when these daily behaviors are being performed. In a study of Canadian adolescents, those that who reported less social support from their family (as assessed by the MSPSS) brushed less often [72]. Spanish speakers also had higher scores on the brushing and dental care utilization scales when the source of social support was a health provider.

Patterns of findings supported convergent validity with three well-cited general social support scales, suggesting that the new OHBSS scales for social support specific to brushing, flossing and dental care did capture the construct of social support. The OHBSS scales exhibited significant, positive, weak-to-moderate correlations that were in a slightly lower range (r = 0.10–0.38), rather than in the expected moderate range (r = 0.30–0.50). It is possible that the general social support scales selected focused more on social support dimensions that were not as well represented in the OHBSS scales. OHBSS scale items skew more heavily to informational and instrumental types of social support, and less on emotional or appraisal support [25]. Scores on the OHBSS scales' different source groups aligned well with the MSPSS scales' different source of support groups for family and friends. The highest correlations were between the OHBSS and the mMOS; OHBSS also correlated significantly with the mMOS tangible and emotional subscales. The patterns of convergent validity findings were similar in the English-speaking group, but there were fewer significant correlations in the Spanish-speaking group. This could be attributed to some cultural differences between the language groups. One study of the MSPSS structure suggested that the scale should merge Family and Significant

Table 14 Test re-test reliability

Subsample 2 (*N* = 56)	Family (F) ICC (95% confidence interval)	Health Providers (P) ICC (95% confidence interval)	Others/Friends (O) ICC (95% confidence interval)
Brushing (12 items)	0.613 (0.419, 0.754)*	0.712 (0.555, 0.820)*	0.602 (0.407, 0.745)*
Flossing (12 items)	0.594 (0.397, 0.740)	0.631 (0.443, 0.766)*	0.506 (0.281, 0.678)
Dental Care (14 items)	0.743 (0.598, 0.841)*	0.800 (0.681,0.878)**	0.681 (0.510, 0.800)*
English (*N* = 35)			
Brushing (12 items)	0.377 (0.050, 0.629)	0.602 (0.338, 0.778)*	0.362 (0.047, 0.615)
Flossing (12 items)	0.372 (0.056, 0.622)	0.470 (0.162, 0.693)	0.246 (-0.098, 0.535)
Dental Care (14 items)	0.605 (0.342, 0.780)*	0.726 (0.520, 0.852)*	0.603 (0.341, 0.778)*
Spanish (*N* = 21)			
Brushing (12 items)	0.851 (0.668, 0.937) **	0.866 (0.693, 0.944) **	0.864 (0.699, 0.942)**
Flossing (12 items)	0.833 (0.633, 0.929) **	0.846 (0.665, 0.934) **	0.819 (0.606, 0.923) **
Dental Care (14 items)	0.877 (0.725, 0.948) **	0.919 (0.814, 0.966) **	0.770 (0.511, 0.900) **

* ICC = intra-class correlation. ICC coefficients 0.60 to 0.74 are "good"

** ICC coefficients ≥ 0.75 are "excellent"

Other subscales, and that a two subscale structure fit better than the three subscale structure in a sample of undocumented Hispanic immigrants [73].

In terms of divergent validity, the OHBSS scales exhibited only a few significant but very small negative correlations with acculturation or dental anxiety, thus demonstrating that the OHBSS scales measured distinct constructs as intended. Future multivariable analyses will explore the relationships between acculturation, dental anxiety, and the OHBSS scales further. This analysis of psychometric properties focused only on the required set of OHBSS items, but there were also optional scales developed (described elsewhere, see Finlayson and colleagues [25]). Two optional items address social support related to dental worries. These items were ultimately shifted to an optional list, since it did not appear to be applicable for all adults, but very relevant for some who suffer from dental-related fears and anxiety. This could be a possible direction for future behavioral interventions.

Timing of when the study was conducted could have affected survey responses. Data were collected during 2022–2023, in the period after shutdowns from the COVID-19 pandemic. A recent literature review shows that COVID-19 negatively affected at-home hygiene routines and limited dental visits [74]. Americans delayed dental care during and after the pandemic, which likely led to pent-up needs and more intense procedures among patients served at FQHCs in particular [75]. Patterns of care-seeking by insured patients were also negatively affected [76]. We recognize the timing of studying social support in a dental context during a global pandemic, and that this may have affected results. It is possible that certain types of social support may have been less salient for some people, and dental behaviors may have changed during and after national stay-at-home orders. Future analyses will explore the relationships between social support and brushing, flossing, dental utilization and other oral health outcomes in more depth.

Limited clinical oral health data were available. Future studies should collect clinical oral health status from a larger sample. Young Mexican-origin adults in this sample, between the ages of 21–40 years old, were expected to be relatively healthy overall, but half had untreated tooth decay, and a quarter were missing teeth due to disease, which may be suggest a high disease burden and unmet needs. This finding should be interpreted with caution due to the very small Subsample 1 size. There were not significant correlations between OHBSS scales and clinical indicators, though there were significant correlations between OHBSS scales and oral health behaviors. The lack of a direct relationship between social support and clinical oral health outcomes could be because those outcomes are more distal; health behaviors may mediate the relationship between social support and oral health outcomes. Future analyses will explore the potential mediational relationship further.

Dental and other healthcare professionals were identified as important sources of support that can play a role in providing social support for oral health behaviors. Dental and other healthcare providers can use the OHBSS scales to quickly screen their patients about a range of oral health behaviors and available social support resources and needs, and ideally provide appropriate referrals or resources to support their patients' oral health behaviors. In dental practices, often dental hygienists and dental assistants spend more time with patients and provide health education. Health providers are

beginning to document social needs in electronic health records [77]. FQHCs may have case managers, health navigators, or community health workers on staff who can screen for social support needs and follow up with patients and offer support directly.

Finally, there was evidence of good test–retest reliability for all OHBSS scales in the full sample. Test–retest reliability by language showed good ICCs for Spanish-speakers across all OHBSS scales, and that scores were stable over the two-to-six week time period. However, test–retest reliability was not as robust among English-speakers, particularly in the OHBSS scales for brushing and flossing, and from OHBSS scales assessing social support from family and others/friends. Subsample 2 had a small sample size that should be considered, together with being skewed mostly female, and included more English than Spanish speakers.

Strengths and Limitations

This study utilized data from a large sample of Mexican-origin young adult men and women to validate nine new OHBSS scales in two languages. A strength of this study is that the OHBSS scales were co-created in English and Spanish simultaneously [25], and the sample size was powered to support analyzing psychometric properties in both languages. Most scales are developed in only one language initially, and translated later. The present study's approach to scale development and validation and reporting psychometric properties for the full sample and for both language groups up front is a major strength. This study's priority population included both monolingual and bilingual (English/Spanish) speakers, and our approach was intentionally and thoughtfully inclusive of both languages throughout all stages of scale development and testing and in this evaluation of psychometric properties.

Study limitations should be recognized. The participants all self-identified as Mexican-origin and resided in the southwestern US and in the US-Mexico border region. The OHBSS scales may perform differently with other Hispanic/Latino subgroups (e.g., Puerto Ricans, Cubans). There may also be unique and relevant cultural influences on young adults in a border region. Notably, the subsample size for the clinical examination was very small. It was challenging to conduct the clinical aspects of this study during and in the immediate aftermath of the COVID-19 pandemic. Although clinics were open, there were staffing challenges and some planned days with study dental exam appointment slots that needed to be rescheduled. Participants also requested to reschedule study appointments often. Further studies are needed to more clearly evaluate the direct or indirect relationship of social support to clinically-determined oral health. Also, the subsample size for test–retest reliability analysis was small; a larger sample size should be employed in future studies to more clearly establish stability of scores.

Conclusion

This study provides evidence for the convergent validity, divergent validity and test–retest reliability for the nine new OHBSS scales in both English and Spanish, in a large sample of Mexican-origin young adults. The OHBSS scales exhibited acceptable psychometric properties and add to the armamentarium of social support scales. Culturally and linguistically appropriate, reliable and valid instruments are needed for intervention and oral health research studies to promote oral health-related behaviors. These oral health behavior-specific scales assess support for oral hygiene behaviors (brushing, flossing) and for dental care utilization from family, health providers, and others/friends.

Abbreviations

AZ	Arizona
BF	Brushing social support from family
BO	Brushing social support from others/friends
BOP	Bleeding on probing
BP	Brushing social support from health providers
CA	California
CAL	Clinical attachment levels
CDC/AAP	Centers for Disease Control and Prevention / American Academy of Periodontology
CI	Confidence interval
CITI	Collaborative Institutional Training Initiative
DF	Dental care social support from family
DO	Dental care social support from others/friends
DP	Dental care social support from health providers
DMFS	Decayed Missing Filled Surfaces
DMFT	Decayed Missing Filled Teeth
DT	Decayed Teeth
FQHC	Federally qualified health centers
FF	Flossing social support from family
FO	Flossing social support from others/friends
FP	Flossing social support from health providers
FT	Filled Teeth
GM	Gingival Margin
HCHS/SOL	Hispanic Community Health Study/Study of Latinos
IRB	Institutional Review Board
ICC	Intra-class correlation
ICDAS	International Caries Detection and Assessment System
ISEL	Interpersonal Support Evaluation List-12 item social support scale
MDAS	Modified Dental Anxiety Scale
mMOS	Modified Medical Outcomes Study Social Support Survey
MOP	Manual of Procedures
MSPSS	Multidimensional Scale of Perceived Social Support
MT	Missing Teeth
NHANES	National Health and Nutrition Examination Survey
NIDCR	National Institutes of Dental and Craniofacial Research
OHBSS	Oral Health Behavior Social Support
PD	Pocket depth
PI	Principal Investigator
RDA	Registered dental assistants
SASH	Short Acculturation Scale for Hispanics
SDSU	San Diego State University

UNC	University of North Carolina
US	United States
VCC	Vista Community Clinic

Supplementary Information

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Additional file 1: Oral Health Behavior Social Support (OHBSS) scales.pdf.

Additional file 2: REDCap template for the Oral Health Behavior Social Support (OHBSS) scales.csv.

Additional file 3: Calibration exercise forms.pdf.

Additional file 4: Calibration participant characteristics.pdf.

Additional file 5: Study Dentist Examiner agreement levels.pdf.

Additional file 6: REDCap template for the OHBSS study dental exam forms.csv.

Additional file 7: OHBSS study dental exam data collection forms.pdf

Additional file 8: REDCap study dental exam form manual.pdf.

Additional file 9: Subsample 1 participants' Oral Health Behavior Social Support (OHBSS) scale scores, by language.pdf.

Additional file 10: Subsample 2 original and repeat survey OHBSS scale scores, by language.pdf.

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Authors' contributions
T.L.F. conceived of the study, obtained grant funding, planned and led all study activities, guided data collection, conducted analysis and results interpretation, coordinated study activities with clinic partners, and led manuscript writing and revision. C.G.A. conducted data analysis and contributed to writing the methods and results sections. V.L.M., G.X.A., M.K.S., K.S.H., S.A.G., and M.R. helped design the study, contributed to data collection and results interpretation. M.R. led the clinical protocol and trained clinic dental staff for study dental exams. S.A.G. contributed to data management. G.X.A. contributed to administrative and IT support funding, and data management. L.S.M. contributed to results interpretation. E.D. contributed to study planning at El Rio Health. N.S. contributed to study planning and oversight at VCC. B.S. contributed to study planning and oversight at Innercare. G.M. contributed to study design and protocol development. All authors reviewed and critically edited the manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study adhered to the Declaration of Helsinki. Ethical approval was obtained from the San Diego State University Institutional Review Board (SDSU IRB Protocol HS-2021–0201) prior to the start of the study. The National Institute of Dental and Craniofacial Research (NIDCR) also reviewed and approved the study protocol (#17–051-E). Written informed consent was obtained from each study participant in either English or Spanish.

Consent for publication
No individual participant has been identified in the details within this manuscript. Each author has approved the final version of this paper.

Competing interests
The authors declare no competing interests.

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References

1. National Institutes of Health. Oral Health in America: Advances and Challenges. Bethesda: US Department of Health and Human Services, National Institutes of Health, National Institute of Dental and Craniofacial Research; 2021. https://www.nidcr.nih.gov/research/oralhealthinamerica.
2. Jiminez MC, Sanders AE, Mauriello SM, Kaste LM, Beck JD. Prevalence of periodontitis according to Hispanic or Latino background among study participants of the Hispanic Community Health Study/Study of Latinos. J Am Dent Assoc. 2014;145(8):805–16.
3. Bøen H, Dalgard OS, Johansen R, Nord E. A randomized controlled trial of a senior centre group programme for increasing social support and preventing depression in elderly people living at home in Norway. BMC Geriatr. 2012;12:20. https://doi.org/10.1186/1471-2318-12-20.
4. Eke PI, Thornton-Evans GO, Wei L, Borgnakke WS, Dye BA, Genco RJ. Periodontitis in US Adults: National Health and Nutrition Examination Survey 2009–2014. J Am Dent Assoc (1939). 2018;149(7):576–88.e6.
5. Li KY, Okunseri CE, McGrath C, Wong MCM. Trends in self-reported oral health of US adults: National Health and Nutrition Examination Survey 1999–2014. Community Dent Oral Epidemiol. 2018;46(2):203–11.
6. Stierman B, Afful J, Carroll MD, Chen T, Davy O, Fink S, et al. National Health and Nutrition Examination Survey 2017–March 2020 prepandemic data files—Development of files and prevalence estimates for selected health outcomes. National Health Statistics Reports; no 158. Hyattsville:

National Center for Health Statistics; 2021. https://doi.org/10.15620/cdc:106273.
7. McNeil DW, Randall CL, Baker S, Borrelli B, Burgette JM, Gibson B, et al. Consensus Statement on Future Directions for the Behavioral and Social Sciences in Oral Health. J Dent Res. 2022;101(6):619–22.
8. Berkman LF, Glass TA. Social integration, social networks, social support and health. In: Kawachi LFBI, editor. Social Epidemiology. Oxford University Press 2000. p. 137–73.
9. Lakey B, Cohen S. Social support theory and measurement. In: Cohen S, Gottlieb BH, Underwod LG, editor. Social support measurement and intervention: A guide for health and social scientists. New York: Oxford University Press; 2000. pp. 29–52. https://doi.org/10.1093/med:psych/9780195126709.003.0002.
10. Cohen S, Gottlieb B, Underwood LG. Social relationships and health In: Cohen S, Gottlieb B, Underwood LG, editor. Social support measurement and intervention: A guide for health and social scientists. New York: Oxford University Press; 2000. pp. 3–26. https://doi.org/10.1093/med:psych/9780195126709.003.0001.
11. Uchino BN, Bowen K, Carlisle M, Birmingham W. Psychological pathways linking social support to health outcomes: a visit with the "ghosts" of research past, present, and future. Soc Sci Med. 2012;74(7):949–57.
12. Uchino BN. Understanding links between social support and physical health: A lifespan perspective with emphasis on the separability of perceived and received support. Perspect Psychol Sci. 2009;4:236–55.
13. Uchino BN. Social support and health: a review of physiological processes potentially underlying links to disease outcomes. J Behav Med. 2006;29(4):377–87.
14. Lee JY, Divaris K. The ethical imperative of addressing oral health disparities: A unifying framework. J Dent Res. 2014;93(3):224–30.
15. Merchant AT, Pitiphat W, Ahmed B, Kawachi I, Joshipura K. A prospective study of social support, anger expression and risk in periodontitis in men. J Am Dent Assoc. 2003;134:1591–6.
16. Bernabe E, Stansfield SA, Marcenes W. Roles of different sources of social support on caries experience and caries increment in adolescents of East London. Caries Res. 2011;45:400–7.
17. Brennan DS, Spencer AJ. Social support and optimism in relation to the oral health of young adults. Int J Behav Med. 2012;19:56–64.
18. Brennan D, Spencer AJ. Life events and oral-health-related quality of life among young adults. Qual Life Res. 2009;18(5):557–65.
19. Laniado N, Cloidt M, Shah P. Social support and oral health among working-age and older adults in the United States. J Public Health Dent. 2023;83(3):247–53.
20. Dahlan R, Ghazal E, Saltaji H, Salami B, Amin M. Impact of social support on oral health among immigrants and ethnic minorities: A systematic review. PLoS ONE. 2019;14(6):e0218678.
21. Dahlan R, Bohlouli B, Saltaji H, Kornerup I, Salami B, Amin M. Immigrant parents' perceived social support and their children's oral health behaviors and caries experience. Int J Environ Res Public Health. 2022;19(14):8250. https://doi.org/10.3390/ijerph19148250. PMID: 35886104; PMCID: PMC9323738.
22. Lally C, Maliq NN, Schreiber M, Wilson A, Tiwari T. Association of parental social support and dental caries in hispanic children. Front Oral Health. 2023;4:1261111.
23. Brooks CV, Maupomé G. Social support associated with restorative treatment, professionally applied fluoride and flossing: A cross-sectional analysis including recent immigrants from Central America and Mexico in the Midwest USA. Comm Dent Oral Epidemiol. 2024;52(2):187–95.
24. Kimberlin CL, Winterstein AG. Validity and reliability of measurement instruments used in research. Am J Health Sys Pharm. 2008;65(23):2276–84.
25. Finlayson TL, Malcarne VL, Ayala GX, Schiaffino MK, Hoeft KS, Garcia-Alcaraz C, et al. Development of new bilingual Oral Health Behavior Social Support (OHBSS) scales in English and Spanish. PloSOne. 2025;20(3):e0317133. https://doi.org/10.1371/journal.pone.0317133. eCollection 2025.
26. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best practices for developing and validating scales for health, social, and behavioral research: A primer. Front Public Health. 2018;6:149.
27. Erkut S, Alarcón O, Coll CG, Tropp LR, García HAV. The dual-focus approach to creating bilingual measures. J Cross-Cult Psychol. 1999;30(2):206–18.
28. Erkut S. Developing multiple language versions of instruments for intercultural research. Child Dev Perspect. 2010;4(1):19–24.
29. Cohen S, Mermelstein R, Kamark T, Hoberman HM. Measuring the functional components of social support. In: Saraon IG, Sarason BR, editors. Social support: theory, research, and applications. Boston: Martinus Nijhoff; 1985. p. 310–57.
30. Kumar S, Calvo R, Avendano M, Sivaramakrishnan K, Berkman LF. Social support, volunteering and health around the world: cross-national evidence from 139 countries. Soc Sci Med. 2012;74(5):696–706. https://doi.org/10.1016/j.socscimed.2011.11.017. Epub 2012 Jan 21.
31. Seeman TE. Social ties and health: the benefits of social integration. Ann Epidemiol. 1996;6(5):442–51. https://doi.org/10.1016/s1047-2797(96)00095-6.
32. Merz EL, Roesch SC, Malcarne VL, Penedo FJ, Llabre MM, Weitzman OB, et al. Validation of Interpersonal Support Evaluation List-12 (ISEL-12) scores among English- and Spanish-Speaking Hispanics/Latinos from the HCHS/SOL Sociocultural Ancillary Study. Psychol Assess. 2014;26(2):384–94. https://doi.org/10.1037/a0035248.
33. Sacco P, Casado BL, Unick GJ. Differential item functioning across race in aging research: An example using a social support measure. Clin Gerontol. 2011;34:57–70.
34. Wang Y, Zhu J, Xu Z, Dai X, Chen K, Wang Y. Social support, oral health knowledge, attitudes, practice, self-efficacy and oral health-related quality of life in Chinese college students. Sci Rep. 2023;13(1):12320.
35. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The Multidimensional Scale of Perceived Social Support. J Pers Assess. 1988;52:30–41.
36. Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. J Pers Assess. 1990;55(3–4):610–7.
37. Dahlem NWZG, Walker RR. The Multidimensional Scale of Perceived Social Support: a confirmation study. J Clin Psychol. 1991;47(6):756–61.
38. Edwards LM. Measuring perceived social support in Mexican American Youth: Psychometric properties of the multidimensional scale of perceived social support. Hisp J Behav Sci. 2004;26(2):187–94.
39. All of Us Research Program. Social Determinants of Health Survey. Available from: https://www.researchallofus.org/data-tools/survey-explorer/social-determinants-survey/.
40. Tesfaye S, Cronin RM, Lopez-Class M, Chen Q, Foster CS, Gu CA, et al. Measuring social determinants of health in the All of Us Research Program. Sci Rep. 2024;14(1):8815.
41. RAND. Social Support Survey. Available from: https://www.rand.org/health-care/surveys_tools/mos/social-support.html.
42. Sherborne CD, Stewart AL. The MOS social support survey. Soc Sci Med. 1991;32(6):705–14.
43. Moser A, Stuck AE, Silliman RA, Ganz PA, Clough-Gorr KM. The eight-item modified Medical Outcomes Study Social Support Survey: psychometric evaluation showed excellent performance. J Clin Epidemiol. 2012;65(10):1107–16.
44. Gómez-Campelo P, Pérez-Moreno EM, de Burgos-Lunar C, Bragado-Álvarez C, Jiménez-García R, Salinero-Fort M. Psychometric properties of the eight-item modified Medical Outcomes Study Social Support Survey based on Spanish outpatients. Qual Life Res. 2014;23(7):2073–8.
45. Marin G, Sabogal F, Marin BV, Otero-Sabogal R, Perez-Stable EJ. Development of a Short Acculturation Scale for Hispanics. Hisp J Behav Sci. 1987;9(2):183–205.
46. Marin G, Gamba RJ. A New Measurement of Acculturation for Hispanics: The Bidimensional Acculturation Scale for Hispanics (BAS). Hisp J Behav Sci. 1996;18(3):297–316.
47. Ellison J, Jandorf L, Duhamel K. Assessment of the Short Acculturation Scale for Hispanics (SASH) among low-income, immigrant Hispanics. J Cancer Educ. 2011;26(3):478–83.
48. Humphris GM, Freeman R, Campbell J, Tuutti H, D'Souza V. Further evidence for the reliability and validity of the Modified Dental Anxiety Scale. Int Dent J. 2000;50(6):367–70.
49. Coolidge T, Hillstead MB, Farjo N, Weinstein P, Coldwell SE. Additional psychometric data for the Spanish Modified Dental Anxiety Scale, and psychometric data for a Spanish version of the Revised Dental Beliefs Survey. BMC Oral Health. 2010;10:12.

50. Eke PI, Genco RJ. CDC periodontal disease surveillance project: Background, objectives, and progress report. J Periodontol. 2007;78(7s):1366–71.
51. Eke PI, Page RC, Wei L, Thornton-Evans G, Genco RJ. Update of the case definitions for population-based surveillance of periodontitis. J Periodontol. 2012;83(12):1449–54.
52. Finlayson TL, Williams DR, Siefert K, Jackson JS, Nowjack-Raymer R. Oral health disparities and psychosocial correlates of self-rated oral health in the National Survey of American Life. Am J Public Health. 2010;100(S1):S246–55.
53. Centers for Disease Control and Prevention. Perceived oral health status among adults with teeth in the United States, 1988–94. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. available at http://www.cdc.gov/nchs/nhanes.htm; 2003.
54. Northridge ME, Chakraborty B, Kunzel C, Metcalf S, Marshall S, Lamster IB. What contributes to self-rated oral health among community-dwelling older adults? Findings from the *ElderSmile* program. J Public Health Dent. 2012;72(3):235–45.
55. Finlayson TL, Moss KL, Jones JA, Preisser JS, Weintraub JA. Loneliness and low life satisfaction associated with older adults' poor oral health. Front Public Health. 2024;12:1428699. https://doi.org/10.3389/fpubh.2024.1428699. eCollection 2024.
56. Pitts NB, Ekstrand KR. International Caries Detection and Assessment System (ICDAS) and its International Caries Classification and Management System (ICCMS) - methods for staging of the caries process and enabling dentists to manage caries. Comm Dent Oral Epidemiol. 2013;41(1):e41-52.
57. Jylhä M. What is self-rated health and why does it predict mortality? Toward a unified conceptual model. Soc Sci Med. 2009;69(3):307–16. https://doi.org/10.1016/j.socscimed.2009.05.013. Epub 2009 Jun 10.
58. Ryder MI, Yao TJ, Russell JS, Moscicki AB, Shiboski CH. Prevalence of periodontal diseases in a multicenter cohort of perinatally HIV-infected and HIV-exposed and uninfected youth. J Clin Periodontol. 2017;44(1):2–12.
59. Moscicki AB, Yao TJ, Ryder MI, Russell JS, Dominy SS, Patel K, et al. The burden of oral disease among perinatally HIV-infected and HIV-exposed uninfected youth. PLoS ONE. 2016;11(6):e0156459.
60. Abma IL, Rovers M, van der Wees PJ. Appraising convergent validity of patient-reported outcome measures in systematic reviews: constructing hypotheses and interpreting outcomes. BMC Res Notes. 2016;9:226.
61. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiroprac Med. 2016;15(2):155–63.
62. Cicchetti DV. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. Psychol Assess. 1994;6(4):284–90.
63. Tiwari T, Maliq NN, Rai N, Holtzmann J, Yates L, Diep V, et al. Evaluating trust in the patient–dentist relationship: A mixed-method study. JDR Clin Transl Res. 2023;8(3):287–98.
64. Smith D. Health care consumer's use and trust of health information sources. J Comm Health. 2011;4(3):200–10.
65. Velez D, Palomo-Zerfas A, Nunez-Alvarez A, Ayala GX, Finlayson TL. Facilitators and barriers to dental care among Mexican migrant women and their families in north San Diego County. J Immigr Minor Health. 2017;19(5):1216–26.
66. Singhal A, Jackson JW. Perceived racial discrimination partially mediates racial-ethnic disparities in dental utilization and oral health. J Public Health Dent. 2022;82 Suppl 1(Suppl 1):63–72.
67. Finlayson TL, Lemus H, Becerra K, Kaste LM, Beaver SM, Salazar CR, et al. Unfair treatment and periodontitis among adults in the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). J Racial Ethn Health Disparities. 2018;5(5):1093–106.
68. Martinez LS, Devi A, Maupomé G, Schiaffino MK, Ayala GX, Malcarne VL, et al. Using a social network approach to characterize Oral Health Behavior Social Support (OHBSS) scales among Mexican-origin young adults. J Health Comm. 2024;Dec 24:1–16. https://doi.org/10.1080/10810730.2024.2433528. Online ahead of print:1–16.
69. Padilla J, Jager J, Updegraff KA, McHale SM, Umaña-Taylor AJ. Mexican-origin family members' unique and shared family perspectives of familism values and their links with parent-youth relationship quality. Dev Psychol. 2020;56(5):993–1008.
70. Sabogal F, Marín G, Otero-Sabogal R, Marín BV, Perez-Stable EJ. Hispanic familism and acculturation: What changes and what doesn't? Hisp J Behav Sci. 1987;9(4):397–412.
71. Maupome G, McConnell WR, Perry BL. Dental problems and Familismo: social network discussion of oral health issues among adults of Mexican origin living in the Midwest United States. Community Dent Health. 2016;33(4):303–8.
72. Gazzaz AZ, Carpiano RM, Aleksejuniene J. Socioeconomic status, social support, and oral health-risk behaviors in Canadian adolescents. J Public Health Dent. 2021;81(4):316–26.
73. Cobb CL, Xie D. Structure of the Multidimensional Scale of Perceived Social Support for undocumented Hispanic immigrants. Hisp J Behav Sci. 2015:1–8. https://doi.org/10.1177/0739986315577894.
74. Wdowiak-Szymanik A, Wdowiak A, Szymanik P, Grocholewicz K. Pandemic COVID-19 influence on adult's oral hygiene, dietary habits and caries disease-Literature review. Int J Environ Res Public Health. 2022;19(19).
75. Choi SE, Mo E, Sima C, Wu H, Thakkar-Samtani M, Tranby EP, et al. Impact of COVID-19 on dental care utilization and oral health conditions in the United States. JDR Clin Trans Res. 2024;9(3):256–64. https://doi.org/10.1177/23800844231165016. Epub 2023 Apr 21.
76. Choi SE, Simon L, Basu S, Barrow JR. Changes in dental care use patterns due to COVID-19 among insured patients in the United States. J Am Dent Assoc. 2021;152(12):1033–43.e3.
77. Bensken WP, Alberti PM, Stange KC, Sajatovic M, Koroukian SM. ICD-10 Z-code health-related social needs and increased healthcare utilization. Am J Prev Med. 2022;62(4):e232–41.

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