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The Association of Acculturation and Health Literacy, Numeracy and Health-Related Skills in Spanish-speaking Caregivers of Young Children

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Abstract

Little is known about the relationship among acculturation, literacy, and health skills in Latino caregivers of young children. Latino caregivers of children <30 months seeking primary care at four medical centers were administered measures of acculturation (SASH), functional health literacy (STOFHLA), numeracy (WRAT-3) and health-related skills (PHLAT Spanish). Child anthropomorphics and immunization status were ascertained by chart review. Caregivers (N = 184) with a median age of 27 years (IQR: 23–32) participated; 89.1 % were mothers, and 97.1 % had low acculturation. Lower SASH scores were significantly correlated ($P < 0.01$) with lower STOFHLA ($\rho = 0.21$), WRAT-3 ($\rho = 0.25$), and PHLAT Spanish scores ($\rho = 0.34$). SASH scores predicted PHLAT Spanish scores in a multivariable linear regression model that adjusted for the age of child, the age and gender of the caregiver, number of children in the family, the type of health insurance of the caregiver, and study site (adjusted β: 0.84, 95 % CI 0.26–1.42, $P = 0.005$). This association was attenuated by the addition of literacy (adjusted β: 0.66, 95 % CI 0.11–1.21, $P = 0.02$) or numeracy (adjusted β: 0.50, 95 % CI −0.04–1.04, $P = 0.07$) into the model. There was no significant association between acculturation and up-to-date child immunizations or a weight status of overweight/obese. Lower acculturation was associated with worse health literacy and diminished ability to perform child health-related skills. Literacy and numeracy skills attenuated

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the association between acculturation and child health skills. These associations may help to explain some child health disparities in Latino communities.

Keywords

Acculturation; Literacy; Numeracy; Infants

Introduction

Acculturation, defined as the complex process by which an ethnic group incorporates the cultural patterns of a host group through the process of immigration, [1] is recognized as having a complex and poorly understood relationship with health behaviors and outcomes among Latinos in the United States (US) [2]. Studies done to explore the role of acculturation on health outcomes and behaviors in the Latino pediatric population have found that higher acculturation is associated with increased health care access, [3] decreased breast feeding behavior, [4–8] increased physical activity, [9] and differing child feeding practices [10–12]. However, results from studies looking at the relationship between acculturation and health outcomes such as child immunization rate [13–18] and weight status [19–24] have yielded conflicting results. Part of the heterogeneity in this body of evidence may be due to unmeasured factors that may be associated with lower acculturation and worse health outcomes such as health literacy.

Inadequate health literacy in the US is common both in the general population and among Latinos [25]. For parents of young children many common child health-related tasks, such as mixing formula or dosing medications, depend on the successful application of literacy and numeracy skills. Caregivers with inadequate literacy skills have been shown to have poorer understanding of anticipatory guidance, [26, 27] report poorer family health behaviors, [28–34] and have worse child health outcomes than those with adequate literacy skills [28, 34–36].

This study sought to examine the associations among acculturation, health literacy, child health-related skills, and their relationships to child health outcomes in Latino families with young children.

Methods

Study Population

From March through September 2009, a convenience sample of parents or legal guardians of young children (under the age of 30 months) was recruited from the out-patient pediatrics clinics of four academic medical centers (Meharry Medical Center, University of Miami, University of North Carolina at Chapel Hill and New York University) as part of a study to validate a Spanish version of the Pediatric Health Literacy Activities Test (PHLAT) [34, 40]. Potential participants were recruited by bilingual research-assistants while waiting with their children for a pediatric visit; caregivers who agreed to participate gave consent at that time. Caregiver-child dyads were eligible for the study if the caregiver reported Spanish as the primary language spoken at home or if both Spanish and English language were used as primary languages. Dyads were excluded from the study if the caregiver: (1) had a corrected visual acuity of worse than 20/50 using Rosenbaum Pocket Vision Screener; or, (2) reported a history of significant dementia, mental illness or blindness.

Measures

All study measures were administered to participants in Spanish by bilingual research assistants, and were validated for use in the Spanish language. Child and caregiver sociodemographic data were ascertained by participant questionnaire. All participants were also administered the Short Acculturation Scale for Hispanics (SASH), a 12-item scale which measures US acculturation in the Latino population [37]. Item responses range from 1 to 4, and average scores were tallied for each respondent across all 12 items, with individual scores that range from 1 (lowest acculturation) to 4 (highest acculturation). While SASH scale developers originally recommended that a score of <3.0 was suggestive of low acculturation, [37] we categorized acculturation SASH score as <1.7 versus ≥1.7, based on the median acculturation score in our sample.

Functional health literacy was measured by administration of the Spanish version of the Short Test of Functional Health Literacy in Adults (STOFHLA), a 36-item validated measure of functional health literacy [38]. Total scores range between 0 and 36; scores ≥23 indicate adequate health literacy, scores between 17 and 22 indicate marginal health literacy, and scores ≤16 indicate inadequate functional health literacy. Numeracy was assessed by the Wide Range Achievement Test, version 3 (WRAT-3) arithmetic subtest, a 55-item validated measure of basic numeracy skills [39]. Raw scores were normalized into a standardized score corresponding to a grade level for numeracy skills [39]. Functional health literacy- and numeracy- related child health skills were measured with the validated Spanish Parental Health Literacy Activities Test (PHLAT Spanish), [34, 40] consisting of 10 items that assess a respondent's ability to apply literacy and numeracy skills to common parental health-related tasks. Each item could be answered correctly or incorrectly.

Child anthropomorphics were measured on the day of recruitment by measuring height and weight and calculating a standardized weight-for-length z-score according to the 2000 CDC charts, stratified by gender [41]. Weight-for-length z-scores, rather than BMI-for–age z-scores, were calculated for the 16 children in the sample between 24 and 30 months to simplify analysis and reporting. As there is no current consensus definition for overweight/obesity in children under 2 years, we dichotomized weight-for-length z-scores as <85th percentile and ≥85th percentile to correspond to the definition of normal versus overweight for children over 2 years [41]. Child immunization status was measured by chart review and classified as "complete" or "incomplete" based on the CDC age-based recommendations for the following vaccinations: hepatitis B, diphtheria/tetanus/acellular pertussis, haemophilus influenzae type B, inactivated polio, measles/mumps/rubella, and varicella [42].

Data Analysis

Demographics were reported as means, medians or proportions along with the standard deviation (SD) or inter-quartile range (IQR). Cronbach's alpha was used to estimate the internal consistency of the SASH. Spearman rank-sum correlation was used to test the association among acculturation and numeracy, literacy, and PHLAT Spanish summary score. The proportion of caregivers with correct responses to each PHLAT Spanish item, children with up-to-date immunizations, and children with weight-for-length z-scores at or above the 85th percentile for participants with SASH scores <1.7 versus ≥1.7 were compared by Pearson Chi-squared test.

Three sets of separate regression models were used to estimate the association between acculturation as the primary variable of interest and three key outcomes: total PHLAT Spanish scores, immunization status, and weight status. Multiple regression models were performed to examine the relationship between acculturation and PHLAT Spanish scores. Logistic regression models were used to evaluate the association of acculturation and child

immunization (complete or incomplete), and to evaluate the relationship between acculturation and weight status (<85th percentile or ≥ 85th percentile). For each of the three key outcomes, Model 1 estimated the unadjusted association between acculturation and the outcome of interest. Model 2 adjusted for variables that were chosen a priori for inclusion in the multivariate model and included: the age of child, the age and gender of the caregiver, number of children in the family, the type of health insurance of the caregiver (no insurance versus Medicare versus private insurance), and study site. Two additional models added adjustment for general literacy (Model 3) or numeracy (Model 4) to the multivariate analysis, to test the hypothesis that literacy or numeracy modified the association between acculturation and study outcomes. Simple imputation was used to replace missing data for caregiver age in each multivariable model; the median age for each category of caregiver (Mother, Father, or Grandmother) replaced missing values. Participants with missing data other than for caregiver age were excluded from multivariable models. A separate analysis was done to test the association between acculturation and weight-for-length z-scores excluding children 24 months or older. All analyses were conducted using STATA v10.0 (College Park, TX). Informed consent was obtained for all participants and the Institutional Review Board at each participating university approved this research.

Results

A total of 184 Spanish-speaking caregiver/child pairs were recruited for the study (Table 1). Study children had a median age (IQR) of 6 months (2–12). Caregivers had a median (IQR) age of 27 years (23–32) and were predominantly female (89.7 %). Caregivers were predominantly mothers (N = 164, 89.1 %), but also included fathers (N = 19, 10.3 %) and one grandmother (0.5 %). The majority of caregivers completed less than a high school education (60.7 %); 25.1 % completed high school, and 14.2 % had completed some college or more. Median (IQR) acculturation score was 1.7 (1.4–2.0); 97.1 % of the sample had low acculturation, corresponding to a SASH score <3.00. The SASH demonstrated good internal consistency (α = 0.86). By STOFHLA measurement, 22.3 % had marginal or inadequate health literacy. The mean (SD) WRAT-3 standardized score was 68 (12.0), corresponding to a 4th grade skill level.

Caregiver age was missing for 14 participants (3 mothers, 11 fathers) and was imputed using the median age for mothers (27) and fathers (22.5) for multivariable analyses. Data were also missing for PHLAT Spanish scores (N = 8), WRAT-3 (N = 11), STOFHLA (N = 4), immunization status (N = 20), and insurance (N = 7).

Lower SASH scores showed a modest but statistically significant ($P < 0.01$) correlation with lower STOFHLA ($\rho = 0.21$), lower WRAT-3 scores ($\rho = 0.25$), and lower overall PHLAT Spanish score ($\rho = 0.34$) (Table 2). Caregivers with SASH scores ≥1.7 had significantly ($P < 0.05$) better ability to perform some common child-health tasks measured by PHLAT Spanish compared to those with SASH scores <1.7, such as (1) preparing a 4 oz bottle of formula from powder using package instructions, (2) converting ½ teaspoon to milliliters using ibuprofen package instructions, (3) interpreting a written antibiotic prescription, (4) calculating how long a WIC-provided 32 oz bottle of juice will last using 2 oz per day; and, (5) interpreting a food label for Vitamin C content based on WIC recommendations. A higher proportion of children of caregivers with SASH scores <1.7 were up-to-date on immunizations (89.7 %) compared to children of caregivers with SASH scores ≥1.7 (80.2 %), however the difference did not reach statistical significance ($P = 0.09$). There was no difference in the proportion of children with weight-for-length z-scores ≥85 % for caregivers with high versus low SASH scores (32.2 % vs. 30.9 %, $P = 0.9$). Excluding infants 24 months of age or older did not change this result.

There was a significant association between acculturation and PHLAT Spanish scores with univariate linear regression (Model 1: β: 1.26, 95 % CI, 0.68–1.85, $P < 0.001$) that persisted after adjusting for child and caregiver age, caregiver gender, the number of children in the family, health insurance status, and study site (Model 2: adjusted β: 0.84, 95 % CI 0.26–1.42, $P = 0.005$). This association was attenuated by including literacy into the multivariate model (Model 3: adjusted β: 0.66, 95 % CI 0.11–1.21, $P = 0.02$), and was statistically non-significant in a separate model that adjusted for numeracy skill (Model 4: adjusted β: 0.50, 95 % CI −0.04–1.04, $P = 0.07$). There was an association between higher caregiver acculturation and lacking up-to-date childhood immunizations in unadjusted logistic regression (Model 1: OR 0.36, 95 % CI 0.16–0.81, $P = 0.01$) that was not observed in adjusted models (Table 3). There was no association between acculturation and child weight-for-length z-score ≥ 85 % observed in our sample in either the unadjusted or adjusted regression models.

Discussion

In this sample of Spanish-speaking caregivers of young children at four academic medical centers, low caregiver acculturation was common, and inadequate literacy and numeracy skills were also highly prevalent. Lower acculturation was associated with lower literacy and numeracy as well as with more difficulty performing specific child health-related skills, but not with utilization of childhood immunizations or child weight status. The strength of the association between caregiver acculturation and child health-related skills was attenuated by accounting for the literacy and numeracy skills of care-givers, suggesting that both literacy skills and cultural factors may be important for caregivers when performing health-related activities.

While it has been established that limited literacy and numeracy skills are associated with difficulty performing some child-health related tasks in other studies and populations, [28–34] this study highlights the possible independent role of cultural context in the successful application of literacy skills to health behaviors. Individuals may have greater difficulty successfully applying basic literacy or numeracy skills to tasks that may be contextually unfamiliar, especially when these tasks may relate to cultural beliefs that may vary considerably between their country of origin and current home. For example, the finding in this study that caregivers with low acculturation had greater difficulty preparing a bottle of formula may be partially explained by the higher rates of breastfeeding in families with low acculturation [4–8]. Individuals with low acculturation may be more familiar with metric units of measurement and less comfortable with the English units commonly provided on package instructions; as a consequence, they may have more difficulty following these instructions properly. In contrast, for tasks that may be more culturally familiar (such as childhood immunizations), success may not be associated as directly with the process of acculturation.

This study adds to the relative paucity of literature exploring the relationship between acculturation and health behaviors or outcomes. Considerable heterogeneity exists in the results reported in studies designed to examine this issue, and the variability of methods used to ascertain acculturation across studies has been cited as one possible factor to explain these mixed results [2]. Additionally, the fact that many acculturation scales rely on language as a construct adds weight to the possibility that language-related skills may be an important factor in explaining some of the observed variability of outcomes in previous work. Our study suggests that inadequate health literacy and numeracy skills may be important factors that explain some of the heterogeneity across studies that examine the relationship between acculturation and health behaviors and outcomes.

This study has several limitations. Caregivers that reported using English as their primary language were not eligible for inclusion in the study; as a result in part, acculturation was generally low in this sample. The study was underpowered to look at small changes in health outcomes such as infant weight status, and the small sample size and limited variation in acculturation precluded our ability to develop mediation analyses to describe further the relationship among literacy, acculturation and health behaviors. Individuals with missing data other than for caregiver age were excluded from multivariable analyses; this conservative approach may have led to bias in the study. The cross-sectional design of the study precluded the ability to measure weight change over time and does not take into account potential unmeasured confounders or other important health outcomes. However, the fact that caregivers from four diverse geographic areas were investigated is novel and one of the strengths of the study.

New Contribution to the Literature

This study suggests that low acculturation is very common in a population of Spanish-speaking patients at four teaching hospitals, and that parents with low acculturation are more likely to have low literacy and numeracy skills. Furthermore it demonstrates that certain child health-related skills, such as dosing liquid medication, may be sensitive to a parent's acculturation level. The development and assessment of culturally sensitive interventions to improve health communication and health materials for low-literacy parents with low acculturation should be a child-health research priority.

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Table 1

Characteristics of 184 Spanish-speaking caregivers and young children

Sample characteristics	Total (N = 184)
Child gender female, %	51.1
Median child age, months (IQR)	6 (2–12)
Median caregiver age, years (IQR)	27 (23–32)
Caregiver gender female, %	89.7
Caregiver is mother, %	89.1
Median # of children in family (IQR)	2 (1–3)
Hispanic, %	98.9
Primary language is spanish, %	94.0
Annual family income, %	
≤$19,999	47.8
$20,000–39,999	6.6
≥$40,000	3.3
Do not know/refused	42.3
Mean years of education, (SD)	9.8 (3.5)
Median SASH score, (IQR)	1.7 (1.4–2.0)
Literacy status (STOFHLA), %	
Inadequate	15.6
Marginal	6.7
Adequate	77.8
Mean WRAT-3 grade-level (SD)	4.0 (1.6)
Median child weight-for-length Z-score (IQR)	0.24 (−0.49–0.99)
Children with up-to-date immunizations, %	84.8
Children with weight-for-length Z-score >85th percentile, %	31.5

SASH short acculturation scale for hispanics, *STOFHLA* short test of functional health literacy in adults, *WRAT*-3 wide range achievement test, version 3

Table 2

Acculturation and literacy, numeracy, child health-related skills, and health outcomes among Spanish-speaking caregivers of children <30 months of age

Continuous outcomes (N responded)	Correlation with SASH (ρ)	*P* value*
Literacy (STOFHLA total score) (N = 180)	0.21	0.005
Numeracy (WRAT-3 standard score) (N = 173)	0.25	0.001
Health-related Skills (PHLAT Spanish total score) (N = 176)	0.34	<0.001

Categorical outcomes	Total sample	SASH < 1.7	SASH ≥ 1.7	*P* value†
Health-related skills, PHLAT Spanish items, % correct				
1. Prepare a 4 oz bottle of formula from powder using package instructions	72.1	62.1	81.5	0.004
2. Prepare a 4 oz. bottle of formula from concentrate using package instructions	16.2	12.6	19.6	0.2
3. Prepare a 8 oz. bottle of half formula, half Pedialyte	6.2	4.6	7.6	0.4
4. Interpret a weight percentile and growth curve	37.6	40.2	35.2	0.5
5. Convert ½ teaspoon of Motrin into ml using package instructions	58.4	46.0	70.3	0.001
6. Interpret ingredients from package labeling	70.8	71.3	70.3	0.9
7. Interpret written antibiotic prescription	45.5	36.8	53.9	0.02
8. Calculate how long a 32 oz bottle of juice will last (2 oz of juice/day)	46.1	29.9	61.5	<0.001
9. Determine if juice meets WIC requirements from nutritional data	31.8	24.1	39.3	0.03
10. Interpret breast feeding anticipatory guidance from written information	33.0	26.4	39.3	0.12
Immunizations, % up-to-date (N = 164)	84.8	89.7	80.2	0.09
Child weight-for-length Z-score, % ≥85th percentile (N = 184)	31.5	32.2	30.9	0.9

*Spearman rank correlation

†Pearson Chi-square

SASH short acculturation scale for Hispanics, *STOFHLA* short test of functional health literacy in adults, *WRAT*-3 wide range achievement test, version 3, *PHLAT* Spanish parental health literacy activities test (Spanish Language)

Table 3

The association of caregiver acculturation on health-related skills, child immunization utilization and child weight status

Health-related skills (PHLAT)	**N**	**Acculturation (SASH)**		
		Beta	**95 % CI**	**P**
Model 1	170	1.26	0.68–1.85	<0.001
Model 2	166	0.84	0.26–1.42	0.005
Model 3	166	0.66	0.11–1.21	0.02
Model 4	164	0.50	−0.04–1.04	0.07
Immunizations up-to-date	N	OR	95 % CI	P
Model 1	155	0.36	0.16–0.81	0.01
Model 2	151	0.33	0.08–1.34	0.1
Model 3	151	0.32	0.08–1.35	0.1
Model 4	147	0.29	0.07–1.27	0.1
Weight-for-length ≥85 % for age	N	OR	95 % CI	P
Model 1	174	1.03	0.56–1.89	0.9
Model 2	169	1.21	0.59–2.46	0.6
Model 3	169	1.19	0.58–2.44	0.6
Model 4	164	1.10	0.53–2.30	0.8

Model 1: unadjusted

Model 2: adjusted for child age, caregiver age and gender, number of children in family, health insurance status, and study site

Model 3: Model 2, plus adjustment for literacy skill

Model 4: Model 2, plus adjustment for numeracy skill

PHLAT parental health literacy assessment test (Spanish Language)