

THE INFLUENCE OF ACCULTURATION ON BREAST-FEEDING INITIATION AND DURATION IN LOW-INCOME WOMEN IN THE US

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Summary. While the ‘immigrant health paradox’ posits better health behaviours and outcomes for immigrants upon arrival to the US, research suggests that this advantage may deteriorate over time. This study analysed the relationship of acculturation and breast-feeding initiation and duration among a sample of predominantly Latina, low-income women in the US. The four measures of acculturation included: mother’s nativity (foreign born vs US born), mother’s parents’ nativity (foreign born vs US born), years of US residence (<8 years vs ≥8 years) and a dichotomous measure of language acculturation adapted from three items on Marin’s acculturation scale (preferred language spoken at home, reading language and writing language) as exclusive use of native language versus non-exclusive use (mixed or English only) (Marin *et al.*, 1987; Marin & Gamba, 1996). Final multivariable models showed that mothers who exclusively used their native language were more likely to initiate breast-feeding as well as breast-feed for longer duration compared with mothers with non-exclusive use, whereas years of US residence and mother’s nativity were not significantly associated with breast-feeding initiation or duration. Mother’s parents’ nativity also emerged as a significant predictor of breast-feeding duration, both within final models for immigrants and across study participants. Programmes providing nutrition education to low-income women may wish to consider the role of language as an important determinant of breast-feeding. The role of mother’s parents’ nativity on breast-feeding practices deserves exploration in future studies, as the cultural practices taught by family members born outside the US may exert strong pressure within immigrant families now living in the US.

Introduction

As the demographic growth rate of Latinos continues to rise in the US faster than any other ethnic group (United States Census Bureau, 2004), there is a pressing need

to better understand the health practices of Latino immigrant populations. By the year 2050 it is estimated that nearly 67 million people of Hispanic origin (of any race) will be added to the US population, comprising 24% of the total population (US Census Press Release, 2004). Hispanics are predicted to have the highest birth rates of any ethnic group in the US as early as 2009 (Beck, 2006). The 'immigrant health paradox' (often referred to as the 'Latino health paradox' given the preponderance of immigrants who are Latino in the US) posits that immigrants may be considered generally healthier than the US-born population upon initial arrival, exhibiting better health behaviours and outcomes compared with other groups of similar socioeconomic status, such as lower overall mortality risk and lower risk of low birth weight infants (Singh & Siahpush, 2002). Recent research, however, appears to show evidence of the negative influence of the acculturation process on health, conferring disadvantage in health outcomes for immigrants over time spent living in the US. Thus, any protective cultural buffering afforded by immigrant status may dramatically diminish over time and approach the US norm (Vega & Amaro, 1994; Kaplan *et al.*, 2004).

Current racial and ethnic differences in breast-feeding rates among US infants suggest this health behaviour may be related to the role of immigrant status and acculturation. Breast-feeding is a behaviour of public health importance due to its positive influence on child growth, development and cognitive performance, protection against a variety of infections in early life (including pathogens such as rotavirus, *Giardia lamblia*, *Shigella*, *Campyobacter*, and *Escherichia coli*, diarrhoeal and lower respiratory disease, otitis media), as well as possible long-term benefits including lower risk of allergic disease (such as eczema, food and respiratory allergies and asthma), insulin-dependent diabetes, Crohn's disease, malignant lymphoma and obesity later in life (Mayer *et al.*, 1988; Saarinen & Kajosaari, 1995; Heinig & Dewey, 1996; Kunz *et al.*, 1999; Hediger *et al.*, 2001; Heinig, 2001). Health benefits of breast-feeding for both the infant as well as the mother may also include lower risk of breast cancer later in life, although studies currently report conflicting findings (Michels *et al.*, 2001; Martin *et al.*, 2005; Kim *et al.*, 2007).

Breast-feeding rates obtained from the nationally representative Ross Laboratories Mothers Survey conducted in the US found that both prevalence of breast-feeding initiation and breast-feeding at 6 months in 2001 were at their highest known levels recorded to date (since 1971) (Ryan *et al.*, 2002). Hispanic women had higher rates of in-hospital breast-feeding initiation compared with white, non-Hispanic women (73% compared with 69.5%) (Ryan *et al.*, 2002). While the breast-feeding initiation rate among Hispanics is close to the 'Healthy People 2010' objective of 75% initiation, it is unlikely that goals for continued breast-feeding at 6 months (50%) and 12 months postpartum (25%) will be met by 2010 (US Department Health and Human Services, 2000). Hispanics are less likely to exclusively breast-feed in hospital compared with non-Hispanic whites (36.2% compared with 53%) and only 32.8% of Hispanics breast-feed at 6 months (Ryan *et al.*, 2002). In addition, reported rates for Hispanics in comparison with other groups may be confounded by nativity, years of US residence and language acculturation. The use of the umbrella term 'Hispanic' or 'Latino' may also be reductive, masking the diverse, heterogeneity of the ethnicities of which such terms are comprised. By studying the different measures of

acculturation and its association with breast-feeding within such populations, research may better discern such differences.

Research currently suggests that women who initiate or intend to breast-feed are more likely to be born outside the US (Noble *et al.*, 2003; Bonuck *et al.*, 2005; Celi *et al.*, 2005; Gibson-Davis & Brooks-Gunn, 2006; Merewood *et al.*, 2006) and have more traditional values compared with their non-breast-feeding counterparts (De La Torre & Rush, 1987). A recent analysis of the 2003 National Study of Children's Health found that children born to immigrant parents were more likely to be breast-fed at 6 and 12 months compared with children with US-born parents (Singh *et al.*, 2007). Language acculturation may also play a role in breast-feeding, as studies have shown that language use and preference is strongly related to the intent or the successful initiation of breast-feeding, at least among Mexican-American women, with breast-feeding initiation highest among the less acculturated mothers and lowest amongst the most acculturated mothers (Rassin *et al.*, 1993, 1994; Byrd *et al.*, 2001; Gibson *et al.*, 2005). Specifically, a recent secondary analysis of the National Health and Nutrition Examination Survey (NHANES) 1999–2000 found that less acculturated Hispanic women, based on language, have higher prevalence of breast-feeding (59.2%) compared with high acculturated Hispanic women (33.1%), suggesting possible negative attitudinal changes towards breast-feeding with greater acculturation to the US (Gibson *et al.*, 2005). In addition, despite relatively high breast-feeding initiation rates reported in the NIS and Ross Laboratories Surveys for Hispanics, research shows that breast-feeding practices may deteriorate the longer immigrant families reside in the US, with negative influences on child health (Desantis, 1986; Romero-Gwynn & Carias, 1989; Hernandez & Charney, 1998; Perez-Escamilla *et al.*, 1998). For example, a study of 1093 Mexican immigrant mother–infant pairs from California found that among mothers who lived in the US less than 6 years, 29% exclusively breast-fed for at least 16 weeks, in comparison with 17% of mothers who had lived in the US for more than 15 years (Guendelman & Siega-Riz, 2002). In a recent study of 490 Mexican immigrants, the median duration of exclusive breast-feeding was 2 months for women living in the US for 5 years or less, 1 month for women living in the US for 6–10 years and less than one week for women living in the US for 11 years or more (Harley *et al.*, 2007). Finally, the relationship of mother's parents' nativity on breast-feeding practices may deserve further exploration, as recent qualitative data suggest that mother's beliefs, attitudes and practices related to early child feeding may be influenced by older family members, particularly grandparents (Lindsay *et al.*, unpublished; Sussner *et al.*, unpublished).

Thus, research evaluating ethnic and acculturation differences in breast-feeding practices is warranted (Gibson *et al.*, 2005). Further, as the majority of previous research in this area has focused on breast-feeding initiation and/or intent to breast-feed (Rassin *et al.*, 1993, 1994; Byrd *et al.*, 2001), studies also should examine the influence of acculturation on breast-feeding duration (Harley *et al.*, 2007; Singh *et al.*, 2007). If such associations between acculturation (measured by mother's nativity, mother's parents' nativity, years of US residence and language) and breast-feeding do in fact exist, such findings support the need for specific interventions and programmes targeted at these multi-ethnic, low-income populations.

In this study, secondary analyses were conducted in order to test the association between acculturation and breast-feeding initiation and duration in a sample of predominantly Latina, low-income women participating and enrolled in the USDA Special Supplemental Nutrition Program for Women, Infants and Children (WIC). This is a Federal grant programme in the US serving low-income women, infants and children up to age 5 considered at nutritional risk by providing nutritious foods to supplement diets, information on healthy eating and referrals to health care.

Methods

Interviewer-administered surveys of individual women were conducted at baseline and after 12-month follow-up in a randomized controlled trial of a nutrition and physical educational programme in two urban areas in the north-east US (Peterson *et al.*, 2002; Ebbeling *et al.*, 2007). Eligibility criteria for participation in the trial included: all women were income-eligible to receive WIC programme benefits (i.e. household income \leq 185% US federal poverty level based on family size) and had given birth to an infant who was less than 20 weeks old at enrolment. Baseline survey information was characterized for two samples, across all participants ($n=679$) and within immigrants only ($n=373$). Although country of origin information was not known for these participants, it is assumed that this sample includes Latinas from a diverse range of country backgrounds including Central and South America, the Dominican Republic and Puerto Rico, due to the authors' knowledge of and previous experience working with Latinas in the Boston area neighbourhoods and communities of which these mothers were sampled. Having this range of backgrounds may allow for a more broad analysis of acculturation within Latina immigrants than previous studies on this topic, which have been conducted primarily on Latinas originating from Mexico. The two primary outcome variables in this secondary analysis included breast-feeding initiation (ever versus never breast-fed, measured at baseline survey) and breast-feeding duration (<6 months versus \geq 6 months, measured at 12 months follow-up). At follow-up, there was a substantially reduced number of available data points ($n=274$ across study participants and $n=165$ within immigrants) for breast-feeding duration, but were distributed across strata for duration of breast-feeding, less than 6 months and \geq 6 months.

While a range of alternative approaches currently exist for the assessment of acculturation, including measuring nativity, language use, years residence in the US and cultural immersion assessed via scales incorporating language use, media use and social relations (Marin *et al.*, 1987; Marin & Gamba, 1996), there is currently no clear consensus on most useful measures (Marin & Marin, 1991; Negy & Woods, 1992). However, recent literature highlights the multi-dimensional and extraordinarily complex nature of acculturation, involving the simultaneous maintenance and adaptation of some cultural characteristics (Abraido-Lanza *et al.*, 2006), suggesting the usefulness of testing multiple measures. The authors of this paper chose to include four measures of acculturation, as one goal of this research was determine which acculturation measures would end up the most significant in multivariate analyses. The four measures of acculturation therefore included: mother's nativity (foreign born

vs US born), mother's parents' nativity (foreign born vs US born), years of US residence (<8 years vs ≥ 8 years) and a dichotomous measure of language acculturation adapted from three items on Marin's acculturation scale (preferred language spoken at home, reading language and writing language) as exclusive use of native language versus non-exclusive use (mixed or English only) (Marin *et al.*, 1987; Marin & Gamba, 1996). For analyses examining acculturation across study participants, information on language use (preferred speaking, reading and writing) and years of US residence were not available from the baseline survey for mothers born in the US. For this reason, it was assumed in all analyses that mothers born in the US had lived in the US ≥ 8 years and would not exclusively use a non-English language from another country, but rather at least use some English in speaking, reading or writing activities.

Baseline socio-demographic maternal covariates considered theoretically relevant were tested in models for breast-feeding initiation and duration and are listed in Table 1. Descriptive statistics (means and percentages) were computed for all predictors and the outcome variables. Linearity assumptions were investigated for all potential continuous variables by grouping all such predictors into bins of equal width, dummy coding and comparing changes in the beta coefficients. Continuous variables that failed to meet linearity assumption tests or based on relevant concerns for power and/or issues of small sample size were categorized.

Crude univariate logistic regression models of breast-feeding outcomes were completed separately across all participants ($n=673$) and within a subsample of immigrants only ($n=373$), testing each variable individually and its potential association with the two primary study outcomes, i.e. breast-feeding initiation and breast-feeding duration at follow-up. Multivariable logistic regression models were developed separately within immigrants and across participants with the following steps in order to determine the association of acculturation measures with breast-feeding initiation and duration, adjusted for all other variables. All covariates significant (at $p \leq 0.05$) in the tests of univariate logistic regression were chosen as covariates for inclusion in the candidate short-list for the multivariable models. In order to control for potential problems with collinearity in the models, a forward selection test with significance level of entry $p \leq 0.05$ was conducted as the automatic statistical procedure of choice in this study.

The forward selection test resulted in significant predictors of outcome, which were the primary variables considered for the final multivariable logistic regression models. After the forward selection test, all other covariates which had been significant on univariate tests were added one by one to test for potential confounding, as long as they had not been identified as collinear variables. Any such covariates producing a change of 20% in the odds ratios of predictors already in the final model (as a result of forward selection) were considered confounders and therefore included in the final models. Any theoretically necessary variables were also added. The final logistic regression models included significant variables from the forward selection as well as confounders and any variables deemed theoretically necessary. A Hosmer and Lemeshow model goodness-of-fit test was computed for each model (with p value close to 1 and χ^2 small representing a good fit of the model), as well as diagnostic tests run to obtain model residuals (with values within ± 2 cut-off

Table 1. Descriptive statistics of baseline maternal socio-demographic covariates

	All participants <i>n</i> (%)	Immigrants only <i>n</i> (%)	All participants lost to follow-up <i>n</i> (%)	Immigrants only lost to follow-up <i>n</i> (%)
Outcomes				
Breast-feeding initiation				
Never	158 (23.3)	58 (15.5)	143 (35.3)	53 (25.5)
Ever	521 (76.7)	315 (84.5)	262 (64.7)	155 (74.5)
Breast-feeding duration at follow-up ^a				
<6 months	151 (55.1)	82 (49.7)	na	na
≥6 months	123 (44.9)	83 (50.3)	na	na
Predictor variables				
Age group				
<21 years	145 (21.3)	56 (15.0)	97 (24.0)	34 (16.4)
21–29 years	365 (53.8)	203 (54.4)	218 (53.8)	117 (56.3)
≥30 years	169 (24.9)	114 (30.6)	90 (22.2)	57 (27.4)
Intervention group status				
Control	342 (50.4)	195 (52.3)	206 (50.9)	116 (55.8)
Intervention	337 (49.6)	178 (47.7)	199 (49.1)	92 (44.2)
Ethnicity				
Hispanic or Latina	505 (74.4)	345 (92.5)	295 (72.8)	192 (92.3)
Non-Hispanic/Latina	174 (25.6)	28 (7.5)	110 (27.2)	16 (7.7)
High school diploma				
No	228 (34.1)	140 (38.5)	114 (37.3)	84 (41.4)
Yes	441 (65.9)	224 (61.5)	250 (62.7)	119 (58.6)
Marital or partner status				
No	240 (35.5)	120 (32.3)	153 (38.0)	71 (34.5)
Yes	437 (64.5)	251 (67.7)	250 (62.0)	135 (65.5)
Working status				
No	597 (88.2)	340 (91.6)	359 (89.1)	192 (93.2)
Yes	80 (11.8)	31 (8.4)	44 (10.9)	14 (6.8)
Mother's nativity				
Born in US	304 (44.9)	0	195 (48.4)	0
Born outside US	373 (55.1)	373 (100)	208 (51.6)	208 (100)
Mother's parents' nativity				
Born in US	245 (36.3)	109 (29.5)	148 (36.7)	146 (70.9)
Born outside US	430 (63.7)	261 (70.5)	255 (63.3)	60 (29.1)
Language acculturation				
Exclusive use native	244 (37.4)	235 (67.9)	126 (32.5)	121 (60.2)
Non-exclusive use	409 (62.6)	111 (32.1)	262 (67.5)	80 (39.8)
Years of US residence				
<8 years	185 (27.6)	185 (50.5)	94 (23.6)	94 (46.1)
≥8 years	485 (72.4)	181 (49.5)	305 (76.4)	110 (53.9)

Table 1. Continued

	All participants <i>n</i> (%)	Immigrants only <i>n</i> (%)	All participants lost to follow-up <i>n</i> (%)	Immigrants only lost to follow-up <i>n</i> (%)
Smoked (≥ 100 cigarettes smoked in lifetime)				
Yes	193 (28.5)	53 (14.3)	128 (31.8)	36 (17.5)
No	484 (71.5)	318 (85.7)	275 (68.2)	170 (82.5)
Number of pregnancies				
1	201 (29.9)	103 (27.8)	117 (29.0)	56 (27.1)
2	182 (27.1)	106 (28.5)	116 (28.8)	64 (30.9)
3+	289 (43.0)	162 (43.7)	170 (42.2)	87 (42.0)
Number of prenatal visits				
0–8	46 (6.9)	17 (4.6)	34 (8.4)	11 (5.3)
9+	625 (93.1)	351 (95.4)	369 (91.6)	196 (94.5)
Infant age at baseline				
0–3 months	544 (80.1)	298 (79.9)	322 (79.5)	164 (78.9)
>3 months	135 (19.9)	75 (20.1)	83 (20.5)	44 (21.2)
Infant age at follow-up				
<12 months	60 (14.9)	29 (13.1)	na	na
12–16 months	207 (51.5)	111 (50.2)		
>16 months	135 (33.6)	81 (36.7)		
Number of children (<18 years) living at home				
0–1	260 (38.3)	141 (37.8)	150 (37.0)	77 (37.0)
2	203 (29.9)	122 (32.7)	118 (29.1)	63 (30.3)
3+	216 (31.8)	110 (29.5)	137 (33.8)	68 (32.7)
Number of people living in home				
2–4	386 (57.4)	216 (58.2)	235 (58.5)	128 (61.8)
5+	287 (42.6)	155 (41.8)	167 (41.5)	79 (38.2)
Emotional support (MOS survey) ^b				
Most/all of the time	542 (79.9)	298 (80.1)	331 (81.9)	167 (80.7)
None/little/some of time	136 (20.1)	74 (19.9)	73 (18.1)	40 (19.3)
Depression (CES-D scale) ^c				
Unlikely clinical depression	372 (54.8)	204 (54.7)	222 (54.8)	112 (53.9)
Possible mild to major depression	307 (45.2)	169 (45.3)	183 (45.2)	96 (46.1)
Self-health rating				
Excellent/very good	222 (32.8)	114 (30.7)	124 (30.7)	58 (28.0)
Good	318 (47.0)	181 (48.8)	183 (45.3)	97 (46.9)
Fair/poor	137 (20.2)	76 (20.5)	97 (24.0)	52 (25.1)

Table 1. *Continued*

	All participants <i>n</i> (%)	Immigrants only <i>n</i> (%)	All participants lost to follow-up <i>n</i> (%)	Immigrants only lost to follow-up <i>n</i> (%)
BMI measured at baseline				
Underweight/normal	167 (24.6)	84 (22.5)	109 (26.9)	51 (24.5)
Overweight/obese	512 (75.4)	289 (77.5)	296 (73.1)	157 (75.5)
Hours TV/day				
≤2	201 (29.6)	123 (33.1)	113 (28.0)	59 (28.5)
3–4	242 (35.7)	151 (40.6)	135 (33.4)	84 (40.6)
5+	235 (34.7)	98 (26.3)	156 (38.6)	64 (30.9)

^aBreast-feeding duration at follow-up only available on subset of mothers who were measured at follow-up.

^bMedical Outcomes Survey scale (Scherbourne & Stewart, 1991).

^cCenter for Epidemiologic Studies Depression Scale (Radloff, 1977).

implying the model fit the data well). The SAS software package v.9.1.3 was used to conduct all statistical procedures involved in this study.

Results

Basic descriptive statistics (including mean and percentages) within immigrants and across study participants are shown in Table 1.

For the two study outcomes, the majority of mothers in the study initiated breast-feeding (76.7% across study participants and 84.5% within immigrants) compared with not initiating breast-feeding. Meanwhile, at follow-up mothers were closely split between breast-feeding for ≥6 months and <6 months (55.1% breast-fed <6 months across study participants and 50.3% breast-fed ≥6 months within immigrants only). In terms of acculturation-related predictor variables of interest within immigrant mothers, the majority of mothers exclusively used their native language (67.9%) for speaking, reading and writing compared with non-exclusive use (32.1%). Half of immigrant mothers had lived in the US for less than eight years (50.5%) and a majority of immigrant mothers were of Hispanic/Latino ethnicity (92.5%) and had parents who were born outside the US (70.5%). Across all participants, mothers who exclusively used the native language of their homeland country were in the minority (37.4%) compared with mothers with non-exclusive use (mixed or English only) (62.6%), while mothers were split between those born in the US (44.9%) and those foreign-born (55.1%). The majority of mothers were of Hispanic/Latino ethnicity (74.4%) and had parents born outside the US (63.7%), highlighting that many mothers were second-generation Latina immigrants. Socio-demographic characteristics of mothers who were lost to follow-up (across all

participants and among immigrants only), and therefore did not have breast-feeding duration information available, are also reported in Table 1 for comparison, although these mothers did not appear to differ substantially from mothers for whom information was available.

Within immigrants

The unadjusted (univariate) predictors of breast-feeding initiation and duration within immigrants are shown in Table 2.

Breast-feeding initiation within immigrants. Table 3 shows the results of the final multivariable logistic regression model for breast-feeding initiation within immigrant mothers. Immigrant mothers who were classified as overweight/obese at baseline postpartum had more than two times the odds of initiating breast-feeding compared with mothers who were normal/underweight at baseline postpartum (OR=2.67; 95% CI=1.34, 5.33). Immigrant mothers who reported never smoking were also more likely to initiate breast-feeding compared with mothers who smoked (≥ 100 cigarettes in their lifetime) (OR=2.77; 95% CI=1.30, 5.89).

Breast-feeding duration within immigrants. Table 4 shows the results of the final multivariable logistic regression model for breast-feeding duration within immigrants. It was found that language acculturation was related to breast-feeding duration, in that immigrant mothers who exclusively used their native language had close to three times the odds of breast-feeding for ≥ 6 months compared with immigrant mothers with non-exclusive use (OR=2.94; 95% CI=1.08, 8.01). In addition, parents' nativity of immigrant mothers was associated with breast-feeding duration, in that mothers with parents who were foreign-born had over two times the odds of breast-feeding for ≥ 6 months compared with mothers with parents who were born in the US (OR=2.25, 95% CI=0.99, 5.14). Mothers who watched 3–4 hours TV/day were close to three times more likely to breast-feed for ≥ 6 months compared with mothers who watched 5 or more hours TV/day (OR=2.76, 95% CI=0.98, 7.72).

Across all participants

The unadjusted (univariate) predictors of breast-feeding initiation and duration across all participants are shown in Table 5.

Breast-feeding initiation across participants. Table 6 shows the results of the final multivariable logistic regression model for breast-feeding initiation across participants. It was found that across study participants mothers who exclusively used the native language of their homeland country had two times the odds of initiating breast-feeding compared with mothers with non-exclusive use (mixed or English only) (OR=2.07, 95% CI=1.11, 3.87). Mothers who were classified as overweight/obese at baseline postpartum were more likely to initiate breast-feeding compared with mothers who were normal/underweight at baseline postpartum (OR=1.91; 95% CI=1.24, 2.96). Mothers who had attained their high school diploma had more than

Table 2. Univariate logistic regression analyses predictors of breast-feeding initiation and duration within immigrants only

Predictor variables	Initiation (ever vs never) OR (95% CI)	Duration at follow-up (≥6 vs <6 months) OR (95% CI)
Age group		
<21 vs 21–29 years old	0.45 (0.26, 0.79)*	0.23 (0.07, 0.75)*
≥30 vs 21–29 years old	1.43 (0.76, 2.67)	1.94 (0.97, 3.86)
Intervention status		
Intervention vs control group	0.47 (0.29, 2.61)	0.73 (0.39, 1.34)
Ethnicity		
Hispanic/Latina vs non-Hispanic/Latina	0.92 (0.26, 3.26)	1.01 (0.31, 3.28)
High school diploma		
Yes vs no	2.08 (1.18, 3.66)*	0.73 (0.38, 1.41)
Marital or partner status		
Yes vs no	1.57 (0.87, 2.81)	1.36 (0.69, 2.66)
Working status		
Yes vs no	1.07 (0.39, 2.90)	0.68 (0.25, 1.89)
Mother's parents' nativity		
Foreign-born vs born in US	2.00 (1.08, 3.71)*	2.36 (1.18, 4.73)*
Language acculturation		
Exclusive use native vs non-exclusive use	2.46 (1.35, 4.48)*	5.26 (2.30, 12.04)*
Years of US residence		
<8 vs ≥8	2.55 (1.40, 4.65)*	2.38 (1.26, 4.49)*
Smoked ≥100 cigarettes in lifetime		
No vs yes	3.04 (1.76, 5.27)*	1.99 (0.69, 5.66)
Number of pregnancies		
1 vs 3+	1.82 (1.00, 3.32)*	0.66 (0.32, 1.36)
2 vs 3+	1.50 (0.84, 2.68)	0.51 (0.24, 1.09)
Number of prenatal visits		
<9 vs 9+	0.58 (0.23, 1.44)	0.99 (0.19, 5.04)
Infant age at baseline		
≥ 3 vs <3 months	0.79 (0.45, 1.38)	na
Infant age at follow-up		
<12 vs 12–16 months	na	2.23 (0.83, 5.97)
>16 vs 12–16 months	na	0.71 (0.36, 1.40)
Number of children (<18 years) living at home		
3+ vs 0–1	0.70 (0.38, 1.29)	0.53 (0.26, 1.09)
2 vs 0–1	0.45 (0.25, 0.80)*	1.22 (0.55, 2.68)
Number of people living in home		
5+ vs 2–4	1.05 (0.65, 1.71)	2.88 (1.53, 5.45)*
Emotional support (MOS survey)		
None/little/some of the time vs most/all of the time	0.64 (0.36, 1.11)	0.85 (0.40, 1.81)
Depression (CES-D scale)		
Possible mild-major depression vs unlikely depression	0.58 (0.33, 1.01)*	0.46 (0.25, 0.87)*

Table 2. *Continued*

Predictor variables	Initiation (ever vs never) OR (95% CI)	Duration at follow-up (≥ 6 vs <6 months) OR (95% CI)
Self-health rating		
Fair/poor vs excellent/very good	0.45 (0.20, 0.99)*	1.79 (0.67, 4.76)
Good vs excellent/very good	0.70 (0.35, 1.42)	1.02 (0.52, 2.02)
BMI measured at baseline postpartum		
Overweight/obese vs normal/underweight	1.97 (1.17, 3.31)*	0.81 (0.38, 1.74)
Hours TV/day		
≤ 2 vs 5+	2.13 (1.19, 3.78)*	1.89 (0.81, 4.42)
3-4 vs 5	1.60 (0.89, 2.87)	2.51 (1.06, 5.94)*

*Significance at $p \leq 0.05$ level. Entered into forward selection automated procedure.

Table 3. Final multivariable logistic regression model predictors of breast-feeding initiation within immigrants

Predictor variables	Initiation (ever vs never) OR (95% CI)
High school diploma	
Yes vs no	1.72 (0.88, 3.36)
Smoked ≥ 100 cigarettes in lifetime	
No vs yes	2.77 (1.30, 5.89)*
BMI measured at baseline postpartum	
Overweight/obese vs normal/underweight	2.67 (1.34, 5.33)*
Language acculturation	
Exclusive use native vs non-exclusive use	1.70 (0.80, 3.61)
Years of US residence	
<8 vs ≥ 8 years	1.81 (0.86, 3.82)

*Significance at $p=0.05$ level. Final model includes variables significant from forward selection procedure (smoking, BMI measured at baseline postpartum and language acculturation) plus confounders (high school diploma and years of US residence). Hosmer and Lemeshow goodness-of-fit test for final model=0.88. $\chi^2=3.76$.

two times the odds of initiating breast-feeding compared with mothers who had not attained their high school diploma (OR=2.34; 95% CI=1.56, 3.52). In addition, in homes with more children (<18 years) living at the home, mothers were less likely to initiate breast-feeding (OR=0.45, 95% CI=0.28, 0.72 for 3+ children versus 0-1 children; OR=0.58, 95% CI=0.35, 0.96 for 2 children versus 0-1 children).

Table 4. Final multivariable logistic regression model predictors of breast-feeding duration within immigrants

Predictor variables	Duration at follow-up (≥ 6 vs < 6 months) OR (95% CI)
Group status	
Intervention vs control	0.73 (0.35, 1.50)
Age group	
< 21 vs 21–29 years old	0.32 (0.09, 1.21)
≥ 30 vs 21–29 years old	1.62 (0.73, 3.58)
Hours TV/day	
≤ 2 vs 5+	1.33 (0.50, 3.55)
3–4 vs 5+	2.76 (0.98, 7.72)*
Mother's parents' nativity	
Foreign-born vs born in US	2.25 (0.99, 5.14)*
Language acculturation	
Exclusive use native vs non-exclusive use	2.94 (1.08, 8.01)*
Years of US residence	
< 8 vs ≥ 8	1.58 (0.69, 3.66)

*Significance at $p \leq 0.05$ level. Final model includes variables significant from forward selection procedure (language acculturation, age group and mother's parents' nativity) plus confounders (years of US residence, and hours TV watched per day) and theoretically necessary (group status). Hosmer and Lemeshow goodness-of-fit test for final model = 0.52; $\chi^2 = 7.15$.

Breast-feeding duration across participants. Table 7 shows the results of the final multivariable logistic regression model for breast-feeding duration across participants. It was found that across all study participants mothers with foreign-born parents had two times the odds of breast-feeding ≥ 6 months compared with mothers who had parents born in the US (OR = 2.18; 95% CI = 1.18, 4.04). Meanwhile, there was a trend towards significance for mothers who exclusively used the native language of their homeland country being more likely to breast-feed for ≥ 6 months compared with mothers with non-exclusive use (mixed or English only) (OR = 1.94; 95% CI = 0.89, 4.24). Other variables related to breast-feeding duration across participants included maternal age, smoking, number of people living in the home, and depression level. Mothers who were ≥ 30 years old had three and a half times the odds of breast-feeding for ≥ 6 months compared with mothers who were 21–29 years old (OR = 3.54; 95% CI = 1.83, 6.82). Mothers who did not regularly smoke had more than two times the odds of breast-feeding for at least 6 months duration compared with mothers who smoked (OR = 2.68, 95% CI = 1.23, 5.85). In families with more than five people living at home, mothers were more likely to breast-feed for at least 6 months compared with families with 2–4 people living at home (OR = 2.08, 95% CI = 1.17, 3.67). Finally, mothers who suffered from possible mild to major clinical depression (based on the CES-D scale) were also less likely to breast-feed for at least 6 months compared with mothers who were unlikely to be suffering from clinical depression (OR = 0.47, 95% CI = 0.26, 0.83).

Table 5. Univariate logistic regression analyses predictors of breast-feeding initiation and duration within all participants

Predictor variables	Initiation (ever vs never) OR (95% CI)	Duration at follow-up (≥6 vs <6 months) OR (95% CI)
Age group		
<21 vs 21–29 years old	0.52 (0.34, 0.79)*	0.63 (0.31, 1.28)
≥30 vs 21–29 years old	1.26 (0.79, 2.01)	2.80 (1.59, 4.93)*
Intervention status		
Intervention vs control group	1.05 (0.73, 1.50)	0.75 (0.46, 1.20)
Ethnicity		
Hispanic/Latina vs non-Hispanic/Latina	1.42 (0.96, 2.11)	0.90 (0.51, 1.58)
High school diploma		
Yes vs no	1.87 (1.29, 2.69)*	0.89 (0.53, 1.51)
Marital or partner status		
Yes vs no	1.27 (0.88, 1.84)	1.23 (0.74, 2.06)
Working status		
Yes vs no	1.39 (0.83, 1.84)	0.90 (0.44, 1.81)
Mother's nativity		
Foreign-born vs born in US	2.66 (1.84, 3.85)*	1.75 (1.06, 2.86)*
Mother's parents' nativity		
Foreign-born vs born in US	1.13 (0.78, 1.64)	1.81 (1.09, 2.98)*
Language acculturation		
Exclusive use native vs non-exclusive use	3.23 (2.08, 5.02)*	2.82 (1.71, 4.65)*
Years of US residence		
<8 vs ≥8	3.73 (2.21, 6.30)*	2.46 (1.47, 4.12)*
Smoked ≥100 cigarettes in lifetime		
No vs yes	2.04 (1.40, 2.97)*	2.40 (1.32, 4.37)*
Number of pregnancies		
1 vs 3+	1.75 (1.12, 2.74)*	0.76 (0.44, 1.34)
2 vs 3+	1.20 (0.78, 1.84)	0.58 (0.31, 1.08)
Number of prenatal visits		
<9 vs 9+	0.76 (0.39, 1.48)	0.40 (0.11, 1.5)
Infant age at baseline		
≥3 vs <3 months	1.02 (0.65, 1.60)	na
Infant age at follow-up		
<12 vs 12–16 months	na	1.43 (0.71, 2.91)
>16 vs 12–16 months	na	0.85 (0.50, 1.45)
Number of children (<18 years) living at home		
3+ vs 0–1	0.64 (0.41, 1.01)	0.77 (0.44, 1.37)
2 vs 0–1	0.47 (0.31, 0.73)*	1.07 (0.60, 1.91)
Number of people living in home		
5+ vs 2–4	1.00 (0.70, 1.43)	2.13 (1.31, 3.48)*
Emotional support (MOS survey)		
None/little/some of the time vs most/all of the time	1.04 (0.66, 1.62)	0.64 (0.36, 1.14)
Depression (CES-D scale)		
Possible mild–major depression vs unlikely depression	0.89 (0.62, 1.27)	0.47 (0.29, 0.76)*

Table 5. *Continued*

Predictor variables	Initiation (ever vs never) OR (95% CI)	Duration at follow-up (≥6 vs <6 months) OR (95% CI)
Self-health rating		
Fair/poor vs excellent/very good	0.77 (0.47, 1.25)	1.25 (0.60, 2.61)
Good vs excellent/very good	0.97 (0.64, 1.46)	0.80 (0.47, 1.35)
BMI measured at baseline postpartum		
Overweight/obese vs normal/underweight	1.73 (1.17, 2.86)*	0.77 (0.43, 1.38)
Hours TV/day		
≤2 vs 5+	1.96 (1.27, 3.03)*	1.89 (1.03, 3.48)*
3–4 vs 5+	1.47 (0.95, 2.27)	2.59 (1.38, 4.88)*

*Significance at $p \leq 0.05$ level. Entered into forward selection automated procedure.

Table 6. Final multivariable logistic regression model predictors of breast-feeding initiation across all participants

Predictor variables	All participants OR (95% CI)
High school diploma	
Yes vs no	2.34 (1.56, 3.52)*
Mother's nativity	
Foreign-born vs born in US	1.46 (0.88, 2.43)
Number of children (<18 years) living at home	
3+ vs 0–1	0.45 (0.28, 0.72)*
2 vs 0–1	0.58 (0.35, 0.96)*
BMI measured at baseline postpartum	
Overweight/obese vs normal/underweight	1.91 (1.24, 2.96)*
Language acculturation	
Exclusive use native vs non-exclusive use	2.07 (1.11, 3.87)*
Years of US residence	
<8 vs ≥8	1.61 (0.80, 3.21)

*Significance at $p \leq 0.05$ level. Final model includes variables significant from forward selection procedure (BMI measured at baseline postpartum, number of children living at home, language acculturation and high school diploma) plus confounders (mother's nativity and years of US residence). Hosmer and Lemeshow goodness-of-fit test for final model = 0.66; $\chi^2 = 5.84$.

Discussion

Current disparities evident in breast-feeding rates among ethnic and racial populations in the US may be partially explained by a better understanding of the processes of acculturation. National surveys suggest that 'Hispanics' show promising breast-feeding rates compared with whites and blacks (Ryan *et al.*, 2002). However, while

Table 7. Final multivariable logistic regression model predictors of breast-feeding duration across all participants

Predictor variables	Participants OR (95% CI)
Group status	
Intervention vs control	0.65 (0.37, 1.16)
Age group	
<21 vs 21–29 years old	0.96 (0.43, 2.14)
>30 vs 21–29 years old	3.54 (1.83, 6.82)*
Smoked \geq 100 cigarettes in lifetime	
No vs yes	2.68 (1.23, 5.85)*
Number of people living in home	
5+ vs 2–4	2.08 (1.17, 3.67)*
Depression (CES-D scale)	
Possible mild–major depression vs unlikely depression	0.47 (0.26, 0.83)*
Mother's parents' nativity	
Foreign-born vs born in US	2.18 (1.18, 4.04)*
Language acculturation	
Exclusive use native vs non-exclusive use	1.94 (0.89, 4.24)*
Years of US residence	
<8 vs \geq 8	1.09 (0.50, 2.40)

*Significance at $p \leq 0.10$ level. Final model includes variables significant from forward selection procedure (age group, number of people living in the home, smoking, mother's parents' nativity, language acculturation and depression) plus confounders (years of us residence) and theoretically necessary (group status). Hosmer and Lemeshow goodness-of-fit test for final model=0.93; $\chi^2=3.04$.

there may be a protective effect of nativity on breast-feeding status upon initial entry to the US, there is now evidence gathering which points to a rapid decline in such effects over time (Desantis, 1986; Romero-Gwynn & Carias, 1989; Hernandez & Charney, 1998; Perez-Escamilla *et al.*, 1998). It is critical that public health researchers further disentangle what is meant by the terms 'Hispanic' or 'Latino' by studying the different measures of acculturation (mother's nativity, mother's parents' nativity, years of US residence and language acculturation) within these individuals.

While previous research suggests an effect of acculturation on breast-feeding initiation and/or intent alone, the results of this study highlight the influence of mother's language acculturation on both breast-feeding initiation and duration. To date, only two other studies have documented an effect of immigrant status on breast-feeding duration (Harley *et al.*, 2007; Singh *et al.*, 2007), yet such research was limited in that it only examined one measure of acculturation, i.e. years in the US (Harley *et al.*, 2007), and nativity of parents and their children (Singh *et al.*, 2007), rather than other possible measures of acculturation. In comparison, this study tested multiple measures of acculturation (mother's nativity, mother's parents' nativity, years of US residence and language acculturation), as previous studies debate the use of

various measures (Marin & Marin, 1991; Negy & Woods, 1992) and one goal of this study was to determine which measure would end up most significant in multivariate analyses. Final multivariable models showed that mothers who exclusively used their native language were more likely to initiate breast-feeding as well as breast-feed for longer duration compared with mothers with non-exclusive use, whereas years of US residence and mother's nativity were not significantly associated with breast-feeding initiation or duration. These results suggest that language acculturation use may provide a more informative measure of breast-feeding initiation and duration compared with years of US residence for immigrant groups.

Mother's parents' nativity also emerged as a significant predictor of breast-feeding duration, both within final models for immigrants and across study participants. To the authors' knowledge, this is the first study to document such an effect. Surprisingly, this finding occurred in the absence of any such association for mother's nativity in multivariable analyses (nativity was significant in univariate analyses) when analysed across all study participants, despite recent literature suggesting that foreign-born mothers are more likely to breast-feed and breast-feed for longer duration compared with mothers born in the US (Bonuck *et al.*, 2005; Celi *et al.*, 2005; Gibson-Davis & Brooks-Gunn, 2006; Singh *et al.*, 2007). For example, a recent study in Massachusetts found that the likelihood of breast-feeding among non-US-born Hispanic mothers was eight times greater than that for US-born white mothers with a preterm infant and almost ten times greater with a term infant (Merewood *et al.*, 2006). Even though such an association based on mother's nativity was not found in the analysis conducted here, it is possible that previous studies may not have been able to control for the generational effect if information about mother's parents' nativity was unavailable. The potential implications of a significant result for mother's parents' nativity, rather than for mother's nativity, suggests that the cultural practices of mother's parents' native countries may also influence the infant-feeding practices of immigrant mothers now living in the US.

Previous research examining the social context of breast-feeding in Latin American countries debates the extent to which grandmothers may promote or discourage breast-feeding in such settings. In a study conducted in Mexico, maternal and paternal grandmothers were particularly influential in contributing positively to exclusive breast-feeding rates (Turnbull-Plaza *et al.*, 2006). Conversely, in a study in the city of Porto Alegre, Brazil, grandmothers advised abandonment of exclusive breast-feeding in favour of water or tea and other kinds of milk (Susin *et al.*, 2005). Meanwhile, in a study investigating the relationship between attitudes of the mother and her family towards breast-feeding and actual feeding patterns conducted in Bolivia, the attitude of the infant's grandmother towards breast-feeding was found to have no effect on infant feeding pattern (Ludvigsson, 2003). Recent qualitative research conducted amongst a sub-sample of Latina mothers enrolled in WIC from the same randomized control trial as analysed in this study suggests that mother's beliefs, attitudes and practices related to early child feeding may be strongly influenced by the beliefs and practices of older family members, particularly grandmothers, although some mothers may be beginning to transition away from such cultural practices (Lindsay *et al.*, unpublished; Sussner *et al.*, unpublished). Combining such qualitative information with this quantitative finding, there is reason to

suggest that the positive breast-feeding outcomes witnessed amongst Latino immigrants may evolve from the cultural practices of mother's parents' native countries that promote breast-feeding practices more so than in the US. Future studies must examine these potential associations in more detail and address how Latino families may continue to sustain such health-promoting practices through generations.

In addition, future research should borrow from recent findings in evolutionary ecology to more thoroughly investigate the relative role of maternal versus paternal grandmothers and grandfathers as well as how gender of the offspring may influence parental investment and early childhood feeding practices. For example, amongst Hadza hunter-gatherers in Tanzania, the beneficial effects of grandmothers on the nutritional status of children have been well documented for quite some time (Blurton Jones, 1993; Hawkes *et al.*, 1997; O'Connell *et al.*, 1999). Through increased provisioning efforts from grandmothers, mothers who have such assistance may be able to wean their children earlier and allocate more energy to the production of the next child, ultimately producing shorter birth spacing along with increased child survivorship and improved health outcomes (Hawkes *et al.*, 1997). In an analysis of data collected from 1950–1974 in rural Gambia, it was found that children with living maternal grandmothers, specifically, had significantly lower mortality during the toddler years, although there was no such effect on child mortality for paternal grandmothers, maternal grandfathers or paternal grandfathers (Sear *et al.*, 2002). In fact, research has found that maternal grandmothers may be the only kin besides mothers to improve nutritional status of children significantly, with the reproductive status of the maternal grandmother playing a critical role (Sear *et al.*, 2000). Similarly, a study conducted in a village in central Japan, showed that a child was 35% less likely to die if the maternal grandmother was present in the household, while grandfathers and the paternal grandmother exerted the opposite effect (Jamison *et al.*, 2002). Gender of the offspring and the parent may also be important in determining early childhood feeding practices, as differential expectations of child weight status may exist. A recent study examining parental perception of offspring body shape and gender-specific patterns of offspring feeding habits in a sample of parents of 36-month-old children ($n=93$), found that both mothers and fathers reported that their daughters ate enough food compared with their sons; however, parents worried that their sons, but not daughters, were underweight (Holm-Denoma *et al.*, 2005).

From a theoretical perspective, while a range of studies have examined the influence of acculturation on breast-feeding practices, it is important to more clearly define what is meant by 'acculturation'. Currently, conceptualization and measurement issues in acculturation research exist (Beck *et al.*, 2006), in effect creating several proxy measures of acculturation and thus highlighting the need for researchers to reconsider which acculturation-related variables are the most meaningful measurements of the phenomena under investigation. In reality, researchers debate the use of different measures of acculturation. While some contend that language preference is the best measure of cultural integration, others believe other core values of the host culture should be included in any analysis of acculturation. Meanwhile, others choose to examine such factors as nativity or years duration in the US alone as proxies of acculturation (Marin & Marin, 1991; Negy & Woods, 1992). For this reason, this study chose to include multiple measures of acculturation in order to determine which

would end up the most significant in multivariate analyses. It is suggested here that years of US residence may not be as informative as previous research suggests and rather, language acculturation will provide a clearer snapshot of the immigrant process. For example, living in the US for 10 years for one person versus living in the US for 10 years for another may result in differing levels of acculturation and assimilation into US culture, based on the degree of contact with individuals, families, friends and neighbours who may share or do not share the cultural identities of the countries from which these immigrants came. While years of US residence is an attractive quantitative variable that is simple to measure, it may be difficult at the very least to entangle the qualitative meaning behind such numbers. Rather, a measurement of language preference and use, such as has been previously validated for use in Latino populations (Marin *et al.*, 1987; Marin & Gamba, 1996), may serve as a better proxy for how immigrants assimilate into American mainstream culture. In fact, previous research suggests that language preference may be the best possible measure of cultural integration and is perhaps the most reliable shorthand measure, as it accounts for the greatest portion of variance of acculturation scales (Marin & Marin, 1991). Language use also represents a modifiable aspect of an individual, amenable to intervention, compared with years in the US. However, at the same time, it is important that researchers acknowledge that language may also be just one possible marker of acculturation.

In conclusion, nutrition education programmes targeted at low-income, multi-ethnic women in the US may wish to consider the role of language acculturation as an influential measure of health behaviours, particularly breast-feeding, in immigrant participants. Such information may be utilized to design more effective and culturally appropriate interventions that promote breast-feeding initiation in immigrants acculturating to the US. Previous research has already found that knowledge of an individual's acculturation is useful in matching consumers' level of cultural compatibility with that of their health care providers (Romero-Gwynn & Carias, 1989). By understanding the contextual demands placed on immigrants as they adapt to an American way of life, it will be easier to identify population-specific risks and health behaviours to ultimately provide better integrated health prevention and promotion programmes (Wallen *et al.*, 2002).

Nutrition education programmes taught in Spanish may prove effective for promoting breast-feeding in Latino populations. For example, a study of lactation classes for Latina mothers found that offering the class in Spanish increased participants' willingness to breast-feed, while providing services in Spanish also made women more likely to access health care services, regardless of their secondary fluency in English (Roby & Woodson, 2004). In addition, the use of one-on-one peer counsellors who deliver messages in Spanish may impact health behaviour change. In a recent randomized prospective controlled study, pregnant women recruited during the prenatal period were randomly assigned to receive routine breast-feeding education or routine breast-feeding education plus peer counselling. The use of the breast-feeding peer counselling intervention demonstrated great success in increasing breast-feeding initiation rates and making a significant impact at 1 and 3 months postpartum in Latinas (Chapman *et al.*, 2004). Similarly, in a predominantly Puerto Rican population in inner-city Hartford, Connecticut, breast-feeding was found to be

more likely in Latinas who had received breast-feeding counselling and postpartum support (Perez-Escamilla *et al.*, 1998). Further interventions and evaluations of such programmes that place greater emphasis and sensitivity on the cultural environment of the women they are trying to reach must be conducted in the near future.

In addition, this research further highlights the need for qualitative studies to examine the immigrant process of acculturation and assimilation in terms of processes of acculturation and changes that may be related to a mother's decision to breast-feed. It may be the case that immigrant mothers adopt the majority culture's attitudes towards breast-feeding as part of the acculturation process (Gibson *et al.*, 2005). Previous surveys have begun to identify possible reasons for women choosing not to breast-feed. A survey with Mexican American mothers in California conducted by Guendelman & Siega-Riz (2002) found that immigrant mothers (30%) cited problems with the baby (rejecting the breast or getting sick) as the primary reasons for not breast-feeding, while US mothers (47%) reported it was their own discomfort, dislike or lack of comfort in breast-feeding that made them stop or never start. Similarly, in a secondary analysis of NHANES 1999–2000, less acculturated mothers were more likely to cite child's physical or medical conditions as reason not to breast-feed, whereas more acculturated mothers said the 'child preferred bottles' (Gibson *et al.*, 2005).

Qualitative research conducted among a subset of Latina mothers from the same WIC population involved in this study in the Boston area found that work may influence the decision to stop breast-feeding in the US, but not in mothers' homeland countries where mothers can often stay at home with their baby (Sussner *et al.*, unpublished). While work did not influence breast-feeding initiation or duration in the analysis presented here, recent research suggests that mothers who are employed part-time or self-employed are more likely to breast-feed at least 4 months compared with those employed full time (Hawkins *et al.*, 2007); and the explanations for such an effect deserve further investigation, including lack of long mother–infant separations, supportive work environments and child-care options that facilitate breast-feeding (Johnston & Esposito, 2007).

Another factor dependent on acculturation level that may impact breast-feeding rates may be perception of public exposure while breast-feeding. In a qualitative study of teenage Latina and African-American girls in Chicago, more acculturated mothers were found to express the belief that breast-feeding was more embarrassing compared with less acculturated mothers (Hannon *et al.*, 2000). Educational programmes that can address such beliefs about infant health and form a more accurate maternal perception of health status will be particularly useful (Gibson *et al.*, 2005). For this reason, more research should be conducted on mother's attitudes, beliefs and perceptions related to infant health and breast-feeding, particularly in low-income, immigrant populations.

Based on the results of this study it may be interesting for future research to investigate how the adoption of breast-feeding promoting behaviours in Latina mothers may favour the adoption of other health-promoting behaviours. For example, research now shows that breast-feeding promotion has been linked to other preventive strategies to treat paediatric overweight, specifically, including reducing TV/video viewing, increasing fruit and vegetable consumption, reducing

sugar-sweetened drink consumption and reducing portion sizes (Sherry, 2005). In the case of this analysis presented here, it was found that immigrant mothers who watched 3–4 hours TV/day were more likely to breast-feed for at least 6 months duration compared with those who watched 5+ hours TV/day. This finding is likely as it is possible that mothers who adopt at least one health-promoting strategy (in this case, increased breast-feeding or reduced TV viewing) may be more likely to adopt a range of other health-promoting strategies at the same time. Such findings are informative for the development and creation of health education programmes that may tackle a range of health problems at once.

Limitations of this study include the fact that the women were recruited through the WIC programme and therefore their breast-feeding practices may not be representative of the general immigrant Latino population. Research suggests that breast-feeding is less common among children receiving WIC benefits during the first year of life compared with those who do not receive WIC (Li *et al.*, 2005). A recent analysis of national-level data from the Ross Laboratories Mothers Survey 1978–2003 suggests that rates of breast-feeding initiation among WIC participants were lower than among non-WIC mothers by $23.6 \pm 4.4\%$ points, with a gap of $16.3 \pm 3.1\%$ points at 6 months of age (Ryan & Zhou, 2006). While mothers enrolled in WIC may be aware of the benefits of breast-feeding, they may have to face significant structural and personal barriers such as lack of family support, work/school and poor living conditions that may prevent mothers from breast-feeding (Bentley *et al.*, 1999; Li *et al.*, 2005). However, it is important to note that recently there have also been substantial improvements and changes to WIC programmes to promote and increase breast-feeding rates among such low-income women. With such changes, the rates of breast-feeding in the WIC community may in fact become more representative of the general population than previously thought and in reality, women not enrolled in WIC of similar socioeconomic status may be expected to have even lower breast-feeding rates. If this is the case, it may be appropriate to assume an even more urgent need to reach out to immigrant, low-income mothers who are not part of WIC, who would perhaps be less likely to initiate breast-feeding and sustain breast-feeding for long periods of time.

Another possible limitation of this study is its inability to examine sub-group differences in Latinas' breast-feeding practices based on country of origin (as country of origin information was not available from the original baseline dataset). Future research should be conducted in this area, as a recent series of analyses examining data from the 1997–2001 National Health Interview surveys found distinct health patterns among Latino ethnic groups, documenting health advantages for Mexicans, health disparities for Puerto Ricans and a mix of health disparities and advantages for Cubans and Dominicans depending on the health outcome (Zsembik & Fennell, 2005). Similarly, a study of 150 families found differing impacts of language usage in Latino immigrants by country of origin with years of US residence (Arcia *et al.*, 2001).

Finally, the results of this study underline the need for more refined analyses in Latino populations that delve beyond examinations based primarily on ethnicity. Public health studies involving immigrant populations must acknowledge the value of measuring and studying acculturation, just as routine as they would measure and

study ethnicity. By more deeply understanding the diversity of groups and individuals found within prescribed racial/ethnic categories such as white, black, Hispanic/Latino, researchers will come closer to designing more effective culturally relevant programmes and policies that may truly promote positive health behaviour change.

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References

- Abraido-Lanza, A. F., Armbrister, A. N. & Aguirre, A. N.** (2006) Towards a theory-driven model of acculturation in health research. *American Journal of Public Health* **96**(8), 1342–1346.
- Arcia, E., Skinner, M., Bailey, D. & Correa, V.** (2001) Models of acculturation and health behaviors among Latino immigrants to the U.S. *Social Science and Medicine* **53**(1), 41–53.
- Beck, C. T.** (2006) Acculturation: implications for perinatal research. *American Journal of Maternal/Child Nursing* **31**(2), 114–120.
- Bentley, M. E., Caulfield, L. E., Gross, S. M., Bronner, Y., Jensen, J., Kessler, L. A. & Paige, D. M.** (1999) Sources of influence on intention to breastfeed among African-American women at entry to WIC. *Journal of Human Lactation* **15**, 27–34.
- Bonuck, K. A., Freeman, K. & Trombley, M.** (2005) Country of origin and race/ethnicity: impact on breastfeeding intentions. *Journal of Human Lactation* **21**(3), 320–326.
- Blurton Jones, N. G.** (1993) The lives of hunter-gatherer children: effects of parental behavior and parental reproductive strategy. In Pereira, M. E. & Fairbanks, L. A. (eds) *Juvenile Primates*. Oxford University Press, New York, pp. 309–326.
- Byrd, T. L., Balcazar, H. & Humel, A.** (2001) Acculturation and breastfeeding intention and practice in Hispanic women on the U.S.–Mexico border. *Ethnicity and Disease* **11**(11), 72–79.
- Celi, A. C., Rich-Edwards, J. W., Richardson, M. K., Kleinman, K. P. & Gillman, M. W.** (2005) Immigration, race/ethnicity and social and economic factors as predictors of breastfeeding initiation. *Archives of Pediatric and Adolescent Medicine* **159**(3), 255–260.
- Chapman, D. J., Damio, G., Young, S. & Perez-Escamilla, R.** (2004) Effectiveness of breastfeeding peer counseling in a low-income, predominantly Latina population: a randomized controlled trial. *Archives of Pediatric and Adolescent Medicine* **158**(9), 897–902.
- De La Torre, A. & Rush, L.** (1987) The determinants of breastfeeding for Mexican migrant women. *International Migration Reviews* **21**(3), 728–742.
- Desantis, L.** (1986) Infant feeding practices of Haitian mothers in South Florida: cultural beliefs and acculturation. *Maternal Child Nursing Journal* **15**(2), 77–89.

- Ebbeling, C. B., Pearson, M., Sorensen, G., Levine, R., Hebert, J. R., Salkeld, J. & Peterson, K. E. (2007) Conceptualization and development of a theory-based healthful eating and physical activity intervention for low-income postpartum women. *Health Promotion and Practice* 8(1), 50–59.
- Gibson, M. V., Diaz, V. A., Mainous, A. G. & Geesey, M. E. (2005) Prevalence of breastfeeding and acculturation in Hispanics: Results from NHANES 1999–2000 Study. *Birth* 32(2), 93–98.
- Gibson-Davis, C. M. & Brooks-Gunn, J. (2006) Couples' immigration status and ethnicity as determinants of breastfeeding. *American Journal of Public Health* 96(4), 641–646.
- Guendelman, S. & Siega-Riz, A. M. (2002) Infant feeding practices and maternal dietary intake among Latino immigrants in California. *Journal of Immigrant Health* 4(3), 137–146.
- Hannon, P. R., Willis, S. K., Bishop-Townsend, V., Martinez, I. M. & Scrimshaw, S. C. (2000) African-American and Latina adolescent mothers infant feeding decisions and breastfeeding practices: a qualitative study. *Journal of Adolescent Health* 26, 399–407.
- Harley, K., Stamm, N. L. & Eskenazi, B. (2007) The effect of time in the U.S. on the duration of breastfeeding in women of Mexican descent. *Maternal Child Health Journal* 11(2), 119–125.
- Hawkes, K., O'Connell, J. F. & Blurton Jones, N. G. (1997) Hadza women's time allocation, offspring provisioning, and the evolution of long postmenopausal life spans. *Current Anthropology* 38(4), 551–577.
- Hawkins, S. S., Griffiths, L. J., Dezateux, C., Law, C. & The Millenium Cohort Study Child Health Group (2007) The impact of maternal employment on breast-feeding duration in the UK Millenium Cohort Study. *Public Health Nutrition* 10(9), 891–896.
- Hediger, M. L., Overpeck, M. D., Kuczmarski, R. J. & Ruan, W. J. (2001) Association between infant breastfeeding and overweight in young children. *Journal of the American Medical Association* 285(19), 2453–2460.
- Heinig, M. J. (2001) Host defense benefits of breastfeeding for the infant. *Pediatric Clinics of North America* 48(1), 105–123.
- Heinig, M. J. & Dewey, K. D. (1996) Health advantages of breastfeeding for infants: a critical review. *Nutrition Research Reviews* 9, 89–110.
- Hernandez, D. & Charney, E. (eds) (1998) *From Generation to Generation: The Health and Well-Being of Children in Immigrant Families*. National Research Council, Washington, DC.
- Holm-Denoma, J. M., Lewinsohn, P. M., Gau, J. M., Joiner, T. E., Striegel-Moore, R. & Otamendi, A. (2005) Parents' reports of the body shape and feeding habits of 36-month old children: an investigation of gender differences. *International Journal of Eating Disorders* 38(3), 228–235.
- Jamison, C. S., Cornell, L. L., Jamison, P. L. & Nakazato, H. (2002) Are all grandmothers equal? A review and a preliminary test of the 'grandmother hypothesis' in Tokugawa Japan. *American Journal of Physical Anthropology* 119, 67–76.
- Johnston, M. L. & Esposito, N. (2007) Barriers and facilitators for breastfeeding among working women in the United States. *Journal of Obstetrics Gynecology and Neonatal Nursing* 36(1), 9–20.
- Kaplan, M. S., Huguet, N., Newsom, J. T. & McFarland, B. H. (2004) The association between length of residence and obesity among Hispanic immigrants. *American Journal of Preventive Medicine* 27(4), 323–326.
- Kim, Y., Choi, J. Y., Lee, K. M., Park, S. K., Ahn, S. H., Noh, D. Y., Hong, Y. C., Kang, D. & Yoo, K. Y. (2007) Dose-dependent protective effect of breast-feeding against breast cancer among ever-lactated women in Korea. *European Journal of Cancer Prevention* 16(2), 124–129.
- Kunz, C., Rodriguez-Palmero, M., Koletzko, B. & Jensen, R. (1999) Nutritional and biochemical properties of human milk, part I: General aspects, proteins and carbohydrates. *Clinics in Perinatology* 26(2), 307–334.

- Li, R., Darling, N., Maurice, E., Barker, L. & Grummer-Strawn, L. M. (2005) Breastfeeding rates in the United States by characteristics of the child, mother, or family: The National Immunization Survey. *Pediatrics* **115**, 31–37.
- Ludvigsson, J. F. (2003) Breastfeeding in Bolivia – information and attitudes. *BMC Pediatrics* **3**(4), Epub 2003, May 26.
- Marin, G. & Gamba, R. (1996) A new measurement of acculturation for Hispanics: the bidimensional acculturation scale for Hispanics (BAS). *Hispanic Journal of Behavioural Sciences* **18**(3), 297–316.
- Marin, G. & Marin, B. V. (1991) *Research with Hispanic Populations*. Applied Social Research Methods Series, Vol. 23. Sage Publications, Newbury Park, California.
- Marin, G., Sabogal, F., Marin, B. V., Otero-Sabogal, R. & Perez-Stable, E. J. (1987) Development of a short acculturation scale for Hispanics. *Hispanic Journal of Behavioural Sciences* **9**(2), 183–205.
- Martin, R. M., Middleton, N., Gunnell, D., Owen, C. G. & Smith, G. D. (2005) Breast-feeding and cancer: the Boyd Orr cohort and a systematic review with meta-analysis. *Journal National Cancer Institute* **97**(19), 1446–1457.
- Mayer, E. J., Hamman, R. F., Gay, E. C., Lezotte, D. C., Savitz, D. A. & Klingensmith, G. J. (1988) Reduced risk of IDDM among breast-fed children. *Diabetes* **37**, 1625–1632.
- Merewood, A., Brooks, D., Bauchner, H., MacAuley, L. & Mehta, S. D. (2006) Maternal birthplace and breastfeeding initiation among term and preterm infants: a statewide assessment for Massachusetts. *Pediatrics* **118**(4), e1048–1054.
- Michels, K. B., Trichopoulos, D., Rosner, B. A., Hunter, D. J., Colditz, G. A., Hankinson, S. E., Speizer, F. E. & Willett, W. C. (2001) Being breastfed in infancy and breast cancer incidence in adult life: results from the two nurses' health studies. *American Journal of Epidemiology* **153**(3), 275–283.
- Negy, C. & Woods, D. J. (1992) The importance of acculturation in understanding research with Hispanic Americans. *Hispanic Journal of Behavioral Sciences* **14**, 224–227.
- Noble, L., Hand, I., Haynes, D., McVeigh, T., Kim, M. & Yoon, J. J. (2003) Factors influencing initiation of breastfeeding among urban women. *American Journal of Perinatology* **20**(8), 477–483.
- O'Connell, J. F., Hawkes, K. & Blurton Jones, N. G. (1999) Grandmothering and the evolution of *Homo erectus*. *Journal of Human Evolution* **36**, 461–485.
- Perez-Escamilla, R., Himmelgreen, D., Segura-Millan, S., Gonzalez, A., Ferris, A. M., Damio, G. & Bermudez-Vega, A. (1998) Prenatal and perinatal factors associated with breastfeeding initiation among inner-city Puerto Rican women. *Journal of the American Dietetic Association* **98**(6), 657–663.
- Peterson, K. E., Sorenson, G., Pearson, M., Hebert, J., Gottlieb, B. R. & McCormick, M. C. (2002) Design on an intervention addressing multiple levels of influence on dietary and activity patterns of low income, post-partum women. *Health Education Research* **17**(5), 531–540.
- Radloff, L. S. (1977) The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement* **1**, 385–401.
- Rassin, D. K., Markides, K. S., Baranowski, T., Bee, D. E., Richardson, C. J., Mikrut, W. D. & Winkler, B. A. (1993) Acculturation and the initiation of breastfeeding on the United States–Mexico border. *American Journal of the Medical Sciences* **306**(1), 28–34.
- Rassin, D. K., Markides, K. S., Baranowski, T., Richardson, C. J., Mikrut, W. D. & Bee, D. E. (1994) Acculturation and the initiation of breastfeeding. *Journal of Clinical Epidemiology* **47**(7), 739–746.
- Roby, J. L. & Woodson, K. S. (2004) An evaluation of a breast-feeding education intervention among Spanish-speaking families. *Social Work in Health Care* **40**(1), 15–31.

- Romero-Gwynn, E. & Carias, L.** (1989) Breast-feeding intentions and practice among Hispanic mothers in Southern California. *Pediatrics* **84**(4), 626–632.
- Ryan, A. S., Wenjun, Z. & Acosta, A.** (2002) Breastfeeding continues to increase into the new millennium. *Pediatrics* **110**, 1103–1109.
- Ryan, A. S. & Zhou, W.** (2006) Lower breastfeeding rates persist among the Special Supplemental Nutrition Program for Women, Infants, and Children participants, 1978–2003. *Pediatrics* **117**(4), 1432–1433.
- Saarinean, U. & Kajosaari, M.** (1995) Breast-feeding as prophylaxis against atopic disease: prospective follow-up study until 17 years old. *Lancet* **346**, 1065–1069.
- Scherbourne, C. D. & Stewart, A. L.** (1991) The MOS social support survey. *Social Science and Medicine* **32**(6), 705–714.
- Sear, R., Mace, R. & McGregor, I. A.** (2000) Maternal grandmothers improve nutritional status and survival of children in rural Gambia. *Proceedings: Biological Sciences* **267** (1453), 1641–1647.
- Sear, R., Steele, F., McGregor, I. A. & Mace, R.** (2002) The effects of kin on child mortality in rural Gambia. *Demography* **39**(1), 43–63.
- Sherry, B.** (2005) Food behaviors and other strategies to prevent and treat pediatric overweight. *International Journal of Obesity (London)* **29** (supplement 2), 2S116–126.
- Singh, G. K., Kogan, M. D. & Dee, D. L.** (2007) Nativity/immigrant status, race/ethnicity, and socioeconomic determinants of breastfeeding initiation and duration in the United States. *Pediatrics* **119** (supplement 1), S38–46.
- Singh, G. K. & Siahpush, M.** (2002) Ethnic-immigrant differentials in health behaviours, morbidity, and cause-specific mortality in the United States: an analysis of two national databases. *Human Biology* **74**(1), 83–109.
- Susin, L. R., Giugliani, E. R. & Kummer, S. C.** (2005) Influence of grandmothers on breastfeeding practices. *Revista de Saúde Pública* **39**(2), 141–147.
- Turnbull-Plaza, B., Escalante-Izeta, E. & Klunder-Klunder, M.** (2006) The role of social networks in exclusive breastfeeding. *Revista Médica del Instituto Mexicano del Seguro Social* **44**(2), 97–104.
- United States Census Bureau** (2004) *Census Bureau Projects Tripling of Hispanic and Asian Populations in 50 Years; Non-Hispanic Whites May Drop to Half of Total Population*. Press Release. <http://www.census.gov/PressRelease/www/releases/archives/population/001720.html>.
- United States Department of Health & Human Services** (2000) *Healthy People 2010: Conference Edition*. Vols I and II. US Government Printing Office, Washington, DC, pp. 47–48.
- Vega, W. & Amaro, H.** (1994) Latino outlook: good health, uncertain prognosis. *Annual Reviews of Public Health* **15**, 39–67.
- Wallen, G. R., Feldman, R. H. & Anliker, J.** (2002) Measuring acculturation among central American women with the use of a brief language scale. *Journal of Immigrant Health* **4**(2), 95–102.
- Zsembik, B. A. & Fennell, D.** (2005) Ethnic variation in health and the determinants of health among Latinos. *Social Science and Medicine* **61**, 53–63.