Acculturation and Low-Birthweight Infants among Latino Women: A Reanalysis of HHANES Data with Structural Equation Models

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ABSTRACT

Previous studies have demonstrated that acculturation is associated with negative birth outcomes among mothers in numerous immigrant populations, including Latinas. This study used structural equation models to reanalyze data employed in the 1989 Scribner and Dwyer study on the effect of acculturation (measured through the Cuellar scale) on mothers' low-birthweight status. Data revealed that language components dominate the effects of acculturation on low-birthweight status. Acculturation appears to affect low-birthweight status indirectly through smoking and dietary intake but not through parity. Acculturation has a persistent direct effect on low-birthweight status, suggesting that other intervening variables are operant. (*Am J Public Health*. 1996;86:394–396)

Introduction

The hypothesis linking acculturation with health behaviors and risk factors has been tested frequently among Hispanics.[1] One notable example is Scribner and Dwyer's[2] analysis. They found acculturation to be a significant predictor of low-birthweight status. US-oriented mothers had a risk of ever having delivered a low-birthweight infant that was 1.64 times as large as that of Mexican-oriented mothers.

Despite its appeal, the acculturation hypothesis suffers from conceptual and methodological problems. First, although there is ample evidence[3–6] that acculturation is a multidimensional phenomenon, no systematic analysis exists of whether all dimensions of acculturation are equally relevant to particular health outcomes. Second, the nature of the linkages connecting acculturation with health outcomes has not been fully explored, and, as a consequence, our understanding of how acculturation influences health criteria is limited.

Some of these uncertainties may be addressed with structural equation modeling, a statistical technique seldom used in health research. In this paper, we use the same data as Scribner and Dwyer and reanalyze the relationship between acculturation and low-birthweight status through structural equation models. Our findings shed new light on how acculturation appears to affect low-birthweight status.

Methods

Our analysis was based on the Mexican American portion of the Hispanic Health and Nutrition Examination Survey. Only women who had experienced at least one live birth were included.

We used the same variables as those employed by Scribner and Dwyer: education, age, poverty index, size of community, language use, ethnic identity, parity, smoking, and low-birthweight status. Education ranged from "never attended or kindergarten only" (coded 0) to "graduate school" (coded 17). Age at the time of interview extended from 14 to 74 years. The poverty index, a ratio of total family income for the 12 months preceding the interview to a poverty threshold (higher values represent less poverty), was transformed to a logarithmic scale because it was highly skewed. Its logged low and high values were −1.4 and 1.0, respectively. Communities ranged in size from a population of 200 to 9999 (coded 1) to a population of 500 000 to 999 999 (coded 8). Parity, smoking, and low-birthweight status were dichotomous variables. Parity was coded 1 for high-risk mothers (more than five births) and coded 0 otherwise. Smoking was scored 1 for current smokers and 0 otherwise. Low-birthweight status was coded 1 if, regardless of parity, any of the children ever delivered by the respon-

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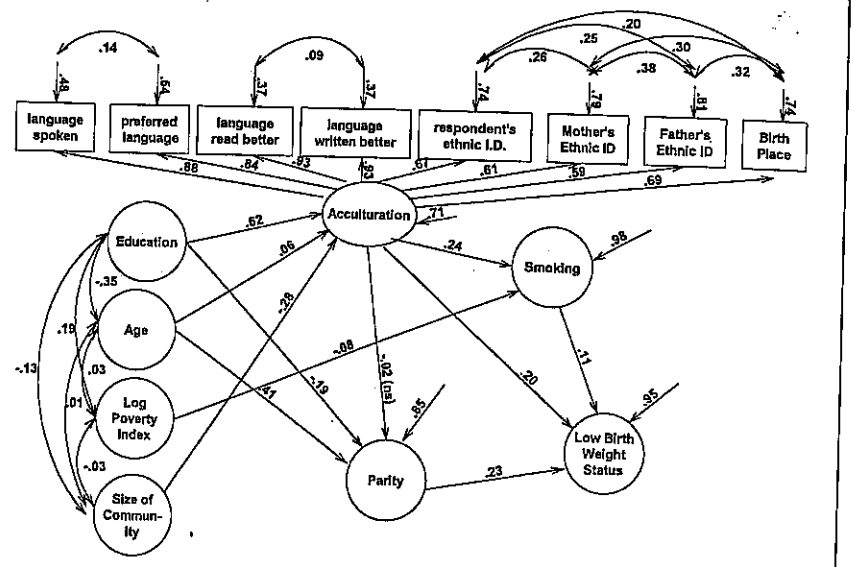
dent weighed less than 2500 g; otherwise, it was coded 0. The remaining variables were part of the shortened version of the Cuellar[7] scale: language spoken, preferred language, language read better, language written better, ethnic identification, mother's ethnic self-identification, father's ethnic self-identification, and birthplace. Coding for the language items extended from 1 (Spanish only) to 5 (English only). The three ethnic self-identification questions ranged in value from 1 (Mexican) to 5 (Anglo or other). Finally, birthplace was coded 1 for first-generation respondents, 2 for second-generation respondents, and 4 for respondents of third generation or higher.

The variables were analyzed through structural equation models. Corresponding to each model were a system of structural equations and a set of statistical assumptions. A full discussion of these issues, not possible in this paper, is available elsewhere.[8,9] Two points, however, are important to note. First, techniques such as logistic regression show whether an independent variable has a significant direct effect on an outcome after control for covariates. Structural equation models permit not only the specification of such direct effects but also the analysis of indirect effects through intervening variables. Second, just as in factor analysis, structural equation models may incorporate latent variables or factors that underlie a set of measured items.

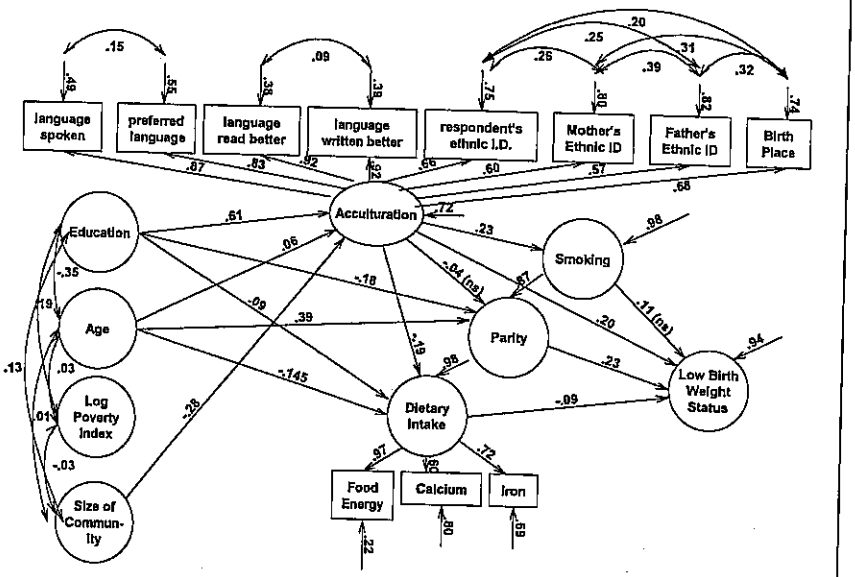
It is customary to provide a justification for the relationships posited in a structural equation model. Education, age, poverty index, and size of community have all been found to have significant effects on acculturation.[10] In the same manner, socioeconomic status and place of residence have been found to influence parity and low-birthweight status.[11]

Of particular relevance to our analysis were the linkages involving acculturation and low-birthweight status. Acculturation may be seen as a marker for values, beliefs, and life-styles that contribute to low-birthweight status.[2] Two such lifestyle factors identified by Scribner and Dwyer were smoking and parity. Acculturated women were predicted to be more prone to smoke but less likely to be in the high parity group. These two variables, in turn, should influence low-birthweight status.[2,12] One central question was whether the effects of acculturation on low-birthweight status are entirely mediated through smoking and parity or whether a direct acculturation effect persists.



Note. Standardized coefficients are shown; all paths are significant unless otherwise indicated ($\chi^2 = 199.65$, $df = 62$, $n = 1426$).

FIGURE 1—Structural equation model for low-birthweight status.



Note. Standardized coefficients are shown; all paths are significant unless otherwise indicated ($\chi^2 = 392.87$, $df = 101$, $n = 1424$).

FIGURE 2—Structural equation model for low-birthweight status with dietary intake added.

These predictions were incorporated into a structural equation model. The model, which had continuous, ordinal, and binary variables, was fitted with the SPSS LISREL 7 statistical package.[13] LISREL estimates parameters through the method of weighted least squares. One of the advantages of that method is

that it makes no assumptions regarding the distributions of the variables in the model.

Results

Figure 1 provides the first set of results. The double-headed arrows indicate correlations among the exogenous variables. To simplify the figure, most of the direct paths shown from the exogenous variables are the statistically significant ones ($P < .05$). The numbers above the arrows represent direct effects and indicate the expected amount of change in the variable at the end of the arrow produced by a one-unit change in the variable at the beginning of the arrow.

In Figure 1, we allowed error terms of acculturation indicators to be correlated. (Without such correlations, the model chi-square was 1036 with 70 degrees of freedom. The ratio of chi-square to degrees of freedom was greater than 14, indicating an unacceptable fit.) Note that the correlated errors are within (rather than across) the major theoretical components of language and ethnic identification. More important, the four language items loaded noticeably higher on acculturation than did the ethnic identity components, indicating that language was more important than ethnic identification in the prediction of smoking and low-birthweight status. Also note that, in this model, acculturation influenced low-birthweight status both directly and indirectly through smoking. That is, more acculturated mothers were more likely to have delivered low-birthweight children, partly because they were more likely to smoke and partly for reasons not explained in this model. While parity had a significant direct effect on low-birthweight status, acculturation was not a significant predictor of parity. The model chi-square was 199.65 ($df = 62$). The ratio of chi-square to degrees of freedom was 3.22, which was a bit high but still acceptable given that we used an eight-indicator variable.

In an effort to further specify variables that intervene between acculturation and low-birthweight status, a second model was fitted. This model, shown in Figure 2, incorporated dietary intake, a variable found to be associated with both acculturation and low-birthweight status.[2,14] The model explored whether dietary intake, as measured by average daily intake of calcium, iron, and food energy, helps specify indirect effects of acculturation on low-birthweight status. (Other measures of dietary intake did not load on the latent variable.) Although its ratio of chi-square to degrees of freedom (3.89) was slightly higher than desired, the model still provided important information.

As anticipated, dietary intake was an intervening variable between acculturation and low-birthweight status. Acculturation had a significant negative effect on dietary intake, and dietary intake, in turn, had a significant direct effect on low-birthweight status. Note that, contrary to most previous studies, smoking had no significant direct effect on low-birthweight status. Log poverty index, the indicator of socioeconomic status, did not have a significant direct effect on any of the endogenous variables in this model. Finally, observe that acculturation still had a significant direct effect on low-birthweight status. That is, independent of dietary intake, acculturated women were more likely to have delivered low-birthweight children.

Discussion

In this paper, we have reanalyzed the data first studied by Scribner and Dwyer pertaining to the association between acculturation and low-birthweight status. None of the current findings disputed Scribner and Dwyer's conclusions. But our results, based on structural equation models, provide a more in-depth analysis of this association than Scribner and Dwyer's.

Not all components of acculturation have the same effect on low-birthweight status; language seems dominant. Acculturation influences low-birthweight status through dietary intake and smoking, but its significant direct effect persists.

Words of caution regarding dietary intake and smoking are required. Dietary intake, based on a 24-hour recall, represented a first approximation to the role of diet in the model that needs to be further analyzed with more robust measures. In addition, smoking's lack of statistical significance in the second model may have derived from the manner in which low-birthweight status was measured. That is to say, it is possible that if the birthweight variable in the model pertained to child's birthweight rather than to mother's low-birthweight status, our results would not have been different from those of previous studies. Further research on both of these issues is needed.

In closing, it is important to remember that before more solid conclusions can be reached regarding the effect of acculturation on low birthweight and the public health implications of this effect, it is necessary to identify additional mechanisms intervening between these two variables (e.g., protective cultural, psychosocial, and behavioral factors). Regardless of what variables are selected, structural equation models would be invaluable in such an investigation. □

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