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Characteristics Associated with Adding Cereal in the Bottle among Immigrant Mother-Infant Dyads of Low Socioeconomic Status and Hispanic Ethnicity

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Abstract

Objective—Determine maternal and infant characteristics associated with adding cereal into the bottle.

Design—Secondary data analysis

Participants—Study participants were immigrant, low-income, urban mother-infant dyads (n=216; 91% Hispanic, 19% US born) enrolled in a randomized controlled trial entitled the Bellevue project for Early Language, Literacy and Education Success.

Main Outcome Measures—Maternal characteristics (age, marital status, ethnicity, primary language, country of origin, education, work status, income, depressive symptoms and concern about infant's future weight), and infant characteristics (gender, first born, and difficult temperament).

Analysis—Fisher's exact, chi-square, and simultaneous multiple logistic regression of significant (p<.05) variables identified in unadjusted analyses.

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Results—Twenty-seven percent of mothers added cereal into the bottle. After adjusting for confounding variables identified in bivariate analyses, mothers who were single ($p=0.02$), had moderate to severe depressive symptoms ($p=0.01$), and perceived their infant had a difficult temperament ($p=0.03$) were more likely to add cereal into the bottle. Conversely, mothers who expressed concern about their infants becoming overweight were less likely to add cereal ($p=0.02$).

Implications for Research and Practice—Health care providers should screen for adding cereal in infant bottles. Further research is needed to investigate the impact of adding cereal into the bottle on weight trajectories over time. Causal associations also need to be identified to effectively prevent this practice.

Keywords

feeding; cereal in the bottle; infant; Hispanic; low-income

INTRODUCTION

The American Academy of Pediatrics (AAP) / Bright Futures and the United States Department of Agriculture (USDA) recommend waiting until after age 4 to 6 months to start solid foods and specifically advise against adding cereal to infant bottles.¹⁻² These recommendations are supported by research suggesting that such practices may be associated with increased caloric intake and impaired self-regulation of hunger and satiety, which could increase the risk of early excess weight gain and subsequent child obesity.³⁻⁵

Despite these recommendations, few studies evaluate adding cereal into the bottle as a practice distinct from introduction to solid foods, even within many of the large national surveys of infant feeding practices.⁶⁻⁷ The studies that do examine this practice specifically find that adding cereal into the bottle is common in low-income groups.⁸⁻¹⁰ Studies using both surveys and focus groups to assess reasons for adding cereal into the bottle found that mothers reported using this practice to help infants sleep or stay full longer, or to help their infant gain weight.⁸⁻¹⁵

Obesity-promoting feeding behaviors associated with excess infant weight include nonresponsive controlling feeding styles such as restrictive and pressuring feeding practices.¹¹⁻¹⁹ Studies of these and other commonly reported obesity-promoting feeding behaviors have previously identified sociodemographic characteristics, maternal psychosocial stressors, maternal concern about infant weight, and negative perceptions of their infant's temperament as risk factors for these practices.^{7-11, 14-22} However, no studies have explored associations between these maternal and infant characteristics and adding cereal into infant bottles. Better understanding of the characteristics associated with adding cereal into the bottle would be particularly important for low socioeconomic status (SES), immigrant, and Hispanic families at high risk for excess weight gain during infancy and early childhood obesity.²¹

Therefore, this study sought to determine whether maternal and infant characteristics associated with obesogenic feeding practices more broadly would be associated with the specific practice adding cereal into the bottle in a sample of primarily low SES, immigrant,

and Hispanic mother infant dyads. The primary study hypothesis was that four types of maternal and infant characteristics would be associated with adding cereal into the bottle during the first 6 months of life, including: 1) sociodemographic characteristics such as young maternal age and single parenthood, 2) maternal psychosocial stress such as maternal depression, 3) maternal concerns about future infant weight, and 4) perceived difficult infant temperament (see Figure 1).

METHODS

Study Design

The study consisted of a secondary analysis of data collected at baseline and 6-month follow-up of mother-infant dyads in a larger longitudinal study (Bellevue project for Early Language, Literacy and Education Success; BELLE).²³ BELLE is a longitudinal randomized clinical trial evaluating primary care-based interventions designed to enhance child development by promoting interactive parenting skills during shared reading, play, and daily routines. Enrollment in the BELLE project took place from November 2005 thru October 2008. This analysis includes a subset of families with babies born between November 2005 and April 2007 for whom information about cereal into the bottle also was collected.

Study Sample

Eligible mother-infant dyads were enrolled consecutively into BELLE in the postpartum ward at Bellevue Hospital Center (BHC), an urban public hospital in New York City. As previously described, inclusion criteria for the larger study were intention to receive pediatric primary care at BHC for at least 3 years, English or Spanish as the primary language, uncomplicated full-term delivery, no early intervention eligibility, the mother as the primary caregiver, ability to contact the mother, mother's age being at least 18 years, and no significant maternal medical problems.¹⁸ For the current analysis, an additional criteria for inclusion was that the mother was not exclusively breastfeeding as such mothers would be less likely to feed their infant using a bottle.

Informed written consent was obtained prior to study participation. Approval to conduct human subjects research was granted by the New York University School of Medicine Institutional Review Board, the Bellevue Hospital Center Research Committee, and the New York City Health and Hospitals Corporation.

Study Variables and Assessments

Data were collected through an interview conducted by a bilingual research assistant at baseline (following study enrollment during the postpartum period) and when the infant was approximately 6 months old. All research assistants were trained prior to conducting baseline and follow-up evaluations to minimize interviewer bias. Interviews were conducted in Spanish or English, according to participant preference. All survey items were read aloud with study participants to maximize validity of obtained data from caregivers with low education and/or literacy.

Dependent variable—The dependent variable was cereal in the bottle as determined by maternal response to questions from the Infant Feeding Questionnaire at 6-month follow-up.¹⁹

1. Did you put infant cereal in the bottle so he would sleep longer at night?
2. Did you put infant cereal in the bottle so he would stay full longer?

These questions assess the frequency with which cereal is added to bottles for the most common non-medical reasons identified in literature.^{8–9,13}

For each of these questions, possible responses were: “never,” “rarely,” “sometimes,” “often,” or “always.” In the analyses that follow, mothers were considered to have put cereal in the bottle if they ever did so, as indicated by an answer other than “never” for either question.

Independent variables—Independent variables consisted of maternal and infant characteristics hypothesized to be associated with cereal in the bottle. Characteristics assessed included sociodemographics, maternal depressive symptoms as an exemplar of psychosocial stressors, maternal concerns about their infant’s future weight, and perceived difficult infant temperament.

Sociodemographic characteristics—Maternal / family sociodemographics were measured at baseline and included: maternal age, marital status, socioeconomic status (SES), ethnicity, primary language spoken in the home, country of origin, education, and work status. Maternal age ranged from 18 to 42 years {median age: 26.8; mean age (Standard Deviation [SD]): 27.7[5.3]} and was dichotomized as less than 21 versus 21 or older. Maternal age was dichotomized at 21 because adolescent mothers under age 18 were excluded from this sample and in previous studies young maternal age was associated with adding cereal in the bottle.^{8–9,12} Marital status was dichotomized as single versus married or living with a partner. Socioeconomic status was assessed using the Hollingshead 4-Factor Index, based on education and occupation.^{23–24} The Hollingshead index was dichotomized as low (index score 4 to 5) or high (3 or less) SES. In addition, 91.9% received nutrition support from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program. Ethnicity was assessed based on study participants’ self-identification, and dichotomized as Hispanic versus other. Primary language spoken in the home was categorized as English (mostly or all English spoken in the home) versus Spanish. Country of origin was categorized based on birth inside versus outside the United States (US). Education was categorized as high school (HS) graduate or GED equivalent and above versus less than HS graduate. Working status was determined by comparing mothers working part time or full time to those who were not working. Infant characteristics measured at baseline included infant gender and first born status.

Maternal depressive symptoms—Maternal depressive symptoms were assessed at infant age 6 months using the Patient Health Questionnaire-9 (PHQ-9), a validated questionnaire frequently used in clinical and research settings to assess patient symptoms for risk of mild, moderate, or severe depression.^{26–28} Mothers were asked to identify how often,

in the prior two weeks, they experienced problems such as “Little interest or pleasure in doing things.” Response options for each item were “not at all,” “several days,” “more than half the days,” or “nearly every day,” scored as 0 to 3 points. Item scores were summed to form a total score of 0–27, with the overall scale categorized as minimal (1 to 4), mild (5 to 10), and moderate to severe (11 to 27) depression.²⁶

Maternal concern about infant’s future weight—Maternal concern about future infant weight was assessed at baseline by two questions drawn from the Child Feeding Questionnaire including: “Are you worried that your baby will become underweight?” and “Are you worried that your baby will become overweight?”¹¹ Mothers responded yes or no to each question.

Perceived infant difficult temperament—Difficult infant temperament was assessed at 6 months using questions adapted from the Short Temperament Scale for Infants, a validated tool used to measure parent perception of infant behavior and temperament (domain alphas .57–.76).²⁹ Seven items related to difficult temperament were assessed, including three related to regularity (“The baby gets sleepy at about the same time each evening,” “The baby gets hungry and eats at about the same time from day to day,” and “The baby is most active at the same time every day”); two related to activity (“The baby moves about a lot during diaper changes & dressing,” and “The baby moves a lot while lying awake”); one related to low soothability (“The baby continues to cry in spite of several minutes of soothing”), and one related to high intensity (“The baby displays much feeling during changing or dressing”). Each item was noted by the mother as “never,” “sometimes” or “often” and scored or reverse scored as 1 to 3, with 3 always representing high difficulty. Items were then summed together to form an infant temperament score, (range 3 to 21) with higher score representing increased difficult temperament. Perceived difficult infant temperament was defined as a score greater than 1 standard deviation above the mean for the sample (mean score [SD]: 13.7 [1.6]).

Statistical Analyses

Analyses were performed using SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY). Unadjusted associations between each of the maternal and infant characteristics (sociodemographic factors, maternal depressive symptoms, concerns about future infant weight, and perceived difficult infant temperament) and adding cereal into the bottle were analyzed using Fisher’s exact tests for comparisons with dichotomous variables and chi-square for comparisons with variables with more than two categories. Adjusted associations were analyzed using a simultaneous multiple logistic regression model, in which all maternal and infant characteristics that had been associated with cereal in the bottle with $p < .05$ in unadjusted analyses were included.

RESULTS

Study Participants

Three hundred sixty-five mother-infant dyads were enrolled in BELLE during the period in which information about cereal in the bottle was collected. Of these families, 254 (69.6%)

completed the baseline and 6-month assessments including information about cereal in the bottle. The 254 mothers completing the 6-month assessments were similar to the 111 who did not complete the 6-month assessments with respect to maternal age, marital status, socioeconomic status, ethnicity, country of origin, education, employment, infant gender, and birth order. Thirty-eight of the 254 mothers reported exclusive breastfeeding, resulting in a final sample of 216 mother-infant dyads.

Maternal and Infant Characteristics

As shown in Table 1, mothers were predominantly older than 21 years old, married or living with their partner, low SES, and Hispanic. The majority of mothers were born outside of the US, with more than half from Mexico (54.6%), followed by Ecuador (11.6%); 44% of mothers were high school graduates and 21% were working. Nearly one-third of mothers had depressive symptoms and over one-third expressed concerns that their baby would become under- or overweight. The mean age for infants studied was 6.5 [0.8] months, 53.7% were female, and 40.7% were first born.

Cereal in the Bottle

As shown in Table 2, the proportion of mothers adding cereal into the bottle so that their infant would “sleep longer at night” was 16.7%. The proportion of mothers adding cereal into the bottle so that their infant would “stay full longer” was 23.1%. Overall, 27.3% (95% Confidence Interval [CI]: 21.6 – 33.9%) of mothers added cereal into the bottle for either reason; 12.5% (95% CI: 8.1 – 16.9%) added cereal into the bottle for both reasons.

Maternal and Infant Characteristics Associated with Cereal in the Bottle

Table 3 shows maternal and infant characteristics that were significantly associated with adding cereal into the bottle in unadjusted and adjusted analyses. In regression analyses, single parent ($p=0.02$), moderate to severe depressive symptoms ($p=0.01$), and perceived difficult infant temperament ($p=0.03$) were each independently associated with adding cereal into the bottle; mothers who were concerned about infant future overweight were **less** likely to add cereal into the bottle ($p=0.02$). Two variables related to adding cereal into the bottle in unadjusted analyses (maternal age and language) lost statistical significance following adjustment. The model accounts for a moderate amount of variation in cereal in the bottle (Nagelkerke $R^2=0.245$).

DISCUSSION

In this study of low-income, primarily immigrant Hispanic mother-infant dyads in an urban health care setting, over one-fourth of mothers reported adding cereal into the bottle. Consistent with study hypotheses, independent associations were identified with adding cereal into the bottle and variables from the four types of maternal and infant characteristics outlined.

Most of the large studies examining infant diets assess early introduction to solids, defined as before age 4 months, but do not analyze adding cereal into the bottle as a separate practice.⁶⁻⁷ This is an important distinction, because adding solids to infant bottles is

considered a non responsive feeding practice,³⁰ as opposed to feeding an infant cereal with a spoon, and therefore may have a separate impact on infant weight gain and obesity risk. The potential impact on overfeeding is one of the reasons that both the USDA and AAP advise against adding cereal or other solids into infant bottles.¹⁻² Screening for groups at increased risk for adding cereal into the bottle could support prevention efforts designed to limit overfeeding infants early in life.”

Approximately 27% of mothers added cereal into the bottle. This number is low compared to that found in other studies of low income populations, and could be due to social desirability bias or reflect the method of measurement.⁸ It also does not capture qualitative data regarding whether mothers adding cereal into the bottle did so in response to advice from a health care provider or family relative.⁹ Nevertheless, the finding is consistent with recent work in predominantly Hispanic immigrant populations and could be influenced by the healthy immigrant effect, in which health behaviors, including dietary practices, deteriorate as immigrants acculturate to the United States.^{15, 31-32}

Maternal depressive symptoms and sociodemographic characteristics, such as single parent status, have previously been shown to impact parent feeding styles for infants.³³⁻³⁴ Prior studies have demonstrated that single mothers are more likely to introduce solid foods early, and mothers with depression are more likely to provide calorically dense foods to infants.^{14, 35}

Findings extend current knowledge by highlighting an association between the practice of adding cereal into the bottle and some of the same maternal characteristics that are associated with other obesogenic feeding practices.¹⁶ These characteristics (maternal depressive symptoms and single parent status) are associated with less responsive feeding styles and are also commonly found in the circumstance of poverty.^{15,36}

Prior studies have shown that maternal concern about infant weight impacts feeding practices.^{15,37} The finding that mothers concerned about infants becoming overweight were less likely to add cereal into the bottle suggests that mothers who view infant overweight as a risk may be more likely to follow guidelines designed to prevent excess early infant weight gain. This is consistent with studies in school-age children, which have shown that parental concern about the health risks of overweight and obesity is needed for parents to make healthy changes in diet and lifestyle habits.³⁷ The finding that mothers concerned about infant underweight were more likely to add cereal into the bottle, although not significant, is consistent with qualitative research showing that parents are worried about infant hunger and adequate weight gain, and perceive a heavier infant as a sign of good parenting.^{9,38}

The finding that mothers who reported their infants to have difficult temperament were more likely to add cereal into the bottle is also consistent with existing literature.³⁹⁻⁴² Perceived difficult infant temperament is associated with other obesity promoting practices such as increased sugar sweetened beverage consumption and TV exposure.⁴³ Difficult infant temperament is also associated with adverse health outcomes such as increased skinfold thickness and cardiovascular risk in late adulthood.^{16,42,44}

Limitations of this study include the fact that the study population was comprised primarily of Hispanic and immigrant mothers of low SES, and findings may not be generalizable to other groups. Another limitation is that although the Hollingshead SES index includes education and occupation, and over 90% of the sample was receiving support from WIC, data on receipt of federal assistance, such as Medicaid or SNAP, were not collected. Also, although study information was collected from a larger longitudinal study, data evaluated were cross-sectional in nature so causal associations cannot be determined.

For the purpose of this study, cereal in the bottle was assessed by maternal report, which is subject to recall and social desirability bias. While the two most common reasons for adding cereal into the bottle, increased satiety and sleep duration, were assessed, other reasons, such as preventing reflux, were not directly assessed and some mothers may add cereal into bottles if they have been instructed to do so by their physicians to treat gastro-esophageal reflux symptoms or disease (GER/GERD).⁴⁵ Thus, study results may underestimate the prevalence of adding cereal into the bottle for the prevention of reflux symptoms or disease.

Another study limitation is the fact that the preparation process of adding cereal into the bottle and process of feeding infants cereal in the bottle were not evaluated. Mothers may add cereal in different amounts, which could have varied impact on the caloric density of bottles given to infants and subsequent risk for child obesity. Additionally, mothers' feeding styles in general were not accounted for in this study and could be a potential moderator or mediator for the associations identified.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This study's findings add to the existing literature by identifying maternal and infant characteristics that are risk factors for the practice of adding cereal into the bottle. Prevention efforts should address these factors, including maternal depressive symptoms, perceived difficult infant temperament, and concerns about infant weight, which are common among mothers with low SES. Health care professionals and nutrition educators working with families of low SES should consider screening for maternal depressive symptoms and perception of difficult infant temperament. Referring families that screen positive to mental health services could foster responsive parenting and infant feeding practices and reduce potential obesogenic practices such as adding cereal into the bottle. Figure scales and modified infant growth charts showing healthy and unhealthy weight zones could also be used to address parents' concerns and perceptions of infant weight.⁴⁶⁻⁵⁰

Future studies on the associations between early infant feeding, maternal characteristics, and child obesity should assess the practice of adding cereal into the bottle in more detail; assessing estimates of cereal milk concentration in bottles, its caloric density, and the frequency and quantity consumed. Qualitative research incorporating focus groups or semi-structured interviews may provide better understanding of associations outlined in this study, and delineate factors outside the scope of this study, which influence the practice of adding cereal into infant bottles. Prospective longitudinal studies in diverse populations are needed

to further elucidate the reasons for this practice, estimate its prevalence, and determine causal relationships with infant weight gain trajectories and child obesity.

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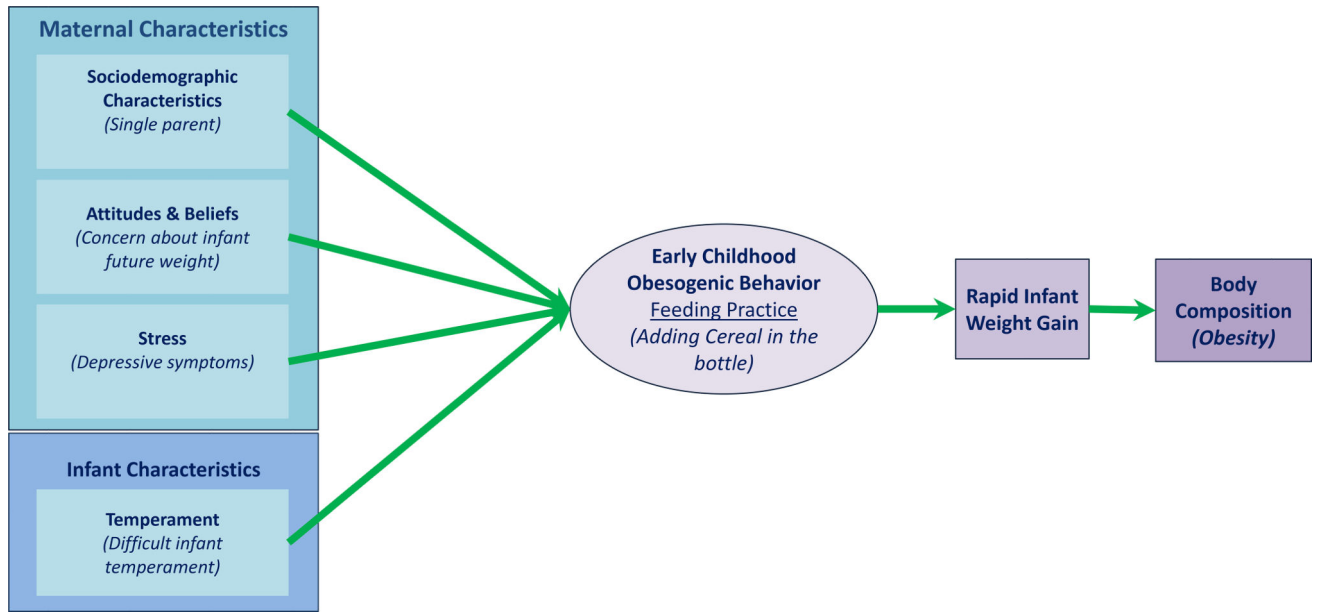


Figure 1.
Conceptual Model

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Table 1

Descriptive Characteristics of Mothers and Infants (n=216) *

	n (%)
Socio-demographic Characteristics	
Maternal / family	
Maternal age 18–21 years	27 (12.5)
Single	46 (21.3)
Low SES ^a	191 (88.4)
Latina	196 (90.7)
Primary Language English	58 (26.9)
United States Born	40 (18.5)
High School Graduate	96 (44.4)
Working	45 (20.8)
Infant	
Female Gender	116 (53.7%)
First Born	88 (40.7%)
Maternal Psychosocial Stressors	
Depressive Symptoms ^b	
Mild (Score 5 – 9)	44 (20.4)
Moderate or Severe (Score ≥ 10)	21 (9.7)
Maternal Concerns About Infant's Future Weight ^c	
Worry that the baby will become underweight	95 (44.0%)
Worry that the baby will become overweight	99 (45.8%)

* Includes non-exclusively breastfeeding mothers who completed both baseline and 6 month follow up surveys

^a) Low Socioeconomic Status (SES) determined by Hollingshead 4, 5

^b) Depressive symptoms were assessed using the Patient Health Questionnaire-9

^c) Maternal perceptions of infant weight were assessed using questions adapted from the Child Feeding Questionnaire

Table 2

Maternal Report of Adding Cereal in the Bottle (n=216) *

Description of Practice	n (%)
Did you put infant cereal in the bottle so he/she would sleep longer at night? ^a	36 (16.7)
Did you put infant cereal in the bottle so he/she would stay full longer? ^a	50 (23.1)
Overall use of cereal in the bottle for either reason ^b	59 (27.3)
Overall use of cereal in the bottle for both reasons ^c	27 (12.5)

* Includes non-exclusively breastfeeding mothers who completed both baseline and 6 month follow up surveys

^a Responses: “never, rarely, sometimes, often or always” dichotomized to never (no cereal in the bottle) versus any

^b Based on positive response to either question.

^c Based on positive response to both questions.

Table 3Maternal and Infant Characteristics Associated with Adding Cereal in the Bottle^{*}

Characteristic	Categories	Cereal in the Bottle n (%)	AOR (95% CI) ^a
Socio-Demographic Characteristics:			
Maternal Age 18–21 years	Yes	12 (44.4)	2.2 (0.8 – 6.2)
	No	47 (24.9)	
Single Parent	Yes	22 (47.8)	2.8 (1.2 – 6.4) ^{**}
	No	37 (21.8)	
Primary Language English	Yes	27 (46.6)	2.2 (0.9 – 5.1)
	No	32 (20.3)	
Maternal Psychosocial Stressors:			
Depressive Symptoms:	Moderate to Severe (Score 10)	10 (47.6)	4.1 (1.4 – 12.2) ^{**}
	Mild (Score 5 to 9)	16 (36.4)	2.01 (0.99 – 4.7)
	Minimal (Score 0 to 4)	33 (21.9)	Ref
Maternal Concerns About Infant's Future Weight:			
Worry that the infant will become overweight	Yes	42 (35.9)	0.34 (0.1 – 0.8) ^{**}
	No	17 (17.2)	
Worry that the infant will become underweight	Yes	37 (30.6)	1.96 (0.8 – 4.8)
	No	22 (23.2)	
Perceived Difficult Infant Temperament			
	1 SD Change in Temperament	N/A	1.44 (1.04 – 1.98) ^{**}

^{*} Includes non-exclusively breastfeeding mothers who completed both baseline and six month follow up surveys.

Nagelkerke R-squared = 0.245

^{**} Significant at p<0.05

OR = Odds Ratio; AOR = Adjusted Odds Ratio

^a AOR based on simultaneous multiple logistic regression model including all characteristics listed in table