

ONLINE FIRST

Perceptions About Water and Increased Use of Bottled Water in Minority Children

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Objective: To describe bottled water use and beliefs and attitudes about water among parents of children from different racial/ethnic groups.

Design: Cross-sectional survey.

Setting: Urban/suburban emergency department.

Participants: Parents of children treated between September 2009 and March 2010.

Main Outcome Measures: The respondents completed a questionnaire in English or Spanish, describing their use of bottled water and tap water for their children and rating their agreement with a series of belief statements about bottled water and tap water. Logistic regression was used to evaluate the association between bottled water use and beliefs and demographic characteristics with odds ratios (ORs).

Results: A total of 632 surveys were completed (35% white, 33% African American, and 32% Latino respondents). African American and Latino parents were more

likely to give their children mostly bottled water; minority children were exclusively given bottled water 3 times more often than non-Latino white children (24% vs 8%, $P < .01$). In logistic regression analysis, the following factors were independently associated with mostly bottled water use: belief that bottled water is safer (OR, 2.4), cleaner (OR, 2.0), better tasting (OR, 2.8), or more convenient (OR, 1.7). After other factors were adjusted for, race/ethnicity, household income, and prior residence outside the United States were not associated with bottled water use.

Conclusions: Minority parents are more likely to exclusively give bottled water to their children. Disparities in bottled water use are driven largely by differences in beliefs and perceptions about water. Interventions to reduce bottled water use among minority families should be based on knowledge of the factors that are related to water use in these communities.

Arch Pediatr Adolesc Med. 2011;165(10):928-932.

Published online June 6, 2011.

doi:10.1001/archpediatrics.2011.83

BOTTLED WATER USE IS BECOMING increasingly common in the United States, with sales of 37 billion liters annually.¹ In addition to environmental concerns related to packaging and energy costs of processing and transporting bottled water, health concerns have been raised as well. Several studies have documented elevated bacterial counts in bottled water,^{2,3} and one recent study found an association between bottled water use and risk of acute diarrheal illness in children.⁴ Use of bottled water in place of tap water may also lead to inadequate fluoride intake for children, with implications for oral health.⁵ Physicians and other providers may be in a position to influence water use choices by providing information on health effects as part of health maintenance visits.⁶

Underserved Latinos and African Americans have been found to have higher rates of bottled water use than non-Latino whites.⁷⁻⁹ Such use patterns may produce adverse health effects and exacerbate economic disparities. Understanding the motivation behind water use choices is essential to developing effective and equitable interventions to decrease bottled water use. However, the reasons parents choose bottled water for their children, and specifically racial and ethnic differences in that decision making, have not been well described.

Theoretical models to help explain health behaviors have been developed. Dixon's Integrative Environmental Health Model postulates that the attitudes and beliefs that are driving choices around environmental health can be categorized into 4 domains: physiological, vulnerability,

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health protection, and epistemological.¹⁰ The aim of the present study was to use qualitative and quantitative survey methods, based on Dixon's model of environmental health behavior, to identify factors associated with bottled water use among parents from different racial and ethnic groups. We hypothesized that health beliefs about water would differ between racial/ethnic groups and that such beliefs would be associated with water use.

METHODS

SURVEY DEVELOPMENT

To identify important themes related to bottled water use, we conducted a qualitative study of a convenience sample of Latino (n=7) and African American (n=9) parents of children seen in a primary care clinic or a pediatric emergency department who reported primary or exclusive use of bottled water. A semi-structured interview was conducted in English or Spanish. Questions were based on the 4 domains of Dixon's Integrative Environmental Health Model.¹⁰ Interviews were recorded and transcribed. Spanish-language interviews were conducted by a bilingual interviewer who also provided an English-language translation of the transcript.

Relevant themes in the transcript text were highlighted and margin coded. Common themes from the interviews were identified through thematic analysis, using grounded theory, or the constant comparative method,¹¹ an inductive approach whereby new theory is generated directly from the data and existing theory is modified and refined in comparison with incoming information. The process ends when all the data can be accommodated.

Six themes were identified, each corresponding to 1 of the domains in our conceptual model: safety/cleanliness, taste, convenience, habit, child preference, and healthiness. A survey instrument (available from the authors on request) was then created, rating agreement with a series of statements; agreement for each statement was rated on a 5-point Likert scale, with 1 indicating "strongly agree" and 5 "strongly disagree." The survey included 11 belief statements, 4 statements about the respondent's prior water use experiences, and 7 items regarding sources of information about tap and bottled water, as well as basic demographic information about the respondent (including highest education level of the respondent and monthly household income, in \$1000 ranges) and information on bottled water use by their children. A Spanish-language version of the questionnaire was also created. The Fleisch-Kincaid reading level was 4.5, and the survey was pilot tested in 3 participants for understanding and ease of completion. No other formal reliability or validity testing was performed.

SURVEY ADMINISTRATION

We conducted a cross-sectional survey of parents of children treated in an urban/suburban pediatric emergency department with an annual census of 65 000 between September 2009 and March 2010. Parents were approached consecutively until the target sample size for a given racial/ethnic group was reached. Race/ethnicity was initially extracted from registration information and then confirmed by parent report. Parents who consented to participate completed the survey instrument on paper in the emergency department. Research assistants were available to answer questions if requested; certified interpreters were used when necessary. No incentives were provided to parents for participation. The study was approved by the institutional review board of the Children's Hospital of Wisconsin, Milwaukee.

Table 1. Characteristics of Survey Respondents

| Race/Ethnicity | College Education, % | Ever Lived Outside United States, % | Median Monthly Income, \$ |
|--------------------------|----------------------|-------------------------------------|---------------------------|
| Non-Latino white (n=223) | 52.3 | 9.4 | 3500 |
| Black (n=207) | 20.7 ^a | 1.2 | 1500 ^a |
| Latino (n=202) | 17.2 ^a | 33.3 ^a | 1500 ^a |

^a $P < .05$ compared with non-Latino white.

DATA ANALYSIS AND SAMPLE SIZE

The primary dependent variable of interest was the use of bottled water by the respondents' children. It was categorized as primarily (mostly or exclusively) bottled water or primarily tap water. Independent variables included respondent race/ethnicity, level of education, and responses to the survey items about beliefs, attitudes, and sources of information.

Standard descriptive statistics were generated, with 95% confidence intervals (95% CIs) where appropriate. Likert scale responses were summarized by median score. Proportions were compared using the χ^2 test, while medians were compared using the Wilcoxon rank sum test. Associations between individual risk factors and bottled water use were evaluated using univariate logistic regression. To identify factors associated with primarily bottled water use, stepwise multivariate logistic regression was performed, using entry and removal probabilities of 0.1 and 0.15, respectively, and adjusted ORs were calculated. However, as race/ethnicity was the primary predictor of interest, we forced this term into the model. For the logistic regression analysis, Likert scale responses were dichotomized as "strongly agree"/"agree" vs "strongly disagree"/"disagree"/"neither agree nor disagree." Also, because all analyses showed the factors to be similar for both Latino and African American respondents, we grouped these 2 racial/ethnic groups together as "minority" for regression analyses. We calculated a sample size of 210 respondents in each of 3 racial/ethnic groups to be able to identify a 10% difference between groups with 80% power. Analyses were conducted using Stata version 11.0 (Stata Corp, College Station, Texas).

RESULTS

RESPONDENT CHARACTERISTICS

A total of 639 respondents were enrolled (67 others were approached and refused); 7 surveys were incomplete and therefore were excluded from the analysis. Respondent characteristics are shown in **Table 1**. The median age was 32 years, and respondents had a median of 2 children living in the household, with no differences by race/ethnicity. We did not collect information on subgroups of Latinos, but other data from our institution show that approximately 75% are of Mexican origin. Among Latino respondents, 4% of surveys were completed in Spanish.

WATER USE

Overall, 44.8% of parents reported that their children drink only or primarily bottled water. As shown in **Figure 1**, both African American and Latino parents were significantly more likely than non-Latino white parents to give their children exclusively or mostly bottled wa-

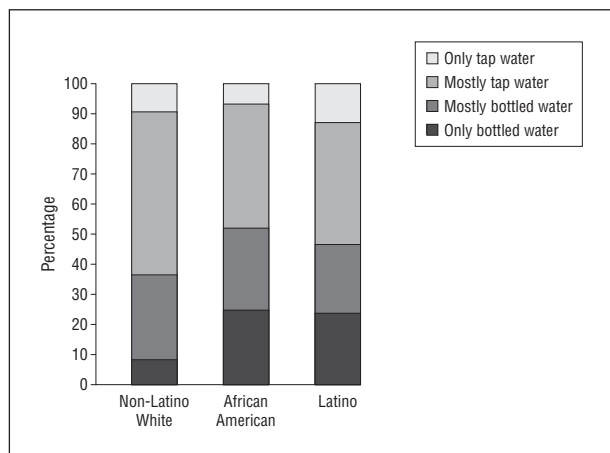


Figure 1. Bottled water use by racial/ethnic category.

Table 2. Distribution of Responses for Positive Belief Statements About Bottled Water

| Statement | % With Strongest Agreement ^a | | |
|--|---|------------------|--------|
| | White | African American | Latino |
| Bottled water is cleaner than tap water | 11.6 | 34.3 | 23.7 |
| Bottled water is safer than tap water | 9.3 | 31.1 | 20.0 |
| Bottled water tastes better than tap water | 14.2 | 28.9 | 24.8 |
| Bottled water is more convenient than tap water | 10.6 | 20.0 | 16.0 |
| Bottled water has minerals and nutrients that tap water does not | 0.9 | 8.3 | 9.0 |

^aAll differences were significant at $P < .001$ by χ^2 test.

ter ($P < .001$). More than 20% of both Latino and African American parents use only bottled water compared with less than 10% of non-Latino white parents ($P < .001$).

BELIEFS AND SOURCES OF INFORMATION ABOUT WATER

Of 11 belief statements, 5 were positive statements about bottled water (**Table 2**); Latino and African American respondents were more likely to endorse a higher level of agreement for all 5 statements than non-Latino white respondents. For the 2 positive statements about tap water, non-Latino white respondents endorsed higher levels of agreement than both African Americans and Latinos. Non-Latino whites were also more likely to endorse higher levels of agreement with the 2 negative statements about bottled water, while Latino and African-American respondents had higher levels of agreement with the single negative statement about tap water. Although median scores on the statement "My family may be protected from illness by choosing the best kind of drinking water" were similar, both Latino and African-American parents were significantly more likely to endorse the highest level of agreement ($P = .007$). There were no

racial/ethnic differences in reports of prior bad experience with bottled or tap water.

Sources of information were similar for the 3 groups (**Figure 2**) except for family, which was more likely to be reported by African American and Latino respondents. Minority respondents showed a trend toward being less likely to obtain information about water from environmental organizations, but this difference was not statistically significant ($P = .06$).

FACTORS ASSOCIATED WITH WATER USE

In univariate analysis, positive statements for all 11 belief statements about bottled water were positively correlated with an increased proportion of use of primarily bottled water. Parents with a higher education level were less likely to report use of bottled water (OR for college education vs less than college, 0.63; 95% CI, 0.44-0.89). There was no association between the number of children in the home and bottled water use. Among the sources of information, getting information about water only from family was associated with bottled water use (OR, 1.64; 95% CI, 1.19-2.27).

The results of multivariate logistic regression are shown in **Table 3**. Beliefs about tap water safety and cleanliness, preference for bottled water taste, and perceived bottled water convenience had the strongest association with the use of bottled water. Obtaining information about tap water from environmental organizations was also associated with greater odds of bottled water use. After beliefs and sources of information were adjusted for, race/ethnicity was no longer significantly associated with bottled water use (OR, 1.22; 95% CI, 0.80-1.85). Forcing race/ethnicity into the model did not alter which variables were selected, and the magnitude of the coefficients for each of the factors in the model changed by less than 5% compared with the model without race/ethnicity.

INCOME AND WATER USE

In univariate analysis, the monthly household income was inversely associated with the likelihood of primarily using bottled water; this association was no longer significant when other factors were adjusted for ($P = .62$). Among the respondents reporting any bottled water use, the median monthly amount spent on bottled water was \$16, with a mean of \$22.75. For non-Latino whites, the median monthly amount spent was \$12 compared with \$20 for African Americans and Latinos. As a percentage of household income, whites reported spending a median of 0.4% on bottled water, with a maximum of 6%. For African Americans and Latinos, the median was 1% (maximum, 16.7% and 12%, respectively). Overall, 10.5% of respondents, including 6% of non-Latino whites, 12% of African Americans, and 14% of Latinos, reported that they had to give up other things in order to purchase bottled water.

COMMENT

Our results confirm and extend findings by other authors that underserved minority children are disproportionate us-

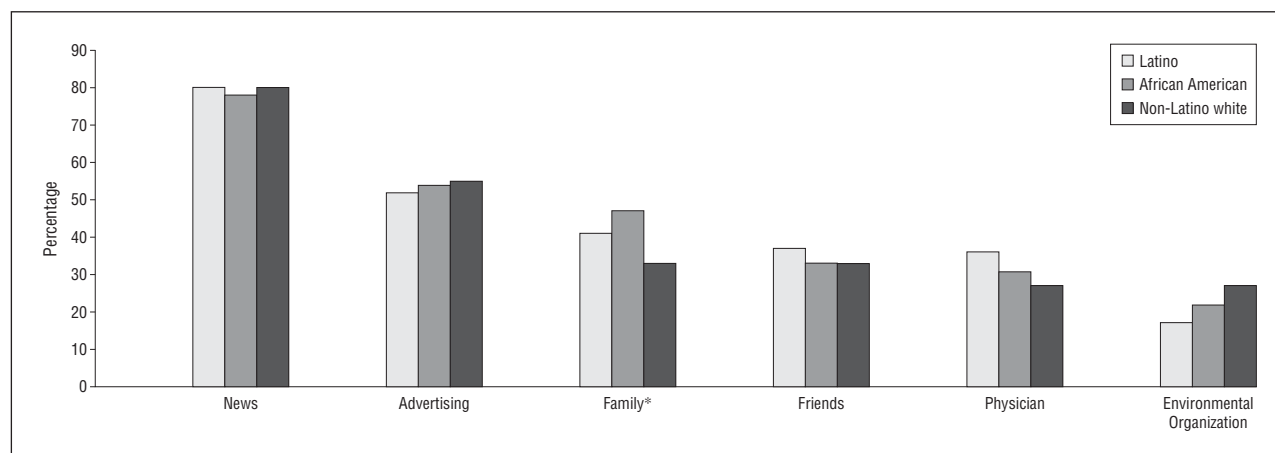


Figure 2. Sources of information about water by racial/ethnic group. * $P < .01$ for Latino and African American vs non-Latino white.

ers of bottled water.⁷ While this finding has been previously reported for Latinos and a combined group of “nonwhites” in the United States, we are unaware of any prior study demonstrating a similar propensity explicitly in African Americans. Moreover, earlier work on determinants of bottled water use has not specifically sought to identify those factors associated with racial and ethnic differences in water consumption. We found that differences in beliefs about water, prior experiences, and sources of information explained the racial/ethnic differences in water use patterns.

Taste, convenience, and concerns about health risks have been most often found to be determinants of bottled water use, but with variations between previous reports. Studies in the United States involving racially diverse groups of individuals have identified health risks and taste to be the most frequently cited factors.^{5,8,12-14} Hobson et al,⁹ in their study of primarily Latino children in Salt Lake City, Utah, found that of 3 choices of reasons for choosing bottled water, health concerns about tap water and taste were the most commonly cited, but only health concerns were more common among Latinos than non-Latinos. In contrast, studies of primarily whites in England,¹⁵ Quebec, Canada,¹⁶ and Portugal¹⁷ found that health risk perceptions were not an important factor and that taste was the most important consideration in choosing bottled water.

These findings are consistent with a population-based survey that identified broad differences in environmental health risk perception between Mexican Americans and non-Latino whites.¹⁸ In our study, health perceptions were important factors for bottled water use among both Latino and African American respondents. It has been suggested that actual differences in current tap water quality or past experiences with poor water quality may account for such racial/ethnic differences^{13,14,19}; this hypothesis is supported by our finding that reported prior experience is related to water choices. Although immigrant status has also been suggested as a factor,⁹ this was not the case in our study.

The Health Belief Model has been used in public health education and preventive medicine and operates under the assumption that health-related behavior is determined by whether a person (1) perceives himself or herself to be susceptible to a particular health problem; (2) sees the problem as serious; (3) feels that prevention activities are ef-

Table 3. Results of Stepwise Regression Showing Factors Significantly Associated With Primarily Bottled Water Use^a

| Factor | Adjusted OR (95% CI) |
|---|----------------------|
| Beliefs | |
| Bottled water is safer than tap water | 2.44 (1.44-4.22) |
| Bottled water is cleaner than tap water | 2.00 (1.14-3.51) |
| Bottled water tastes better than tap water | 2.76 (1.78-4.28) |
| Bottled water is more convenient than tap water | 1.72 (1.16-2.54) |
| My family may be protected from illness by choosing the best kind of drinking water | 1.53 (1.01-2.32) |
| Experiences | |
| Used primarily tap water when younger | 0.44 (0.23-0.83) |
| Had a bad experience with tap water | 1.63 (1.06-2.46) |
| Sources of information | |
| Gets information on tap water from environmental organization | 1.74 (1.03-2.93) |

Abbreviations: CI, confidence interval; OR, odds ratio.

^aStatements/variables that did not meet criteria for model entry: “Bottled water has minerals and nutrients that tap water does not”; “Tap water has minerals and nutrients that bottled water does not”; “My family may become ill from drinking bottled water”; “My family may become ill from drinking tap water”; had a bad experience with bottled water; ever lived outside the United States; level of education; race/ethnicity; and information on water from friends, physicians, news, advertising, water company, or family

fective and not overly costly; and (4) is exposed to a cue to take a health action.²⁰ Dixon’s Integrative Environmental Health Model¹⁰ expands on this model and incorporates perspectives from psychology, toxicology, and health behavior to elucidate how people perceive and act on environmental agents and their health implications.²¹ It is made up of 4 domains: physiological (eg, agents, exposure, health effects), vulnerability (individual and community characteristics), health protection (eg, environmental health concerns, risk reduction activities), and epistemological (eg, sources of information). The factors associated with bottled water use in this study can be categorized into these 4 domains, thus providing support for this theoretical model of environmental health decision making. Moreover, while the relative importance of these factors may differ between racial and ethnic groups, racial and ethnic differences in water use were completely explained by other factors in this model, suggesting that this model is cross-culturally applicable.

The disproportionate use of bottled water by poor and minority families may contribute to health disparities. Despite these perceptions about the safety and health effects of bottled water, there is little if any objective evidence that in most circumstances there is any actual health benefit of bottled water over tap water in the United States.^{19,22} Indeed, several studies have suggested increased rates of contamination of bottled water and illness.^{4,23,24} Specifically with regard to children, concerns have been raised about the use of unfluoridated bottled water and the effect on oral health.^{5,9} For poor families, the use of bottled water may lead to less availability of resources for other health needs, as suggested in our study by the rather striking levels of expenditure on water relative to household income (similar to other studies)¹³ and the greater self-reported likelihood among minority respondents of having to give up other things to be able to pay for water.

Our findings could inform potential interventions to decrease bottled water use, especially among high-risk minority populations. Individual clinicians can incorporate discussions about water use into their anticipatory guidance, addressing perceptions about safety and health benefits of bottled water vs tap water. They should be aware, however, of the influence of information from family members on water choices and be prepared to address beliefs in a family context. The finding that information from environmental organizations influences behavior suggests that community-based interventions could also be effective. Interestingly, information from environmental organizations appears to cut in both directions, perhaps reflecting the mixed message (ie, bottled water is bad, but so is tap water) that may be given by such groups.²²

Although we used in-depth qualitative interviews to identify themes and to develop survey questions, our survey may not have included all factors that are important in decision making about drinking water. Because the study participants were enrolled in clinical settings, the results might not generalize to the population at large. Also, while we specifically asked respondents to answer questions about usual water use, responses could have been influenced by more recent use in a child with an acute illness. Finally, parental report of water use may not be accurate for older children, although we have previously validated parent-reported use for children of various ages.²⁵

We conclude that there are important racial and ethnic differences in the use of bottled water and that the increased bottled water use among Latinos and African Americans is based on beliefs about, prior experiences with, and sources of information regarding drinking water. These water consumption patterns can contribute to health disparities. Interventions to reduce bottled water use among minority families should be based on knowledge of the factors related to water use in these communities.

Accepted for Publication: March 17, 2011.

Published Online: June 6, 2011. doi:10.1001/archpediatrics.2011.83

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