Brief Intervention for Alcohol Use by Pregnant Women

Mary J. O'Connor, PhD, Shannon E. Whaley, PhD

Objectives. We examined the efficacy of brief intervention as a technique to help pregnant women achieve abstinence from alcohol. A second aim was to assess newborn outcomes as a function of brief intervention.

Methods. Two hundred fifty-five pregnant women who were participants in the Public Health Foundation Enterprises Management Solutions Special Supplemental Nutrition Program for Women, Infants, and Children and who reported drinking alcohol were assigned to an assessment-only or a brief-intervention condition and followed to their third trimester of pregnancy. Brief intervention consisted of 10- to 15-minute sessions of counseling by a nutritionist who used a scripted manual. Newborn outcomes of gestation, birthweight, birth length, and viability were assessed.

Results. Women in the brief intervention condition were 5 times more likely to report abstinence after intervention compared with women in the assessment-only condition. Newborns whose mothers received brief intervention had higher birthweights and birth lengths, and fetal mortality rates were 3 times lower (0.9%) compared with newborns in the assessment-only (2.9%) condition.

Conclusions. The success of brief intervention conducted in a community setting by nonmedical professionals has significant implications for national public health policies. (*Am J Public Health.* 2007;97:XXX–XXX. doi:10.2105/AJPH.2005.077222)

The prevalence of alcohol use among pregnant women is more than 12%, which suggests that approximately 1 in 8 fetuses is exposed to alcohol in utero.[1] Moreover, it is estimated that about 1 in 100 children has fetal alcohol spectrum disorder, which is associated with substantial life-long impairments in neurocognitive and socioemotional development.[2] Even low levels of alcohol consumption have been shown to be related to negative developmental sequelae.[3–7] Furthermore, children from low-income ethnic minority populations are particularly vulnerable to the long-term effects of prenatal alcohol exposure, because their mothers are less likely to receive appropriate counseling regarding alcohol use during pregnancy.[8,9] For these reasons, effective prevention of alcohol use by pregnant women has become an important national priority.[10]

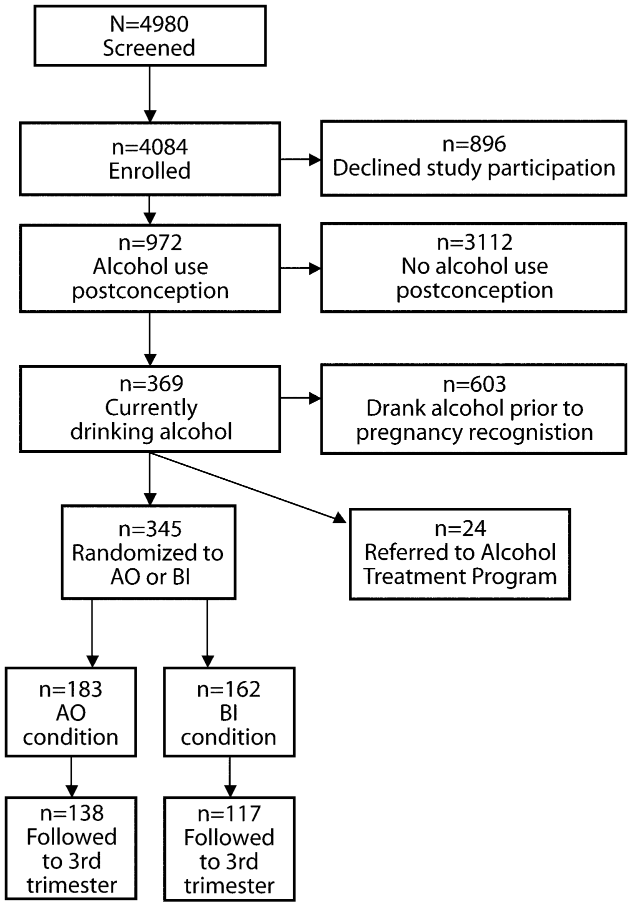
Derived from the principals of social learning theory, brief intervention is an effective methodology that has been empirically validated in a number of alcohol-related studies.[11–14] The approach uses 10- to 15-minute sessions of counseling that can be delivered by personnel who are not specialists in the treatment of alcohol abuse or dependence. Most successful brief interventions include (1) feedback aimed at increasing awareness of the negative consequences of drinking, (2) advice focused on identifying risky situations and actions aimed at reducing consumption, and (3) assistance with formulating drinking reduction goals.[11–14] Brief intervention has been shown to be a low-cost, effective treatment alternative for alcohol use problems. The methodology uses time-limited, self-help strategies to promote reductions in alcohol use in nondependent individuals, and in the case of dependent persons, to facilitate referral to specialized treatment programs.[15–17]

In spite of the proven effectiveness of brief intervention in the general population, there have been few controlled studies on the use of this technique for counseling pregnant women. Three studies have been published to date, and in all of these studies, the interventions were integrated into obstetric care in primary care settings where advice was typically provided by physicians.[18–21] With the exception of a small pilot study that used motivational interviewing,[22] and another study[18] that used a manual approach, intervention has typically concentrated on middle-class, White, non-Hispanic women. Given the focus of most research on nonminority, middle-class women seen in obstetric clinics, the purpose of our study was to examine the effectiveness of brief intervention in helping low-income minority women achieve abstinence from alcohol during pregnancy, in an accessible community-based setting, and by using nonmedical providers (nutritionists from the Public Health Foundation Enterprises Management Solutions Special Supplemental Nutrition Program for Women, Infants, and Children; PHFE-WIC). Gestational age, neonatal weight and length, and fetal viability served as outcome variables for evaluating the efficacy of brief intervention.[23–26]

METHODS

Design and Procedure

PHFE-WIC in Southern California is the largest WIC agency in the country and serves more than 316 000 pregnant women, infants, and children every month in 53 centers in Los Angeles and Orange Counties. Approximately 11% of the PHFE-WIC caseload is pregnant women. For our study, 12 PHFE-WIC centers were selected and randomized into 1 of 2 conditions: assessment only or brief intervention. Within the 6 centers in the assessment-only condition, current drinkers received a comprehensive assessment of alcohol use and were advised to stop drinking during pregnancy. Within the 6 centers in the brief intervention condition, participants received the same comprehensive assessment of alcohol use plus a standardized workbook-driven brief intervention, designed specifically to help women reduce alcohol consumption during pregnancy. Women were screened at every monthly prenatal visit and, if they were still drinking, were provided brief intervention or assessment only. In this way, a controlled design was used in which participants were



Note. AO = assessment only; BI = brief intervention.

FIGURE 1—Participant accountability.

nested within centers and centers were nested within condition.

Participants

From June 2001 to March 2004, 4980 women were screened for postconception drinking, and 4084 were enrolled in the study. Analyses of demographic data, using the PHFE-WIC database, revealed that women who volunteered for the study did not differ from the general PHFE-WIC population regarding major demographic variables of age, ethnicity, or education. Of the individuals who enrolled, 345 were currently drinking and were randomized to assessment only (n=183) or brief intervention (n=162). Figure 1 shows participant accountability throughout the protocol. Of the 345 women, 255 (74%) continued to return to their original WIC center into their third trimester. This number is consistent with the overall population of pregnant women in WIC, who move often. Participant attrition was not significantly related to treatment condition (assessment only n=45/183, 24.6%; brief intervention n=45/162, 27.8%; Fisher exact test, $P=1.0$), alcohol risk, or consumption levels. However, women lost to follow-up averaged approximately 1 more year of education (mean=12.15 years; SD=2.86) than did those who were followed (mean=11.09 years; SD=3.42; $t^{343}=2.62$, $P<.01$), and were more likely to be Black, non-Hispanic, or English-speaking Hispanic ($\chi^2_4[N=345]=12.82$, $P<.01$; Table 1).

Measures

All measures were printed in English or Spanish and were understandable to women with a fourth-grade reading level. PHFE-WIC staff was available to read to those women who requested help.

Women completed a 2-page alcohol screening questionnaire that incorporated quantity–frequency measures to inquire about typical consumption patterns.[27] Women were also queried about whether or not they had any alcohol during the previous week, the previous weekend, or the previous month. The TWEAK[28] 5-question scale was included in the questionnaire to assess high-risk drinking.[28–35]

If a woman provided a positive answer on any of the alcohol questions on the screening questionnaire, she was administered the Health Interview for Women,[5] adapted from a questionnaire developed by Day and Robles.[36] Maximum drinks per drinking occasion (MAX), was selected as the outcome measure on the basis of previous work that demonstrated it is a valid predictor of teratogenic effects.[5,6,37] Estimates were taken at the first enrollment visit before the intervention (MAX_1) and in the third trimester of pregnancy (MAX_3). One drink was considered to be 0.60 ounces of absolute alcohol; therefore, one 12-ounce can of beer that contained 5% absolute alcohol was considered 1 drink, whereas one 16-ounce can of 8% malt liquor was considered 2 drinks.[38,39]

Caffeine ingestion per day was calculated according to the procedure of Jacobson and colleagues.[40] Cigarette smoking was defined as the number of cigarettes the woman reported smoking each day. The number of prescription, over-the-counter, and illegal drugs was estimated during a typical week. For example, marijuana and cocaine use were each coded on a scale from 0 to 2: 0 represented no cocaine or marijuana use, 1 represented use 1–2 times a week, and 2 represented use 3 or more times a week.

Newborn Measures

To establish the gestational age of the infants, women were asked the due date that was given at pregnancy confirmation. This date was compared with the infant's birth date. Data on twin births were also collected. Newborn birthweight and birth length are obtained routinely by WIC during the infant enrollment process, and these data were retrieved from the PHFE-WIC database. Other

TABLE 1—Characteristics of Sample Population: PHFE-WIC, California, June 2001–March 2004

	No Follow-up (n = 90)	Follow-up (n = 255)	Assessment Only (n = 138)	Brief Intervention (n = 117)
Ethnicity (%)				
White, non-Hispanic	10.0	7.1*	6.5	7.7
Black, non-Hispanic	23.3	17.3	13.8	21.4
English-speaking Hispanic	38.9	26.3	27.5	24.8
Spanish-speaking Hispanic	25.6	44.3	46.4	41.9
Other	2.2	5.1	5.8	4.3
Age, y, mean (SD)	27.68 (6.09)	28.18 (5.97)	27.90 (6.09)	28.52 (5.84)
Marital status, married or has partner, %	63.3	71.4	71.0	71.9
Education, y, mean (SD)	12.15 (2.86)	11.09 (3.42)*	11.00 (3.42)	11.19 (3.44)
Income, $15 000 or less, %	67.9	67.0	69.6	63.9
Weeks at pregnancy recognition, mean (SD)	6.83 (4.08)	6.51 (3.57)	6.51 (3.80)	6.51 (3.31)
Weeks gestation at enrollment, mean (SD)	19.49 (8.79)	17.98 (7.87)	18.15 (7.99)	17.78 (7.76)
MAX_1 mean (SD)	2.48 (4.00)	1.90 (2.60)	1.73 (1.73)	2.10 (3.35)
TWEAK mean (SD)	2.08 (1.61)	1.81 (1.46)	1.84 (1.54)	1.77 (1.36)
Caffeine drinks mean (SD)	1.67 (3.20)	1.74 (2.40)	1.86 (2.70)	1.61 (2.02)
Cigarettes per day mean (SD)	1.29 (4.14)	0.49 (1.94)	0.47 (1.60)	0.53 (2.29)
Marijuana mean (SD)	0.05 (0.27)	0.01 (0.11)	0.37 (0.22)	0.07 (0.32)
Cocaine mean (SD)	0.23 (0.21)	0.01 (0.89)	0.00 (0.00)	0.01 (0.13)

Note. MAX1 = maximum drinks per drinking occasion at first enrollment visit; PHFE-WIC = Public Health Foundation Enterprises Management Solutions Special Supplemental Nutrition Program for Women, Infants, and Children.
*$P < .01$.

birth measures such as head circumference are not required and were not collected. Infants who did not survive pregnancy were recorded in the database as miscarriages, spontaneous abortions, or stillbirths.

Brief Intervention

The brief intervention represented a logical extension of the individual nutrition education that women enrolled in WIC already receive. A brief intervention workbook was designed by study investigators to help nutritionists standardize and administer the intervention.[18,19] The workbook consisted of traditional brief intervention techniques, including education and feedback, cognitive-behavioral procedures, goal setting, and contracting.

Nutritionist Training

Nutritionists from the 12 PHFE-WIC centers were trained by study investigators to score the alcohol screening questionnaire and the Health Interview for Women. All training was designed to complement existing WIC training practices and to build upon the participant-centered education principles practiced by the PHFE-WIC Program. Issues related to confidentiality, reporting abuse, and referring high-risk clients were explained. After this training, the nutritionists reviewed the alcohol-use screening tool, completed it themselves, scored the results, and developed strategies to incorporate the screening tool into standard practice. Additional training included a description of ways to increase self-reporting of alcohol use, observation of the research staff as they administered the Health Interview for Women for this study, and practice administering the interview.

In a separate training session, nutritionists from the 6 WIC centers in the brief intervention condition were taught to give the intervention. Nutritionists were given a manual that included the goals of brief intervention and a step-by-step explanation of how to conduct the intervention using the brief intervention workbook. We provided live demonstrations of the brief intervention. Nutritionists practiced administering the intervention and answering problematic questions with standard replies.

Nutritionist Reliability and Treatment Compliance

Nutritionists were required to attain 100% reliability, as assissed by the use of fidelity checklists, in administering the Health Interview for Women in training before they could administer the interview to the study participants. We reviewed completed interviews daily for accurate scoring. If an interview form was inaccurate or incomplete, the nutritionist was refreshed on the correct procedure. To ensure fidelity of the administration of the intervention, and to avoid nutritionist drift, quarterly meetings were held at PHFE-WIC headquarters to observe the nutritionists practice the administration of the study protocol. In addition, we made monthly visits to participating WIC centers to assure that the protocol was being followed correctly. An independent scorer used a fidelity checklist of the primary brief intervention content to score a random sample of audiotaped sessions that were collected throughout the study period.

Data Analysis Plan

We examined descriptive information about participants, including ethnicity, age, language preference, marital status, education, income, number of weeks of gestation at pregnancy recognition, and weeks of gestation at enrollment in WIC. TWEAK scores and the use of substances, including prescription or nonprescription medications, illegal drugs, caffeinated drinks, and smoking, were estimated. We used χ^2 and *t* tests for independent samples to compare differences in demographic and other study variables between the assessment-only and brief intervention groups.

To test the efficacy of the brief intervention, we conducted a logistic regression analysis using a generalized linear mixed effects model in SAS version 9 (SAS Institute Inc., Cary, NC) with the GLIMMIX macro, assigning brief intervention or assessment only as the primary fixed effect. We included WIC center as a random design effect and MAX_1 (initial alcohol consumption level) as a fixed covariate. All demographic and other baseline study variables were examined as possible covariates ($P<.05$) of alcohol abstinence at the third trimester follow-up (MAX_3). Only weeks of gestation at enrollment in WIC ($r=-.16$, $P<.01$) was significantly associated with outcome, and this variable was entered into the model as a covariate. The dependent variable was drinking status at the third trimester follow-up, and women were classified as either abstinent (0) or continuing to drink (1). Degrees of freedom were estimated using the Satterthwaite approximation as implemented in the SAS MIXED procedure.

We analyzed infant outcome measures of gestational age, birthweight, and birth length using a 2 (condition: brief intervention or assessment only)×2 (initial consumption level: $MAX_1<2$ drinks or ≥2 drinks) mixed-effects analysis of covariance (SAS MIXED) in which WIC center was a random effect and statistically significant baseline covariates were controlled. The initial consumption level (MAX_1) cutpoint was selected on the basis of current research and national guidelines, which suggest that episodic drinking of 2 or more drinks per drinking occasion during pregnancy can be dangerous for the developing fetus.[41] Two twin pairs (n=4) were eliminated from these analyses, because twins tend to have shorter gestations and lower growth parameters at birth, independent of prenatal alcohol exposure.

Gestational age was analyzed both as a dependent variable and as a potential covariate in the analyses of the other 2 newborn outcomes. There were no significant correlations between any of the potential covariates and gestational age, so no covariates were included in that analysis. The analysis of infant birthweight included gestational age ($r=.37$, $P<.001$), infant gender ($r=.17$, $P<.01$), maternal weight ($r=0.18$, $P<.01$), height ($r=.19$, $P<.01$), and smoking ($r=-.17$, $P<.01$) as covariates. The analysis of infant birth length included gestational age ($r=.21$, $P<.01$), infant gender ($r=.21$, $P<.01$), maternal height ($r=.12$, $P<.08$), and smoking ($r=-.16$, $P<.02$). Fetal mortality rates were calculated as percentages.

RESULTS

The average MAX_1 for the final sample (n=255) was 1.90 (SD=2.60) as shown in Table 1. Scores were not normally distributed: 54% of women drank a maximum of 1 drink per occasion, 21% drank a maximum of 2 drinks, and 25% reported drinking 3 or more drinks per occasion. The average TWEAK score for the sample was 1.81 (SD=1.46), and 61% of the women sampled scored 2 or higher on the TWEAK scale, which has been suggested as a cutpoint for pregnant women who may not be alcohol dependent but who may, nevertheless, drink at levels that place the fetus at risk.[30] The use of other substances is highlighted in Table 1.

Our examination of the data found that there were no differences between women in the brief intervention and assessment-only conditions regarding demographic or alcohol variables, including initial levels of alcohol consumption (MAX_1) or high-risk drinking status as measured by the TWEAK scale. There were no differences between the groups in the use of other substances (Table 1).

Our analysis of abstinence from drinking yielded a significant intervention effect, $F_{1,24}=4.33$, $P<.04$. Compared with women in the assessment-only condition, women in the brief intervention condition were 5-times more likely to be abstinent by the third trimester (odds ratio [OR]=5.39; 95% confidence interval [CI]=1.59, 18.25). Table 2 shows the logistic regression coefficients for the fixed effects, SE, OR, and 95% CIs in this model.

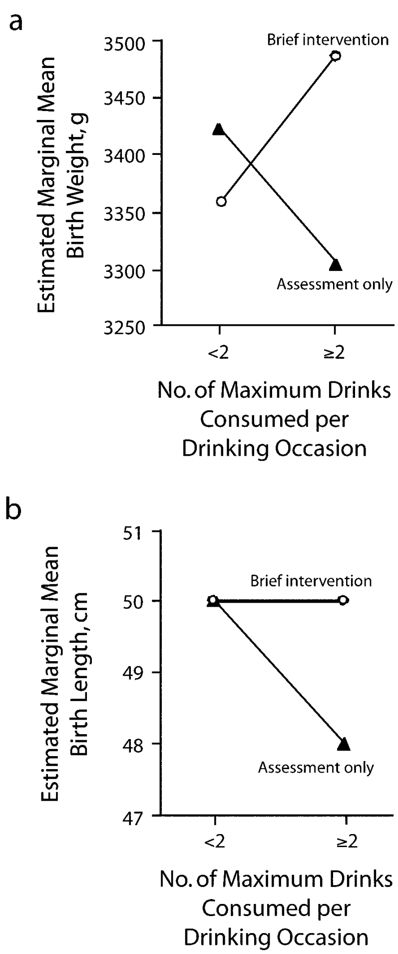
TABLE 2—Logistic Regression Examining Reported Abstinence From Alcohol at Third Trimester Follow-up: PHFE-WIC, California, June 2001–March 2004

	β	SE	Odds Ratio (95% Confidence Interval)
MAX_1	0.07	0.09	1.07 (0.94, 1.22)
Weeks gestation at enrollment	−0.11	0.03	1.11 (1.05, 1.17)**
Assessment only/brief intervention	1.60	0.77	5.39 (1.59, 18.25)*

Note. MAX_1 = maximum drinks per drinking occasion at first enrollment visit; PHFE-WIC = Public Health Foundation Enterprises Management Solutions Special Supplemental Nutrition Program for Women, Infants, and Children.
*$P<.05$; **$P<.01$.

Our analysis of gestational age revealed neither a significant main effect nor interaction associated with brief intervention; consequently, this variable was included as a covariate in the analyses of infant birthweight and birth length. Our analysis of infant birthweight revealed a marginally statistically significant condition×initial consumption level interaction, $F_{1,194}=3.59$, $P<.06$. Nevertheless, these results suggest a clinically significant effect: infants in the brief intervention high-consumption group averaged 180.45 g (estimated) more than infants in the assessment only high-consumption group and, in fact, slightly reversed the pattern for the brief-intervention high-consumption group.[1] The estimated mean for the brief intervention high-consumption group was 3486.11 g (SE=67.90) compared with 3305.66 g (SE=75.15) for the assessment-only high-consumption group. The estimated means for the brief intervention and assessment-only low-consumption groups were 3356.89 g (SE=60.46) and 3421.96 g (SE=51.76), respectively (Figure 2).

Analysis of birth length yielded a statistically significant interaction between condition and initial consumption level, $F_{1,194}=4.48$, $P<.03$. For women consuming fewer than 2 drinks per drinking occasion before intervention, newborn birth lengths were the same regardless of experimental condition (estimated mean=49.98 cm, SE=0.37; and mean=49.90 cm, SE=0.31 for brief intervention and assessment only, respectively). However, for women who were consuming 2 or more drinks, brief intervention had a significant effect on newborn birth length. Infants of women in the high-consumption group who received brief intervention did not differ in birth length from infants in the low-consumption groups (mean=50.35 cm, SE=0.42); whereas, infants of women in the high-consumption assessment-only group (mean=48.68 cm, SE=0.44) were significantly shorter than infants of mothers in the other 3 groups. Comparison of the



[1]It should be noted that the birthweights of infants in the brief intervention, low-consumption group were lower than those in the brief intervention, high-consumption group, which suggests that women in the high-consumption group were more concerned about their high-risk drinking and more likely to reduce their drinking following brief intervention; whereas, those in the low-consumption group may have been more resistant to behavioral change believing that their consumption levels were too low to affect the fetus.

FIGURE 2—Infant birthweight and birth length as a function of brief intervention.

high-consumption groups across conditions revealed that there was an average difference of 1.69 cm (estimated) in length between the brief intervention and assessment-only groups (Figure 2).

Five infants in the study sample did not survive. Results revealed that 2.9% (n=4; 2 miscarriages, 2 stillborns) of the pregnancies in the assessment-only condition resulted in a nonviable outcome compared with 0.9% (n=1; miscarriage) in the brief intervention condition.

DISCUSSION

Research reveals that brief intervention techniques have been highly successful in increasing an individual's motivation to change unhealthy behavior.[42] Our results strongly suggest that women who use alcohol during pregnancy are receptive to brief intervention strategies, that brief intervention can be successfully provided by nonmedical professionals, and that negative neonatal consequences of prenatal exposure to alcohol can be prevented through intervention. However, although results suggested that brief intervention was more effective than assessment alone, women in both groups reduced their drinking substantially. This may have been because the women sampled wanted to have healthy pregnancies and because of the time and attention that nutritionists provided for women in both conditions.

Nevertheless, more positive newborn outcomes were found to be associated with brief intervention, particularly for the newborns of heavier drinkers. There was also a lower rate of fetal death in the brief intervention group compared with the assessment-only group. Extrapolating from the study data, the fetal mortality rate in the intervention group would be estimated at 9 in 1000 compared with 29 in 1000 in the assessment-only group. In minority populations of Black, non-Hispanic and Hispanic women, the recorded fetal mortality rates are 11.02 and 5.57, respectively.[43] A rate of 29 in 1000 is significantly higher than these population rates would predict and confirms that prenatal alcohol exposure is a significant risk factor for the fetus. In spite of the relative success of brief intervention on infant survival, the fetal death rate of 9 in 1000 in the intervention condition is almost twice as high as that found in White non-Hispanic populations, which is estimated at 4.91 in 1000. These higher rates may relate to factors associated with being an economically disadvantaged minority woman, including mistrust of medical professionals and a reluctance to seek medical care.[44,45]

Of special concern is the fact that many women are often unaware of their pregnancy status and may drink alcohol well into the first trimester before recognition of the pregnancy. This pattern was confirmed in our sample of low-income women: 62% of postconception drinkers reported drinking before pregnancy recognition. Because pregnancy recognition in this sample did not occur until almost the seventh week of gestation, this suggests a relatively long period of exposure. The remaining 38% of women who reported continued drinking following pregnancy recognition were not screened, on average, until 18 weeks gestation, well into their second trimester, and later enrollment was found to be associated with lower rates of abstinence. These findings suggest that more-aggressive methods of early detection are needed to identify women who require more-intensive intervention.

As with any study conducted in a community setting, certain limitations in study design are expected. In our study, PHFE-WIC centers were randomized to treatment condition, and participants were nested within centers; therefore, lack of a fully randomized controlled design represents a study limitation. A fully randomized design was seriously considered; however, discussion with nutritionists revealed that they felt it would not be feasible for them to withhold intervention from a random selection of participants. Because of this potential methodological shortcoming, the WIC center effect was examined statistically and found not to be a significant factor in treatment outcome.

Although attrition was not found to be related to treatment condition, women lost to third trimester follow-up were likely to be more educated and to be Black, non-Hispanic or English-speaking Hispanic compared with women who remained in the study. Thus, future intervention strategies should consider ways to best follow and intervene with these women throughout pregnancy.

Because this sample was drawn from women living in Southern California who volunteered to be screened, our ability to generalize the results to other populations of women in other parts of California and the United States is limited. Specifically, the sample was highly saturated with low-income

Hispanic participants. Nevertheless, many sample demographic characteristics are consistent with those that have been identified in larger, stratified populations of women[46–48] and in smaller samples of Hispanic women of Puerto Rican, Central, or South American descent from the northeastern United States.[49] Furthermore, Hispanics are the fastest growing ethnic group in the United States and are expected to constitute 24.4% of the population by 2050.[50] Thus, results likely have relevance for public health practices nationwide that address the prevention of drinking during pregnancy in minority women.

Brief intervention provided by nonmedically trained health professionals (WIC nutritionists) proved to be highly successful for reducing alcohol consumption during pregnancy and improving newborn outcomes. The success of brief intervention with low-income minority women who often do not have adequate health insurance or prenatal care suggests that the programs like WIC could be instrumental in preventing alcohol-exposed pregnancies. Given the nationwide presence of WIC centers and the comparable services provided across centers, there is a significant opportunity to protect a large number of children at risk because of alcohol exposure during pregnancy. ■

About the Authors

Mary J. O'Connor is with the Department of Psychiatry and Biobehavioral Sciences, David Geffen School of Medicine, University of California, Los Angeles. Shannon E. Whaley is with the Public Health Foundation Enterprises Management Solutions–Women, Infants, and Children, Los Angeles.

Requests for reprints should be sent to Mary J. O'Connor, Department of Psychiatry and Biobehavioral Sciences, David Geffen School of Medicine, University of California, 760 Westwood Plaza, Room 68–265A, Los Angeles, CA 90024 (e-mail: moconnor@mednet.ucla.edu).

This article was accepted February 20, 2006.

Contributors

M.J. O'Connor was the principal investigator and oversaw all aspects of the study and led the development of study materials, the brief intervention procedure, and data analysis, and was the lead author of this article. S.E. Whaley was the co–principal investigator and assisted in all aspects of the study, served as the liaison between University of California-Los Angeles and Public Health Foundation Enterprises Management Solutions Special Supplemental Nutrition Program for Women, Infants, and Children, and led the training of the nutritionists, oversight of the study protocol, data collection, and treatment fidelity. Both authors helped to conceptualize ideas, interpret findings, and review drafts of the article.

Acknowledgments

This research was supported by the National Institute on Alcohol Abuse and Alcoholism (grant RO1-AA12480) and the Office of Research on Minority Health.

Special thanks go to Faye Ebeling and Nelly Mallo for their efforts on this project. We also thank Eloise Jenks and the nutritionists and pregnant women who participated in the study.

Human Participant Protection

Protocols and consent forms were approved by the University of California, Los Angeles, institutional review board, and a Certificate of Confidentiality was obtained from the National Institute on Alcohol Abuse and Alcoholism. A Single Project Assurance of Compliance with Department of Health and Human Services regulations for the Protection of Human Research Subjects (45 CFR 46) was completed by Public Health Foundation Enterprises Management Solutions Special Supplemental Nutrition Program for Women, Infants, and Children. Women participating in this study were provided with a clear description of the study protocol and signed an informed consent form.

References

1. Centers for Disease Control and Prevention. Alcohol consumption among pregnant and childbearing-aged women-United States, 1991–1999. *MMWR Morb Mortal Wkly Rep.* 2002;511:273–276.

2. May PA, Gossage JP. Estimating the prevalence of fetal alcohol syndrome. *Alcohol Res Health.* 2001;25: 159–167.

3. Lupton C, Burd L, Harwood R. Cost of fetal alcohol spectrum disorders. *Am J Med Genet.* 2004;127C(1): 42–50.

4. Jacobson JL, Jacobson SW. Drinking moderately and pregnancy: effects on child development. *Alcohol Health Res World.* 1999;23:25–30.

5. O'Connor MJ, Kasari C. Prenatal alcohol exposure and depressive features in children. *Alcohol Clin Exp Res.* 2000;24:1084–1092.

6. O'Connor MJ, Sigman M, Kasari C. Interactional model for the association among maternal alcohol consumption, mother-infant characteristics and infant cognitive development. *Infant Behav Dev.* 1993;16: 177–192.

7. Sood B, Delaney-Black W, Covington C, et al. Prenatal alcohol exposure and childhood behavior at age 6 to 7 years: I. Dose-response effect. *Pediatrics.* 2001;108:1–9.

8. Abel EL. An update on incidence of FAS: FAS is not an equal opportunity birth defect. *Neurotoxicol Teratol.* 1995;17:437–443.

9. Dufour MC, Williams GD, Campbell KE, Aitken SS. Knowledge of FAS and the risks of heavy drinking during pregnancy, 1985 and 1990. *Alcohol Health Res World.* 1994;18:86–92.

10. *Healthy People 2010: Understanding and Improving Health.* Washington, DC: US Department of Health and Human Services; 2000.

11. Bien TH, Miller WR, Tonigan JS. Brief interventions for alcohol problems: a review. *Addiction.* 1993;88: 315–335.

12. Kahan M, Wilson L, Becker L. Effectiveness of physician-based interventions with problem drinkers: a review. *CMAJ.* 1995;162(5):851–859.

13. Miller WR. Rediscovering fire: small interventions, large effects. *Psychol Addict Behav.* 2000;14:6–18.

14. Wilk AI, Jensen NM, Havighurst TC. Meta-analysis of randomized control trials addressing brief interventions in heavy alcohol drinkers. *J Intern Med.* 1997;12: 274–283.

15. Zweben A, Fleming ML. Brief interventions for drug and alcohol problems. In: Tucker JA, Marlatt GE, eds. *Changing Addictive Behavior.* New York, NY: Guilford Press; 1999.

16. Fleming MF. (2003). Brief interventions and the treatment of alcohol use disorders: current evidence. *Recent Dev Alcohol.* 2003;16:375–390.

17. Gentilello LM, Rivara FP, Donovan DM, et al. Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. *Ann Surg.* 1999; 230:473–480.

18. Hankin J, McCaul ME, Heussner J. Pregnant, alcohol-abusing women. *Alcohol Clin Exp Res.* 2000; 24:1276–1286.

19. Manwell LB, Fleming MF, Mundt MP, Stauffacher EA, Barry KL. Treatment of problem alcohol use in women of childbearing age: results of a brief intervention trial. *Alcohol Clin Exp Res.* 2000;24:1517–1524.

20. Chang G, Goetz MA, Wilkins-Haug L, Berman S. A brief intervention for prenatal alcohol use: an in-depth look. *J Subst Abuse Treat.* 2000;18:365–369.

21. Chang G, McNamara TK, Orav EJ, et al. Brief intervention for prenatal alcohol use: a randomized trial. *Obstet Gynecol.* 2005;105:991–998.

22. Handmaker NS, Miller WR, Manicke M. Findings of a pilot study of motivational interviewing with pregnant drinkers. *J Stud Alcohol.* 1999;60:285–287.

23. Kesmodel U, Olsen SF, Secher NJ. Does alcohol increase the risk of preterm delivery? *Epidemiology.* 2000;11:512–518.

24. Kesmodel U, Wisborg K, Olsen SF, Henriksen TB, Secher NJ. Moderate alcohol intake during pregnancy and the risk of stillbirth and death in the first year of life. *Am J Epidemiol.* 2002;155:305–312.

25. Nordstrom-Klee B, Delaney-Black V, Covington C, Ager J, Sokol R. Growth from birth onwards of children prenatally exposed to drugs: a literature review. *Neurotoxicol Teratol.* 2002;24:481–488.

26. Whitehead N, Lipscomb L. Patterns of alcohol use before and during pregnancy and the risk of small-for-gestational-age birth. *Am J Epidemiol.* 2003;158: 654–662.

27. Sobell LC, Sobell MB. Alcohol consumption measures. In: Allen JP, Columbus M, eds. *Assessing Alcohol Problems: A Guide for Clinicians and Researchers.* Washington, DC: National Institute on Alcohol Abuse and Alcoholism Treatment Handbook Series 4; 1995. NIH Publication No. 95–3745.

28. Russell M. New assessment tools for drinking in pregnancy, T-ACE, TWEAK, and others. *Alcohol Health Res World.* 1994;18:55–61.

29. Russell M, Martier SS, Sokol RJ, Jacobson S,

Jacobson J, Bottoms S. Screening for pregnancy risk drinking: TWEAKING the tests. *Alcohol Clin Exp Res.* 1991;15:638–642.

30. Russell M, Martier SS, Sokol RJ, Mudar P, Jacobson S, Jacobson J. Detecting risk drinking during pregnancy: a comparison of four screening questionnaires. *Am J Public Health.* 1996;86:1435–1439.

31. Cherpitel CJ. Gender, injury status and acculturation differences in performance of screening instruments for alcohol problems among US Hispanic emergency department patients. *Drug Alcohol Depend.* 1999;53:147–157.

32. Bradley TF, Boyd-Wickizer J, Powell SH, Burman ML. Alcohol screening questionnaires in women: a critical review. *JAMA.* 1998;280:166–171.

33. Dawson DA, Das A, Faden VB, Bhaskar B, Krulewitch CJ, Wesley B. Screening for high- and moderate-risk drinking during pregnancy: a comparison of several TWEAK based screeners. *Alcohol Clin Exp Res.* 2001;25:1342–1349.

34. Connors, G. Screening for alcohol problems. In: Allen JP, Columbus M, eds. *Assessing Alcohol Problems: A Guide for Clinicians and Researchers.* Washington, DC: National Institute on Alcohol Abuse and Alcoholism Treatment Handbook Series 4; 1995. NIH Publication No. 953745.

35. O'Connor MJ, Whaley SE. Alcohol use in pregnant low-income women in WIC. *J Stud Alcohol.* 2003; 64:773–783.

36. Day NL, Robles N. Methodological issues in the measurement of substance abuse. *Ann NY Acad Sci.* 1989;562:8–13.

37. O'Connor MJ, Paley B. The relationship of prenatal alcohol exposure and the postnatal environment to child depressive symptoms. *J Ped Psych*, in press.

38. Kaskutas LA, Graves K. Pre-pregnancy drinking: how drink size affects risk assessment. *Addiction.* 2001;96:1199–1209.

39. Serdula MK, Mokad AH, Byers T, Siegel PZ. Assessing alcohol consumption: beverage specific vs group-beverage questions. *J Stud Alcohol.* 1999;60: 99–105.

40. Jacobson SW, Fein GG, Jacobson JL, Schwartz PM, Dowler JK. Neonatal correlates of prenatal exposure to smoking, caffeine, and alcohol. *Infant Behav Dev.* 1984; I:121–140.

41. Bertrand J, Floyd RL, Weber MK, et al. *Fetal Alcohol Syndrome: Guidelines for Referral and Diagnosis. Screening and Brief Intervention.* Atlanta, GA: Centers for Disease Control and Prevention; 2004.

42. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. *J Consult Clin Psychol.* 1983;51: 390–395.

43. Wingate MS, Alexander GR. Racial and ethnic differences in prenatal mortality: the role of fetal death. *Ann Epidemiol.* 2006;16:485–491.

44. Wells K, Klap R, Koike A, Sherbourne C. Ethnic disparities in unmet need for alcoholism, drug abuse, and mental health care. *Am J Psychiatry.* 2001;158: 2027–2032.

45. Day NL, Richardson GA. Analysis of the effects of prenatal alcohol exposure on growth: a teratologic model. *Am J Med Genet.* 2004;127:28–34.

46. Randolph WM, Stroup-Benham C, Black SA, Markides KS. Alcohol use among Cuban Americans, Mexican-Americans, and Puerto Ricans. *Alcohol Health Res World.* 1998;22:265–269.

47. Sidhu JS, Floyd RL. Trends in alcohol consumption among Hispanic pregnant and nonpregnant women in the United States, 1995–2000. Proceedings of the 2002 Scientific Meeting of the Research Society on Alcoholism, San Francisco, CA, June 28–July 3, 2002.

48. Caetano R, Clark CL. Trends in alcohol consumption patterns among Whites, Blacks, and Hispanics: 1984 and 1995. *J Stud Alcohol.* 1998;22:659–668.

49. Polednak AP. Gender and acculturation in relation to alcohol use among Hispanic (Latino) adults in two areas of the northeastern United States. *Subst Use Misuse.* 1997;32:1513–1524.

50. US Census Bureau. US interim projections by age, sex, race, and Hispanic origin, 2004. Available at: http://www/census.gov/ipc/www/usinterimproj. Accessed July 10, 2005.