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Alcohol, Breastfeeding, and Development at 18 Months

Ruth E. Little, ScD*; Kate Northstone, MSc‡; Jean Golding, PhD, ScD‡; and the ALSPAC Study Team‡

ABSTRACT. ***Objective.*** **We aimed to replicate a previous study of 1-year-olds that reported a deficit in motor development associated with moderate alcohol use during lactation, using a different but comparable population.**

Methodology. **The mental development of 915 18-month-old toddlers from a random sample of a longitudinal population-based study in the United Kingdom was measured using the Griffiths Developmental Scales. Frequent self-administered questionnaires during and after pregnancy provided maternal data. The dose of alcohol available to the lactating infant was obtained by multiplying the alcohol intake of the mother by the proportion of breast milk in the infant's diet. We compared this dose with the Griffiths Scales of Mental Development, taking into account potentially confounding variables.**

Result. **Three of the Griffiths scales increased slightly but significantly with increasing infant alcohol exposure; there was no association in the remaining 2 or average of the scales.**

Discussion. **We were unable to replicate the earlier deficit in motor skills associated with lactation alcohol use. One reason may be that the dose of alcohol reaching the lactating infant is small, and tests of infants and toddlers have limited ability to pick up small effects. Studies of older children may resolve the question of the safety of drinking while nursing.** ***Pediatrics*** **2002;109(5). URL: http://www.pediatrics.org/cgi/content/full/109/5/e72;** ***alcohol, lactation, child development.***

ABBREVIATIONS. ALSPAC, Avon Longitudinal Study of Parents and Children; AA, absolute alcohol (ethanol); IAA, infant alcohol score; GQ, General Intelligence Quotient of the Griffith Scales of Mental Development; NIEHS, National Institute of Environmental Health Sciences.

The effect on the infant when the mother drinks alcohol during lactation has not been established. Alcohol consumption, its availability via breast milk, and infant development are all difficult to measure, and they are highly correlated with other important variables that must be taken into account, especially drinking during pregnancy. These difficulties may explain in part why little human research has been done on this topic. In our literature search, we found only 1 systematic study[1] that measured drinking during lactation and subsequent child development. The authors reported a decrease in the motor development of infants at 1 year of age, as measured by the Bayley Scales,[2] when the lactating mother had as little as 1 drink daily in the first 3 months after delivery. This result was independent of drinking during pregnancy.

Lactation is the preferred method of early infant feeding, and drinking alcohol is a common social custom in most of the western world. Knowing the effect on the infant when lactation and alcohol drinking are combined is of high importance, especially in view of the previous report of its adverse effects. We, therefore, undertook to replicate this study in a different but comparable population, aiming to confirm or reject the hypothesis that infant motor development is adversely affected when the mother drinks alcohol on a regular basis while nursing.

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METHODS

The Sample: The Avon Longitudinal Study of Parents and Children (ALSPAC) Study

In 1985, the World Health Organization supported the initiation of a series of studies in Europe to address the environmental, genetic, biological, and social factors affecting the health and development of children.[3] The ALSPAC, conducted in Avon County, United Kingdom, is the largest of these. The goal was to enroll all women resident in a defined area of Avon County with expected delivery date within a specified window of time (April 1, 1991, to December 31, 1992), and to follow the children, with their parents, into adulthood. Approximately 85% of eligible women were recruited for study,[4] and approximately 10 000 children and their parents are being followed at present.[3]

All participants in ALSPAC and their partners are asked to complete frequent mail questionnaires about themselves and their children. Information about the mother, the partner, and infant is generally obtained in separate questionnaires. Medical and educational records are abstracted, biological samples taken, and environmental measurements made. All children were examined at birth and at ages 7 and 8, with annual examinations thereafter. Throughout the life of the study, ethical issues in the use of human participants in ALSPAC have been addressed by an independent committee specifically charged with oversight of this responsibility, meeting monthly. There are also 4 ethics committees (institutional review boards) in the 4 residential districts where the majority of participants live. Participants are asked annually for their approval to continue in the ALSPAC cohort, and separate consent is obtained in advance for each specific Children in Focus procedure.

A subset of 10% of the ALSPAC children was randomly selected for more intensive assessment, with initial enrollment of about 1400; they form the Children in Focus cohort. The sample for the present study was drawn from this cohort, restricting to make it as comparable as possible to the sample used in the earlier study.[1] Of all the developmental tests given to the Children in Focus cohort, the Griffiths Scales of Mental Development[5] administered at 18 months of age was the most comparable to the 12-month Bayley Scales; thus only children who received this

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evaluation were included ($N = 1175$). We also required that there be information on usual alcohol consumption and alcohol binges in the postpartum period, as well as on length of lactation and timing of supplementation in the first 3 months after birth. In addition, we required that mothers be enrolled in the study by the end of the sixth month of pregnancy, that the birth be a singleton of at least 34 weeks' gestation, and that all parts of the Griffiths evaluation be completed by the child. This resulted in a sample of 921 children. The test scores were then adjusted for the psychometrist, gestational age at birth, and gender (4 cases missing gestational age) and 1 case each of Down syndrome and cerebral palsy were dropped, for a final sample size of 915.

Data Collection and Variable Measurement

Data on alcohol consumption during pregnancy and lactation were obtained from the maternal questionnaires at 18 and 32 weeks of pregnancy and at 8 weeks after delivery. Other data regarding the mother's demographics and lifestyle were also taken from these instruments. Nutrient intake of the mother was assessed with a food frequency questionnaire at 32 weeks' gestation.[6] Lactation history was obtained from questionnaire information taken at 4 weeks and 6 months after delivery.

Alcohol Intake

The questions in the eighth week postpartum maternal questionnaire addressed both usual drinking since delivery and binge drinking in the previous month. The questions were based on servings of standard-sized drinks that usually contain about 0.5 fl oz of ethanol; examples are a 4-fl oz serving of 12% wine, a 12-fl oz bottle of 4% beer, or 1 fl oz of 100-proof whiskey. The usual drinking scale was a combination of modal quantity consumed and frequency of this consumption; the binge question asked for number of times in the last month that the respondent had consumed 4 or more standard-sized drinks on a single occasion. Responses were quantified generally following work done earlier with the ALSPAC cohort[7] to obtain an estimate of the average fluid ounces of absolute alcohol (ethanol) (AA score) consumed by the mother each day via both usual drinking and binge drinking. An AA score of 0.5 for usual drinking is equivalent to about 1 standard sized drink every day, on the average (approximately 0.5 fl oz or 10 g ethanol). Mother's usual alcohol use during pregnancy was estimated for the first and last trimester of gestation in the questionnaires completed after these periods.

The number of days that a binge occurred in the month preceding questionnaire completion (rather than their average ethanol content) was used as an alternate variable because the physical effect of a massed drinking pattern is different from the physical effect of a spaced drinking pattern. For example, 7 drinks on Saturday night elevates blood alcohol levels on the drinking occasion considerably more than 1 drink each night for a week. A bolus of ethanol available in breast milk could have a different effect than frequent low levels.

Breastfeeding

History of breastfeeding was described by the mother in the 6-month postpartum infant questionnaire. This instrument also indicated the age when formula and other supplemental foods were introduced, so it was possible to identify women who fed by bottle or breast exclusively as well as partial breastfeeders in each month. A 1-day infant food diary, given to a subset of the cohort at 4 months of age,[8] showed that the liquid nourishment of an infant who was being partially but not wholly breastfed was on the average 55% breast milk and 45% formula milk (Dr P. Emmett, written and oral communication, July 2001). We determined the breastfeeding status for the first 3 months' postpartum (in keeping with the earlier study) for each child in our sample, and assigned a monthly breastfeeding weight (1.00 for totally breastfed, 0.55 for partially breastfed, 0 for formula-fed). The average of the weights was the summary index of the infant's breastfeeding experience.

The Surrogate Measure for Exposure of the Infant to Alcohol in Breast Milk

The variable infant alcohol score (IAA), a proxy variable for the amount of ethanol available to the infant via breast milk, was obtained by multiplying the maternal AA score by the summary index of the infant's breastfeeding experience. An IAA score of 1.0 for an exclusively breastfed infant meant that the mother was consuming 1 fl oz of ethanol daily (about 2 standard-sized drinks) on the average. In a partially breastfed infant, it could mean that the mother was consuming 2 fl oz of ethanol daily and providing half the nutrition of the infant from breast milk.

A similar indicator of infant exposure to number of binge days was also calculated.

Child Development at 18 Months of Age

The Griffiths Scales of Mental Development[5] includes 5 scales: Locomotor Development, Personal-Social Development, Hearing and Speech, Hand and Eye Coordination, and Performance Tests; the General Intelligence Quotient (GQ) is their average. The scales have been standardized in a British sample; the GQ has a mean of 100.1 and a standard deviation of 12.76. In this study, the Griffiths scales were administered at 18 months ± 2 weeks of age; however, 10% of the children were evaluated later than that because of illness or other extenuating circumstances. Eight trained psychometrists performed the assessments using the extended scales (0–8 years). Each child was seen for approximately 45 minutes at a play session and was scored immediately. Interobserver consistency was addressed by tester observation and by repeatedly comparing each tester's scoring of a single assessment. Only year 2 scores are used in the analysis because there was not always time to proceed onto year 3 tests for children who scored highly enough. These 12- to 24-month items have been converted to standard developmental quotient scores, assuming that the children would have scored full marks on the 0- to 12-month items, and that they would have not performed the year 3 part of the assessment correctly. These assumptions should be true for all but a very small number of children with considerably delayed or advanced development. Such children would have relatively inflated or deflated scores, respectively. Similarly, children who did not finish the entire test battery included both delayed and advanced developers.

Potential Confounders or Effect Modifiers

Pregnancy drinking was measured in the same way as postpartum drinking, described above, using data for the first and last trimesters. Postpartum smoking and marijuana use was reported at 8 weeks after delivery; for pregnancy it was reported at 18 weeks' gestation. These variables were expressed as yes/no in the analysis. Other drugs of abuse were reported too infrequently to be useful. For the same periods, caffeine from all sources (coffee, tea, colas) was estimated from a structured protocol that used British caffeine concentrations in these items. High caffeine intake in postpartum or pregnancy was the equivalent of 2 or more cups of coffee daily, based on information obtained at 8 weeks' postpartum and 18 weeks' gestation. Maternal dietary information was obtained from the 32-week food frequency.[6] Parity was defined as the number of pregnancies of at least 20 weeks' gestation. Employment (any) was ascertained at 32 weeks' gestation, because many women are on leave during the postpartum period. Housing situation (buying, renting, or public) at 8 weeks' gestation was used as a surrogate for current income information, which was not obtained until the second year of the child's life. Marital and cohabitation status were similarly ascertained. All of the above variables have been reportedly related to maternal drinking or to child development in other studies and hence were evaluated as potential confounders of any observed association between drinking during lactation and development at 18 months of age.

Statistical Methods

IAA (infant alcohol exposure via breast milk) and the Griffiths Scales of Mental Development were the primary exposure and outcomes in this work. After adjustment for gender, gestational age at birth, the psychometrist, the Griffiths scores, and the IAA scores, were compared with each of the secondary variables, using analysis of variance (generalized linear models), the Kruskal-Wallis test, and Spearman correlations. If a variable had associations with both IAA and at least 1 Griffith scale that yielded a P value of $\leq .15$ for any statistic, it was considered eligible for inclusion in the regression of IAA on the primary outcome. This procedure was repeated for the infant binge variable.

We also compared IAA in the highest and lowest quartile for each of the adjusted Griffiths scales, ran duplicate analyses on

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exclusive breastfeeders and also on partial breastfeeders, and finally searched for possible interactions between IAA and the Griffiths scales by breastfeeding status.

Throughout the analysis, data were transformed if needed and outliers examined. A statistically significant result means that the related statistic has a P value of $\leq .05$.

RESULTS

Maternal characteristics of the sample are shown in Table 1. In general, the mothers were well-educated, with more than 40% completing college preparatory or receiving their degree. Based on the usual indicators, the sample was low-risk, with <10% at extreme ages or high parities, of nonwhite race, and living in public housing.

The usual drinking patterns in the sample (Table 2) showed only 5% having 2 or more drinks a day during the postpartum period, on the average (average daily alcohol use ≥1.0). During pregnancy, 2% or less drank at this level. Binges in the postpartum period were reported by 37% of all women, up from 14% to 15% during pregnancy (data not shown).

Eighty percent of the mothers in the sample breastfed at some time during the first 3 months after delivery (Table 3). Nearly 60% provided at least half of the infant's nourishment from breast milk, and nearly half of these (29% of the sample) were exclusive breastfeeders.

All the Griffiths scores except Locomotor Development increased significantly with increasing education. Virtually every secondary variable, including the pregnancy drinking indicators, was significantly related to the scores of at least 1 scale. However, among the variables of Tables 1 through 3, only education, maternal age, marijuana use postpartum, and high caffeine intake during pregnancy showed sufficient relation to IAA to be classified as a potential confounder. Eight nutrients (thiamin, niacin, B6, C, folate, magnesium, soluble fiber, and total iron) also met the requirement for both associations, with (Spearman) correlation coefficients of ≤0.2 for IAA and ≤0.1 for the developmental scales (data not shown). Each Griffiths scale was thus adjusted for the specific variables meeting the criteria for potential confounding of the given association.

The means of the Griffith scores adjusted for the appropriate secondary variables were computed across categories of IAA and infant binge exposure (Table 4). Three scales showed a significant association with IAA, but the scores tended to rise with increasing IAA. For all scales with the exception of hand-eye coordination and hearing and speech, infants with the highest alcohol exposure via breast milk had the highest Griffiths scores after adjustment for education and other associated variables. An abstainer effect,[9] with nondrinkers having the lowest mean scores, was apparent in all but 2 of the scales, accentuating the rise with increasing alcohol exposure. Aside from the abstainers, the difference in the scores across categories was at most 4 points in all of the scales. When infant exposure via binge was the independent variable, only the GQ (average) showed

TABLE 1. Unadjusted Griffith Scores by Maternal Characteristics ($N = 915$)

Characteristics (N Valid Values; Percentage in Each Category Shown)	Average of All Scales	Hand-Eye Coordination	Hearing and Speech	Locomotor Scale	Social/Personal	Performance
Maternal education (906)						
No qualifications or vocational school (21.4%)	106.0***	104.9**	96.1***	113.2	103.9***	111.8***
O level ("secondary school" completed) (36.1%)	108.0	107.1	100.2	112.4	106.7	113.5
A level (college preparatory completed) (27.2%)	108.5	107.1	101.6	112.0	106.7	115.0
College degree (15.3%)	110.3	108.3	105.3	112.6	107.8	117.3
Maternal age (915)						
Under 20 (2.3%)	104.6	104.5	94.2	112.4	100.0*	112.1
20–29 (51.0%)	108.1	106.7	100.6	112.6	106.4	113.8
30–39 (45.1%)	108.2	107.0	100.6	112.4	106.4	114.6
40 or more (1.5%)	106.1	104.6	97.9	108.5	103.4	115.6
Parity (905)						
1 (45.9%)	108.7***	106.4	103.0***	112.6	107.1***	114.0
2–3 (48.7%)	107.9	107.4	98.8	112.5	105.9	114.7
4 or more (5.4%)	104.2	104.3	92.9	110.0	101.9	111.5
Ethnicity (896)						
White (97.7%)	108.0	106.7	100.4	112.3*	106.2	114.1
Nonwhite (2.3%)	110.7	108.6	102.1	116.9	109.7	116.1
Married (905)						
Yes (83.5%)	108.3*	106.8	100.8	112.6	106.5*	114.5*
No (16.5%)	106.7	106.5	98.4	111.6	104.5	112.4
Employed (797)						
Yes (50.1%)	108.6*	106.5	101.8*	112.7	106.9*	115.0*
No (49.9%)	107.5	106.9	99.1	112.2	105.5	113.3
Housing situation (909)						
Owned/mortgaged (83.3%)	108.3*	107.0	101.1**	112.4	106.6*	114.5
Public housing (9.2%)	106.6	106.1	96.2	112.7	105.1	112.3
Rented/other (7.5%)	106.4	104.9	98.5	112.7	103.9	111.9
All infants (915)	108.0	106.8	100.4	112.4	106.2	114.2

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$ for significance of P value for the variable in generalized linear models analysis.

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TABLE 2. Unadjusted Griffith Scores by Maternal Alcohol and Other Drug Use (N = 915)

Characteristics (N Valid Values; Percentage in Each Category Shown)	Average of All Scales	Hand-Eye Coordination	Hearing and Speech	Locomotor Scale	Social/ Personal	Performance
Alcohol use[a]						
Average daily alcohol use postpartum (oz ethanol) (915)						
None (16.6%)	107.3	107.5	96.0***	112.4	105.1*	115.0
>0 but <0.1 (29.0%)	107.6	106.3	99.9	112.1	106.0	113.7
0.1–0.4 (39.6%)	108.8	107.0	102.7	112.9	107.3	114.1
0.5–0.9 (9.7)	107.6	106.7	100.9	111.3	104.3	114.8
1.0-or more (5.1%)	107.3	104.9	98.8	113.3	106.2	113.3
Binges postpartum (days in previous month) (915)						
None (62.6%)	107.8	106.6	100.0	111.9*	106.1	114.3
1–2 days (22.3%)	108.9	107.5	101.7	114.0	107.2	114.0
3–4 days (11.6%)	108.2	106.5	101.5	112.6	105.7	114.6
5 or more (3.5%)	106.9	106.0	98.7	111.9	104.9	113.0
Average daily alcohol use, early pregnancy (oz ethanol) (887)						
None (41.0%)	108.5	107.5	100.4	112.5	106.7	115.3*
>0 but <0.1 (34.3%)	107.1	105.7	99.5	111.7	105.8	112.8
0.1–0.4 (19.5%)	109.0	107.1	103.1	113.7	106.3	114.5
0.5–0.9 (3.2%)	107.4	107.4	98.3	111.1	106.6	113.3
1.0 or more (2.0%)	107.2	106.4	98.4	113.3	105.9	111.7
Average daily alcohol use, late pregnancy (oz ethanol) (887)						
None (43.1%)	107.8	106.6	98.9*	112.5	106.1	114.7
>0 but <0.1 (31.1%)	108.6	106.9	102.6	112.1	107.0	114.1
0.1–0.4 (20.1%)	107.7	106.3	101.0	112.1	105.3	113.8
0.5–0.9 (4.1%)	108.4	108.9	99.7	114.0	107.4	111.8
1.0-or more (1.7%)	108.3	108.3	97.5	116.4	105.0	114.1
Other drug use						
Smoker postpartum (909)						
Yes (15.2%)	107.4	106.7	98.4	113.8*	105.6*	111.9
No (84.8%)	108.1	106.8	100.8	112.1	106.3	114.6
Smoker during pregnancy (911)						
Yes (11.9%)	107.0	107.3	97.7*	112.7	105.5	111.8*
No (88.1%)	108.2	106.7	100.8	112.4	106.3	114.5
Regular caffeine use postpartum (816)						
Yes (63.5%)	108.0	107.2	100.1	112.4	106.1	114.3
No (36.5%)	108.1	106.3	100.7	112.4	106.7	114.3
Regular caffeine use during pregnancy (908)						
Yes (53.0%)	107.3**	106.3	99.7	111.5***	105.3**	113.6
No (47.0%)	108.8	107.3	101.2	113.5	107.3	114.7
Marijuana use postpartum (870)						
Yes (1.4%)	104.8	108.9	95.6	111.2	98.9**	109.1
No (98.6%)	108.1	106.7	100.6	112.5	106.3	114.2
Marijuana use during pregnancy (880)						
Yes (1.4%)	109.4	109.6	99.6	114.2	105.7	117.4
No (98.6%)	108.0	106.7	100.5	112.5	106.3	114.2
All infants (915)	108.0	106.8	100.4	112.4	106.2	114.2

[a] Usual alcohol use is presented in average ounces of ethanol consumed per day. One standard size drink of any alcoholic beverage contains about 0.5 fl oz of ethanol.
* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$ for significance of F value for the variable in generalized linear models analysis.

an association, and that also was for higher scores with higher binging frequency.

The results were similar when we restricted to exclusive breastfeeders, partial breast feeders, considered interaction by breastfeeding status, and compared the exposure of infants having the lowest and highest Griffiths scores.

When the sample was compared with the Children in Focus participants who were not included, there were significantly more nonwhite, unmarried mothers who lived in public housing or smoked among the nonparticipants. The differences between the groups ranged from 4 percentage points for being nonwhite to 15 points for living in public housing.

DISCUSSION

We did not replicate the findings of the original lactation study showing that infant motor development was adversely associated by infant exposure to alcohol via breast milk. Instead, several facets of development were weakly but positively related to maternal drinking during lactation.

What could account for this difference? There were fewer high infant alcohol scores in the present study ($N = 17 \geq 1.0$) than in the original study ($N = 30 \geq 1.0$). However, in the original study, the decrease in PDI scores began at an IAA of 0.5 and dropped nearly a standard deviation as IAA rose. In the ALSPAC sample, there was a statistically significant

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TABLE 3. Unadjusted Griffith Scores by Proportion of Breast Milk Provided, First 3 Months (N = 915)

Characteristics (N Valid Values; Percentage in Each Category Shown)	Average of All Scales	Hand-Eye Coordination	Hearing and Speech	Locomotor Scale	Social/ Personal	Performance
Proportion of diet provided by breast milk first 3 mo (915)						
Exclusive bottle-feeding (19.8%)	105.8***	105.4	96.9**	111.2	103.3***	112.0*
Some breast, but under 50% (19.5%)	108.0	106.7	99.8	112.3	106.7	114.5
50% or more, but not exclusive breastfeeding (31.9%)	108.7	107.5	101.8	113.0	107.0	114.2
Exclusive breastfeeding (28.9%)	108.8	106.9	101.7	112.7	107.0	115.4
All infants (915)	108.0	106.8	100.4	112.4	106.2	114.2

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$ for significance of F value for the variable in generalized linear models analysis.

TABLE 4. Adjusted Griffith Scores by Infant Alcohol Exposure[a] (N = 915)[b]

	Average of All Scales	Hand-Eye Coordination	Hearing and Speech	Locomotor Scale	Social/ Personal	Performance
Estimated infant exposure to alcohol in breast milk (oz/d) (N in group)[c]						
None (295)	107.3	106.7	98.3**	111.9	103.0*	114.2*
>0 but <0.1 (295)	108.1	106.6	100.4	112.7	104.5	114.1
0.1–0.4 (257)	108.9	107.2	102.9	112.9	105.2	114.1
0.5–0.9 (51)	108.2	106.7	102.0	111.9	104.1	114.5
1.0 or more (17)	109.8	105.3	100.6	115.8	108.7	115.2
Estimated infant alcohol exposure via binge (binges per month) (N in group)[c]						
0 (656)	107.7*	106.6	99.9	112.1	103.7	114.0
<0.5 (60)	108.9	105.6	101.9	114.2	105.6	113.1
0.5–0.9 (81)	108.4	107.6	101.4	113.2	104.3	113.4
1.0–1.9 (74)	110.7	108.6	103.8	114.6	106.8	117.2
2.0+ (44)	108.1	106.2	101.0	111.8	105.1	113.7

[a] Variables considered in the adjustment include all those in Tables 1 to 3. Only variables related to both infant alcohol and at least 1 Griffiths score were entered into the regression analysis.
[b] Because of missing values in the variables used for adjustment, N varies in each scale.
[c] Infant alcohol exposure is the absolute alcohol content of maternal alcohol intake on an average day multiplied by the proportion of breast milk in the infant's diet. For example, an exclusively breastfed infant would have a score of 1.0 if the mother drank an average of 1.0 fl oz ethanol (about 2 drinks) daily. This estimator includes the ethanol in binges. Infant alcohol exposure via binge is the product of the number of binges in the previous month and the proportion of breast milk in the diet. For example, a value of 1.0 would occur when the exclusively breastfed infant was exposed to 1 maternal binge a month in the study period; it could also occur when the infant who received 50% breast milk was exposed to 2 maternal binges a month in the study period.
* $P \leq .05$; ** $P \leq .01$ for significance of F value for the variable in generalized linear models analysis.

increase in 3 of the 5 scales and the GQ, with the remaining 2 scales dropping <1/5 of a standard deviation in the upper categories of IAA. These discrepant results do not appear to reflect a lack of power to detect true differences.

Differences in demographics, diet, and lifestyle of the 2 samples existed. There were no major discrepancies in usual alcohol use or binging, but there may have been unmeasured differences, such as the time of day the drinking occurred in relation to the feed. The mothers in the original study were twice as likely to smoke and 14 times more likely to use marijuana; they were also twice as likely to be nonwhite, although percentages of nonwhites in both samples are small. These characteristics are usually related to higher risk outcomes. On the other hand, we cannot say exactly how they could be responsible for the discrepant results, for no maternal characteristic but age was related to the Bayley scores in the original study, and the variables were taken into account in the present study.

The tests that measured development in the 2 investigations are widely used as measures of general development, and the discrepant results are unlikely to be attributable to different test sensitivities or precision. However, the age at testing may be an important factor. To our knowledge, there are no reports of developmental deficits at 18 months associated with moderate alcohol use during *pregnancy*. For example, a study of 592 18-month-old infants in Europe saw no effect of moderate drinking, using the Bayley scales.[10] In Sweden, Larsson and colleagues[11] examined children aged 18 to 27 months whose mothers drank excessively before first prenatal visit; their Griffiths scores were not significantly different from those of a control group, although the authors noted that many were retarded in speech. A longitudinal study of 500 children in Seattle found prenatal alcohol deficits at birth, 8 months, and 4, 7, 11, and 14 years[12] but no effects in these children at 18 months[13]; presumably the continuing deficits could not be picked up by the 18-month instruments.

The brain is developing rapidly in late gestation and on into the postpartum period, and could well be vulnerable to toxic exposures throughout this growth spurt. However, the proportion of a given dose of alcohol that reaches the infant during lactation is much smaller than the proportion that reaches the fetus in late pregnancy.[14] Thus, in this study, we are probably attempting to detect a smaller effect on

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development than one would find with comparable drinking during pregnancy. Perhaps our failure to detect a relationship reflects the smaller effect of lactational exposure as well as the age at which the child was tested.

Streissguth and colleagues[15(pp105–107)] have written that "mild effects on behavior that represent the effects of alcohol at low doses cannot easily be observed in the infant or toddler as a passive responder to stimuli, but go best with the active cooperation of the subject in the cognitive component of tests at pre-school age and beyond. . . *There is no gold standard for measuring alcohol-induced brain damage* across the first 7 years of human life; rather the presence of alcohol damage is a truly latent variable, one developed more and more clearly by longer and longer series of outcomes, studied more and more patiently" (italics theirs). If alcohol exposure via breast milk is consistent with this model, only additional work will clarify which study, if either, is an artifact and support 1 hypothesis over another regarding the safety of drinking during lactation.

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