Predictors of Postpartum Change in Alcohol Use in Norwegian Mothers

SONJA MELLINGEN, PH.D., FELLOW,^{a,*} TORBJØRN TORSHEIM, PH.D.,^b & FRODE THUEN, PH.D.^c

^aCompetence Centre, Bergenclinics Foundation, Bergen, Norway

^bDepartment of Psychosocial Science, Faculty of Psychology, University of Bergen, Bergen, Norway

^cCentre for Evidence-Based Practice, Bergen University College, Bergen, Norway

ABSTRACT. Objective: This study examined the relationship between marital status, family size, and postpartum alcohol use from birth to 36 months postpartum, based on data from the Norwegian Mother and Child Cohort Study. **Method:** Mothers' self-reported alcohol frequency and alcohol units per drinking occasion at 0–3 months, 4–6 months, 18 months, and 36 months postpartum were modeled using linear mixed models for repeated measures. **Results:** There was a strong main effect of time on alcohol use, with increases in alcohol use from childbirth to 36 months after childbirth. Adjusting for covariates, there were three-

way interaction effects for Time $\times$ Family Structure $\times$ Family Size for alcohol units and alcohol frequency, indicating that a change in alcohol use varied as a function of family structure and family size. Single mothers had a lower increase in frequency of alcohol use but a steeper increase in the number of alcohol units. However, this effect was less pronounced with increasing family size. **Conclusions:** The patterns of findings are consistent with a differential opportunity perspective on alcohol use. (*J. Stud. Alcohol Drugs*, 76, 559–568, 2015)

WOMEN USUALLY REDUCE OR STOP ALCOHOL consumption during pregnancy. In a recent Norwegian study, 90% of first-time mothers reported being abstainers, whereas most others were drinking very little at about 17 weeks of gestation (Mellingen et al., 2013). Similar findings have been reported in a number of studies from various countries (for a review, see Skagerström & Nilsen, 2012). Much less emphasis and research have focused on mothers' postpartum drinking (Fried et al., 1985; Gilchrist et al., 1996; Jagodzinski & Fleming, 2007; Laborde & Mair, 2012). Between 38% and 49% of mothers report any alcohol use within the first year after giving birth (Jagodzinski & Fleming, 2007; Laborde & Mair, 2012; Maloney et al., 2010), whereas 6% report at least one heavy drinking episode during the last month (Laborde & Mair, 2012). These studies indicate that a significant proportion of mothers resume drinking patterns within the first year postpartum, but there are several knowledge gaps about the timing and shape of the drinking trajectories. The majority of studies on postpartum alcohol use have compared women's drinking level at various times during pregnancy and in the first 10–12 months after birth, using a cross-sectional design (e.g., Ja-

godzinski & Fleming, 2007; Laborde & Mair, 2012; Maloney et al., 2010). Studies of individual changes in drinking patterns throughout this transition phase and beyond the first year after birth are scarce. The present study focuses on the extent to which mothers resume drinking during the first 3 years after giving birth, the speed and timing of their resumption of previous drinking behavior, and family characteristics (size and structure) associated with their alcohol use during this period.

Knowledge about postpartum drinking trajectories may be particularly valuable in efforts to prevent excessive alcohol use and alcohol problems among women. First, the longer the reduced drinking period lasts, the more opportunities there will be to prevent resumption of any high-risk drinking behavior. If mothers start to increase their drinking shortly after the child is born, the preventive potential may be much more limited than if they wait a year or two, or longer, before they resume their previous alcohol use. Second, mothers following a fast track toward previous drinking levels may be a high-risk group (Jagodzinski & Fleming, 2007). Knowledge about characteristics associated with drinking behavior in the time following pregnancy could therefore be used to identify special target groups for preventive measures and to develop preventive strategies tailored to the target groups (Fried et al., 1985).

In this study, we examined the importance of two family characteristics: family size and parental marital status. Existing theoretical perspectives have different predictions about the potential role of family size and parental marital status. Becoming a mother for the first time implies that a woman will take on a new social role. According to classical role theory (Hajema & Knibbe, 1998; Knibbe et al., 1987), holding multiple social roles may have various effects. First,

Received: August 22, 2014. Revision: February 23, 2015.

The Norwegian Mother and Child Cohort Study is supported by the Norwegian Ministry of Health and the Ministry of Education and Research, National Institute of Environmental Health Sciences Contract No. N01-ES-75558, and National Institute of Neurological Disorders and Stroke Grants U01 NS 047537-01 and U01 NS 047537-06A1. The authors are grateful to all the participating families in Norway who take part in this ongoing cohort study.

*Correspondence may be sent to Sonja Mellingen at the Competence Centre, Bergenclinics Foundation, Vestre Torggt. 11, 5015 Bergen, Norway, or via email: sonja.mellingen@bergenclinics.no.

it may be gratifying and therefore have beneficial health effects. Applied to alcohol use particularly among women it suggests that the greater the number of social roles a woman holds, the greater her well-being will be, and the lesser she will need to drink excessively in order to relieve stress (Cho & Crittenden, 2006; Hibbard & Pope, 1987). Multiple roles also involve a high level of monitoring and social control that might inhibit heavy drinking (Hajema & Knibbe, 1998; Kuntsche et al., 2009). A second approach suggests that multiple roles may increase the probability of running out of time and resources and experiencing competing role expectations (Cho & Crittenden, 2006). According to this role-overload perspective, multiple roles may be more stressful than gratifying to women and therefore make them more prone to excessive alcohol use. A third approach, the opportunity perspective, holds that various social roles give different opportunities to engage in social activities that typically involve alcohol use and that drinking patterns are explained more by the opportunity to drink than by the level of stress or well-being (Cho & Crittenden, 2006). Thus, being the mother of a small child may restrict a woman's opportunities to go out for dinner or a party or to take part in other social activities in which she could drink excessively (Paradis, 2011).

Studies applying social role theory to women's drinking generally have not differentiated between first-time mothers and experienced mothers, even though it is only when becoming a mother for first time that women take up a new social role. On one hand, one can argue that the role demands of motherhood increase with the number of children. From a role-overload perspective, one may expect an association between the number of children and alcohol use among mothers. Also, from an opportunity perspective, one may argue that the more children a mother has, the less opportunity she will have to participate in social activities involving drinking. On the other hand, if a mother has two or more children and there is a sufficient span of time between them, the oldest child might be old enough to babysit the younger brothers or sisters or to play together, thus relieving some of the mother's role demand and maybe even making it easier for her to go out and drink.

Few studies have investigated the relationship between alcohol use and the number of children. A study from Switzerland found a positive correlation, but only for mothers performing paid work (Kuntsche et al., 2012). A cross-sectional study reported lower alcohol consumption among first-time parents as opposed to families with previous children (Laborde & Mair, 2012). Other studies have been inconclusive about the role of family size. A prospective study from the United States found that the number of children was not predictive of subsequent alcohol and other drug dependence (Swendsen et al., 2009). Similarly, Jagodzinski and Fleming (2007) reported no effects of family size on postpartum risky drinking. Thus, the evidence of any effects of the number of children on mothers' drinking during the

postpartum period is ambiguous; therefore, more knowledge is needed.

Regarding any effect of marital status on alcohol consumption, several studies have indicated that marriage seems to protect against excessive drinking (Bachman et al., 1997; Bogart et al., 2005; Oesterle et al., 2011), although this is not always the case. In a study of French women, those who were married had higher alcohol consumption than those who were single (Zins et al., 2003), which may suggest that there could be cultural differences when it comes to the role of married women. However, the relatively low levels of alcohol use among married individuals compared with single individuals observed in most studies might be explained by various changes in values and lifestyle related to the role of married or cohabitating women. For example, interdependent and socially positive values tend to replace more individualistic values, and social networks tend to be reorganized in such a way that the partners get more involved with each other's extended families and friends (Leonard & Homish, 2008). These changes may be indicative of married mothers experiencing more barriers to excessive drinking. Any "marriage effect" may not apply to cohabitants because a number of studies across different countries have revealed that cohabitation is associated with a higher risk of heavy drinking, as compared with marriage (Li et al., 2010; Plant et al., 2008). Wilsnack and Wilsnack (1991) found that women who started cohabitating increased their drinking compared with other unmarried women and married women.

Studies report less alcohol use among married mothers (Cho & Crittenden, 2006; Leonard & Rothbard, 1999; Paradis et al., 2011). Focusing on the first years postpartum, Parackal and colleagues (2007) found no difference in alcohol consumption among married and unmarried individuals. Laborde and Mair (2012) found that married mothers were less likely to drink alcohol during the first year postpartum compared with cohabitating and single mothers. In line with Laborde and Mair (2012), Paradis and colleagues (2011) reported a higher number of alcohol units per drinking occasion among unmarried mothers.

We are not aware of any studies focusing on associations between women's marital status and alcohol use beyond the first year after having a child. However, this is a period of vulnerability in which the risk of excessive alcohol use could either increase because of heightened stress or isolation or decrease because of changing social norms, increased responsibility, and restricted opportunities. Entering this period as a single mother may be particularly challenging; thus, one may expect more drinking among single mothers compared with mothers living in a marriage or cohabitation situation. On one hand, this would be in keeping with studies of parenthood in general, indicating that single mothers drink relatively more alcohol than mothers living in couple relationships (Maloney et al., 2010). On the other hand, single mothers with small children may generally have less

opportunity to engage in social activities involving alcohol use, which could indicate that they consume less alcohol than mothers living in a stable couple relationship. Moreover, based on findings from other studies (Cho & Crittenden, 2006; Leonard & Rothbard, 1999; Paradis, 2011), we would expect that cohabitant mothers resume their drinking at a faster pace than their married counterparts.

The current study examined two research questions: First, to what extent do mothers change their alcohol consumption as a function of time from the child's birth to 36 months postpartum? Second, do the number of children and mothers' marital status moderate postpartum alcohol use trajectories?

Method

Procedures and design

The Norwegian Mother and Child Cohort Study (MoBa; Magnus et al., 2006) is a prospective, population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health (www.fhi.no/morogbarn). Participants were recruited from all over Norway from 1999 to 2008. Recruitment was performed in connection with a routine ultrasound examination that was offered to all pregnant women in Norway at 17–18 weeks of gestation, and 40.6% of the women consented to participate. The invitation to undergo ultrasound was based on a pregnancy validation performed by a physician. The cohort now includes 114,500 children, 95,200 mothers, and 75,200 fathers. All pregnant women in Norway were invited to participate, provided they could read Norwegian. Prevalence estimates of exposure and outcomes have been tested. No estimates were biased because of self-selection in these previous analyses (Nilsen et al., 2009).

MoBa has obtained a license from the Norwegian Data Protection Authority. The current study is based on Version 6 of the quality-assured data files released for research on April 22, 2011, including 101,111 pregnancies. Informed consent was obtained from each MoBa participant at recruitment. The Regional Committee for Medical Research Ethics approved the study.

The data were collected by means of self-administered questionnaires, received by mail at home, and delivered at eight time waves from approximately 17 weeks of gestation (Q1) to when the child was 7 years old (Q8). In the present study, we used data from the first wave (Q1, 17 weeks of gestation), fourth wave (Q4, 4–6 months after child's birth), fifth wave (Q5, 18 months after child's birth), and sixth wave (Q6, 36 months after child's birth).

Participants

The present study includes mothers participating in the MoBa study for the first time (82,362 pregnancies). To avoid

pseudo-replication, multi-time participating mothers were included with only their first participating pregnancy. For the purposes of the current study, inclusion criteria consisted of the following: (a) that mothers had indicated their status as either married ($n = 34,516$), cohabitating ($n = 40,824$), or single ($n = 1,797$) and (b) that they were alcohol users. Thus, the available sample was 77,137. Mother's mean age was 29.6 years ($SD = 4.61$).

Measures and variables

Alcohol consumption was measured at 17 weeks of gestation, with questions about current drinking and drinking 3 months before pregnancy, and again after birth at 6, 18, and 36 months. At Q4 (6 months postpartum), there were questions about drinking when the child was 0–3 and 4–6 months old. Alcohol consumption was measured according to monthly frequency and the number of alcohol units per drinking occasion.

Alcohol frequency was measured with the question "How often did you consume alcohol in the 3 months before you became pregnant, and how often do you consume alcohol now?" The response categories were (1) *approximately 6–7 times a week*, (2) *approximately 4–5 times a week*, (3) *approximately 2–3 times a week*, (4) *approximately once a week*, (5) *approximately 1–3 times a month*, (6) *less than once a month*, and (7) *never*. The same question was repeated at each of the time points but with retrospective reports at 17 weeks of gestation (Q1) and 6 months after birth (Q4).

Amount of drinking was measured in alcohol units, wherein 1 unit was equivalent to 150 ml of pure alcohol (1 bottle of alcopop/cider, 1 glass of beer [1/3 liter], 1 wine glass of red wine or white wine, 1 sherry glass of sherry or other fortified wine, and 1 glass with a single measure of distilled spirits). In Q1, this was measured as, "How many alcohol units did you normally drink when you consumed alcohol in the 3 months before you became pregnant, and how many do you consume now?" In Q4, the response categories were *10 or more*, *7–9*, *5–6*, *3–4*, *1–2*, and *less than 1*. At Q5 (18 months) and Q6 (36 months), the last two time points, the alcohol units were reported for weekdays and weekends as "How many units do you normally drink when you consume alcohol? (Enter a cross for both weekends and weekdays)." The current study used reports from weekends, which is typically when Norwegians consume their alcohol (Rossow, 1996). In the analysis, all item values were recoded to reflect the continuous underlying metric (*1–2 units* coded as 1.5, *3–4 units* coded as 3.5, *5–6 units* coded as 5.5, *7–9 units* coded as 8, and *10 or more units* coded as 10).

Marital status was based on mother reports. Three groups were compared: married mothers, cohabitating mothers, and single mothers. Family size was measured by the number of children in the family. We compared first-child families with second-child families and third-or-more child families.

TABLE 1. Characteristics of the sample

Variable	<i>n</i>	<i>M (SD)</i> or %
Marital status		
Married	34,516	44.7%
Cohabiting	40,824	52.9%
Single	1,797	2.3%
Family size		
First child	42,918	55.6%
Second child	22,567	29.3%
Third or more child	11,652	15.1%
Education		
Compulsory	1,981	2.7%
Lower secondary school	3,703	5.1%
Vocational school	9,792	13.4%
Upper high school	10,995	15.0%
Three-year college	29,685	40.6%
Master's degree	16,971	23.2%
System missing	4,010	
Breastfeeding		
No	13,319	20.3%
Yes	52,133	79.7%
System missing	11,685	
Age	77,135	29.61 (4.61)
Alcohol frequency per week		
Before pregnancy	76,840	0.71 (0.77)
During pregnancy	69,534	0.05 (0.17)
Typical units of alcohol		
Before pregnancy	74,248	3.21 (2.14)
During pregnancy	50,873	0.56 (0.41)

Statistical procedure

All statistical procedures were conducted in R language using the lmerTest (Kuznetsova et al., 2014) and lme4 (Bates et al., 2014) packages. Alcohol consumption patterns were modeled as the dependent variables across four time points postpartum, with Time 1 at 3 months after birth (measured retrospectively at Q4), Time 2 at 4–6 months after birth (Q4), Time 3 at 18 months after birth (Q5), and Time 4 at 36 months after childbirth (Q6). When evaluating mothers' pre-pregnancy and in-pregnancy alcohol use, we included as control variables age, level of education (all measured at Q1), and breastfeeding (measured at Q4).

Missing data on dependent variables (y-variables) was estimated with the direct likelihood method, based on a missing at random (MAR) assumption. The MAR assumption

implies that the missing data mechanism, conditional on observed variables, is unrelated to unobserved variables. The number of missing values differed across analysis, depending on the number of observed covariates. Cases with missing information on any exogenous observed indicators (x-variables) (education, age, breastfeeding, pre-pregnancy alcohol use, and in-pregnancy alcohol use) were excluded from the analysis. Thus, analysis including observed covariates was based on a smaller effective sample than analysis without such covariates.

Results

Descriptive statistics

Table 1 shows sample characteristics. The sample consisted of 55.6% first-time mothers, 29.3% mothers who had one child before, and 15.1% mothers who had two or more children before. Mothers' education was relatively high, with almost 64% having a bachelor's degree or higher. Mothers' mean reported drinking was about 0.71 times per week before pregnancy and 0.05 times per week in pregnancy. The typical number of units consumed was 3.21 before pregnancy and 0.56 in pregnancy. As measured 4–6 months after childbirth, 79.7% of the mothers were breastfeeding their children.

Univariate missing statistics (Table 2) showed that 13.7% were missing on Q4 (4–6 months), 34.0% were missing on Q5 (18 months), and 48.5% were missing on Q6 (36 months). To examine whether missing was monotone, multivariate missing patterns across time were analyzed. Of the original sample of 77,137 participants at Q1, 46.2% of the respondents were present on all measurement occasions; 17.4% were missing on Q6 only; 19% were missing on Q5 and Q6; and 11% were missing on Q4, Q5, and Q6. Non-monotone missing was observed for 6.4% of the material.

To examine selection effects of missing, groups with different missing status were compared on baseline characteristics measured at Q1. Missing status was related to marital status, $\chi^2(10) = 365.82, p < .001$; family size, $\chi^2(10) = 441.18, p < .001$; education, $\chi^2(25) = 1,234.02, p < .001$; age, $F(5, 77134) = 31.95, p < .001, \eta = .045$; pre-pregnancy alcohol frequency, $F(5, 76834) = 18.26, p < .001, \eta = .034$; and alcohol frequency in the first trimester of pregnancy, $F(5, 69528) = 15.54, p < .001, \eta = .033$. The observed missing pattern is not consistent with the missing completely at random assumption but is consistent with an MAR assumption; that is, conditional on the observed baseline characteristics, missing is random. To achieve conditional estimates, the observed variables that predict missing values were included in the linear mixed model of postpartum alcohol use.

Table 3 shows the level of alcohol frequency per month and the typical number of alcohol units. The level and variation in alcohol use differed sharply across measurements;

TABLE 2. Univariate and multivariate attrition patterns

Variable	<i>n</i>	%
No missing	35,806	46.4
Univariate		
Missing Q4	10,559	13.7
Missing Q5	26,226	34.0
Missing Q6	37,449	48.5
Multivariate		
Nonmonotone	4,967	6.4
Q4–Q6 missing	8,370	10.9
Q5–Q6 missing	14,588	18.9
Q6 missing	13,406	17.4
Total	77,137	100.0

TABLE 3. Correlation and descriptive statistics for postpartum alcohol drinking reports

	1.	2.	3.	4.	5.	6.	7.	<i>M</i>	<i>SD</i>
1. Alcohol frequency 0–3 months								0.20	0.37
2. Alcohol frequency 4–6 months	.707**							0.41	0.55
3. Alcohol frequency 18 months	.458**	.562**						0.54	0.72
4. Alcohol frequency 36 months	.490**	.585**	.630**					0.63	0.77
5. Typical units 0–3 months	.278**	.152**	.073**	.087**				1.13	1.14
6. Typical units 4–6 months	.124**	.128**	.029**	.043**	.629**			1.83	1.61
7. Typical units 18 months	.024**	.018**	-.01	-.01	.350**	.506**		2.56	1.87
8. Typical units 36 months	.022**	.012*	-.01	-.00	.339**	.481**	.630**	2.59	1.89

* $p < .05$; ** $p < .01$.

frequency ranged from 0.20 per week at 3 months to 0.63 at 36 months after birth. Similarly, the mean number of alcohol units was 1.13 per drinking occasion for 3 months but 2.59 units per drinking occasion 36 months after birth. As demonstrated by the correlation matrix, the correlations between time points were moderate to strong, ranging from .34 to .70. The correlation between typical number of units and frequency was weak for all measurements, indicating that how often the mothers drank was almost unrelated to how much they typically consumed when they did drink.

Table 4 shows the cross-tabulation of postbirth timing of first alcohol drinking episodes, family status, family size, and pre-pregnancy drinking status. As many as 44.6% of mothers had been drinking alcohol by 3 months after birth, another 26.8% by 4–6 months, another 18.6% by 18 months, and another 4.8% by 36 months after birth. About 5% were still abstaining from drinking alcohol 36 months after birth. Cross-tabulation revealed small differences in Timing of Drinking Alcohol $\times$ Time $\times$ Couple Status and Number of Children but revealed strong links to pre-pregnancy drinking pattern. Among those who were drinking more than once a week before pregnancy, 81.2% had been drinking alcohol by 3 months after birth, and another 15.1% had been drinking

alcohol by 4–6 months. At 36 months, 0.3% of pre-pregnancy frequent drinkers had not been drinking.

Pre-birth influence on mother's postbirth alcohol use

Linear mixed models showed that the trend in drinking patterns was dependent on the alcohol use patterns before pregnancy, as indicated by significant pre-pregnancy Drinking $\times$ Time effect on postpartum drinking for alcohol frequency, $F(18, 191726) = 771.9, p < .001$, and for alcohol units per drinking occasion, $F(15, 167560) = 780.1, p < .001$. There was also a statistically significant in-pregnancy Drinking $\times$ Time interaction for alcohol frequency, $F(12, 171334) = 121.57, p < .001$, and alcohol units per drinking occasion, $F(9, 167095) = 1191.5, p < .001$. Figure 1 shows that mothers with a high alcohol frequency and alcohol units before becoming pregnant had a higher initial level 3 months after birth and a higher increase in the following months.

Family structure, family size, and postpartum alcohol use

To examine whether postpartum alcohol use differed according to family structure, a linear mixed model was used,

TABLE 4. Period at first drink postpartum by family size, marital status, and pre-pregnancy alcohol use

Independent factor	First reported drinking postpartum				
	0–3 months	4–6 months	7–18 months	19–36 months	Never drank
Marital status					
Married ($n = 15,525$)	45.6% _a	24.9% _a	18.7% _a	4.7% _a	6.2% _a
Cohabiting ($n = 16,562$)	44.4% _b	28.5% _b	18.1% _a	4.8% _a	4.1% _b
Single ($n = 579$)	41.8% _{a,b}	27.3% _{a,b}	19.5% _a	4.0% _a	7.4% _a
Family size					
First child ($n = 18,722$)	44.2% _a	28.7% _a	15.9% _a	5.6% _a	5.7% _a
Second child ($n = 9,349$)	46.8% _b	24.6% _b	21.2% _b	3.5% _b	3.9% _b
Third child or more ($n = 4,595$)	44.3% _a	23.3% _b	23.0% _c	3.8% _b	5.5% _a
Pre-pregnancy drinking					
Less than weekly ($n = 23,297$)	33.9% _a	29.1% _a	23.7% _a	6.2% _a	7.1% _a
Weekly ($n = 6,062$)	67.9% _b	23.9% _b	6.6% _b	1.3% _b	0.3% _b
Several times weekly ($n = 3,214$)	81.2% _c	15.1% _c	2.7% _c	0.7% _c	0.3% _b
In-pregnancy drinking					
Less than weekly ($n = 29,920$)	44.3% _a	26.9% _a	18.7% _a	4.9% _a	5.3% _a
Weekly ($n = 222$)	91.4% _b	6.3% _b	1.4% _b	0.9% _b	0.0% _b
Total	44.6%	26.8%	18.6%	4.8%	5.2%

Note: Within each independent factor, numbers with different subscript letters in the column are statistically significant different.

FIGURE 1. Mean frequency and units of alcohol by pre-pregnancy levels; m = month

which included marital status and family size entered as modifiers of the time trend in alcohol use and which was adjusted for breastfeeding, education, and pre-pregnancy alcohol use. We examined two- and three-way interaction effects with time after birth, marital status, and family size as factors.

For alcohol frequency, there were three-way interaction effects between time, family size and marital status, $F(12, 163733) = 5.01, p < .001$. The three-way interaction effects indicated that the impact of marital status on change in alcohol frequency decreased as a function of family size.

For alcohol units, the three-way interaction between time, marital status, and family size on units was statistically significant, $F(12, 112097) = 3.21, p < .01$, indicating that the interaction between time and marital status differed as a function of family size. The upper panel of Figure 2 shows the three-way interaction between marital status, family size, and time. Families consisting of married/cohabitating parents had a higher frequency of postpartum drinking compared with single mothers. The lower panel shows that change in alcohol units differed according to family size and marital status. For first-time mothers, single mothers had the strongest increase in units per drinking occasion.

Discussion

Mothers' alcohol use was strongly related to their drinking patterns before they became pregnant, in terms of frequency of drinking and amount of alcohol intake per drinking occasion. A considerable proportion of the mothers had started to resume their alcohol consumption 3 months postpartum, and the frequency of drinking continued to increase throughout the following months. For experienced mothers, the curve leveled off from 18 months, whereas this was not the case for first-time mothers. Furthermore, single mothers had significantly fewer drinking episodes than mothers in a stable relationship. This difference was particularly evident for mothers having one more child. Finally, married mothers tended to drink more often than cohabitating mothers at 18 and 36 months postpartum.

Alcohol units per drinking occasion increased steadily from 3 to 18 months but leveled off considerably or even decreased somewhat at 36 months postpartum. First-time mothers tended to drink fewer units than experienced mothers. Single mothers without any previous children showed a particularly strong increase throughout the entire period. At 36 months after birth, single mothers reported on average

FIGURE 2. Mean frequency and units of alcohol by family status and family size; m = month

almost one more alcohol unit per occasion compared with other mothers. Married mothers drank fewer alcohol units than cohabiting mothers. This applied to both first-time mothers and experienced mothers.

However, first-time mothers generally resumed their alcohol use at a slower speed and at lower levels than the

experienced mothers. This may suggest that assuming the role of a mother has more impact on alcohol use than just having another child. Because few other studies on alcohol use among mothers have made such a distinction, these findings may add valuable knowledge to our understanding of alcohol use in relation to parenthood.

The most striking finding of this study seems to be the drinking pattern of single mothers compared with mothers living in a stable couple relationship. Single mothers' relatively low frequency of drinking episodes throughout the entire period might reflect fewer opportunities to engage in social activities involving alcohol use. This interpretation corresponds well with the opportunity perspective, suggesting that social roles may promote or inhibit the probability of participating in social settings where people usually drink alcohol (Cho & Crittenden, 2006; Paradis, 2011).

Single mothers with only one child reported significantly more units per drinking occasion. There is no obvious explanation for why these mothers reported considerably more alcohol units compared to single mothers with one more child or even to single mothers with two or more additional children. It might suggest that being a single mother for the first time is especially stressful and that this is reflected in a tendency to drink more when the person has the opportunity to drink in order to relieve stressful feelings. Most other studies of alcohol use involving single mothers have failed to make a distinction between one or more children; thus, the general finding that single mothers tend to drink more alcohol than mothers living in a stable relationship may reflect a tendency notably among first-time mothers not living with the father to drink more than other mothers. Alternatively, because first-time mothers are generally younger than experienced mothers, the observed effect of being a single mother with only one child could be accounted for by any confounding variables related particularly to being a young single mother. For example, they may have more single or childless friends who are drinking heavily, and they may be somewhat more immature or less responsible than more experienced single mothers and therefore drink more when they have the opportunity to drink.

Regarding marital status in general, the findings were somewhat ambiguous: The married mothers drank more frequently than both the single and the cohabitating mothers, yet married mothers drank fewer alcohol units per drinking occasion. This may indicate that Norwegian married mothers have a drinking pattern similar to what is common in typical "wet" drinking cultures, such as France and other Mediterranean countries (Zins et al., 2003), where alcohol is consumed quite often but usually in smaller amounts. Yet, cohabitating mothers and particularly first-time single mothers may seem to have a drinking pattern more in accordance with a "dry" drinking culture, characterized by relatively high alcohol consumption typically restricted to weekends (Rossow, 1996). However, the observed differences were small to moderate, and any distinction between a dry and wet drinking pattern should not be considered categorical but rather as overlapping distributions along a continuum, wherein married mothers seem to be closer to the wet end and cohabitating mothers and first-time single mothers seem to be closer to the dry end.

Some limitations of the study should be considered. Self-selection or loss at follow-up can potentially bias findings in longitudinal designs. Regarding self-selection, the overrepresentation of higher education groups should be commented on, posing a possible threat to the external validity of the findings. Education was only weakly related to drinking, and education was controlled for in all analyses. Thus, it is not likely that education has influenced the findings to any considerable degree. A study of participants of the Norwegian Mother and Child Cohort Study on 23 exposure and outcome variables indicated significant differences between the cohort participants and the total population in 20 of the prevalence estimates. However, no differences were observed between the cohort participants and the total population in any exposure-outcome associations (Nilsen et al., 2009). Therefore, even though the prevalence estimates may be different from what is found in the total population, the estimate of associations and trends can still be valid.

The analysis of loss to follow-up indicated systematic differences at baseline between those who dropped out and those who did not drop out; however, the differences were small and consistent with an MAR mechanism. Because the baseline covariates were included in the prediction models, selective dropout should not bias the obtained estimates, although the loss of cases lowers the precision somewhat compared with a complete sample.

Drinking before pregnancy and at 3 months postpartum was assessed in retrospect, at about 17 weeks of gestation and at 6 months postpartum, respectively. Retrospective reports on these two periods might be influenced by recall bias. However, such biases are usually stronger the further in the past the behavior occurred (Greenfield & Kerr, 2008). In the present study, the recall period was only a few months, making it unlikely that any recall biases had a large effect on their reports. In general, it can be argued that self-reports of alcohol use, particularly among pregnant women or women who recently have given birth, may be unreliable because of the social desirability of reporting low consumption. However, in a survey of pregnant women, self-reported alcohol use did not differ between confidential and anonymous questionnaires, which may indicate that social desirability of reporting low levels of alcohol use did not influence their responses (Alvik et al., 2005). Moreover, self-reports of alcohol use seem to have acceptable reliability and validity in community populations (Del Boca & Darkes, 2003; Dollinger & Malmquist, 2009). In many countries, there are now three sizes of a "glass of wine." In the current study, a glass of wine was defined as 150 ml, which is also the amount of wine generally served in Norwegian bars and restaurants when a person orders a glass of wine.

The exact timing of the pregnancy might be difficult to determine. However, because participants were recruited to the study at a defined stage of pregnancy—that is, after the

pregnancy was confirmed by a physician—it is reasonable to assume that the women were able to assess the reference period of “3 months before pregnancy” quite accurately.

This study provides valuable knowledge about mothers’ drinking behavior during a vulnerable period of life wherein there is little previous information, and the current study’s findings may have important clinical implications. Women who drink heavily before they become pregnant should be targeted for preventive measures during pregnancy because they tend to resume high consumption drinking soon after the child is born. Without any preventive measures, these mothers may develop a drinking pattern that might inflict harm on themselves, their children, or both. Any such measures should be particularly targeted toward single women pregnant for the first time in order to reduce their alcohol consumption per drinking occasion.

The current results can also be contextualized with findings on quality of parenting and early child development. Previous research has indicated that any use of alcohol during the mid-trimester of pregnancy was related to more non-responsive behavior from the mothers toward their infant 12 months after birth (Pearson et al., 2012), and pre-pregnancy drinking level may predict internalizing and externalizing problems in early childhood (Knudsen et al., 2014). We are not aware of studies exploring similar relationships in the postpartum phase, but it has been shown that even subclinical levels of maternal depression may affect early interaction and child development (Skotheim et al., 2013). Future studies should investigate the extent to which mothers’ postpartum alcohol use might affect interaction with the child beyond the first year.

References

- Alvik, A., Haldorsen, T., & Lindemann, R. (2005). Consistency of reported alcohol use by pregnant women: Anonymous versus confidential questionnaires with item nonresponse differences. *Alcoholism: Clinical and Experimental Research*, 29, 1444–1449.
- Bachman, J. G., Wadsworth, K. N., O’Malley, P. M., Johnston, L. D., & Schulenberg, J. E. (1997). *Smoking, drinking, and drug use in young adulthood: The impacts of new freedoms and new responsibilities*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). lme4: Linear mixed-effects models using Eigen and S4, Version 1.1-7. Retrieved from <http://cran.r-project.org/web/packages/lme4/index.html>
- Bogart, L. M., Collins, R. L., Ellickson, P. L., Martino, S. C., & Klein, D. J. (2005). Effects of early and later marriage on women’s alcohol use in young adulthood: A prospective analysis. *Journal of Studies on Alcohol*, 66, 729–737.
- Cho, Y. I., & Crittenden, K. S. (2006). The impact of adult roles on drinking among women in the United States. *Substance Use & Misuse*, 41, 17–34.
- Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction*, 98, Supplement 2, 1–12.
- Dollinger, S. J., & Malmquist, D. (2009). Reliability and validity of single-item self-reports: With special relevance to college students’ alcohol use, religiosity, study, and social life. *Journal of General Psychology*, 136, 231–242.
- Fried, P. A., Barnes, M. V., & Drake, E. R. (1985). Soft drug use after pregnancy compared to use before and during pregnancy. *American Journal of Obstetrics and Gynecology*, 151, 787–792.
- Gilchrist, L. D., Hussey, J. M., Gillmore, M. R., Lohr, M. J., & Morrison, D. M. (1996). Drug use among adolescent mothers: Prepregnancy to 18 months postpartum. *Journal of Adolescent Health*, 19, 337–344.
- Greenfield, T. K., & Kerr, W. C. (2008). Alcohol measurement methodology in epidemiology: Recent advances and opportunities. *Addiction*, 103, 1082–1099.
- Hajema, K. J., & Knibbe, R. A. (1998). Changes in social roles as predictors of changes in drinking behaviour. *Addiction*, 93, 1717–1727.
- Hibbard, J. H., & Pope, C. R. (1987). Employment characteristics and health status among men and women. *Women & Health*, 12, 85–102.
- Jagodzinski, T., & Fleming, M. F. (2007). Postpartum and alcohol-related factors associated with the relapse of risky drinking. *Journal of Studies on Alcohol and Drugs*, 68, 879–885.
- Knibbe, R. A., Drop, M. J., & Muijtens, A. (1987). Correlates of stages in the progression from everyday drinking to problem drinking. *Social Science & Medicine*, 24, 463–473.
- Knudsen, A. K., Skogen, J. C., Ystrom, E., Sivertsen, B., Tell, G. S., & Torgersen, L. (2014). Maternal pre-pregnancy risk drinking and toddler behavior problems: The Norwegian Mother and Child Cohort Study. *European Child & Adolescent Psychiatry*, 23, 901–911.
- Kuntsche, S., Knibbe, R. A., & Gmel, G. (2009). Social roles and alcohol consumption: A study of 10 industrialised countries. *Social Science & Medicine*, 68, 1263–1270.
- Kuntsche, S., Knibbe, R. A., & Gmel, G. (2012). Parents’ alcohol use: Gender differences in the impact of household and family chores. *European Journal of Public Health*, 22, 894–899.
- Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2014). lmerTest: Tests for random and fixed effects for linear mixed effect models (lmer objects of lme4 package), Version 2.0-11, Retrieved from <http://cran.r-project.org/web/packages/lmerTest/index.html>
- Laborde, N. D., & Mair, C. (2012). Alcohol use patterns among postpartum women. *Maternal and Child Health Journal*, 16, 1810–1819.
- Leonard, K. E., & Homish, G. G. (2008). Predictors of heavy drinking and drinking problems over the first 4 years of marriage. *Psychology of Addictive Behaviors*, 22, 25–35.
- Leonard, K. E., & Rothbard, J. C. (1999). Alcohol and the marriage effect. *Journal of Studies on Alcohol, Supplement 13*, 139–146.
- Li, Q., Wilsnack, R., Wilsnack, S., & Kristjanson, A. (2010). Cohabitation, gender, and alcohol consumption in 19 countries: A multilevel analysis. *Substance Use & Misuse*, 45, 2481–2502.
- Magnus, P., Irgens, L. M., Haug, K., Nystad, W., Skjaerven, R., & Stoltenberg, C., & the MoBa Study Group. (2006). Cohort profile: The Norwegian Mother and Child Cohort Study (MoBa). *International Journal of Epidemiology*, 35, 1146–1150.
- Maloney, E., Hutchinson, D., Burns, L., & Mattick, R. (2010). Prevalence and patterns of problematic alcohol use among Australian parents. *Australian and New Zealand Journal of Public Health*, 34, 495–501.
- Mellingen, S., Torsheim, T., & Thuen, F. (2013). Changes in alcohol use and relationship satisfaction in Norwegian couples during pregnancy. *Substance Abuse Treatment, Prevention, and Policy*, 8, 5.
- Nilsen, R. M., Vollset, S. E., Gjessing, H. K., Skjaerven, R., Melve, K. K., Schreuder, P., . . . Magnus, P. (2009). Self-selection and bias in a large prospective pregnancy cohort in Norway. *Paediatric and Perinatal Epidemiology*, 23, 597–608.
- Oesterle, S., Hawkins, J. D., & Hill, K. G. (2011). Men’s and women’s pathways to adulthood and associated substance misuse. *Journal of Studies on Alcohol and Drugs*, 72, 763–773.
- Parackal, S., Ferguson, E., & Harraway, J. (2007). Alcohol and tobacco

- consumption among 6-24-months post-partum New Zealand women. *Maternal and Child Nutrition*, 3, 40–51.
- Paradis, C. (2011). Parenthood, drinking locations and heavy drinking. *Social Science & Medicine*, 72, 1258–1265.
- Paradis, C., Demers, A., Nadeau, L., & Picard, E. (2011, March). Parenthood, alcohol intake, and drinking contexts: *Occasio furem facit*. *Journal of Studies on Alcohol and Drugs*, 72, 259–269.
- Pearson, R. M., Heron, J., Melotti, R., Joinson, C., & Evans, J. (2012). The impact of alcohol use during pregnancy on maternal responses after birth. *Archives of Women's Mental Health*, 15, 433–443.
- Plant, M., Miller, P., Plant, M., Kuntsche, S., Gmel, G., Ahlstrom, W. S., . . . Vidal, A. (2008). Marriage, cohabitation and alcohol consumption in young adults: An international exploration. *Journal of Substance Use*, 13, 83–98.
- Rossow, I. (1996). Alcohol-related violence: The impact of drinking pattern and drinking context. *Addiction*, 91, 1651–1661.
- Skagerström, J., & Nilsen, P. (2012). Drinking during pregnancy in Sweden—Prevalence and predictors [Abstract P055]. *Alcoholism: Clinical and Experimental Research*, 36, Supplement S2, 105A.
- Skotheim, S., Braarud, H. C., Høie, K., Markhus, M. W., Malde, M. K., Graff, I. E., . . . Stormark, K. M. (2013). Subclinical levels of maternal depression and infant sensitivity to social contingency. *Infant Behavior and Development*, 36, 419–426.
- Swendsen, J., Conway, K. P., Degenhardt, L., Dierker, L., Glantz, M., Jin, R., . . . Kessler, R. C. (2009). Socio-demographic risk factors for alcohol and drug dependence: The 10-year follow-up of the national comorbidity survey. *Addiction*, 104, 1346–1355.
- Wilsnack, S. C., & Wilsnack, R. W. (1991). Marital drinking and the quality of marital relationships: Patterns from a U.S. longitudinal survey. Paper presented at the 35th International Institute on the Prevention and Treatment of Alcoholism and Drug Dependence, Berlin, Germany. In Mudar, P., Leonard, K. E., & Soltysinski, K. (2001). Discrepant substance use and marital functioning in newlywed couples. *Journal of Consulting and Clinical Psychology*, 69, 130–134.
- Zins, M., Guéguen, A., Leclerc, A., & Goldberg, M. (2003). Alcohol consumption and marital status of French women in the GAZEL cohort: A longitudinal analysis between 1992 and 1996. *Journal of Studies on Alcohol*, 64, 784–789.