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Effect of Marriage on Risk for Onset of Alcohol Use Disorder: A Longitudinal and Co-Relative Analysis in a Swedish National Sample

Kenneth S. Kendler, M.D., **Sara Larsson Lönn, Ph.D.**, **Jessica Salvatore, Ph.D.**, **Jan Sundquist, M.D., Ph.D.**, and **Kristina Sundquist, M.D., Ph.D.**

Department of Psychiatry, the Department of Psychology, the Department of Human and Molecular Genetics, and the Virginia Institute for Psychiatric and Behavioral Genetics, Virginia Commonwealth University, Richmond; and the Center for Primary Health Care Research, Lund University, Malmö, Sweden

Kenneth S. Kendler: kenneth.kendler@vcuhealth.org

Abstract

Objective—The authors sought to clarify the relationship between marriage and risk for alcohol use disorder.

Method—The association between marital status and risk for first registration for alcohol use disorder in medical, criminal, and pharmacy registries was assessed in a population-based Swedish cohort (N=3,220, 628) using longitudinal time-dependent survival and co-relative designs.

Results—First marriage was associated with a substantial decline in risk for onset of alcohol use disorder in men (hazard ratio=0.41, 95% CI=0.40–0.42) and women (hazard ratio=0.27, 95% CI=0.26–0.28). This association was slightly stronger when the spouse had no lifetime alcohol use disorder, while marriage to a spouse with lifetime alcohol use disorder increased risk for subsequent alcohol use disorder registration in both men (hazard ratio=1.29, 95% CI=1.16–1.43) and women(hazard ratio=1.18, 95% CI=1.06–1.30). In both sexes, the protective effect of marriage was significantly stronger in those with than those without a family history of alcohol use disorder. In both men and women, the associations between marriage and risk for alcohol use disorder in cousins, half siblings, full siblings, and monozygotic twins discordant for marital status were as strong as that seen in the general population.

Conclusions—First marriage to a spouse with no lifetime alcohol use disorder is associated with a large reduction in risk for alcohol use disorder. This association cannot be explained by standard covariates or, as indicated by co-relative analyses, familial genetic or shared environmental confounders. These results are consistent with the hypothesis that the psychological and social aspects of marriage, and in particular health-monitoring spousal interactions, strongly protect against the development of alcohol use disorder. The protective effects of marriage on risk for alcohol use disorder are increased in those at high familial risk for alcoholism.

Correspondence to: Kenneth S. Kendler, kenneth.kendler@vcuhealth.org.

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Marital status is strongly associated with alcohol consumption, problem drinking, and, in particular, risk for alcohol use disorder (1–6). For example, in a general population survey of Swedish young adults, the frequency and quantity of alcohol consumption among married individuals were 41% and 51% lower, respectively, than among single individuals (7). In an epidemiological study of Stockholm County, a diagnosis of alcoholism was 2.1 times as common in single compared with cohabiting adults (8). Understanding the causal processes underlying this robust association could provide important insights into the etiology of alcohol use disorder and elucidate potential avenues for prevention. However, this is a challenging problem. The etiology of the association between marriage and alcohol use disorder is likely to be complex and reflect 1) the impact of confounding variables that influence both marital rates and disorder risk, 2) selection effects (i.e., the impact of heavy drinking on marital status), and 3) direct causal effects of marital status on risk for alcohol use disorder (9).

Confounding factors such as social class, family history of alcohol use disorder, and externalizing personality traits could have an impact on both the risk for problematic drinking and alcohol use disorder (10–12) and the probability of getting and staying married (13–19). The possible importance of selection is suggested by evidence in some (14, 20) but not all studies (21–23) that heavy drinking in young adulthood can delay marriage. Direct causal effects of marriage on risk for alcohol use disorder could arise as a result of the incompatibility between alcohol use disorder and the social and psychological obligations associated with marriage (9), and/or direct spousal interactions in which spouses monitor and try to control each other's drinking (24). Longitudinal and quasi-experimental studies have provided converging support that marriage may indeed be causally related to reductions in alcohol use (4, 25–27). The protective effects of marriage are likely to depend, in part, on characteristics of the individual, as problem drinkers show the greatest decreases in drinking after marriage (28). Individuals at high risk for alcohol use disorder may be especially sensitive to the protective effects of marriage. Spousal characteristics likely also have an impact on the effects of marriage (29). Marriage to a spouse with alcohol problems may be associated with an increased risk for alcohol use disorder (30). Whether these effects differ for men and women is not confidently known, given the small and sometimes unrepresentative samples historically used in this area of research (31).

In this study, using time-dependent survival models and co-relative designs applied to a large population-based Swedish cohort (N=3,220,628), we sought to clarify the nature of the relationship between first marriage and subsequent risk for first registration for alcohol use disorder. We had six aims:

1. To clarify in the general population the prospective association between marital status and risk for alcohol use disorder.
2. To determine the degree to which this association can be explained by parental education, family history, and early history of criminal behavior or drug abuse.
3. To clarify the differential impact on risk of being married to a spouse who, during their lifetime, will or will not develop alcohol use disorder.

4. To evaluate whether individuals at increased familial risk of alcohol use disorder are more sensitive to the protective effects of marriage.
5. To determine, using co-relative designs, the degree to which the association between marital status and alcohol use disorder can be explained by familial confounding factors.
6. To determine the degree to which the answers to the above questions differ in men and women.

METHOD

Sample

We linked nationwide Swedish registers via the unique 10-digit identification number assigned at birth or immigration to all Swedish residents. The identification number was replaced by a serial number to ensure anonymity.

The following sources were used to create a data set for analysis: the Total Population Register, containing year of birth, sex, and annual data on place of residence; the Swedish National Census; the Swedish Mortality Register, containing dates of death; the Multigeneration register, linking children born after 1932 to their parents; the Swedish Hospital Discharge Register, containing data on hospitalizations from 1964 to 2010; the Outpatient Care register, containing information from all outpatient clinics between 2001 and 2010; the Prescribed Drug register, containing data on all prescriptions in Sweden picked up by patients from 2005 to 2010; the Primary Health Care Register, containing data on outpatient diagnoses from 2001 to 2007 for 1 million patients from Stockholm and parts of southern Sweden; the Swedish Crime Register, which contains complete national data an all convictions in lower courts from 1973 to 2011; the Swedish Suspicion Register, which includes complete national data on individuals strongly suspected of crime from 1998 to 2011; and the Swedish Twin Register (32).

The analysis was based on individuals born between 1960 and 1990. For the co-relative analysis, we identified relative pairs from the Multigeneration register born within 3 years of each other.

Measures

Cohabiting couples are not registered but can be identified in the Swedish registers if married or living together with common children. For the period before 1990, this information is provided in 5-year increments, and after 1990 it is provided yearly. In all of our analyses, we defined categorized as “married” any member of a couple who are officially married and cohabiting or are cohabiting with a common biological child.

Alcohol use disorder was identified in three ways. The first was medical diagnosis from the medical registers: ICD-8 codes 571.0, 291, 303, and 980; ICD-9 codes V79B, 305A, 357F, 571A–571D, 425F, 535D, 291, 303, and 980; and ICD-10 codes E244, G312, G621, G721, I426, K292, K700–K709, K852, K860, O354, T510–T519, and F101–F109. The second was registration in the prescription registry for well-recognized drugs to treat alcohol use

disorder using the ATC Classification System codes N07BB01, N07BB03, andN07BB04. The third was registration in the suspicion and conviction registers for at least two records of drunk driving (suspicion code 3005, law1951:649 [paragraph 4 and 4A]) or drunk in charge of a maritime vessel (suspicion code 3201, law 1994–1009 [chapter 20, paragraph 4 and 5]).

Early-onset deviant behavior was defined as criminal behavior or drug abuse before age 18. As a dichotomous measure of familial risk we assessed whether the individual had one or more parents, full and half siblings, or cousins with an alcohol use disorder registration.

Statistical Methods

We used Cox proportional hazard methods to estimate the risk of onset of alcohol use disorder as a function of marital status, which was included in the model as a time-dependent covariate. The outcome variable was time to onset of alcohol use disorder after age 18, and we censored at death, end of marriage, migration, or end of follow-up (2011), whichever came first. Subjects with an onset of alcohol use disorder prior to age 18 were also censored; they are uninformative in our analyses because marriage prior to age 18 is illegal in Sweden. We adjusted for year of birth and parental education. To account for early deviant behavior, we included registration of criminal behavior or drug abuse through age 18. We investigated whether lifetime registration for alcohol use disorder in the spouse affected the association with marital status, and, finally, we explored whether a higher genetic risk modified the marital impact. To test for gender differences, we constructed a joint model including both sexes and allowing all covariates to differ by gender by including the relevant interactions in the model.

In the next step, we used a co-relative design utilizing same-sex cousin, half-sibling, full-sibling, and monozygotic twin pairs. We identified unique combinations of pairs and used conditional Cox regression, where each pair is treated as a stratum, meaning the effect of the covariates are estimated within each pair, thereby controlling for confounding factors shared within that pair. Neither of the members of the pair was registered for alcohol use disorder or was married before age 18. Marital status is included as a time-dependent covariate; either one member of the pair met our criteria for marriage over the follow-up period and one did not, or they were married at different ages.

RESULTS

Our total sample consisted of over 3.2 million individuals, of whom 72,252 met our criteria for alcohol use disorder, with an average age at first registration of ~27 years (Table 1). The prevalence of the disorder was 3.3% in men and 1.1% in women, and slightly less than half of the affected individuals had one or more relatives similarly affected. Thirty-four percent of the men and 12% of the women with alcohol use disorder had early-onset deviant behavior.

Findings in Men

In our Cox proportional hazard model, marital status was associated with a hazard ratio for first registration for alcohol use disorder of 0.41 (95% CI=0.40–0.42) (Table 2, model 1). The hazard ratio did not change with the addition in model 2 of birth year, parental

education, early-onset externalizing syndromes, or positive family history, the latter three of which were all strongly associated with disease risk. Model 3 added lifetime registration for alcohol use disorder in the spouse, which in model3awasshownto strongly increase risk for subsequent alcohol use disorder registration (hazard ratio=3.37). In model 3b, we reparameterized the model to calculate the hazard ratios for subsequent registration for marriage to a spouse without and a spouse with a lifetime registration for alcohol use disorder, which were estimated at 0.38 and 1.29, respectively. That is, for men, marriage to a wife with no history of registration for alcohol use disorder was associated with a substantial reduction in risk for alcohol use disorder, while marriage to a wife with a history of registration for alcohol use disorder increased risk beyond that observed in single men. Finally, in model 4, we added to model 3a the interaction between familial risk and marital status. This interaction was significant (hazard ratio=0.89, $p<0.001$) and indicated that individuals with a positive family history of alcoholism had increased sensitivity to the protective effects of marriage on risk for alcohol use disorder.

Findings in Women

The inverse association between marriage and risk for alcohol use disorder was stronger in women than in men, with a hazard ratio of 0.27 (95% CI=0.26–0.28) (Table 3, model 1). The hazard ratio increased slightly with the addition in model 2 of birth year, parental education, early-onset externalizing behaviors, and family history. In model 3a, we see that a history of registration for alcohol use disorder in the spouse was more strongly related to risk for alcohol use disorder in women (hazard ratio=4.71) than in men. In model 3b, we can see that in women, marriage to a spouse without and a spouse with history of registration for alcohol use disorder is associated with, respectively, a substantially reduced (hazard ratio=0.25) and a modestly increased risk for alcohol use disorder (hazard ratio=1.18) compared with the nonmarried state. In model 4, we see that the reduction in risk for alcohol use disorder associated with marriage was stronger in those with a positive family history compared with those with a negative family history (hazard ratio=0.88, $p=0.01$).

When we modeled the effect of marital status jointly in both sexes, the inverse association between marriage and alcohol use disorder was significantly stronger in women than in men ($p<0.001$), and the association between risk for alcohol use disorder and history of registration for alcohol use disorder in the spouse was stronger for women than for men ($p<0.001$).

Co-Relative Analyses

As detailed in Tables S1 and S2 in the data supplement that accompanies the online edition of this article, we identified, in men and in women respectively, the following number of unique same-sex sibling pairs discordant for both the occurrence of or age at marriage and the occurrence of or age at first registration for alcohol use disorder: cousins, 21,849 and 6,599; half siblings, 1,519 and 487; full siblings, 7,250 and 2,388; and monozygotic twins, 100 and 26. As seen in Table 4, within-pair analyses demonstrated no evidence in either men or women for an attenuation of the association between marital status and alcohol use disorder with increased sharing of genetic and environmental background. Although known imprecisely, the association seen with risk for alcohol use disorder in monozygotic twin

pairs discordant for marital status was slightly stronger than that seen in the general population; for men the hazard ratio was 0.31 (95% CI=0.11–0.85) and for women 0.18 (95% CI=0.04–0.82). Perhaps more importantly, in our large sample of discordant full siblings, the observed associations were very similar to those seen in the population, where for men the hazard ratio is 0.36 (95% CI=0.33–0.39) and women 0.25 (95% CI=0.21–0.30).

DISCUSSION

We sought in this study of the Swedish general population to clarify the nature and causes of the association between marital status and risk for onset of alcohol use disorder. We posed six major aims for our analyses, which we address in turn.

First, congruent with past studies examining alcohol intake and problem drinking (1–4), we found, in a prospective design, an association between marital status and risk for onset of alcohol use disorder. The association was strong, with married men and women having, respectively, a 60% and 71%lower risk for onset of alcohol use disorder compared with individuals who remained single. This mirrors recent epidemiological findings from the National Epidemiologic Survey on Alcohol and Related Conditions III, in which individuals who were never married had a substantially higher risk for alcohol use disorder in the past year (odds ratio=1.6) compared with those who were married (10). It is also consistent with prior evidence that young adults who remain single have a higher incidence of symptoms of alcohol use disorder (risk ratio=2.1) compared with those who stay or become married (33); that being married is associated with reduced risk for the onset of alcohol use disorder (34); and that getting married is associated with reductions in heavy drinking (2, 4). Our findings are also congruent with evidence that marriage reduces risk for other externalizing behaviors, including crime and drug abuse (19, 35).

Second, one obvious explanation for this association is that the exposure and outcome are both predicted by key confounding variables. We considered three: socioeconomic status, early criminal behavior or drug abuse, and a family history of alcohol use disorder. There is evidence in some studies that antisocial individuals are less likely to be or become married (19, 36, 37); however, other studies have found no association between some forms of antisocial behavior and marital status (38) and an increased likelihood of early marriage among those with antisocial personality disorder (39). When good measures of these three constructs were added to the statistical model, no attenuation was seen in the relationship between marital status and alcohol use disorder. These confounding variables could not explain any appreciable proportion of this association.

Third, how much would the protective effect of marriage on risk for alcohol use disorder in an individual depend on the history of alcohol use disorder in his or her spouse? Our initial analyses focused on a lifetime registration for alcohol use disorder in the spouse, and we found strong effects. While marriage to a spouse without lifetime registration for alcohol use disorder was strongly protective, marriage to an affected spouse significantly increased the risk for future alcohol use disorder. These findings go beyond previous studies showing that spouses tend to be concordant for alcohol use disorder (40) and are consistent with a substantial literature documenting partner influence (29) and convergence for alcohol use

(41) as well as the heightened risk for developing alcohol problems when one's spouse has an alcohol problem (30). We also conducted follow-up analyses examining marriage to women who had a registration for alcohol use disorder prior to marriage; the effect on future risk for alcohol use disorder in their husbands was modestly weaker than that seen for our broader definition of any lifetime disorder (hazard ratio=2.13, 95% CI=1.73–2.63). These results provide insight into the nature of the protective effect of marriage on risk for alcohol use disorder. If social role expectations were the critical component of marriage that reduced such risk, then marriage to an alcohol-abusing spouse should remain protective. That it is not in our data suggests that direct spousal interaction is more critical. This would be consistent with the position articulated by Umberson that "marriage may be beneficial to health because many spouses monitor and attempt to control their spouse's health behaviors" (24, p. 907).

Fourth, previous studies of gene-environment interaction in alcohol intake or problems have focused on reduced social control or increased psychosocial adversity (42, 43). Here we asked a different question—whether individuals at high familial risk for alcohol use disorder had a different sensitivity to the protective effects of marriage than those without such risk. As expected, we found a substantial main effect of those with a positive family history having a stronger risk for alcohol use disorder. More interestingly, we found robust evidence that the protective effects of marriage were *stronger* in those with a family history compared to those without. This effect is consistent with recent findings that severe problem drinkers show the greatest decrease in drinking after the transition to marriage (28). Those at highest risk for alcohol problems appear to be the most likely to benefit from the protective effects of marriage.

Fifth, the most important question in the large literature on the association of marital status and drinking behavior and alcohol use disorder is the degree to which the association is likely causal. In our study, in which we show that marital status predicts subsequent onset of alcohol use disorder, we have two plausible and non–mutually exclusive causal hypotheses: 1) some set of confounding factors act inversely on the probability of marriage and directly on the risk for alcohol use disorder or 2) marriage reduces the risk of disorder. Our initial analyses with covariates provided evidence against the first hypothesis, but it is difficult to be confident that we identified all the relevant confounding variables. Therefore, we proceeded to co-relative analyses in which we compared the association between marital status and risk for first onset alcohol use disorder in the general population and among informative pairs of monozygotic twins, full and half siblings, and first cousins discordant for marital status. The advantage of a co-relative design is that it controls for *any* confounding risk factors that are themselves familial—which constitutes the large majority of human behavioral traits (44). If the association between marital status and alcohol use disorder resulted from such confounding factors, we would expect that it would be modestly weaker in distant relationships and then become further weakened among more closely related relative pairs who share more of their genetic and environmental background. In particular, the expectation would be that among informative monozygotic twin pairs, who share all of their genetic and rearing environment, the association would be substantially attenuated compared with that observed in the general population. This is not the trend observed in our data. Rather, we see no weakening of the association between marital status

and alcohol use disorder as we move from the general population to cousins, half siblings, full siblings, and, finally, monozygotic twins discordant for marital status. These results provide support for the second hypothesis—that marriage is causally related to a reduction in risk for alcohol use disorder. This conclusion is consistent with recent smaller quasi-causal studies of young adult twin and sibling pairs that found that marriage predicted lower alcohol use after controlling for genetic and familial environmental confounders (25, 26).

Lastly, because of its large population-based sample, this study was well powered to explore whether the association of marital status and risk for alcohol use disorder differed between the sexes. Previous studies have typically found a greater “marriage benefit” with respect to health for men than for women (24, 45). However, our results were inconsistent with these expectations. This may be attributable to the fact that there are more male problem drinkers for women with this predisposition to partner with than vice versa (46, 47). By contrast, the impact of a family history and the interaction between a family history and marital status on risk for alcohol use disorder were similar in men and women. Historically, sex differences for interactions have not been systematically examined (48), in part because of concerns about statistical power and type II error. Although it has been suggested that men may be more sensitive to relationship factors than women (49),we do not find evidence of that here.

These results should be interpreted in the context of two potentially important methodological limitations. First, we identified subjects with alcohol use disorder from medical, legal, and pharmacy records. While this method does not require respondent cooperation or accurate recall and reporting, it could produce both false negative and false positive diagnoses. Given that the population prevalence of alcohol use disorder in this sample is much lower than estimates from epidemiologic surveys (10, 50), including one from neighboring Norway (which estimated lifetime prevalence for alcohol use disorder at 13.2% and 5.2% in men and women, respectively) (51), false negative diagnoses are surely much more common than false positive ones. Compared with those identified in epidemiologic surveys, the cases of alcohol use disorder that we studied are likely to be more severe and to be associated with more prominent alcohol-related social and medical consequences. The best available validation for our definition of illness is the high rates of concordance for registration observed across our different ascertainment methods (52).

Second, in our definition of marriage we combined couples who were officially married and those cohabiting with common children. To confirm our findings with a “narrower” definition, we repeated our main analyses including only couples who were legally married. Using our standard covariates (model 2), the protective effect of marriage so defined on the risk for alcohol use disorder changed only slightly and was modestly stronger in men (hazard ratio=0.34, 95% CI=0.33–0.36) and slightly weaker in women (hazard ratio=0.32, 95% CI=0.30–0.35).

In summary, first marriage to a spouse with no history of registration for alcohol use disorder is associated with a large reduction in risk for alcohol use disorder. This association does not arise as a result of confounding assessed either through the use of standard covariates or by co-relative analyses including marriage-discordant siblings and monozygotic twins. The protective effects of marriage on risk for alcohol use disorder are

likely to arise largely from direct spousal interactions, and they are stronger in individuals who have an elevated familial risk for alcoholism. While causal effects are difficult to prove in observational data, and we cannot rule out the impact of hidden biases, these results are consistent with the hypothesis that the psychological and social aspects of marriage strongly protect against the development of alcohol use disorder.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Characteristics of a Population-Based Swedish Cohort (N=3,220,628) in a Study of the Effect of Marriage on Risk for Onset of Alcohol Use Disorder

Measure	Men		Women	
	N	**%**	**N**	**%**
Total sample	1,654,512	51.4	1,566,116	48.6
Early-onset externalizing syndromes	134,079	8.1	47,263	3.0
At least one relative with alcohol use disorder	434,277	26.2	413,165	26.4
Alcohol use disorder	54,435	3.3	17,817	1.1
	Mean	SD	Mean	SD
Birth year	1974.8	9.1	1974.8	9.1
Individuals with alcohol use disorder				
Age at marriage	24.9	3.1	23.8	3.4
Age at alcohol use disorder onset[a]	27.2	7.6	26.8	8.1
	N	%	N	%
Early-onset deviant behavior	18,318	33.7	2,181	12.2
Marriage before alcohol use disorder onset or censoring	5,905	10.8	2,163	12.1
At least one relative with alcohol use disorder	21,127	49.8	8,351	46.9

[a]For men, median=25 years (quartile range=21, 32); for women, median=24 years (quartile range=20, 31).

TABLE 2

Hazard Ratios From a Cox Proportional Hazard Model With Time-Dependent Covariates in Men Examining the Effect of Marriage on Risk for Onset of Alcohol Use Disorder

	Model 1		Model 2		Model 3a[a]		Model 3b[a]		Model 4	
Variable	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**
Marriage	0.41	0.40, 0.42	0.40	0.39, 0.41					0.41	0.39, 0.42
Marriage to spouse with no history of registration for alcohol use disorder					0.38	0.37, 0.39	0.38	0.37, 0.39		
Marriage to spouse with a history of registration for alcohol use disorder							1.29	1.16, 1.43		
Birth year (by year)			1.01	1.01, 1.02	1.01	1.01, 1.02	1.01	1.01, 1.02	1.01	1.01, 1.02
Parental education										
Middle versus low level			0.90	0.88, 0.92	0.90	0.89, 0.92	0.90	0.89, 0.92	0.90	0.89, 0.92
High versus low level			0.64	0.63, 0.66	0.64	0.63, 0.66	0.64	0.63, 0.66	0.64	0.63, 0.66
Early-onset deviant behavior			5.33	5.23, 5.43	5.31	5.21, 5.41	5.31	5.21, 5.41	5.31	5.21, 5.40
Family history of alcohol use disorder			2.26	2.22, 2.30	2.26	2.22, 2.30	2.26	2.22, 2.30	2.29	2.25, 2.33
Spouse with a history of registration for alcohol use disorder					3.37	3.02, 3.75			3.18	2.84, 3.56
Interaction of family history of alcohol use disorder and marital status									0.89	0.85, 0.95

[a]Models 3a and 3b are reparameterizations of one another with an identical model fit and explanatory power. Model 3a demonstrates the impact of marriage to a spouse with no history of registration for alcohol use disorder and then shows the additional risk involved if that spouse has a history of alcohol use disorder (increasing risk ~3.4-fold). Model 3b reparameterizes this to allow us to compare directly the risk association with marriage to aspouse without versus aspouse with a history of registration for alcohol use disorder (hazard ratios of 0.38 versus 1.29).

TABLE 3

Hazard Ratios From a Cox Proportional Hazard Model With Time-Dependent Covariates in Women Examining the Effect of Marriage on Risk for Onset of Alcohol Use Disorder

	Model 1		Model 2		Model 3a[a]		Model 3b[a]		Model 4	
Variable	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**	**Hazard Ratio**	**95% CI**
Marriage	0.27	0.26, 0.28	0.29	0.28, 0.31					0.27	0.25, 0.28
Marriage to spouse with no history of registration for alcohol use disorder					0.25	0.24, 0.26	0.25	0.24, 0.26		
Marriage to spouse with a history of registration for alcohol use disorder							1.18	1.06, 1.30		
Birth year (by year)			1.06	1.06, 1.06	1.06	1.06, 1.06	1.06	1.06, 1.06	1.06	1.06, 1.06
Parental education										
Middle versus low level			0.93	0.90, 0.97	0.94	0.90, 0.98	0.94	0.90, 0.98	0.94	0.90, 0.97
High versus low level			0.72	0.69, 0.74	0.72	0.69, 0.75	0.72	0.69, 0.75	0.72	0.69, 0.75
Early-onset deviant behavior			4.11	3.92, 4.30	4.06	3.88, 4.25	4.06	3.88, 4.25	4.06	3.88, 4.24
Family history of alcohol use disorder			2.38	2.31, 2.45	2.37	2.30, 2.44	2.37	2.30, 2.44	2.40	2.32, 2.47
Spouse with a history of registration for alcohol use disorder					4.71	4.22, 5.25			4.43	3.93, 4.99
Interaction of family history of alcohol use disorder and marital status									0.88	0.80, 0.97

[a]See the footnote to Table 2 for an explanation of these two models.

TABLE 4

Co-Relative Results: Hazard Ratios From a Cox Proportional Hazard Model With Time-Dependent Covariates Examining the Effect of Marriage on Risk for Onset of Alcohol Use Disorder

	Population		Cousins		Half Siblings		Full Siblings		Monozygotic Twins	
Sex	Hazard Ratio	95% CI	Hazard Ratio	95% CI	Hazard Ratio	95% CI	Hazard Ratio	95% CI	Hazard Ratio	95% CI
Men	0.41	0.40, 0.42	0.40	0.38, 0.42	0.42	0.34, 0.51	0.36	0.33, 0.39	0.31	0.11, 0.85
Women	0.27	0.26, 0.28	0.28	0.26, 0.32	0.26	0.17, 0.39	0.25	0.21, 0.30	0.18	0.04, 0.82