

The Health Effects of Parental Problem Drinking on Adult Children

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Abstract

Background: Much of the research on adult children of alcoholics has focused on the transmission of drinking patterns from parents to their children and the development of alcohol-related problems. Less is known about how exposure to parental problem drinking affects children as they progress into adulthood in terms of other mental health outcomes. This is crucial information, in part because the average age of onset for depression and other mental health disorders is during late adolescence or young adulthood.

Aims: The objective of this study was to rigorously assess the long-term impacts of parental problem drinking on adult children's mental and self-perceived overall health. The study improves on previous literature by analyzing a range of mental health markers and other predictors of morbidity, by focusing on a period of adulthood that only a limited number of studies have examined, and by using data from a highly regarded and nationally representative panel study.

Data: The analysis used data from the NLSY79, a nationally representative sample of 12,686 men and women. The NLSY79 collected detailed information about personal and family characteristics, including alcohol and other substance use, for a cohort of individuals who were between the ages of 14 and 22 when first surveyed in 1979. The survey was re-administered each year through 1994 and on a biennial basis since then. The dataset provides information on parental drinking and identifies problematic drinking behaviors both among mothers and fathers. Beginning with the 1998 survey, an extensive health module was administered to respondents over 40 years of age to provide a baseline health profile of the respondents before retirement. It includes a set of measures that assess the mental, physical, and behavioral health of the respondents when they reached the age of 40.

Methods: Estimation was conducted using propensity score matching (PSM) methods. Through the use of PSM methods, we

control for a rich set of observed demographic, household, geographic, and economic characteristics, as well as unobserved features correlated with these variables, that predispose a parent to drink problematically, thereby reducing the possibility of estimation bias. In addition, PSM is superior to traditional multivariate regression in that it allows for the possibility of non-linear effects and the comparison of treatment and control individuals with similar characteristics.

Results: The results indicate that parental problem drinking is associated with significant mental health consequences for children that persist far into adulthood. Adult respondents with a problem-drinking father were more likely to have been diagnosed with mental health problems relative to other respondents, while those with a problem-drinking mother had poorer self-perceived health and mental health (SF-12) scores. Respondents with a problem-drinking mother were also more likely to have ever been diagnosed with a mental health problem. Outcomes were worse for daughters of problem drinkers than for sons.

Policy Implications: These long-lasting consequences of parental problem drinking on adult children's mental health should be considered when designing and financing interventions targeting problem drinkers and their families.

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Introduction

According to estimates from the 1992 National Longitudinal Alcohol Epidemiologic Survey, approximately one quarter of children under the age of 18 in the United States have encountered familial alcohol abuse or dependence.¹ Our own estimates, which are based on more recent data, reveal that 22 percent of the 42,000 individuals aged 18 and older participating in the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions [NESARC] reported having a problem-drinking father or mother.² Studies focused on children and adolescents have found a positive association between parental alcohol problems and anxiety,^{3,4} depressive symptoms,³⁻⁶ poor self esteem,⁶ behavior problems,^{7,8} and conduct disorder.⁹ As these children of alcoholics (COAs) mature, many become resilient adults who overcome or avoid the behavioral and mental health problems for which they are at risk.⁶ For other more vulnerable adult children of alcoholics (ACOs), however,

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the burden of parental alcohol abuse and/or dependence can have serious and long-lasting consequences.

Much of the research on ACOAs has investigated the transmission of drinking patterns from parents to their children and the development of alcohol-related problems. ACOAs are at significantly greater risk of developing alcohol abuse or dependence than the general population as a result of a combination of genetic and environmental factors.^{3,10-12} Risk of drinking problems is higher among male ACOAs than female ACOAs.^{12,13} Less is known about how exposure to parental problem drinking affects children as they progress into adulthood in terms of other mental health outcomes. This is crucial information, in part because the average age of onset for depression and other mental health disorders is during late adolescence or young adulthood.^{14,15} While some studies have suggested that ACOAs may be at high risk for depression and anxiety compared to non-ACOA,^{11,16-19} most of these investigations identify associations. Whether adverse health effects on adult children are due to parental alcohol consumption or to other family or environmental characteristics is not yet fully understood.

Studies have identified several pathways through which parental alcohol abuse can impact ACOA's mental health. Children of problem drinkers face increased risks of adverse childhood experiences and environmental stresses such as economic pressure or marital conflict.^{18,20-23} In addition, ACOAs may have been more exposed to parents with comorbid psychopathology.^{3,11,24} Genetics, complications during prenatal development, and exposure to the parent's behavior and knowledge are also mechanisms that relate parental alcohol abuse to children's outcomes.²³

Several of the studies of children and adolescents have shown that the effects of parental alcoholism on children differ according to which parent is the problem drinker.^{3,5,23} A review article reported that maternal alcoholism was more strongly associated with externalizing problems while paternal alcoholism was more strongly associated with internalizing problems in children.²³ The influence of the mothers and the fathers varied as the children grew older.²³ Mental health consequences may be more severe among individuals exposed to maternal alcoholism for several reasons: (i) the mother's ability to serve as the primary caretaker may be impaired by her alcohol abuse, (ii) there is a tendency for women who abuse alcohol to marry men with chemical dependency problems, and (iii) maternal alcohol abuse significantly increases the likelihood a child will be abused or neglected.^{12,20,21}

The existing literature on health consequences among ACOAs contains several methodological limitations. First, analysis samples are often comprised of college students or individuals obtained from clinical settings who are not representative of the general population.²⁵ Second, sample sizes in many studies have fewer than 1,000 observations^{3,5} and rarely investigate health status in middle age. Third, many studies examine bivariate relationships, with only a limited number of investigations using multivariate regression or other statistical techniques to control for confounding factors.¹⁹ Fourth, most previous studies have considered only clinical measures of mental health status,

such as a hospital-based diagnosis of mental illness²¹ or a lifetime DSM-IV diagnosis of major depression.¹⁷ Few papers have examined self-reported measures of less severe mental health problems. Finally, these relationships are complicated by the possibility that both parental alcohol misuse and ACOA's health outcomes are jointly affected by important unmeasured or unobserved variables. For example, a tragic death in the family when the ACOA was a child may have significantly affected parental drinking as well as the child's risk of developing mental health problems that persist into adulthood. In such cases, any estimated associations between parental problem drinking and the mental health of ACOAs would be spurious. To our knowledge, very few studies in the literature have addressed this statistical challenge when investigating outcomes related to parental alcohol misuse,^{7,8} and none of them examined mental health problems among ACOAs.

The objective of the present study was to rigorously assess the long-term impacts of parental problem drinking on adult children's mental and self-perceived overall health using data from the National Longitudinal Survey of Youth, 1979 cohort (NLSY79). The current study overcomes many of the limitations noted above. Analyzing a highly regarded and nationally representative panel dataset such as the NLSY79 will produce results that are more generalizable than those of many other studies in the literature that relied on cross-sectional samples of individuals from addiction treatment programs or other narrow settings. The findings offer information about health consequences during a period of adulthood that only a limited number of studies have examined.^{17,20-22} Moreover, the key measures include a range of mental health markers, and this is one of the first studies to evaluate the relationship between parental alcohol misuse and the self-perceived health of ACOAs,²⁶ a consistent predictor of mortality.²⁷ Through the use of propensity score matching (PSM) methods, we control for a rich set of observed variables and unobserved features correlated with these variables that predispose a parent to drink problematically, thereby reducing the possibility of estimation bias. In addition, PSM is superior to traditional multivariate regression in that it allows for the possibility of non-linear effects and the comparison of treatment and control individuals with similar characteristics. Finally, the analysis provides additional insight into gender differences by evaluating the effects of having a problem-drinking mother or father on adult sons and daughters.

Data

National Longitudinal Survey of Youth, 1979 Cohort (NLSY79)

This analysis used data from the NLSY79, a nationally representative sample of 12,686 men and women. The NLSY79 collected detailed information about personal and family characteristics, including alcohol and other substance use, for a cohort of individuals who were between the ages of

14 and 22 when first surveyed in 1979. The survey was re-administered each year through 1994 and on a biennial basis since then. Individuals from the active-duty military as well as economically disadvantaged minorities of the supplemental sub-sample were excluded from this analysis because the supplemental sub-sample was discontinued in the early 1990s.

Measures

Although the NLSY79 was mainly designed as a survey of labor market outcomes, it contains several key questions pertaining to the relationships between parental problem drinking and the health status of their adult children. Its main advantage over other datasets that have been used to study ACOAs is that it is longitudinal and nationally representative, which allows us to overcome some of the limitations of earlier studies with more narrow cross-sectional samples. The dataset provides information on parental drinking and identifies problematic drinking behaviors both among mothers and fathers. Beginning with the 1998 survey, an extensive health module was administered to respondents over 40 years of age to provide a baseline health profile of the respondents before retirement. It includes a set of measures that assess the mental, physical, and behavioral health of the respondents when they reached the age of 40. Sixteen percent of the respondents completed the health module in 1998; twenty-seven percent in 2000; twenty-eight percent in 2002; and the remainder in 2004.

Self-perceived Health

The age-40-and-over health module included the SF-12, a twelve-question health status index designed by John Ware of the New England Medical Center Hospital.²⁸ The SF-12 is intended to provide a standardized measure of the respondent's mental and physical health status irrespective of their proclivity to use formal health services. As part of the SF-12 instrument, respondents were asked whether their overall health status was excellent, very good, good, fair, or poor. A categorical measure of self-perceived health ranged from 1 for excellent to 5 for poor. Approximately 60% of the sample reported having excellent or very good health status.

SF-12 Mental Health Index NLSY79

The SF-12 index is composed of a physical and a mental health sub-scale. After computing the SF-12 mental health sub-scale using available algorithms, we reversed the coding of the variable so that higher levels of the index reflected worse mental health status. This variable ranged between 0 and 100, with 0 reflecting no mental health problems and 100 the highest level of problems.

Other Mental Health Measures

Two dichotomous variables were constructed to indicate whether respondents had received a diagnosis for a mental health condition from a doctor in the past 12 months or in their lifetimes and whether they had any emotional, nervous, or psychiatric problems during the past 12 months.

Parental Problem Drinking

The questionnaire administered in 1988 asked respondents whether they had a relative who had ever been an alcoholic or problem drinker and, if so, to describe their relationship with that relative. Based on these responses, we created a variable equal to 1 if the respondent reported having a problem-drinking father and 0 otherwise, and another variable equal to 1 if the respondent reported having a problem-drinking mother and 0 otherwise. Both biological and adoptive parents were considered.

Control Variables

Binary measures for age in 1979 (9 categories ranging from 14 to 22 years old), gender, and race/ethnicity (White, Hispanic, Black, or Other) were incorporated into our models. The score for the Armed Forces Qualification Tests (AFQT) in 1979 was added as a proxy for intelligence and ability.

The analyses also took into account an extensive set of individual, family, and household characteristics collected when the baseline interview was administered in 1979. While some of these measures referred to when the respondent was 14 years old, others were reported only for 1979. The control variables pertaining to the time when the respondent was 14 included the family structure (intact family, single parent household, step parent, and other non-intact family structures), whether the respondent was the oldest child, whether a library card was used at home, highest education level in the family (no high school, high school, or college or more), whether the father's type of employment was white collar, and whether the adult female in the household worked. Variables pertaining to 1979 included the number of siblings, respondent's birth order, primary language spoken at home (foreign versus English), religion (none, Baptist, Catholic, other), attendance at religious services, family income, public assistance, and family poverty status.

From the health modules administered in 1998-2004, we obtained indicators of whether the mother and/or father had a major health and/or mental health problem. Indicators for problem-drinking grandfather and problem-drinking grandmother were constructed using the same questions that defined parental problem drinking. The drinking status of the parent that was not defining the "treatment" condition was included as a control variable (i.e., mother's drinking status was included as a control when analyzing the effect of paternal problem drinking and vice versa).

Questions from the NLSY79 enabled us to control for other conditions that could influence the outcomes of interest. Dichotomous variables were constructed to represent region of residence in 1979, rural or urban residence at age 14, and whether the respondent lived in the same house until 1979. To control for economic and environmental factors, we used the per capita crime rate in the area of residency in 1975 and the unemployment rate in the respondent's county of residence in 1979. Other variables included the beer tax, spirits tax, and whether alcohol sale controls were in place in the respondent's state of residence at the time the respondent was born (as determinants of parental problem drinking).

If any of the explanatory variables above contained more

Table 1: Variable Means, by Parental Problem-drinking Status

	Problem-drinking father (N=1,516)	Problem-drinking mother (N=325)	No problem- drinking parent (N=5,679)	Sig. test ^a
Health status at age 40				
Self-perceived health categorical (1=Exc; 5=Poor)	2.421	2.535	2.306	**
SF-12 mental health index (high = worse health)	31.165	32.662	28.992	**
Ever diagnosed with a mental health problem	0.106	0.142	0.062	**
Had a mental health problem past 12 months	0.071	0.080	0.037	**
Demographics				
Male	0.414	0.363	0.509	**
Age in 1979	17.890	18.120	17.874	
Non-Hispanic White	0.516	0.616	0.485	**
Hispanic	0.185	0.129	0.190	*
Black	0.290	0.240	0.314	*
Other race	0.009	0.015	0.011	
AFQT score	38.748	43.476	39.835	*
AFQT missing	0.039	0.055	0.041	
Married in 1979	0.127	0.142	0.087	**
Family background in 1979 (age 14-22)				
Foreign language spoken at home	0.227	0.154	0.231	**
Not religious	0.129	0.150	0.100	**
Catholic	0.316	0.330	0.318	
Baptist	0.269	0.224	0.277	
Attended religious services past year	0.393	0.289	0.472	**
Single-parent family	0.226	0.217	0.157	**
Step-parent family	0.146	0.130	0.062	**
Other non-intact family structure	0.079	0.133	0.057	**
Number of siblings	4.035	3.806	3.860	**
Birth order (first child)	0.209	0.209	0.218	
Birth order missing	0.051	0.058	0.061	
Ln (average annual family income)	10.359	10.349	10.539	**
Family income missing	0.062	0.092	0.069	
Living below poverty threshold	0.273	0.230	0.241	*
Poverty level missing	0.049	0.049	0.061	
Received public assistance past year	0.194	0.141	0.134	**
Public assistance status missing	0.049	0.040	0.038	
White collar father	0.195	0.272	0.252	**
Father's employment status missing	0.061	0.062	0.065	
Adult female in household worked	0.572	0.517	0.521	**
Highest education in family: no high school	0.374	0.288	0.334	**
Highest education in family: high school	0.515	0.516	0.504	
Highest education in family: college or more	0.111	0.196	0.162	**
Family education missing	0.038	0.058	0.036	
Family had a library card	0.715	0.744	0.696	
Other family-related controls				
Mother suffered from a mental health problem	0.017	0.049	0.009	**
Maternal mental health problems missing	0.084	0.126	0.079	**
Mother suffered from a major health problem	0.507	0.533	0.448	**
Maternal health problem missing	0.029	0.058	0.022	**
Father suffered from a mental health problem	0.058	0.039	0.006	**
Paternal mental health problem missing	0.156	0.203	0.122	**
Father suffered from a major health problem	0.581	0.577	0.453	**
Paternal health problem missing	0.098	0.135	0.073	**
Mother had drinking problems	0.092	n/a	n/a	
Father had drinking problems	n/a	0.431	n/a	



→ Table 1. Variable Means, by Parental Problem-drinking Status

	Problem-drinking father	Problem-drinking mother	No problem- drinking parent	Sig. test ^a
	(N=1,516)	(N=325)	(N=5,679)	
Paternal grandfather had drinking problems	0.104	0.095	0.035	**
Paternal grandmother had drinking problems	0.029	0.034	0.009	**
Maternal grandfather had drinking problems	0.080	0.175	0.058	**
Maternal grandmother had drinking problems	0.029	0.077	0.014	**
Alcohol-related policy variables in year and state of birth				
Beer tax rate (cents per 12oz.)†	6.844	6.125	7.643	**
Spirits tax rate (\$ per gallon)†	7.556	7.522	7.597	
Tobacco tax rate (cents per 20-pack)†	27.371	26.509	28.983	**
State controls on alcohol sales	0.317	0.318	0.327	
Alcohol policies missing	0.071	0.034	0.089	**
Residential characteristics in 1979 (age 14-22)				
Lived in same residence since birth	0.403	0.369	0.473	**
Urban residency	0.825	0.833	0.784	**
County of residency crime rate	54.790	56.766	53.420	**
Crime rate missing	0.071	0.055	0.058	
County of residency unemployment rate	0.063	0.062	0.063	
Unemployment rate missing	0.049	0.031	0.032	**
Region of residency: North	0.244	0.303	0.253	*
Region of residency: South	0.340	0.285	0.388	**
Region of residency: West	0.242	0.241	0.172	**
Region of residency: Northeast	0.174	0.170	0.187	
Region of residency missing	0.075	0.080	0.083	

^a Kruskal-Wallis equality of population rank test. ** Statistically significant at $p < 0.01$; * statistically significant at $p < 0.05$.

Note: Data excludes NLSY79 respondents from the military and economically disadvantaged minorities of the supplemental sub-sample. It also excludes observations with missing data on familial problem-drinking questions or respondents that were not interviewed between 1998 and 2004 (attrition). The final sample analyzed has 7380 observations.

† Converted to 2002 dollars.

than 5% missing observations, we replaced the missing values with the variable mean and added as a control a dummy variable with the value of 1 if an observation was missing and 0 otherwise. As a result of this adjustment, we maintained close to the full sample size for all analyses.

Descriptive Statistics

Table 1 reports mean values for all analysis variables by whether respondents had a problem-drinking father, a problem-drinking mother, or no problem-drinking parents. Adult children of problem-drinking parents had worse overall self-perceived health and worse scores based on the SF-12 mental health index. They were also more likely to have had a mental health problem in the past year and to have ever been diagnosed with a mental health problem. In addition, the descriptive statistics indicated worse health status for respondents with a problem-drinking mother compared to those with a problem-drinking father. The distribution of the measures for self-perceived health and SF-12 mental health index are presented in **Figure 1** for respondents with and without problem-drinking parents.

Problem-drinking parents were overrepresented among non-Hispanic Whites and families with a single parent,

stepparent, or other non-intact family structures. They were underrepresented among Blacks and Hispanics. Families with low income or education were more likely to have a problem-drinking father. Families in which a parent had attended college and respondents with higher AFQT scores were more likely to have a problem-drinking mother. It appears from the descriptive statistics that children exposed to problem drinking by one parent were also at risk of having another parent or family member with drinking, mental health, or physical health problems.

Methods

The effects of having a problem-drinking parent on health outcomes at age 40 were first estimated using single-equation techniques. As seen in **Table 1**, however, respondents with and without a problem-drinking parent differed systematically across many dimensions. Simple multivariate analyses (e.g., ordinary least squares or logit models) are likely to produce biased estimates of the effect of parental problem drinking even when a rich set of covariates are used to control for demographic, family, and socioeconomic

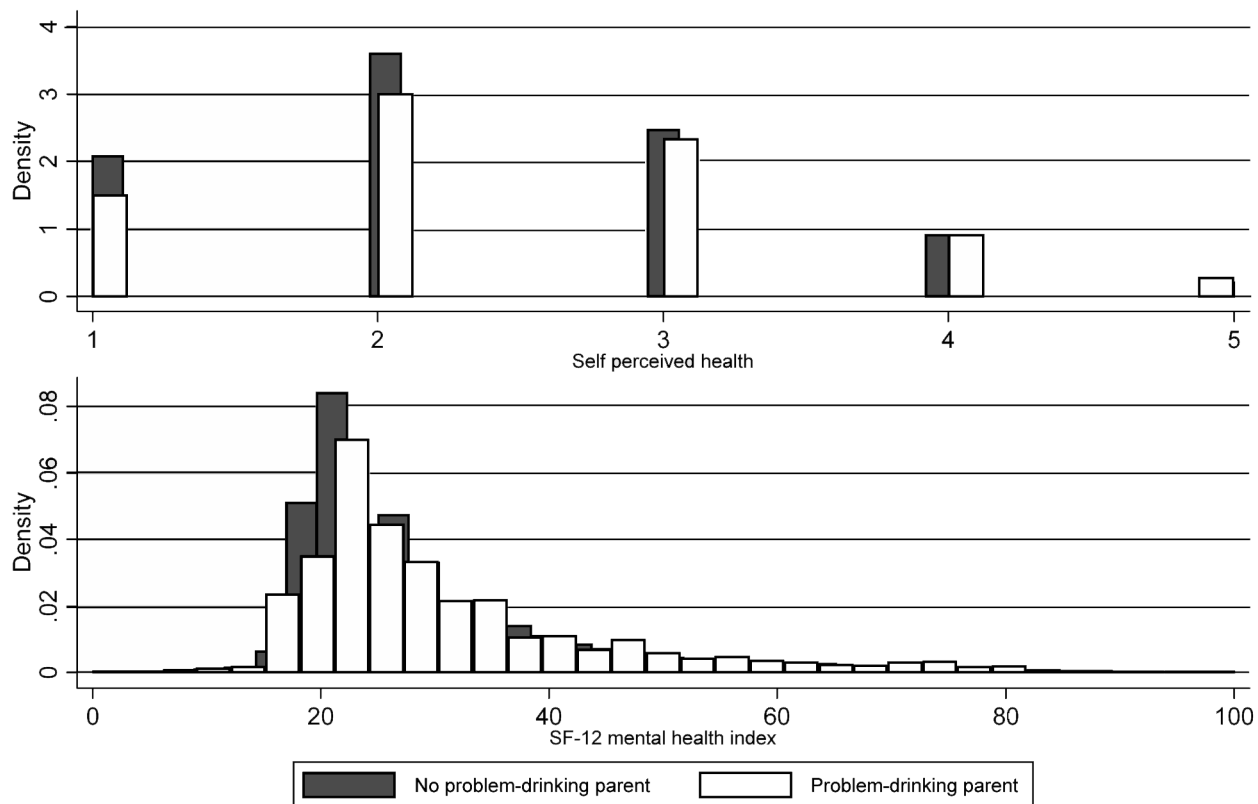


Figure 1 - Distribution of Health Status Measures at Age 40.

Note: The scale for self-perceived health categorical ranges from 1 for excellent health to 5 for poor health. On SF-12 mental health index, higher scores represent worse health.

characteristics. First, the control variables may be related to parental alcohol misuse in a nonlinear fashion. Second, the distribution of the covariates might have little overlap across the treated and untreated individuals.^{29,30} Third, it is possible to over-control the estimation if the number of covariates entering the equation approaches the degrees of freedom in the model. Finally, single-equation multivariate models cannot account for important unmeasured or unobserved factors that may be jointly correlated with parental problem drinking and the outcomes of interest.

With PSM techniques, a group of “treated” individuals (those who reported having a problem-drinking father or mother) are compared to a group of “untreated” individuals (those with similar characteristics for all of the non-health measures who did not report a problem-drinking parent). This approach can address limitations associated with standard regression models by selecting a subset of untreated individuals for whom the distribution of covariates is similar to the distribution in the treated group.^{30,31} Although this technique will not mimic the statistical properties of a randomized controlled trial (i.e., unmeasured or unobserved factors could still create bias if they are uncorrelated with the included controls), PSM, when performed properly with quality data, enables researchers to make meaningful comparisons between treated and control individuals and produces estimates that perform well compared to experimental designs.³¹⁻³⁴

To execute PSM, we first estimated each respondent’s propensity for having a problem-drinking parent conditional on a set of demographic, family, and socioeconomic measures collected during adolescence. In a second stage, we matched each “treated” individual with an “untreated” individual that had a similar propensity score. This produced a new, balanced control group that did not differ systematically from the treated group in terms of the available covariates. Finally, for each health outcome analyzed, we computed the mean difference between the treated and untreated group, or what is known in the literature as the average treatment effect on the treated (ATT). We used the command *psmatch2* in Stata version 9 to estimate propensity scores, match treated with untreated individuals, test the balance of the treated and untreated groups, estimate the differences in the outcomes of interest, and compute standard errors. We conducted separate analyses for individuals reporting a problem-drinking father (in which case the untreated group did not have a problem-drinking father) and problem drinking mother (defined similarly) and for male and female respondents.

To calculate the matched outcome for the untreated group, our default-matching criterion was nearest neighborhood matching with three neighbors ($k=3$). This method matched each treated individual with the three neighbors who had the closest propensity score. In addition, we tested for robustness using other matching algorithms: single nearest neighbor with

Table 2. Estimated Effects of a Problem-drinking Parent on Children's Health Status at Age 40

Health status measures	Problem-drinking father		Problem-drinking mother	
	Propensity score ATT ^a	Single equation ^b	Propensity score ATT ^c	Single equation ^b
Self-perceived health categorical (1=Exc, 5=Poor)	-0.028 (0.038)	0.021 (0.030)	0.195** (0.072)	0.181** (0.059)
SF-12 mental health index (high = worse health)	0.606 (0.512)	1.099** (0.421)	2.034* (0.991)	2.115* (0.832)
Ever diagnosed with a mental health problem	0.015 (0.011)	0.019** (0.007)	0.046* (0.023)	0.025# (0.137)
Had a mental health problem past 12 months	0.018* (0.009)	0.015** (0.006)	0.018 (0.018)	0.010 (0.009)

Note: Standard errors in parentheses. ** Statistically significant at $p < 0.01$; * statistically significant at $p < 0.05$; # statistically significant at $p < 0.10$

^a Average treatment effect on the treated (ATT), with nearest neighborhood propensity score matching (3 neighbors) and marginal effects derived from single equation regressions (OLS or logit, depending on the distribution of the dependent variable). 1,486 treated and 5,736 untreated.

^b Coefficients reported for continuous outcomes, and marginal effects reported for dichotomous outcomes. $n = 7,212$

^c Average treatment effect on the treated (ATT), with nearest neighborhood propensity score matching (3 neighbors) and marginal effects derived from single equation regressions (OLS or logit, depending on the distribution of the dependent variable). 315 treated and 6,907 untreated.

and without replacement, nearest neighborhood matching with five neighbors, and radius matching with calipers of 0.00005. We bootstrapped the standard errors of the matched outcome when using nearest neighborhood with $k = 3$.

As noted earlier, the PSM method can remove potential bias associated with all observed covariates or due to unmeasured/unobservable characteristics that are correlated with the observed covariates. Nevertheless, PSM can still generate biased estimates if there is any heterogeneity between the treated and untreated groups that is not correlated with the covariates used to construct the propensity score. To further investigate the extent to which the effects respond to changes in the set of covariates used to estimate the propensity score, we estimated the effects of a problem drinking parent on children's health status by adding groups of control variables incrementally starting with the most exogenous ones (e.g., demographic controls, regional alcohol-related policy variables), and ending with those more likely to have an endogenous association with parental problem drinking (e.g., parental mental health problems). By incrementally adding groups of variables that could proxy for potential omitted variables and observing how the inclusion of each block influences the coefficients of interest vis-à-vis the parsimonious models, this approach provides insight into the possibility of omitted variable bias and into the range of effect sizes when different controls are considered. Our analysis cannot determine whether parental problem drinking led to parental mental health problems (a potential mediator of the effect of parental alcohol misuse on children's health) or if these mental health problems preceded the parent's problem drinking status and were the primary cause of the children's deteriorated health status. The stacked analysis, however, does allow us to assess the magnitude of the effects in one hypothesis versus the other. We believe that PSM has many advantages over standard

multivariate methods and that the rich set of covariates used in the computation of propensity scores and our stacked approach reduces concerns about potential biases.

Results

Table 2 presents the estimated effects of a problem-drinking parent on children's health status at age 40 using PSM and single equation techniques. While there were some differences between PSM and single equation results, no single pattern of bias was identified. The results from the propensity score analysis indicate that having a problem-drinking father significantly increased the likelihood of having a mental health problem in the past 12 months (by 1.8 percentage points or 29 percent when compared to those without a problem-drinking parent).

Adults with a problem-drinking mother were significantly less likely to be in good health compared to respondents in the control group. Quantitatively, those with a problem-drinking mother had scores on the SF-12 mental health component that were 2 points higher (higher scores correspond to lower health status) than those of respondents in the untreated group. Having a problem-drinking mother also increased the likelihood of ever having been diagnosed with a mental health problem by 4.6 percentage points (124 percent above the likelihood of diagnosis for those without a problem-drinking parent). Besides being statistically significant, these magnitudes are also clinically meaningful, given that the average SF-12 mental health score was 29, the prevalence of lifetime mental health diagnoses averaged 6.2%, and the likelihood of experiencing mental health problems in the past 12 months averaged 3.7% for respondents who did not report a problem-drinking parent. Respondents with a problem-drinking mother were not

Table 3. Estimated Marginal Effects of a Problem-drinking Parent on Children's Health Status at Age 40, by Gender^a

Health status measures	Problem-drinking father		Problem-drinking mother	
	Men	Women	Men	Women
	Propensity score ATT ^b	Propensity score ATT ^c	Propensity score ATT ^d	Propensity score ATT ^e
Self-perceived health categorical (1=Exc, 5=Poor)	0.000 (0.057)	-0.034 (0.052)	0.121 (0.123)	0.211* (0.092)
SF-12 mental health index (high = worse health)	0.945 (0.702)	1.472* (0.718)	-0.41 (1.562)	2.791* (1.319)
Ever diagnosed with a mental health problem	0.016 (0.013)	0.036* (0.016)	0.021 (0.033)	0.054# (0.032)
Had a mental health problem past 12 months	0.014 (0.011)	0.042** (0.013)	-0.006 (0.027)	0.018 (0.025)

Note: Standard errors in parentheses. ** Statistically significant at $p < 0.01$; * statistically significant at $p < 0.05$; # statistically significant at $p < 0.10$

^a Average treatment effect on the treated (ATT), with nearest neighborhood propensity score matching (3 neighbors) and marginal effects derived from single equation regressions (OLS or logit, depending on the distribution of the dependent variable).

^b 615 treated and 2,886 untreated.

^c 871 treated and 2,850 untreated.

^d 113 treated and 3,388 untreated.

^e 202 treated and 3,519 untreated.

significantly more likely to report having a mental health problem in the past year.

To further investigate how these relationships varied for male and female ACOAs, we estimated the marginal effects of having a problem-drinking father and having a problem-drinking mother on adult sons and daughters using PSM. **Table 3** shows that the significant effects presented earlier appear to be driven largely by the negative impact of having a problem-drinking parent on female ACOAs. Having a problem-drinking father or mother did not significantly affect the mental health of sons. Scores on the SF-12 mental health index were 1.5 percentage points higher among daughters of problem-drinking fathers and 2.8 percentage points higher for daughters of problem-drinking mothers. Women with a problem-drinking parent were also significantly more likely to have ever been diagnosed with a mental health problem, and the magnitude of the marginal effects of having a problem-drinking mother were larger than those for having a problem-drinking father. Having a problem-drinking father also increased the likelihood of having a mental health problem in the past 12 months by 4.2 percentage points among women. Daughters of problem-drinking mothers reported worse self-perceived health than those without a problem-drinking parent.

As mentioned in the Methods section, entering the control variables in stacks and observing changes in the coefficients can help assess the sensitivity of the estimated PSM effects to changes in the set of adjusters used to construct the propensity score. Results from three different models are presented in **Table 4**. Models A-C include the control variables presented in **Table 1**. The demographic controls,

alcohol-related policy variables in year and state of birth, and residential characteristics in 1979 are entered first in Model A because these are the least likely to be endogenous. In Model B, family background characteristics in 1979 as reported in **Table 1** (such as language, religion, family structure, parental employment status, and income) are added, followed by the other family-related controls in Model C (parental health problems and drinking problems among other family members). The estimates in Model C are the same as those presented in our main model in **Table 2**. The effects of having a problem-drinking father and mother decrease in size and significance as each stack of controls are added. As we include more endogenous controls in our model, we reduce concerns about omitted variable bias, although it seems that some of these variables mediate the association between parental drinking and children's health.

The results in **Table 2** were estimated using the default matching criterion, which matched each individual to the three neighbors with the closest propensity scores. To assess the robustness of these results to the matching criteria used, **Table 5** and **Table 6** present the estimates from alternate matching methods (i.e., three nearest neighbors, five nearest neighbors, single nearest neighbor with and without replacement, and radius matching). In addition, we bootstrapped the standard errors from our main specification to account for the estimation of the propensity score in the first stage. In general, the ATTs of a problem-drinking father and mother were similar in sign, magnitude, and significance regardless of the matching technique applied. These results provide empirical support for our core specifications.

ANA I. BALSAL ET AL.

Table 4. Estimated Marginal Effects of a Problem-drinking Father on Children's Health Status at Age 40 with Stacked Controls^a

Health status measures	Problem-drinking father			Problem-drinking mother		
	Propensity score ATT ^b			Propensity score ATT ^c		
Models	A	B	C	A	B	C
Self-perceived health categorical (1=Exc, 5=Poor)	0.086* (0.034)	0.068# (0.035)	-0.028 (0.038)	0.305** (0.069)	0.270** (0.071)	0.195** (0.072)
SF-12 mental health index (high = worse health)	1.242** (0.466)	1.446** (0.475)	0.606 (0.512)	3.679** (0.947)	2.941** (0.974)	2.034* (0.991)
Ever diagnosed with a mental health problem	0.037** (0.01)	0.037** (0.01)	0.015 (0.011)	0.072** (0.022)	0.067** (0.022)	0.046* (0.023)
Had a mental health problem past 12 months	0.03** (0.008)	0.026** (0.008)	0.018* (0.009)	0.044* (0.017)	0.030# (0.018)	0.018 (0.018)

Note: Standard errors in parentheses. ** Statistically significant at p<0.01; * statistically significant at p<0.05; # statistically significant at p<0.10. Model A includes demographic controls, alcohol-related policy variables in year and state of birth, and residential characteristics in 1979 reported in **Table 1**. Model B includes the variables in Model A and family background characteristics in 1979 reported in **Table 1**. Model C includes the variables in Model B and the other family-related controls reported in **Table 1**.

^a Average treatment effect on the treated (ATT), with nearest neighborhood propensity score matching (3 neighbors) and marginal effects derived from single equation regressions (OLS or logit, depending on the distribution of the dependent variable)

^b 1,486 treated and 5,736 untreated.

^c 315 treated and 6,907 untreated.

Table 5. Average Treatment Effect on the Treated (ATT) of a Problem-drinking Father on Children's Health Status at Age 40 Alternative Propensity Score Matching Methods

Health status measures	ATT Matching method 1a	ATT Matching method 1b	ATT Matching method 2	ATT Matching method 3a	ATT Matching method 3b	ATT Matching method 4
Self-perceived health categorical	-0.028 (0.038)	0.009 (0.041)	-0.035 (0.036)	-0.09 (0.046)	-0.031 (0.038)	0.033 (0.046)
SF-12 mental health index	0.606 (0.512)	1.186# (0.612)	0.794 (0.488)	-0.218 (0.622)	0.598 (0.518)	0.221 (0.614)
Ever diagnosed with a mental health problem	0.015 (0.011)	0.022* (0.010)	0.015 (0.01)	-0.002 (0.013)	0.012 (0.011)	0.009 (0.013)
Had a mental health problem past 12 months	0.018* (0.009)	0.022* (0.009)	0.022** (0.008)	0.004 (0.011)	0.017# (0.009)	0.007 (0.01)

Note: Standard errors in parentheses. ** Statistically significant at p<0.01; * statistically significant at p<0.05; # statistically significant at p<0.10

Alternative matching methods:

^{1a} ATT using nearest neighborhood matching with 3 neighbors. Standard errors computed analytically. Observations in common support: 1,486 treated and 5,736 untreated.

^{1b} ATT using nearest neighborhood matching with 3 neighbors. Standard errors bootstrapped using 50 replications.

² ATT using nearest neighborhood matching with 5 neighbors. Standard errors computed analytically. Observations in common support: 1,486 treated and 5,736 untreated.

^{3a} ATT using nearest neighborhood matching with a single neighbor, with replacement. Standard errors computed analytically. Observations in common support: 1,486 treated and 5,736 untreated.

^{3b} ATT using nearest neighborhood matching with a single neighbor, without replacement. Standard errors computed analytically. Observations in common support: 1,486 treated and 5,736 untreated.

⁴ ATT using radius matching with calliper of 0.00005. Standard errors computed analytically. Observations in common support: 864 treated and 5,736 untreated.

Table 6. Average Treatment Effect on the Treated (ATT) of a Problem-drinking Mother on Children's Health Status at Age 40
Alternative Propensity Score Matching Methods

Health status measures	ATT Matching method 1a	ATT Matching method 1b	ATT Matching method 2	ATT Matching method 3a	ATT Matching method 3b	ATT Matching method 4
Self-perceived health categorical	0.195** (0.072)	0.233** (0.081)	0.18** (0.068)	0.238** (0.088)	0.26** (0.084)	0.265** (0.086)
SF-12 mental health index	2.034* (0.991)	2.257# (1.325)	2.171* (0.934)	2.241# (1.193)	2.24# (1.136)	2.947* (1.186)
Ever diagnosed with a mental health problem	0.046* (0.023)	0.058* (0.028)	0.047* (0.022)	0.032 (0.027)	0.051# (0.026)	0.058* (0.027)
Had a mental health problem past 12 months	0.018 (0.018)	0.027 (0.026)	0.02 (0.017)	0.016 (0.021)	0.025 (0.02)	0.033 (0.021)

Note: Standard errors in parentheses. ** Statistically significant at $p < 0.01$; * statistically significant at $p < 0.05$; # statistically significant at $p < 0.10$

Alternative matching methods:

^{1a} ATT using nearest neighborhood matching with 3 neighbors. Standard errors computed analytically. Observations in common support: 315 treated and 6,907 untreated.

^{1b} ATT using nearest neighborhood matching with 3 neighbors. Standard errors bootstrapped using 50 replications.

² ATT using nearest neighborhood matching with 5 neighbors. Standard errors computed analytically. Observations in common support: 315 treated and 6,907 untreated.

^{3a} ATT using nearest neighborhood matching with a single neighbor, with replacement. Standard errors computed analytically. Observations in common support: 315 treated and 6,907 untreated.

^{3b} ATT using nearest neighborhood matching with a single neighbor, without replacement. Standard errors computed analytically. Observations in common support: 315 treated and 6,907 untreated.

⁴ ATT using radius matching with calliper of 0.00005. Standard errors computed analytically. Observations in common support: 211 treated and 6,907 untreated.

Discussion and Conclusion

The results of this research clearly demonstrate that parental problem-drinking is often associated with adverse health and mental health outcomes in children that extend well into adulthood. Moreover, the consequences differed in magnitude and significance based on the gender of the problem-drinking parent and the ACOA. Having a problem-drinking father significantly affected the likelihood of having a mental health problem in the past 12 months, but did not affect the other mental health outcomes. Respondents with a problem-drinking mother, however, were more likely to have higher (i.e., worse) scores on the categorical self-perceived health scale and the SF-12 mental health index, and were more likely to have ever been diagnosed with a mental health problem. A number of studies have reported worse outcomes among children of alcoholic mothers,^{3,12,20} which is not surprising given that mothers are often the primary caregivers during childhood and adolescence and serve a critical role directing the household. In addition, outcomes were worse for daughters of problem-drinking parents, and especially for daughters of problem-drinking mothers. Sons of problem-drinking parents did not appear to fare worse than the comparison group in terms of the outcomes evaluated in this study. One possibility is that parental problem drinking leads to internalizing effects among female ACOAs, with more severe consequences for their health

status and health perceptions later in life.²² If male ACOAs suffer mainly from externalizing or other problems, we could see effects among sons in different areas such as conduct disorders, deviance, heavy alcohol or drug use, violence, or criminal activity.¹³ Future research should explore these outcomes in ACOAs.

One of the key strengths of using the nationally representative NLSY79 dataset is that it enabled us to evaluate health risks as children of problem drinkers entered middle age and was large enough to enable us to consider the effects of problem-drinking fathers apart from problem-drinking mothers. A range of mental health outcomes as well as self-perceived overall health, an important indicator of future health problems, were considered in this analysis to provide a comprehensive assessment of health status in adulthood. These outcomes will have important implications for medical care utilization and associated costs as these late baby-boomers continue to age. Moreover, along with just a handful of other studies,^{7,8} our analysis is unique in its use of PSM techniques to minimize the potential bias associated with non-experimental data.

Despite these strengths, there are several limitations to the analysis. First, our definition of problem drinking was based on respondent self-reports and not on professional diagnoses. Individual-specific assessments may have introduced some measurement error, as female respondents were more likely to report a problem-drinking parent than male respondents. Second, our sample included a relatively small number of

problem-drinking mothers, thus reducing statistical power in this area. Third, we could not tell from the data the timing when parents' drinking problems started, nor whether the problem-drinking parent was absent from the respondent's household by the time these problems became apparent. Because of this timing uncertainty, all problem-drinking parents were considered as a homogeneous group in our analysis. Finally, PSM cannot account for important unobserved variables that are unrelated to the covariates in the models. Controlling for an extensive set of demographic, social, and family characteristics, however, makes it unlikely that this would be a serious problem. Many of the control variables used in the analysis may be mediators representing some of the pathways through which parental alcoholism influences ACOA's health outcomes.

In conclusion, these findings reveal that there are important and costly externalities that affect the children of problem drinkers well into adulthood. These long-term consequences of parental alcohol misuse should be taken into account when designing and financing addiction treatment programs and providing medical and social support services to COAs, ACOAs, and individuals with alcohol abuse or dependence. Furthermore, current estimates of the costs of parental alcohol abuse that do not consider these externalities are not capturing the full extent of this disease. Future research should focus on developing a better understanding of which pathways are important contributors to ACOA's long-term health outcomes. In particular, the issue of how maternal problem drinking affects a child's health differently than paternal problem drinking demands further exploration. Such research could influence changes in intervention design and lead to programs that are better tailored to the needs of ACOAs. The clinical and economic benefits of effective treatment for alcohol abuse and dependence may prove to be as intergenerational as the consequences of parental alcoholism, resulting in positive externalities that influence future generations.

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