



Regular drinking may strengthen the beneficial influence of social support on depression: Findings from a representative Israeli sample during a period of war and terrorism

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ABSTRACT

Background: Social support is consistently associated with reduced risk of depression. Few studies have investigated how this relationship may be modified by alcohol use, the effects of which may be particularly relevant in traumatized populations in which rates of alcohol use are known to be high.

Methods: In 2008 a representative sample of 1622 Jewish and Palestinian citizens in Israel were interviewed by phone at two time points during a period of ongoing terrorism and war threat. Two multivariable mixed effects regression models were estimated to measure the longitudinal association of social support from family and friends on depression symptoms. Three-way interaction terms between social support, alcohol use and time were entered into the models to test for effect modification.

Results: Findings indicated that increased family social support was associated with less depression symptomatology ($p < .01$); this relationship was modified by alcohol use and time ($p < .01$). Social support from friends was also associated with fewer depression symptoms ($p < .01$) and this relationship was modified by alcohol use and time as well ($p < .01$). Stratified analyses in both models revealed that the effect of social support was stronger for those who drank alcohol regularly than those who did not drink or drank rarely.

Conclusions: These findings suggest that social support is a more important protective factor for depression among regular drinkers than among those who do not drink or drink rarely in the context of political violence. Additional research is warranted to determine whether these findings are stable in other populations and settings.

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1. Introduction

Israel has traditionally had some of the lowest rates of alcohol use problems in the world (Adler and Kandel, 1983; Bamberger and Barhom-Kidron, 1998; Rahav et al., 1999). However, increases in immigration and ongoing terrorist attacks in recent decades have contributed to an increase in alcohol use rates (Bar-Hamburger et al., 2009; Bleich et al., 2003, 2005; Shoham et al., 1980). Since 2000, over 6400 Palestinians and 1000 Israeli citizens have been

killed (B'Tselem, 2012). Terrorism is particularly traumatogenic as it targets civilians and can occur anywhere, especially in highly populated civilian areas (Canetti et al., 2013). This perpetual violence has negatively affected the physical and mental health of people living in Israel (Hobfoll et al., 2012). Recent studies report a high incidence of depression and war-related stress in Israel and the Palestinian territories (Canetti et al., 2010).

Heavy drinking is associated with a number of negative consequences including unintentional injury, violence, risk-taking behaviors, neurological problems, liver disease, depression and risk for suicide (Castaneda et al., 1996; Centers for Disease Control and Prevention, 2012; Corrao et al., 2004; Heron, 2007; National Center on Addiction and Substance Abuse, 1999; Smith et al., 1999; Sullivan et al., 2005; Wechsler et al., 1994). Studies focusing on alcohol use following terrorist attacks primarily examine these

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adverse effects of heavy alcohol use. Findings have demonstrated that heavy alcohol use may impede recovery or treatment of psychiatric problems following a terrorist attack and is thought to be an avoidant coping strategy for dealing with stress in such circumstances (Adams et al., 2006; North et al., 2002; Schiff et al., 2006; Thoits, 1995).

Other research has described the potentially positive effects of alcohol use. A review by Baum-Baicker (1985) found that light to moderate alcohol use increased psychological well-being and that heavy drinkers and non-drinkers had higher rates of depression than moderate drinkers. A longitudinal investigation in Norway found that adults who abstained from alcohol their entire lives had weaker social networks and a higher risk for depression than those who did not abstain from alcohol (Pedersen, 2013). Despite these indications of the positive effects of moderate alcohol use, it is not yet known whether moderate drinking is causally associated with diminished psychiatric symptoms (Peele and Brodsky, 2000) or whether drinking behavior interacts with other factors to produce these benefits. The nature of this relationship within the context of terrorism also remains unclear.

People rely on social support as a coping mechanism following potentially traumatic events (Bleich et al., 2003; Thoits, 1995) and social support has consistently been shown to be a strong protective factor against the development of depression (Belle, 1987; Brown et al., 1986; Kendler et al., 2005). Although heavy alcohol use is generally and appropriately seen as an unhealthy coping strategy following traumatic events (Adams et al., 2006), it is plausible that there is a moderating effect of alcohol use on social support. For example, a study in Japan found that moderate drinkers reported greater social support from friends than did heavy drinkers or non-drinkers (Yoshihara and Shimizu, 2005). Ikehara et al. (2009) found an interactive effect between light-to-moderate alcohol drinking and social support such that light-to-moderate drinking demonstrated a stronger protective effect against cardiovascular disease among those with higher social support compared to those with lower social support.

We were unable to locate studies that investigated similar effects between moderate alcohol use and social support on mental health, and in particular, depressive symptomatology, within a population living under threat of terrorism. The present study explores the modifying effects of regular alcohol use on the relationship between perceived social support and depression among a representative sample of Israeli adults. We also extend the literature by examining whether modifying effects are similar for perceived support from family and perceived support from friends. We hypothesize that perceived social support from both family and friends will be associated with lower self-reported depression scores and that both of these relationships will be modified by regular alcohol use.

2. Methods

2.1. Participants and procedure

The institutional review boards of the University of Haifa, Kent State University, and Rush University Medical Center approved this study.

A nationally representative sample of 1622 Jewish and Palestinian citizens of Israel (PCI) was obtained through a random telephone survey. Structured telephone interviews were conducted at 3 time points during a period of ongoing violence in Israel; the first wave was conducted from May–July, 2007, the second wave was conducted from November, 2007 to January, 2008, and the third wave was conducted from October to November, 2008. The response rate was 68% of eligible responders, which compares favorably to similar studies (Johnson et al., 2009). A structured

survey was translated and back-translated from English into Hebrew, Arabic, and Russian. Native speakers interviewed participants in Hebrew, Arabic, or Russian.

This study is a longitudinal analysis using data from waves 2 and 3 of the data collection. The alcohol use variable of interest at wave 1 referenced a different time period than waves 2 and 3 (drinking in past 12 months vs. past 6 months), and had substantial missing responses, therefore we restricted our analysis to wave 2 and wave 3 data. Wave 2 included a total of 1292 respondents, 1103 Jews and 189 PCI, representing a dropout rate of 20.3% from wave 1; wave 3 included a total of 1206 respondents, 1051 Jews and 155 PCI, representing a 25.6% dropout rate from wave 1. Using logistic regression for continuous predictors and chi-square tests for categorical predictors we determined that dropout was significantly associated with ethnicity ($\chi^2(df)=31.57(1)$, $p<0.001$), age (OR=0.98, SE=0.004, $p<0.001$), sex ($\chi^2(df)=4.20(1)$, $p=0.04$), marital status ($\chi^2(df)=9.44(1)$, $p=.002$), and language (Arabic: OR=2.08, SE=0.30, $p<.001$; Russian: OR=0.67, SE=0.13, $p=0.04$). Participants who were PCI, younger, male, and Arabic speaking were more likely to dropout and those who were Russian speaking and married were less likely to dropout. To minimize the potential influence of emigrative selection bias on the results and maintain a representative sample, we conducted multiple imputation to impute values for participants with missing data at waves 2 and 3. All 1622 participants who participated in the first wave were thus included in analyses. Wave 1 data were not included in the current analysis, therefore for the purposes of this study, wave 2 will be referred to as time 1 and wave 3 will be referred to as time 2.

2.2. Measures

Demographic variables included sex, marital status, age, education, ethnicity (Jewish and PCI), immigration status, and income in relation to the average monthly household income (9000 New Israeli Shekel; below average, average or above average).

2.2.1. Covariates

Exposure to terrorism. Participants were asked to report whether they witnessed or had been exposed to a terror or rocket attack, were seriously injured in an attack, and/or had experienced a death or injury of a person close to them as a result of terror or rocket attacks in the past 6 months (Hobfoll et al., 2009). A dichotomous variable was created indicating experiencing any of these events or not.

Financial loss. Participants were asked whether they experienced significant financial losses as a result of rockets or terror attacks during the past 6 months (Hobfoll et al., 2009, 2006; Norris, 2001).

Subjective health was assessed by asking “How would you rate your overall health during the past month?” Responses were: much worse than before; somewhat worse; about the same; somewhat better than before; and much better (Ware and Sherbourne, 1992).

PTSD symptoms occurring in the past month in response to exposure to political violence were measured with the PTSD Symptom Scale Interview (Foa et al., 1993). Participants responded on a 4-point Likert-type scale from 0 (*not at all*) to 3 (*to a very great degree*). This measure demonstrated adequate psychometric properties in Palestinian and Jewish samples (Hall et al., 2010; Hobfoll et al., 2011). Cronbach’s alpha at wave 2 was .92 and .93 at wave 3.

Religiosity. Religiosity was defined as a dichotomous variable as either religious or not religious following culturally appropriate labels self-reported by Jews and PCI.

2.2.2. Predictor variables. Alcohol use was assessed by asking “In the past 6 months, how many times did you drink beer, wine, liquor, or any alcoholic beverage?” Response choices included 1 (*everyday*), 2 (*at least once a week*), 3 (*rarely*), and 4 (*not at all*). The variable

was dichotomized with regular drinkers defined as drinking at least once a week (score of 1 or 2).

Perceived social support was measured with two items based on the social provision scale (Sarason et al., 1987). Participants were asked to report to what extent they could turn to family members or friends for help with problems or to share problems or concerns. Participants responded on a 4-point Likert-type scale from 1 (*not at all*) to 4 (*to a very great degree*).

2.2.3. Outcome variable. *Depression symptoms* were measured with the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). Participants were asked to report the extent to which they had experienced 9 depressive symptoms in the past 2 weeks on a Likert-type scale ranging from 0 (*not at all*) to 3 (*nearly every day*). The PHQ-9 demonstrates good diagnostic accuracy, reliability, and construct validity in Israeli Jewish and PCI populations (Hobfoll et al., 2011). Cronbach's alpha at wave 2 was .85 and at wave 3 was .84.

2.3. Data analysis

Missing values for fixed variables such as sex and ethnicity were carried forward from wave 1. All other missing data were imputed using multiple imputation with chained equations in Stata, Version 12 (StataCorp, 2011). This method allows for the simultaneous imputation of multiple continuous and categorical variables using fully conditional specifications of prediction equations for each variable with missing data (Azur et al., 2011; Royston and White, 2011; van Buuren et al., 1999). Data were imputed (10 datasets) for participants who did not participate in wave 2 or wave 3 and for participants who remained in the study at those waves but had item-level missingness. *t*-Tests and chi-squared tests are not available in Stata's *mi estimate* command for analysis with imputed data, therefore, in Table 1 the *t*-statistics presented are from simple linear or logistic regressions of each variable as the outcome, and alcohol use (dichotomized) as the single predictor. For these regression models as well as the regression models estimated in Table 2 (Model 1) and Table 3 (Model 2), the coefficients and standard errors presented are the averages of all 10 multiply imputed datasets using combination rules described by Rubin (1987).

For Model 1, we fit a multivariable mixed effects linear regression of depression with family social support as the primary fixed effect predictor. The model also included an effect of time (a factor variable with time 1 as the reference), as well as additional covariates (described above) that were included based on *a priori* theory and literature reviews to control for possible confounding of the social support-depression relationship. Model 2 was an identical multivariable mixed effects linear regression but with friend social support included as the predictor. Based on methodology described by Liang and Zeger (1986), for both models we assumed an independent within-person correlation structure and estimated the model using weighted least squares with a robust variance estimator and Wald tests for *p*-values. This methodology calculates appropriate standard errors and *p*-values that account for repeated measures.

Both Model 1 and Model 2 were estimated using the *mi estimate: xtmixed* command in Stata (StataCorp, 2011). We modeled the social support predictors (family and friend) separately to investigate how they independently predicted depression and due to concerns of multicollinearity given the moderately high correlation between the two ($r = .47$ at wave 2 and $.51$ at wave 3). Both social support variables were also centered at their means before estimating the regression models.

For both models, 2-way interactions (alcohol use X time, social support X time, and social support X alcohol use) as well as a 3-way interaction term (social support X alcohol use X time) were added in a second step to test the potentially modifying effects of alcohol use and time on the relationship between perceived social support

and depression. Due to the high collinearity between the 2-way and 3-way interaction terms, statistical significance of the interactions was determined through model fit statistics. Previous studies have employed this method through chi-squared tests of nested models (Misra et al., 2005), however, these types of tests, such as likelihood ratio tests, are not appropriate with multiply imputed data. Therefore, an *F*-test for multiply imputed data using the *mi test* command in Stata following the estimation of the regression equations was employed. This command is based upon procedures described elsewhere (Li et al., 1991; Rubin, 1987) and in our study is a test of whether the interaction terms jointly add to the statistical significance of the model.

3. Results

Table 1 summarizes the demographic characteristics of the sample at time 1, stratified by drinking frequency. Regular drinkers were more likely to be male, have above average income, be Jewish rather than PCI, and have immigrated to Israel from Russia, but were less likely to be married than those who did not drink or drank rarely. No significant differences were found amongst any of the other variables.

The results of Model 1 indicated that greater familial social support was strongly associated with lower depression scores ($\beta = -.491$, $SE = .129$, $p \leq .01$). In a second step, three 2-way interactions (alcohol use X time, social support X time, and social support X alcohol use) and the 3-way interaction (social support X alcohol use X time) were added to the model. Results of the *F*-test [$F(4, 557.7) = 4.64$, $p \leq .01$] indicated that we could reject the null hypothesis that the interaction terms were jointly equal to zero, which suggests that including the interaction terms in the model statistically significantly improved the fit of the model. To enhance interpretability, results were then stratified by time 1 alcohol use. The stratified results suggested a stronger effect of social support among those who reported regular drinking ($\beta = -.834$, $SE = .241$, $p \leq .01$) than those who did not drink or drank rarely ($\beta = -.411$, $SE = .135$, $p \leq .01$) and that depression significantly increased from time 1 to time 2 among those who did not drink or drank rarely ($\beta = .625$, $SE = .164$, $p \leq .0001$) but not among regular drinkers ($\beta = .193$, $SE = .400$, $p = .63$). The complete stratified results by alcohol use are presented in Table 2.

In order to enhance interpretability of the interaction graphically (Fig. 1), we categorized participants into 4 groups: low social support/rare or no alcohol use; low social support/regular alcohol use; high social support/rare or no alcohol use; high social support/regular alcohol use. Social support was dichotomized at its mean to create these categories for the figure. The regression lines for the 4 categories are presented with time on the *x*-axis and depression on the *y*-axis.

The results of Model 2 indicated that greater social support from friends was also significantly associated with lower depression scores ($\beta = -.284$, $SE = .099$, $p < .01$). Interaction terms were then added to the model as with Model 1, and were significant [$F(4, 799.5) = 3.50$, $p \leq .01$]. Results stratified by alcohol use at time 1 indicated that social support was significantly associated with lower depression scores among regular alcohol drinkers ($\beta = -.483$, $SE = .210$, $p = .02$). Among those who did not drink or drank rarely, social support had a significant but weaker effect ($\beta = -.242$, $SE = .106$, $p = .03$). Depression increased significantly from time 1 to time 2 among those who did not drink or drank rarely ($\beta = .604$, $SE = .162$, $p \leq .0001$) but not among regular drinkers ($\beta = .094$, $SE = .406$, $p = .82$). The full results from the Model 2 analysis stratified by time 1 alcohol use are displayed in Table 3. The interaction is graphically represented in Fig. 2 using the same methodology as with Fig. 1.

Table 1
Characteristics of sample at time 1 (n = 1622).

	Regular alcohol use ^a (n = 267) n (%)	Rare or no alcohol use ^a (n = 1355) n (%)	Total sample (n = 1622) n (%)	t-Statistic ^b	Odds ratio	p Value
Female	106 (39.70)	744 (54.91)	850 (52.40)		REF	
Male	161 (60.30)	611 (45.09)	772 (47.60)	4.04	1.87 (1.37, 2.52)	<.0001
Income ^a						
Below average	87 (32.58)	576 (42.51)	663 (40.88)		REF	
Average	71 (26.59)	331 (24.43)	402 (24.78)	1.80	1.21(0.97, 2.07)	.07
Above average	109 (40.83)	448 (33.06)	557 (34.34)	2.56	1.60(1.11, 2.30)	.01
Marital status ^a						
Single	72 (26.97)	263 (19.41)	335 (20.72)		REF	
Married	173 (64.79)	949 (70.04)	1122 (69.11)	-2.32	0.66(0.47, 0.94)	.02
Divorced/separated	13 (4.87)	83 (6.13)	96 (7.08)	-1.69	0.55 (0.27, 1.10)	.09
Widowed	9 (3.37)	60 (4.42)	69 (3.09)	-1.46	0.53(0.23, 1.25)	.15
Ethnicity						
PCI ^c	12 (4.49)	245 (18.08)	257 (15.84)		REF	
Jewish	255 (95.51)	1110 (81.92)	1365 (84.16)	4.11	4.59(2.19, 9.61)	<.0001
Immigrated from Russia ^a						
Did not immigrate	192 (71.91)	1101 (81.25)	1293 (79.72)	2.65	REF	.01
Immigrated	75 (28.09)	254 (18.75)	329 (20.28)		1.70 (1.14, 2.55)	
Experienced financial loss ^a						
No						
Yes	253 (94.76)	1242 (91.66)	1495 (92.17)	-1.58	REF	.12
No	14 (5.24)	113 (8.34)	127 (7.83)		0.60 (0.32, 1.14)	
Experienced terror attack ^a						
No	249 (93.26)	1295 (95.57)	1544 (95.19)	1.43	REF	.15
Yes	18 (6.74)	60 (4.43)	78 (4.81)		1.54(0.85, 2.77)	
Self-reported health ^a						
Same as before	195 (73.03)	947 (69.89)	1142 (70.41)		REF	
Much worse	21 (7.87)	114 (8.41)	135 (8.32)	-0.38	0.88(0.46, 1.69)	.70
Somewhat worse	22 (8.24)	142 (10.48)	164 (10.11)	-1.18	0.75(0.47, 1.21)	.24
Somewhat better	22 (8.24)	79 (5.83)	101 (6.23)	1.09	1.33(0.80, 2.21)	.28
Much better	7 (2.62)	73 (5.39)	80 (4.93)	-1.90	0.47(0.21, 1.03)	.06
Religiosity ^a						
Not religious/secular	198 (74.16)	817 (60.30)	1015 (62.58)	-3.11	REF	<.01
Religious/orthodox	69 (25.84)	538 (39.70)	607 (37.42)		0.59(0.43, 0.83)	
	Mean (SD)	Mean (SD)	Mean (SD)			
Age ^a	45.02 (17.08)	45.30 (16.21)	45.25 (16.36)	-0.24	-	.81
Depression ^a	4.11 (4.70)	4.35 (4.64)	4.31 (4.65)	-0.68	-	.49
PTSD ^a	5.25 (7.21)	6.38 (7.58)	6.19 (7.53)	-1.92	-	.06
Friendship social support ^a	2.84 (0.91)	2.77 (0.90)	2.78 (0.90)	1.11	-	.27
Familial social support ^a	3.07 (0.87)	3.10 (0.83)	3.09 (0.84)	-0.49	-	.63

^a Variable had missing data. The mean and SD or N and % associated with each were calculated from 10 multiply imputed datasets. Similarly, there are varying levels of alcohol use across the 10 imputations (i.e., the range of those who drank alcohol regularly ranged from 262 to 276 across the 10 imputed datasets and those who did not drink or drank rarely ranged from 1346 to 1360). The N reported with "Regular alcohol use" and "rare or no alcohol use" is an average N across the imputations.

^b The t-statistics presented are from simple linear or logistic regressions of the variable in question as the outcome, and alcohol use (dichotomized) as the single predictor. For categorical variables, either bivariate logistic or multinomial logistic regressions were estimated and the odds ratios of regular drinking are presented.

^c PCI = Palestinian Citizen of Israel.

In addition to these primary analyses, we also conducted a limited sensitivity analysis to investigate whether the moderating effect of alcohol use remained significant if the alcohol use variable was split into 3 categories: 0 = drink rarely or not at all; 1 = drink at least once per week; and 2 = drink every day. Stratified analysis suggested that for individuals who drank rarely or not at all, family social support ($\beta = -.398$, $SE = .119$, $p \leq .01$) and friend social support ($\beta = -.245$, $SE = .100$, $p = .02$) were both significantly associated with less depression. The relationship between social support and depression was comparatively stronger for those who drank at least once a week for both family ($\beta = -.699$, $SE = .289$, $p = .02$) and friend ($\beta = -.443$, $SE = .233$, $p = .06$) social support. The largest effect of family social support on depression was for those who reported drinking everyday ($\beta = -1.56$, $SE = .515$, $p \leq .01$), however, the effect of friend social support on depression among those who reported drinking everyday was not significant ($\beta = -.459$, $SE = .520$, $p = .38$).

4. Discussion

This study utilized a large nationally representative sample of Israeli Jews and Palestinians to investigate the modifying effects

of alcohol use on the relationship between social support and depression. We hypothesized that perceived social support from both family and friends would be associated with lower self-reported depression scores and that both of these relationships would be modified by regular alcohol use, defined as having at least one drink per week. Our findings indicate that both types of social support were associated with lower depression scores over time, consistent with previous research (Belle, 1987; Brown et al., 1986; Kendler et al., 2005). These effects were significant even after controlling for a number of possible confounding variables.

Alcohol use was a significant moderator of both the friend and family social support–depression relationships: those who reported drinking at least once per week displayed a stronger inverse relationship between social support and depression than those who did not drink or drank rarely. This effect was modified by time, given the statistical significance of our 3-way interaction variables. Stratified analyses revealed that depression increased on average from time 1 to time 2 among participants who reported not drinking or drinking rarely, but that depression did not increase over time among participants who reported regular drinking. Our finding is in line with the literature on the

Table 2
Mixed effects regression model results of family social support predicting depression stratified by regular alcohol use and rare or no alcohol use (n = 1622).^a

	Regular alcohol use (n = 267)			Rare or no alcohol use (n = 1355)		
	β	SE	p value	β	SE	p value
Family social support	-.834	.241	<.01	-.411	.135	<.01
Time	.193	.400	.63	.625	.164	<.0001
Sex (REF = female)	-.160	.393	.69	.037	.199	.85
Age	-.022	.019	.25	-.016	.007	.03
Ethnicity (REF = PCI ^b)	-2.42	1.58	.13	-1.90	.316	<.0001
Self-reported health (REF = same as before)						
Much worse	.601	1.19	.62	1.65	.628	.01
Somewhat worse	.107	.729	.88	1.51	.290	<.0001
Somewhat better	.026	.582	.97	.064	.307	.84
Much better	-.522	.807	.52	-.196	.383	.61
Marital status (REF = single)						
Married	.312	.726	.67	-.258	.276	.35
Divorced/separated	-.440	1.02	.67	-.426	.426	.32
Widowed	.263	1.18	.82	-.398	.531	.46
Income (REF = below average)						
Average	-.166	.524	.75	-.145	.253	.57
Above average	-.269	.493	.59	-.512	.207	.01
Immigration (REF = did not immigrate)	.119	.354	.74	.303	.280	.29
PTSD score	.349	.036	<.0001	.277	.015	<.0001
Experienced terror attack	-1.45	.747	.05	-.042	.423	.92
Experienced financial loss	1.20	1.09	.28	-.139	.437	.75
Religiosity (REF = not religious/secular)	-.221	.518	.67	-.200	.205	.33
	F(19, 1312.9) = 7.52 p < .0001			F(19, 1673.2) = 35.80 p < .0001		

^a Stratified by drinking status at time 1. Beta coefficients and standard errors were calculated from 10 multiply imputed datasets. Due to the multiple imputation methods employed, there were varying levels of alcohol use across the 10 imputations (i.e., the range of those who drank alcohol regularly at time 1 ranged from 262 to 276 across the 10 imputed datasets and those who did not drink or drank rarely at time 1 ranged from 1346 to 1360). Stata uses estimates from all of these imputations to generate the coefficients. Therefore the N reported with “regular alcohol use” and “rare or no alcohol use” is an average N across the imputations.

^b PCI = Palestinian Citizens of Israel.

positive association between moderate alcohol use and several health outcomes (Adams et al., 2006; Agarwal, 2002; Baum-Baicker, 1985; Gea et al., 2013; Goldberg et al., 2001; Koppes et al., 2005; Standridge et al., 2004), including psychological well-being (Baum-Baicker, 1985).

Previous studies have found that regular drinkers may have more social support from friends than non-regular drinkers (Yoshihara and Shimizu, 2005) and that individuals who rely on social support to cope with perceived stress may be more likely to report increased alcohol use than those who use other types

Table 3
Mixed effects regression model results of friend social support predicting depression stratified by regular alcohol use and rare or no alcohol use (n = 1622).^a

	Regular alcohol use (n = 267)			Rare or no alcohol use (n = 1355)		
	β	SE	p value	β	SE	p value
Friend social support	-.483	.210	.02	-.242	.106	.03
Time	.094	.406	.82	.604	.162	<.0001
Sex (REF = female)	-.155	.394	.69	.074	.198	.71
Age	-.026	.019	.18	-.016	.007	.03
Ethnicity (REF = PCI ^b)	-2.55	1.57	.11	-1.92	.319	<.0001
Self-reported health (REF = same as before)						
Much worse	.630	1.18	.60	1.72	.632	.01
Somewhat worse	-.017	.725	.98	1.52	.289	<.0001
Somewhat better	-.020	.578	.97	.090	.305	.77
Much better	-.600	.814	.46	-.244	.388	.53
Marital status (REF = single)						
Married	.369	.730	.62	-.279	.279	.32
Divorced/separated	-.293	1.03	.78	-.432	.421	.31
Widowed	.325	1.20	.79	-.370	.530	.49
Income (REF = below average)						
Average	-.197	.518	.71	-.143	.251	.57
Above average	-.223	.499	.66	-.507	.209	.02
Immigration (REF = did not immigrate)	.150	.354	.67	.252	.285	.38
PTSD score	.351	.036	<.0001	.277	.015	<.0001
Experienced terror attack	-1.30	.752	.09	-.054	.421	.90
Experienced financial loss	1.02	1.09	.36	-.176	.435	.69
Religiosity (REF = not religious/secular)	-.222	.530	.68	-.206	.204	.32
	F(19, 1308.8) = 6.68 p < .0001			F(19, 1816.7) = 35.90 p < .0001		

^a Stratified by drinking status at time 1. Beta coefficients and standard errors were calculated from 10 multiply imputed datasets. Due to the multiple imputation methods employed, there were varying levels of alcohol use across the 10 imputations (i.e., the range of those who drank alcohol regularly at time 1 ranged from 262 to 276 across the 10 imputed datasets and those who did not drink or drank rarely at time 1 ranged from 1346 to 1360). Stata uses estimates from all of these imputations to generate the coefficients. Therefore the N reported with “regular alcohol use” and “rare or no alcohol use” is an average N across the imputations.

^b PCI = Palestinian Citizens of Israel.

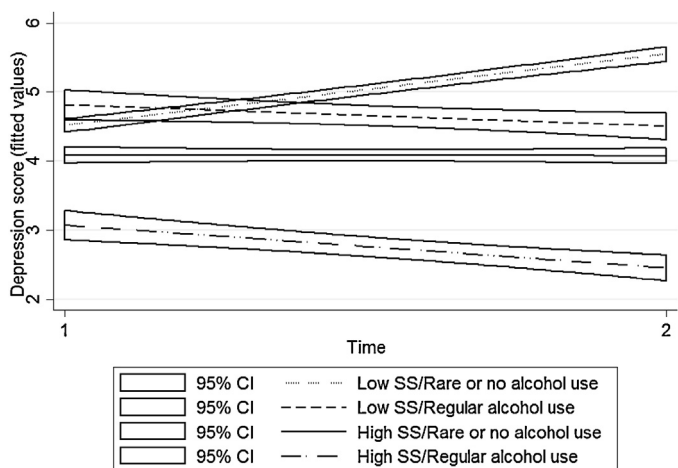


Fig. 1. Interaction of family social support and alcohol use. In order to increase interpretability, we constructed this figure by categorizing participants into 4 categories of social support and alcohol use. The figure displays the regression lines and 95% confidence intervals for those 4 categories. The tables and text of the manuscript refer to the regression models that included the continuous measure of social support, as described in Section 2. The inference of both methods was the same.

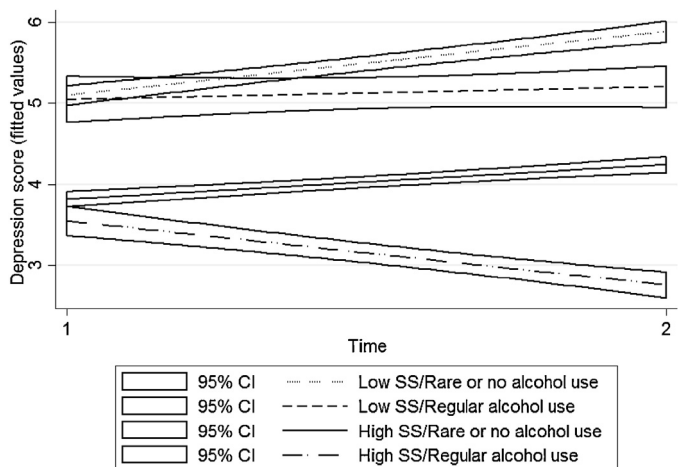


Fig. 2. Interaction of friend social support and alcohol use. In order to increase interpretability, we constructed this figure by categorizing participants into 4 categories of social support and alcohol use. The figure displays the regression lines and 95% confidence intervals for those 4 categories. The tables and text of the manuscript refer to the regression models that included the continuous measure of social support, as described in Section 2. The inference of both methods was the same.

of coping strategies (Aldridge-Gerry et al., 2011). In our bivariate analyses, we found no difference in the amount of perceived social support between regular drinkers and those who did not drink or drank rarely.

Previous research, suggesting that drinking behavior is related to drinking motives (Cooper, 1994; Cox and Klinger, 1988; Engels et al., 2005) and alcohol expectancies (Abrams and Niaura, 1987; Brown et al., 1980; Cooper et al., 1988) may help to explain our findings that social support had a stronger inverse relationship with depression among those who drank alcohol regularly compared to those who drank rarely or not at all. Alcohol outcome expectancy theory argues that positive expectations related to alcohol consumption, such as social rewards and alleviation of stress or negative psychological states, are associated with increased drinking (Christiansen and Goldman, 1983; Connors et al., 1986; Cooper et al., 1988; Fromme and D'Amico, 2000; Jones et al., 2001). These expectancies may then affect drinking behavior by acting on a

person's motivation to drink (Cooper et al., 1995). In the context of our sample, one expectation of drinking may be a reduction of stress or negative psychological states that are related to the continuing threat of terrorism and that this alleviation of stress occurs through social engagement with family and friends. This expectation may serve as a motivation to drink socially, thereby activating a person's social support network which, as we have seen in the present study, is directly associated with reduced depression.

It is important to emphasize that the positive influence of alcohol noted in the literature is for moderate drinking (Adams et al., 2006; Agarwal, 2002; Baum-Baicker, 1985; Goldberg et al., 2001; Koppes et al., 2005; Standridge et al., 2004). In our study, regular drinking behavior is a proxy for moderate drinking. Therefore, we were not able to distinguish between those who drank once or twice per week with those who drank more heavily. It may be possible that once drinking reaches problematic levels, it is no longer associated with increased effectiveness of social support. This follows as chronic heavy drinking may be associated with decreased quality and number of social relationships (World Health Organization, 2011).

Our sensitivity analysis indicated that family social support had the strongest benefit for those who drank everyday relative to those who drank at least once a week or rarely/never. These results need to be considered in light of the fact that there was a very small number of participants who reported drinking everyday ($n=27$), which is also why in our primary analysis we used a dichotomized alcohol use variable. Therefore, we can infer from the sensitivity analysis that the frequent drinkers (i.e., those who drank at least once every day) did not unduly influence the results of our original analysis that included all regular drinkers.

4.1. Limitations

The present study had several important limitations. We relied on a measure of alcohol use that did not include reported frequency of alcohol consumption or related impairment. Future research would benefit from more refined measures of alcohol use that include direct measures of problematic drinking, diary accounts, or ecological momentary assessments. Without additional measures of alcohol expectancies or motives in our survey it was not possible to further explore these potential mechanisms underlying the associations observed. Finally, we examined a nationally representative sample in Israel during a period of conflict; the results will need to be replicated in other settings to determine the generalizability of the findings.

4.2. Conclusions

Our study was unique in its exploration of alcohol use in a modifying role of the social support–depression relationship during ongoing terror in the Israeli context. Our primary finding, that the inverse association between social support and depression over time is stronger among those who drink regularly compared with those who do not drink or drink rarely, indicates that alcohol may be beneficial to psychological well-being when used moderately and in social situations. Our findings suggest that clinicians treating depression consider the potential benefits of alcohol consumption for their clients, but only within the context of adequate and available social supports. Naturally, clinicians need to use good clinical judgment. Careful monitoring of total alcohol consumption, documenting potential alcohol-related consequences, assessing the adequacy of a patient's support system, and tracking symptoms of depression, would all be indicated. Our study is too preliminary to offer conclusive support for a moderating role of alcohol consumption on depression, given the limitations noted for our alcohol use measure. The study findings warrant replication in other samples

and contexts and with more specific measures of alcohol use and problematic drinking.

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Contributors

The original study was designed by Dr. Hobfoll and Dr. Canetti and they contributed substantially to the development of this manuscript. Mr. Kane and Dr. Hall conceived the research question for the present study. Dr. Rapaport and Dr. Canetti led in drafting the Introduction and Dr. Zalta led in drafting the Methods. Mr. Kane and Dr. Hall conducted the statistical analysis and led in writing the Discussion. All authors contributed significantly to and edited all sections of the manuscript and have approved the final version.

Conflicts of interest

All authors declare that they have no conflicts of interest.

References

- Abrams, D., Niaura, R., 1987. Social learning theory. In: Blane, H., Leonard, K. (Eds.), *Psychological Theories of Drinking and Alcoholism*. Guilford Press, New York, pp. 131–178.
- Adams, R.E., Boscarino, J.A., Galea, S., 2006. Alcohol use, mental health status and psychological well-being 2 years after the World Trade Center attacks in New York City. *Am. J. Drug Alcohol Abuse* 32, 203–224.
- Adler, I., Kandel, D., 1983. Risk periods for drug involvement in adolescence in France and in Israel: application of survival analysis to cross-sectional data. *Soc. Forces* 62, 375–397.
- Agarwal, D.P., 2002. Cardioprotective effects of light-moderate consumption of alcohol: a review of putative mechanisms. *Alcohol* 37, 409–415.
- Aldridge-Gerry, A.A., Roesch, S.C., Villodas, F., McCabe, C., Leung, Q.K., Da Costa, M., 2011. Daily stress and alcohol consumption: modeling between-person and within-person ethnic variation in coping behavior. *J. Stud. Alcohol Drugs* 72, 125–134.
- Azur, M.J., Stuart, E.A., Frangakis, C., Leaf, P.J., 2011. Multiple imputation by chained equations: what is it and how does it work? *Int. J. Methods Psychiatr. Res.* 20, 40–49.
- B'Tselem, 2012. Statistics: casualties. Available at <http://old.btselem.org/statistics> (accessed 13.02.14).
- Bamberger, P., Barhom-Kidron, A., 1998. Spirits at work in the promised land: ethnic identity, work-related risk factors, and drinking behavior among Israeli Jews. *J. Appl. Behav. Sci.* 37, 445–467.
- Bar-Hamburger, R., Ezrachi, Y., Roziner, I., Nirel, R., 2009. *Illegal Use of Drugs and Alcohol in Israel 2009*. 7th Epidemiological Survey, Jerusalem.
- Baum-Baicker, C., 1985. The psychological benefits of moderate alcohol consumption: a review of the literature. *Drug Alcohol Depend.* 15, 305–322.
- Belle, D., 1987. Gender differences in social moderators of stress. In: Barnett, R., Biener, L., Baruch, G. (Eds.), *Gender and Stress*. Free Press, New York, pp. 257–277.
- Bleich, A., Gelkopf, M., Melamed, Y., Solomon, Z., 2005. Emotional impact of exposure to terrorism among young-old and old-old Israeli citizens. *Am. J. Geriatr. Psychiatry* 13, 705–712.
- Bleich, A., Gelkopf, M., Solomon, Z., 2003. Exposure to terrorism, stress-related mental health symptoms, and coping behaviors among a nationally representative sample in Israel. *JAMA* 290, 612–620.
- Brown, S.A., Goldman, M.S., Inn, A., Anderson, L.R., 1980. Expectations of reinforcement from alcohol: their domain and relation to drinking patterns. *J. Consult. Clin. Psychol.* 48, 419–426.
- Brown, G., Andrews, B., Harris, T., Adler, Z., Bridge, L., 1986. Social support, self-esteem, and depression. *Psychol. Med.* 16, 813–831.
- Canetti, D., Galea, S., Hall, B.J., Johnson, R.J., Palmieri, P.A., Hobfoll, S.E., 2010. Exposure to prolonged socio-political conflict and the risk of PTSD and depression among Palestinians. *Psychiatry* 73, 219–231.
- Canetti, D., Rapaport, C., Hall, B.J., Hobfoll, S.E., 2013. An exposure effect? Evidence from a rigorous study on the psycho-political outcomes of terrorism. In: Sinclair, S., Antonius, D. (Eds.), *The Political Psychology of Terrorism Fears*. Oxford University Press, New York.
- Castaneda, R., Sussman, N., Westreich, L., Levy, R., O'Malley, M., 1996. A review of the effects of moderate alcohol intake on the treatment of anxiety and mood disorders. *J. Clin. Psychiatry* 57, 207–212.
- Centers for Disease Control and Prevention, 2012. CDC – Fact Sheets–Alcohol Use and Health. Available at <http://www.cdc.gov/alcohol/fact-sheets/alcohol-use.htm> (accessed 23.05.13).
- Christiansen, B.A., Goldman, M.S., 1983. Alcohol-related expectancies versus demographic/background variables in the prediction of adolescent drinking. *J. Consult. Clin. Psychol.* 51, 249–257.
- Connors, G.J., O'Farrell, T.J., Cutter, H.S., Thompson, D.L., 1986. Alcohol expectancies among male alcoholics, problem drinkers, and nonproblem drinkers. *Alcohol. Clin. Exp. Res.* 10, 667–671.
- Cooper, M., 1994. Motivations for alcohol use among adolescents: development and validation of a four-factor model. *Psychol. Assess.* 6, 117–128.
- Cooper, M.L., Frone, M.R., Russell, M., Mudar, P., 1995. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. *J. Pers. Soc. Psychol.* 69, 990–1005.
- Cooper, M.L., Russell, M., George, W.H., 1988. Coping, expectancies, and alcohol abuse: a test of social learning formulations. *J. Abnorm. Psychol.* 97, 218–230.
- Corrao, G., Bagnardi, V., Zambon, A., La Vecchia, C., 2004. A meta-analysis of alcohol consumption and the risk of 15 diseases. *Prev. Med.* 38, 613–619.
- Cox, M., Klinger, E., 1988. A motivational model of alcohol use. *J. Abnorm. Psychol.* 97, 168–180.
- Engels, R.C., Wiers, R., Lemmers, L., Overbeek, G.J., 2005. Drinking motives, alcohol expectancies, self-efficacy, and drinking patterns. *J. Drug Educ.* 35, 147–166.
- Foa, E.B., Riggs, D.S., Dancu, C.V., Rothbaum, B.O., 1993. Reliability and validity of a brief instrument for assessing post-traumatic stress disorder. *J. Trauma. Stress* 6, 459–473.
- Fromme, K., D'Amico, E.J., 2000. Measuring adolescent alcohol outcome expectancies. *Psychol. Addict. Behav.* 14, 206–212.
- Gea, A., Beunza, J.J., Estruch, R., Sánchez-Villegas, A., Salas-Salvadó, J., Buil-Cosiales, P., Martínez-González, M.A., 2013. Alcohol intake, wine consumption and the development of depression: the PREDIMED study. *BMC Med.* 11, 192.
- Goldberg, I.J., Mosca, L., Piano, M.R., Fisher, E.A., 2001. AHA Science Advisory: wine and your heart: a science advisory for healthcare professionals from the Nutrition Committee, Council on Epidemiology and Prevention, and Council on Cardiovascular Nursing of the American Heart Association. *Circulation* 103, 472–475.
- Hall, B.J., Hobfoll, S.E., Canetti, D., Johnson, R.J., Palmieri, P.A., Galea, S., 2010. Exploring the association between posttraumatic growth and PTSD: a national study of Jews and Arabs following the 2006 Israeli-Hezbollah War. *J. Nerv. Ment. Dis.* 198, 180–186.
- Heron, M., 2007. Deaths: Leading Causes for 2004. National Center for Health Statistics, Hyattsville, MD. Available at http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_05.pdf (accessed 23.05.13).
- Hobfoll, S.E., Canetti-Nisim, D., Johnson, R.J., 2006. Exposure to terrorism, stress-related mental health symptoms, and defensive coping among Jews and Arabs in Israel. *J. Consult. Clin. Psychol.* 74, 207–218.
- Hobfoll, S.E., Hall, B.J., Canetti, D., 2012. Political violence, psychological distress, and perceived health: a longitudinal investigation in the Palestinian Authority. *Psychol. Trauma* 4, 9–21.
- Hobfoll, S.E., Mancini, A.D., Hall, B.J., Canetti, D., Bonanno, G.A., 2011. The limits of resilience: distress following chronic political violence among Palestinians. *Soc. Sci. Med.* 72, 1400–1408.
- Hobfoll, S.E., Palmieri, P.A., Johnson, R.J., Canetti-Nisim, D., Hall, B.J., Galea, S., 2009. Trajectories of resilience, resistance, and distress during ongoing terrorism: the case of Jews and Arabs in Israel. *J. Consult. Clin. Psychol.* 77, 138–148.
- Ikehara, S., Iso, H., Yamagishi, K., Yamamoto, S., Inoue, M., Tsugane, S., The JPHC Study Group, 2009. Alcohol consumption, social support, and risk of stroke and coronary heart disease among Japanese men: the JPHC Study. *Alcohol. Clin. Exp. Res.* 33, 1025–1032.
- Johnson, R.J., Canetti, D., Palmieri, P.A., Galea, S., Varley, J., Hobfoll, S.E., 2009. A prospective study of risk and resilience factors associated with posttraumatic stress symptoms and depression symptoms among Jews and Arabs exposed to repeated acts of terrorism in Israel. *Psychol. Trauma* 1, 291–311.
- Jones, B.T., Corbin, W., Fromme, K., 2001. A review of expectancy theory and alcohol consumption. *Addiction* 96, 57–72.
- Kendler, K.S., Myers, J., Prescott, C., 2005. Sex differences in the relationship between social support and risk for major depression: a longitudinal study of opposite-sex twin pairs. *Am. J. Psychiatry* 162, 250–256.
- Koppes, L.L.J., Dekker, J.M., Hendriks, H.F.J., Bouter, L.M., Heine, R.J., 2005. Moderate alcohol consumption lowers the risk of type 2 diabetes: a meta-analysis of prospective observational studies. *Diab. Care* 28, 719–725.
- Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613.
- Li, K.-H., Meng, H.-L., Raghunathan, T.E., Rubin, D.B., 1991. Significance levels from repeated *p*-values with multiply-imputed data. *Stat. Sin.* 1, 65–92.

- Liang, K., Zeger, L., 1986. Longitudinal data analysis using generalized linear models. *Biometrika* 73, 13–22.
- Misra, D., Astone, N., Lynch, C., 2005. Maternal smoking and birth weight: interaction with parity and mother's own in utero exposure to smoking. *Epidemiology* 16, 288–293.
- National Center on Addiction and Substance Abuse, 1999. No safe haven: children of substance-abusing parents. Available at <http://www.casacolumbia.org/articlefiles/379-no%20safe%20haven.pdf> (accessed 30.05.13).
- Norris, F., 2001. Measuring exposure to the events of September 11, 2001. National Institutes of Health, Office of Behavioral and Social Sciences Research, Available at <http://obsr.od.nih.gov.ezproxy.welch.jhmi.edu/activities/911/attack.htm> (accessed 30.05.13).
- North, C.S., Tivis, L., McMillen, J.C., Pfefferbaum, B., Cox, J., Spitznagel, E.L., Bunch, K., Schorr, J., Smith, E.M., 2002. Coping, functioning, and adjustment of rescue workers after the Oklahoma City bombing. *J. Trauma. Stress* 15, 171–175.
- Pedersen, W., 2013. Abstainers: a risk group? *Tidsskr. Nor. Laegeforen.* 133, 33–36.
- Peele, S., Brodsky, A., 2000. Exploring psychological benefits associated with moderate alcohol use: a necessary corrective to assessments of drinking outcomes? *Drug Alcohol Depend.* 60, 221–247.
- Rahav, G., Hasin, D., Paykin, A., 1999. Drinking patterns of recent Russian immigrants and other Israelis: 1995 national survey results. *Am. J. Public Health* 89, 1212–1216.
- Royston, P., White, I., 2011. Multiple imputation by chained equations (MICE): implementation in stata. *J. Stat. Softw.* 45, 1–20.
- Rubin, D., 1987. *Multiple Imputation for Nonresponse in Surveys*. John Wiley & Sons, New York.
- Sarason, I.G., Sarason, B.R., Shearin, E.N., Pierce, G.R., 1987. A brief measure of social support: practical and theoretical implications. *J. Soc. Pers. Relat.* 4, 497–510.
- Schiff, M., Benbenishty, R., McKay, M., DeVoe, E., Liu, X., Hasin, D., 2006. Exposure to terrorism and Israeli Youths' Psychological Distress and Alcohol Use: an exploratory study. *Am. J. Addict.* 15, 220–226.
- Shoham, S.G., Rahav, G., Esformes, Y., Markovski, R., Chard, F., Kaplinsky, N., 1980. Some parameters of the use of alcohol by Israeli youth and its relationship to their involvement with cannabis and tobacco. *Drug Alcohol Depend.* 6, 263–272.
- Smith, G.S., Branas, C.C., Miller, T.R., 1999. Fatal nontraffic injuries involving alcohol: a metaanalysis. *Annu. Emerg. Med.* 6, 659–668.
- Standridge, J.B., Zylstra, R.G., Adams, S.M., 2004. Alcohol consumption: an overview of benefits and risks. *S. Med. J.* 97, 664–672.
- StataCorp., 2011. *Stata Statistical Software: Release 12*. StataCorp LP, College Station, TX.
- Sullivan, L.E., Fiellin, D.A., O'Connor, P.G., 2005. The prevalence and impact of alcohol problems in major depression: a systematic review. *Am. J. Med.* 118, 330–341.
- Toits, P.A., 1995. Stress, coping, and social support processes: where are we? what next? *J. Health Soc. Behav., Spec No.* 53–79.
- van Buuren, S., Boshuizen, H.C., Knook, D.L., 1999. Multiple imputation of missing blood pressure covariates in survival analysis. *Stat. Med.* 18, 681–694.
- Ware Jr., J.E., Sherbourne, C.D., 1992. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med. Care* 30, 473–483.
- Wechsler, H., Davenport, A., Dowdall, G., Moeykens, B., Castillo, S., 1994. Health and behavioral consequences of binge drinking in college. A national survey of students at 140 campuses. *JAMA* 272, 1672–1677.
- World Health Organization, 2011. *Global Status Report on Alcohol and Health*, Available at http://www.who.int/substance_abuse/publications/global_alcohol_report/msbgsruprofiles.pdf (accessed 17.06.13).
- Yoshihara, C., Shimizu, S., 2005. Social networks in drinking behaviors among Japanese: support network, drinking network, and intervening network. *Nihon Arukoru Yakubutsu Igakkai Zasshi* 40, 441–454.