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Running head: SOCIAL NETWORKS, AFFECT AND HEALTH

**Why Would Social Networks be Linked to Affect and Health Practices?**

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## Abstract

**Objective.** Those with more diverse social networks (higher in social integration [SI]) are healthier than those with less diverse networks. We examine whether greater SI is associated with less alcohol consumption and cigarette smoking and with greater positive and less negative affectivity. We also test a range of potential pathways that might link SI to “healthier” behaviors and emotions.

**Methods.** Social network and psychological questionnaires were administered to 193 adults who were then interviewed on 14 consecutive evenings about their daily social interactions, affect, and smoking and alcohol consumption.

**Main Outcome Measures.** Smoking, alcohol consumption, positive and negative affect.

**Results.** Those high in SI interacted with more people and smoked and drank less. SI was not, however, associated with affectivity. In contrast, within-subject analyses found the more people participants interacted with during a day, the greater their positive affect, drinking, and smoking on that day. This occurred primarily for persons low in SI. High SI persons reported high positive affect irrespective of the number of people they interacted with, and their smoking and drinking behaviors were less influenced by number of interactants. In general, SI associations with health behaviors and affect could not be explained by individual differences in mastery, purpose, social support, or psychological stress, or by social personality or relationship characteristics.

**Conclusion.** SI may be related to better health because having a diverse social network is associated with resistance to momentary negative behavioral influences that can occur when spending time with others.

Social integration (SI) refers to participation in a broad range of social relationships (Brissette, Cohen, & Seeman, 2000) and is rooted in Durkheim's (1897/1951; Thoits, 1983) seminal work indicating that suicide was most prevalent among those who were neither married nor had close ties with the community and church. There is no accepted or standard measure of integration, but most assess the number of recognized social positions (roles) or identities (e.g., points are assigned for being a spouse, father, friend, or church member). SI has attracted the attention of psychologists interested in the role of our interpersonal relationships in health because of its reliable association with both psychological and physical well-being. Over a dozen prospective community based studies have reported that socially integrated people live longer (reviews by Berkman & Glass, 2000; Cohen, 1988; 2004; House, Landis, & Umberson, 1988; Uchino, 2004) while other studies have found that greater integration predicts increased survival from heart attacks (reviewed by Berkman, 1995; Seeman, 1996), less risk for cancer recurrence (reviewed by Helgeson, Fritz & Cohen, 1998), for upper respiratory illness (Cohen, Doyle, Skoner, Rabin & Gwaltney, 1997), for depression and anxiety (reviewed by Cohen & Wills, 1985; Kawachi & Berkman, 2001), and less severe cognitive decline with aging (Bassuk, Glass & Berkman, 1999).

Despite this sizable descriptive literature linking diverse social networks to morbidity and mortality, there have been virtually no analytic studies to test well-formulated hypotheses about why this occurs. Here we examine whether people with more diverse social networks differ on daily affect, and rates of smoking and alcohol use, all of which are ultimately relevant for health status. We also test several models of how

SI might influence these outcomes. First, we examine traditional theories that suggest SI operates by generating dispositional-like characteristics including feelings of mastery, purpose and positive affectivity that are thought to motivate better health behaviors and regulate affect (reviews in Cohen, 1988; Thoits, 1983; Uchino, 2004). Second, we test the proposal that SI is associated with better health because it is a marker of having social support for addressing life adversities (House, Landis & Umberson, 1988; Uchino, 2004). In turn, this support is thought to provide protection from stress-triggered increases in smoking, drinking and negative affect and decreases in positive affect. Third, we test the possibility that the SI associations with health are driven by social isolation. Specifically we examine whether being below some threshold of social contact results in stress and negative affect that in turn contribute to higher rates of smoking and drinking and poorer affect regulation (Cacioppo & Hawkley, 2003; Cohen, 2004; Rook, 1984).

We also propose the possibility that persons with diverse social networks respond to others differently than those with less diverse networks. This could occur because those higher in SI have higher levels of purpose, mastery and self-esteem as suggested earlier, but may also occur because those higher in SI interact with different types of people, or because the experiences of interacting with a broad range of others alters how one views one's social world. In specific we are interested in how SI might influence affect regulation and the conduct of health relevant behaviors in social settings. We hypothesize that those high in SI are accustomed to interacting with a broad range of people and are consequently less emotionally responsive to being with others. We also predict that the diversity of their networks make them less subject to social pressures by specific subgroups to drink or smoke. Moreover, because they have a broad range of

experiences interacting across social domains they may be less dependent on alcohol and cigarettes to facilitate social interaction.

Finally, we investigate the role of a number of variables that might provide alternative spurious (third factor) explanations for associations between SI, health behaviors and affective response. These include social dispositions that have evolved from the traditional personality literature such as extraversion and agreeableness as well as other variables representing our ability to form and maintain social networks such as caring, communal orientation and tendencies toward negative social interaction (Reis & Collins, 2000; Lakey & Cohen, 2000).

In the present study we monitored subject interactions, health-related behaviors, and affect for 14 consecutive days. We conducted between-subject analyses to determine whether SI was associated with positive and negative affectivity and with smoking and consuming alcohol. We expected to find SI associated with more PA, less NA and less smoking and alcohol consumption (Berkman & Breslow, 1983; Cohen & Wills, 1985; Uchino, 2004; Umberson, 1987). We also tested whether these relations can be explained by the mechanisms discussed earlier including mastery, purpose, social support or psychological stress. Finally, we asked whether SI moderates how we respond (affect, drinking and smoking) in social situations. We also examined the possibility that any relationship we found might be attributable to SI merely acting as a proxy for the social personality characteristics extraversion and agreeableness or for common measures of interpersonal relationships such as caring and communal orientation.

## Methods

The participants were 95 men and 98 women ages 21 to 54 years (mean age=37.3, SD=8.8) who responded to newspaper advertisements soliciting participants for studies of psychosocial risk factors for upper respiratory infections. One hundred eight were white, 72 African-American, and 13 indicated other racial/ethnic categories. The mean years of education was  $13.76 \pm 2.21$  and median income was \$17,500 with a range of \$2,500 to \$162,500. The sample contained 28.5% full time employees, 26.9% working part-time, 22.3% unemployed, 15.3% other nonworking categories (e.g., housewife, retired) and 7.3% were other unidentified categories. Finally 47.2% were smokers and 65.8% drank at least 1 alcoholic drink during the 14 days of monitoring. Here, we report an analysis of baseline data obtained prior to any of the parent study-related interventions. All components of the study received IRB approval and participants were paid \$820 for completing all aspects of the parent study.

After a physical exam found them to be in good health (no acute or chronic illnesses), participants filled out the SI measure as well as demographic, personality, social support, mastery and purpose scales. They were subsequently interviewed on the phone for 14 consecutive evenings to assess their daily interactions, moods, and rates of smoking and alcohol consumption. Approximately one week later they completed the remaining social interaction, stress and negative affect scales.

### *Psychological Questionnaires*

*Social integration.* The Social Network Index assesses participation in twelve types of social relationships (Cohen et al., 1997). These include spouse, parents, parents-in-law, children, other close family members, neighbors, friends, workmates, schoolmates,

fellow volunteers (e.g., charity or community work), members of groups without religious affiliations (e.g., social, recreational, professional), and members of religious groups. One point was assigned for each kind of relationship indicated for which respondents reported that they spoke (in person or on the phone) to someone in that relationship at least once every two weeks. The total possible score was 12.

*Social personality.* Extraversion and agreeableness were each measured with shortened (five-item) versions of the subscales from the Goldberg Big Five Questionnaire (Goldberg, 1992; Cohen et al., 1997). Each item is a trait (extraversion: talkative [+], bashful [-], shy [-], extraverted [+], quiet [-]; agreeableness: cold [-], rude [-], unkind [-], pleasant [+], harsh [-]) and respondents indicated how accurately the trait described how they “typically are” on a scale ranging from 0 (not at all accurate) to 4 (extremely accurate). These two scales were each administered twice, approximately 4 weeks apart and the scores from the two assessments were averaged.

*Interpersonal relationships.* The nine-item version of the Positive Relationship with Others Scale (Ryff, 1989) assesses caring about others and the ability to have satisfying relationships. An example of an item is “Most people see me as loving and affectionate.” The 14-item Communal Orientation Scale measures the tendency to view one’s relationships as communal (caring for others’ needs) (Clark, Ouellette, Powell, & Milberg, 1987). The frequency of negative interactions with significant others was assessed by a 5-item scale (Krause, 1995). Examples of questions include how often have others made too many demands on you?; been critical of you?; pried into your affairs?

*Social support.* Perceived availability of social support when facing adversity was assessed with a short (12-item) version of the Interpersonal Support Evaluation List (ISEL; Cohen, Mermelstein, Kamarck & Hoberman, 1985). The short measure includes equal numbers of questions assessing appraisal, belonging, and self-esteem support.

*Mastery.* Perceived mastery over important life outcomes was assessed with the 7-item Mastery Scale (Pearlin & Schooler, 1978).

*Purpose.* Purpose in life, defined in terms of the extent to which a person engages in activities that are personally valued, was assessed with the 6-item Life Engagement Scale (LES; Scheier et al., 2005).

*Negative affect and stress.* Psychological stress was assessed by the 10-item Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983). The scale measures the degree to which situations in life were perceived as stressful during the last month. The negative affect scale included 9 items from the three subscales (depression, anxiety, and anger) from a factor analysis of the Profile of Mood States (Usala & Hertzog, 1989). Participants reported affect frequency during the last week. Finally, the 5-item version of the emotional instability subscale from the Goldberg Big 5 (Goldberg, 1992) required participants to rate how accurate various single-word traits (irritable, nervous, resentful, tense, depressed) describe how they typically are.

For all the scales, the appropriate items were reversed and the scale scores were summed. The test-retest correlations were .81 for extraversion and .64 for agreeableness ( $p < .001$ ). The internal reliabilities were .71-.78 for extraversion, .69-.79 for agreeableness, .79 for positive relationships, .80 for the ISEL, .73 for Communal

Orientation, .77 for negative interactions, .72 for mastery, .73 for life engagement, .80 for emotional instability, .88 for negative affect, and .88 for perceived stress.

### *Interviews*

Participants were interviewed on the telephone for 14 consecutive evenings. Interviewers were blind to psychological questionnaires and to the hypotheses of this study. Each evening participants were asked if they participated with someone else in each of 7 different broadly defined activity categories during the previous 24 hours. These included: have a meal, drink or dessert, cup of coffee, etc.; leisure activities at home; leisure activities away from home; work around the house; family or personal errands; anything else with anyone such as visiting, exercising, going to church; and spent at least 15 minutes with other(s) in any other activity. For each category they participated in, they were asked what exactly they did, and with whom? They could list more than one activity for each category. We calculated the number of people they interacted with (within these activities) during each 24 hour period. Individuals were only counted once within any day.

The interviews also queried how many cigarettes participants smoked and how many alcoholic drinks they consumed during the previous 24 hours. A bottle of beer, shot of whiskey, or glass of wine each counted as one drink. A sizable body of public health literature that included biochemical measures shows that reports of smoking and alcohol use are quite valid under these conditions (e.g., Patrick et al., 1994; Wills & Cleary 1997).

Finally, they were asked to rate how they felt since they got up this morning using 6

positive and 6 negative adjectives (Cohen, Doyle, Turner, Alper, & Skoner, 2003; from factor analysis by Usala & Hertzog, 1989). The positive scale contained items assessing vigor (full of pep, lively), calm (at ease, calm), and well-being (cheerful, happy). The negative scale included depression (sad, unhappy), anxiety (on edge, tense) and anger (angry, hostile). These scales have been described as representing activated (anxiety, anger, vigor and well-being) and unactivated (calm and depression) dimensions of affect (Cohen et al., 2003). Ratings ranged from 0="you haven't felt that way at all today" to 4="you felt that way a lot today". The Cronbach alpha coefficients over the 14 days ranged from .82-.90 for the positive scale and .83-.90 for the negative scale.

## Results

### *Analysis Strategy*

A series of two-level multilevel models were tested using HLM 5.05 (Raudenbush, Bryk, Cheong, & Congdon, 2000) to appropriately analyze the current nested data structure (see Bryk & Raudenbush, 1992; Nezlek, 2001). The 2,674 daily interviews (Level 1) were nested within 191 participants (Level 2). (Two subjects were dropped from the analysis because of missing data). All within-person (daily) variables were centered on each individual's mean and their effects were modeled as randomly varying across individuals. Between-person predictors (i.e., SI) were centered around the sample mean. Analyses examined effects of daily number of interaction partners on same-day outcome variables. Interactions of SI and daily number of interaction partners were decomposed using procedures recommended by Aiken and West (1991). Conditional slopes were estimated by centering SI at low (-1 SD) or high (+1 SD) values and testing the effect of daily interaction partners after replacing SI with one of these transformed

variables. Effect sizes (ES) were computed using Rosenthal and Rosnow's (1984) suggested formula, based on  $t$  values of fixed effects. Percent change in ES (mediation analyses) was calculated (ES when mediator was added to the equation – original ES / original ES).

### *Covariates*

Neither age nor race were associated with SI ( $ps > .17$ ). However, women ( $M = 5.68$ ) reported greater SI than men ( $M = 5.11$ ),  $t = -2.14$ ,  $p < .05$ . Consequently, gender was included as a covariate in all models. All covariates, including individual difference variables described below, were modeled both as main effects and as interactions with all daily-level predictors.

### *Means and Variance Components*

Totally unconditional models (intercepts only) were analyzed to generate means and variance components for each of the daily variables (see Table 1). Substantial Level 1 variance (within-participants, across the day observations) was found for each of the measures, suggesting that participants' values on these measures fluctuated from one day to the next. This suggests the utility of day-level predictors (i.e., number of interaction partners) for modeling daily changes in affect and health behaviors. In addition, the substantial Level 2 variance components indicate individual differences in affect and health behaviors (as averages across all the days), suggesting the utility of individual difference predictors in modeling these averages (i.e., social integration).

### *Main Effects of Social Integration (Between Participants)*

Greater SI was associated with interacting with more people ( $b = .31$ ,  $ES=.32$ ,  $p < .001$ ), consuming fewer alcoholic drinks ( $b = -.09$ ,  $ES=.16$ ,  $p < .05$ ) and smoking fewer cigarettes ( $b = -.50$ ,  $ES=.15$ ,  $p < .05$ ) on an average day over the two week period. However, it was not associated with average PA or NA ( $ps > .16$ ).

#### *Main Effects of Daily Number of Interaction Partners (Within Participant)*

The more people that participants interacted with during a day, the greater their PA ( $b = .10$ ,  $ES=.16$ ,  $p < .05$ ), their alcoholic consumption ( $b = .14$ ,  $ES=.31$ ,  $p < .001$ ) and the number of cigarettes smoked ( $b = .11$ ,  $ES= .22$ ,  $p < .01$ ) that day. Number of interaction partners was not associated with daily NA,  $p = .14$ .

#### *Interactions of SI and Number of Daily Interaction Partners*

*Health practices.* Effects of daily number of interaction partners on alcohol consumption and smoking were moderated by SI (interaction:  $b = -.03$ ,  $ES=.17$ ,  $p < .05$  for drinking and  $b = -.04$ ,  $ES=.15$ ,  $p < .05$  for smoking). The effects of number of interaction partners on increased drinking and smoking were greater for people low in SI (drinking:  $b = .21$ ,  $ES=.27$ ,  $p < .001$ ; smoking:  $b = .20$ ,  $ES=.25$ ,  $p < .01$ ) than for people high in SI (drinking  $b = .08$ ,  $ES=.19$ ,  $p < .01$ ; smoking:  $b = .07$ ,  $ES=.14$ ,  $p < .05$  (see Figures 1 and 2).

*Affect.* The effect of daily interaction partners on PA was moderated by SI (interaction was marginal:  $b = -.04$ ,  $ES=.13$ ,  $p = .08$ ). Specifically, those high in SI reported high levels of PA irrespective of the number of people they interacted with during the day ( $p=.58$ ); in contrast, those low in SI who interacted with few people during

the day had low levels of PA, but as the number of people they interacted with increased, their PA increased ( $b = .19$ ,  $ES=.19$ ,  $p < .01$ ).

Because the interaction with the total PA scale was marginal, we examined each of the subscales separately to see if the type of PA mattered. The interaction held up for vigor ( $b = -.02$ ,  $ES=.15$ ,  $p < .04$ ) and marginally for well-being ( $b = -.02$ ,  $ES=.13$ ,  $p = .07$ ) subscales but did not approach significance for calm ( $p = .60$ ). The interactions of SI-by-number of interaction partners in predicting vigor and well-being are displayed in Figure 3. These patterns of results are similar to what we found when using total PA (all 3 subscales); number of interaction partners predicted increased well-being ( $b=.09$ ,  $ES=.23$ ,  $p = .002$ ) and vigor ( $b=.09$ ,  $ES=.24$ ,  $p=.001$ ) for those low in SI but had no effect for those high in SI ( $ps>.27$ ). SI did not moderate the effect of daily number of interaction partners on daily negative affect ( $p = .32$ ) or any of the daily negative affect subscales (anxiety, depression, anger) ( $ps>.23$ ).

#### *Why do High and Low SI People Differ in Their Response to Others?*

*Positive affect.* Could the differences in well-being or vigor explain why low and high SI people behave differently in response to an increasing number of people? If PA is the mediator, then entering well-being and vigor and the SI-by-well-being and SI-by-vigor interactions into the health behavior analyses reported above should substantially reduce the interaction of SI-by-number of interaction partners. As apparent from Table 2, these control variables had only a small impact on the interaction predicting smoking (18% reduction in ES) and resulted in no reduction at all on the interaction predicting drinking (2% increase).

*Type of interaction partners.* Another possibility is that people who are high in SI have qualitatively different types of interaction partners than do people who are low in SI. We computed the number and percent of interactions with close (parents, children, close relatives and friends, in-laws, and significant others) and other partners (e.g., non-close relatives and friends, neighbors, church and social group members, school mates, fellow volunteers). SI was associated with having both more close ( $b=.22$ ,  $p < .001$ ; high SI [+ 1 SD] close  $M = 2.8$ ; low SI [-1 SD] close  $M = 1.98$ ) and more distant ( $b=.09$ ,  $p < .05$ ; high SI distant  $M = 1.2$ ; low SI distant  $M = .86$ ) partners. However, the percent of partners who were close was not correlated with SI,  $r = -.05$ . As indicated in Table 2, all of the interactions between SI and number of partners reported earlier were nearly identical (no reductions in effect sizes) after controlling for individual differences in average percent of partners who were close and the SI-by-percentage of close partner interaction.

*Health practices.* We also conducted an analysis to determine whether changes in drinking and smoking may have been responsible for improvement in mood with increased numbers of interaction partners among those with high SI. Controlling for daily drinking, daily smoking, and the interactive effects of SI and these variables resulted in minimal reductions in the ES for either concurrent daily vigor or well-being (Table 2).

#### *Is Social Integration Merely a Proxy for Social-Personality and Relationship Variables?*

SI was significantly correlated with communal orientation,  $r = .19$ ,  $p < .01$ , negative interactions,  $r = .25$ ,  $p < .001$  and relationship caring and satisfaction,  $r = .28$ ,  $p < .001$ , but it was not related to extraversion,  $r = .05$  or agreeableness,  $r = .13$ . Adding all of

these variables as Level 2 covariates did not substantially influence the main effects of SI (Table 3) with the largest reduction (25%) in the association of SI and number of interaction partners. Similarly, adding these covariates and their interaction with SI did not reduce the ES of the SI-by-number of interaction partner interactions (Table 2).

#### *Does Social Integration Operate Through Social Support?*

We found only a moderate correlation between the ISEL and SI ( $r=.21, p<.05$ ). Moreover, adding ISEL as a Level 2 covariate had little impact on the main effects of SI (Table 3) and adding the ISEL and the SI-by-ISEL interaction had little effect on the interaction of SI with number of interaction partners (Table 2).

#### *Does Social Integration Operate Through Mastery or Purpose?*

SI was correlated with mastery,  $r = .20, p < .01$  and purpose,  $r = .27, p < .001$ . In analyses controlling for both of these variables main effects of SI on daily interaction partners and drinking were only marginally reduced (Table 3), but the main effect of SI on smoking was reduced substantially by the inclusion of mastery and purpose (39% effect reduction). Instead, purpose predicted reduced smoking ( $b = -.35, p = .056$ ). In contrast, none of the interactions of SI with daily number of interaction partners were substantially reduced by the inclusion of mastery and purpose and their interactions with SI (Table 2).

#### *Does Social Integration Operate Through Stress and Negative Affect?*

SI was correlated with perceived stress,  $r = -.21, p < .01$  and emotional instability,  $r = -.13, p = .08$  but was not significantly correlated with averaged negative affect across the 14-interview days,  $p = .69$  or retrospective reports of negative affect,  $p = .53$ . Adding

all 4 variables as Level 2 covariates did not substantially influence the main effects of SI (Table 3). Similarly, these covariates and their interactions with SI did not at all reduce the SI-by-number of interaction partner interactions predicting health outcomes (Table 2)

#### *Analyses of Smokers and of Drinkers*

To rule out the possibility that the lack of within-participant variance for nonsmokers and nondrinkers may have biased our conclusions, additional analyses of smoking and drinking restricted the sample only to smokers ( $n = 103$ ) and drinkers ( $n = 127$ ). Smoking was defined as indicating smoking cigarettes on at least one day during the 14 days of interviews and drinking as indicating have an alcoholic beverage on at least one of these days. These analyses produced virtually identical results to those involving the whole sample.

#### *Considering Email Contact in Social Integration*

Studies on social integration and health have traditionally assessed face-to-face contacts and/or phone contacts. Because a major purpose of this study was to explain associations reported in those studies, we did the same in the primary analyses. However, we also asked participants whether they had email contacts at least once every two weeks with people in each social role, and calculated a revised SI measure that took these into account. (Only 43% of our participants used email). The score on the revised scale was correlated .96,  $p < .001$  with the original score. Moreover, analyses using the revised score resulted in virtually identical results.

## Discussion

As expected, the greater the SI score, the more people participants joined with in activities on the average day. Those high in SI interacted with more people in their family and close circle, but also with more people with distant relationships like fellow workers, students and volunteers. These data are supportive of the view that social integration taps diversity of participation in a broad social network.

Higher SI scores were also associated with consuming fewer alcoholic drinks and smoking fewer cigarettes (cf. Berkman & Breslow, 1983). Our evidence does not, however, support hypotheses that attribute these associations to SI relations with positive or negative affect. Nor does it support the hypothesis that SI associations with health practices are mediated by greater perceptions of social support or mastery. In contrast, SI associated purpose-in-life may play some role at least in relation to smoking. Probably a more potent source of mediation (although not directly tested here) is that SI is associated with social pressure by the network to stay healthy and greater responsibility of socially integrated people to others (Cohen, 1988; 2004; Uchino, 2004; Umberson, 1987). Given that the focus here is on health practices, social influences are potentially mechanisms at the forefront. It is still possible that other expected mediators of health outcomes such as changes in endocrine or cardiovascular levels, could be driven by the cognitive and affective pathways that did not play a role in mediating the health behavior outcomes.

As we have discussed, increases in SI were associated with less smoking and alcohol consumption. One might similarly expect that interacting with more people would be a positive indicator of social and psychological well-being. In fact, the within participant analyses indicated that increases in the number of people interacted with during a day were associated with increases in PA on the same day. Paradoxically, more

interaction partners during a day was also associated with *increases* in smoking and alcohol consumption on that day. These effects may be attributable to alcohol and cigarettes playing a role in facilitating social interactions (Mohr et al., 2001). It is also possible that more interactants increase participant participation in these behaviors through traditional means of social influence. Finally, persons low in SI might find interacting with others stressful, and use smoking and drinking as coping strategies (Shiffman & Wills, 1985), although the failure of smoking or drinking to mediate effects of interaction partners on positive affect suggests that if this were the mechanism, it is not very effective.

Unique to this article was the proposal that SI might influence how we react to our social environment. In fact, it was primarily the low SI people whose PA, smoking and drinking increased with the number of people they interacted with. In contrast, PA, smoking and alcohol consumption of those higher in SI was relatively independent of the number of interaction partners. This result is consistent with the argument that higher SI people are responsive to the ongoing normative constraints to live a healthy lifestyle that belonging to an integrated social network places on them. In contrast, the less integrated may be more susceptible to moment-by-moment social pressures that influence their smoking and drinking behaviors. Differences in SI are not associated with the proportion of interactants with whom they have close relationships, but it is possible that those lower in SI are more likely to interact with others who drink and smoke and hence more people may represent more negative social pressure.

Interestingly, when we broke PA into the three subscales, it was feelings like full-of-pep, cheerful and happy (“activated” PA) that were associated with more social

interaction in those with low SI. Unactivated affects like at ease and calm were not. This suggests a somewhat different perspective than the generally held position that increased social interaction is associated with increases in “undifferentiated” PA.

Finally, drinking and smoking in the presence of others might be responsible for the association between more interactants and greater positive affect in persons with low SI. However, this turns out not to be the case. More interaction partners are associated with higher PA irrespective of drinking and smoking rates. Thus it is something about the interaction itself that is associated with PA, not the drugs.

None of the effects we reported could be explained by common interpersonal relationship measures (communal orientation, the ability to have caring and satisfying relationships, negative interactions) or by social personality measures (extraversion and agreeableness) suggesting a unique role of our network structure in how we react to others. Similarly, with the exception of the role of purpose in smoking, the psychological mediators tested here (mastery, social support, affect) did not play important roles in explaining associations we found. Nevertheless, it is possible that SI associations with health behaviors are mediated by feelings of loneliness, a potential mediator that was not assessed here (Cacioppo & Hawkley, 2003). However, smoking and drinking were not mediated by a more global measure of NA or perceived stress that are highly correlated with loneliness and are thought to mediate its effects on health (Pressman et al., 2005). Moreover, social isolation is often not strongly associated (sometimes not at all) with loneliness, nor is it considered a sufficient or necessary cause of loneliness (Pressman et al., 2005; Peplau & Perlman, 1982).

This study does have limitations. Because the analyses were concurrent, causal inferences are not possible. We cannot be sure of the extent to which the health behaviors and affect influenced number of interactants, or whether number of interactants influenced the health behaviors. It seems reasonable, however, that in the case of health behaviors, it was probably the number of people which triggered the behaviors rather than vice versa. In the case of positive affect either direction seems quite plausible. It is also possible that unspecified third (spurious) factors were responsible for changes in both variables, although we did account for the potential spurious effects of the most obvious alternatives, including age, gender, race, and an array of social and psychological variables.

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Table 1

*Means and Variance Components of Daily Variables*

Variable	<i>M</i>	Within Participant (Level 1) Variance	Between Participant (Level 2) Variance
Number of Interaction Partners	3.43	4.25	3.66
Positive Affect	14.94	12.24	15.64
Negative Affect	3.19	14.23	7.15
Calm	5.21	2.02	2.26
Well-being	5.34	1.81	1.90
Vigor	4.39	2.32	2.67
Anger	.74	2.01	.55
Anxiety	1.37	2.31	1.44
Depression	1.07	2.28	1.08
Number of Cigarettes	5.49	10.63	57.10
Number of Alcoholic Drinks	.90	4.11	1.48

Table 2

*Changes in Effect Sizes of the Interactions between Social Integration and Daily Number of Interaction Partners when Covariates are Added to the Equation.*

Covariate	Daily well-being			Daily vigor			Daily Number of Alcoholic Drinks			Daily Number of Cigarettes		
	b	ES	% ES Change	b	ES	% ES Change	b	ES	% ES Change	b	ES	% ES Change
None (gender only)	-.02 <sup>†</sup>	.13	--	-.02*	.15	--	-.03*	.17	--	-.04*	.15	--
PA	--	--	--	--	--	--	-.03*	.17	+2	-.03 <sup>†</sup>	.13	-18
Percent close partners	-.02 <sup>†</sup>	.13	0	-.02*	.15	0	-.03*	.17	+2	-.04*	.16	+2
Health Practices	-.01	.12	-11	-.02*	.15	+1	--	--	--	--	--	--
Social-Personality	-.02*	.15	+18	-.03*	.16	+10	-.03*	.17	-1	-.04*	.15	0
Social Support	-.02*	.14	+6	-.02*	.15	+2	-.04**	.19	+14	-.04*	.15	+1
Mastery and Purpose	-.02 <sup>†</sup>	.12	-8	-.02 <sup>†</sup>	.13	-12	-.03*	.17	+2	-.04*	.16	+4
Stress & Negative Affect	-.02*	.14	+8	-.02*	.15	+3	-.04*	.18	+9	-.04*	.16	+4
All covariates	-.02 <sup>†</sup>	.14	+6	-.02 <sup>†</sup>	.14	-7	-.03*	.17	+2	-.03*	.16	+4

*Note.* All models controlled for gender. Individual difference covariates were modeled as main effects on daily outcomes and as moderators of all daily-level predictors. ES = Effect size.

\*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$ . <sup>†</sup> $p < .10$ .

Table 3

*Changes in Effect Sizes of Main Effects of Social Integration on Daily Outcome Variables when Covariates are Added to the Equation.*

Covariates	Daily # of Interaction Partners			Daily Number of Alcoholic Drinks			Daily Number of Cigarettes		
	b	ES	% ES Change	b	ES	% ES Change	b	ES	% ES Change
None (gender only)	.31***	.32	-	-.09*	.16	-	-.50*	.15	-
Social-Personality	.24**	.24	-25	-.08 <sup>†</sup>	.14	-11	-.40 <sup>†</sup>	.12	-19
Social Support	.27***	.27	-16	-.12**	.20	+28	-.53*	.16	+7
Mastery and Purpose	.27***	.27	-14	-.09*	.16	-1	-.33	.09	-39
Stress & Negative Affect	.29***	.28	-12	-.10*	.18	+18	-.45 <sup>†</sup>	.13	-17
All covariates	.23**	.22	-30	-.09*	.18	+13	-.30	.08	-46

*Note.* All models controlled for gender. ES = Effect size.

\*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$ . <sup>†</sup> $p < .10$ .

## Figure Captions

Figure 1. Effect of Daily Total Interaction Partners (deviations from participants' average) on Concurrent Daily Number of Drinks as a Function of Individual Differences in Social Integration (SI) (controlling for gender)

Figure 2. Effect of Daily Total Interaction Partners (deviations from participants' average) on Concurrent Daily Number of Cigarettes as a Function of Individual Differences in Social Integration (SI) (controlling for gender)

Figure 3. Effect of Daily Total Interaction Partners (deviations from participants' average) on Concurrent Daily PA (Vigor [A] and Well-Being [B]) as a Function of Individual Differences in Social Integration (SI) (controlling for gender)

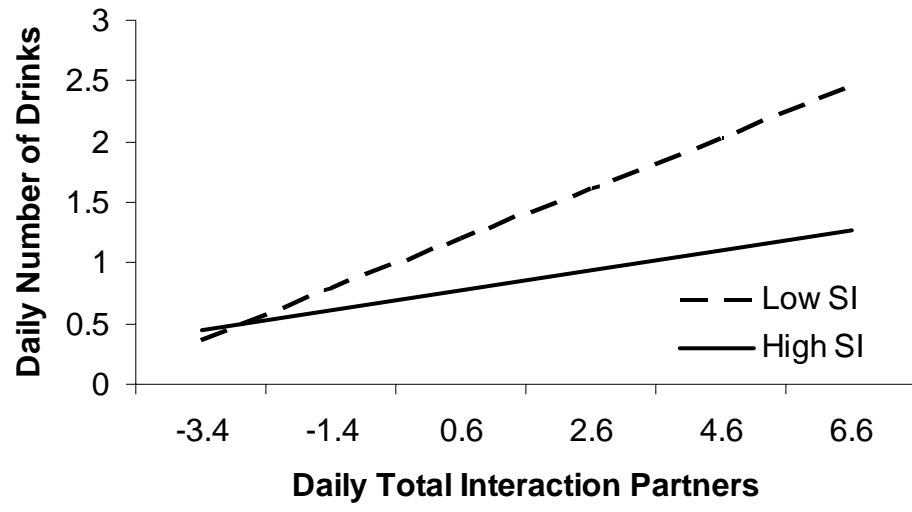


Figure 1.

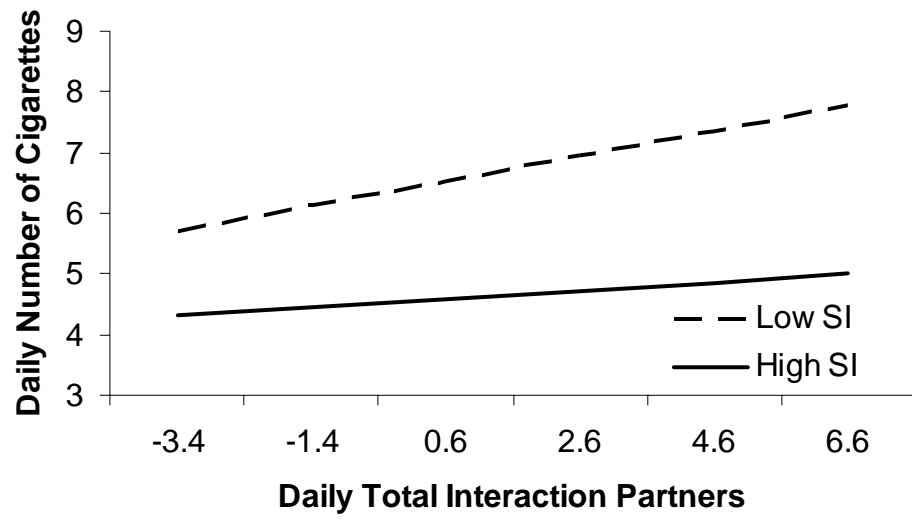


Figure 2.

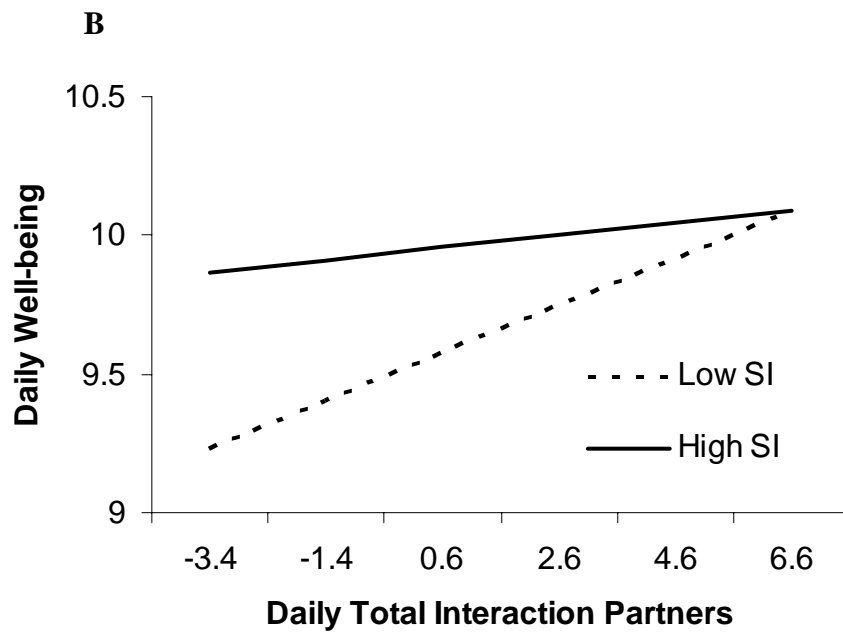
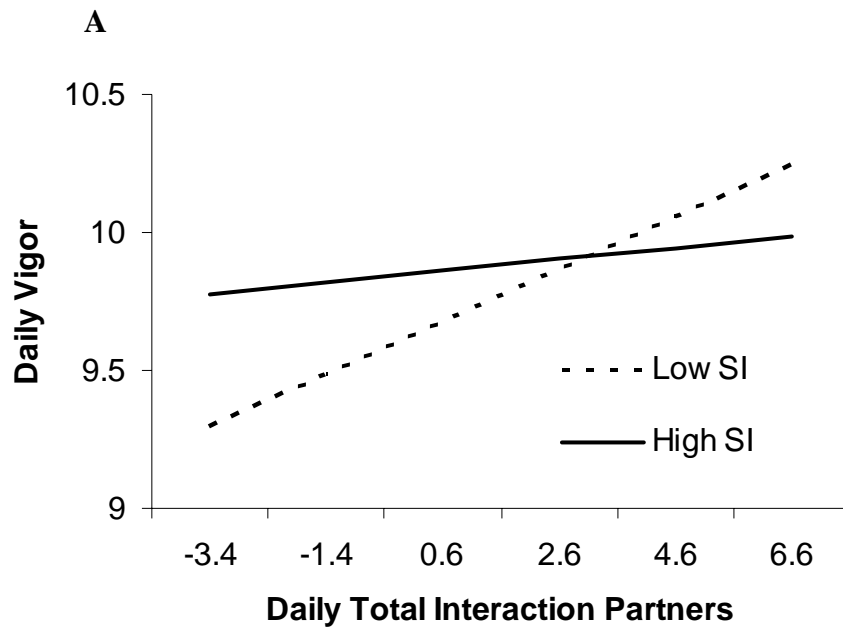


Figure 3.