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Perceived Isolation, Social Integration, and Health Behavior: A Daily Process Examination of Responses to Loneliness

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Perceived Isolation, Social Integration, and Health Behavior: A Daily Process

Examination of Responses to Loneliness

by

Sarah Noel Arpin

A thesis submitted in partial fulfillment of the
requirements for the degree of

Master of Science
in
Psychology

Thesis Committee
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Abstract

Researchers have examined social relationships as a basic need, showing that being well integrated in a network of social ties is related to various positive health outcomes including reduced mortality and risk behavior (e.g. reduced alcohol consumption). Conversely, a lack of strong social ties is related to negative outcomes including depression, suicide, and substance use (Berkman & Syme, 1979; Durkheim, 1951; Sarason, Sarason, & Gurung, 2001). Loneliness, a negative affective experience resulting from relationship deficits, is related to similar health outcomes as social isolation including depression and problematic alcohol use (Cacioppo, Hawkley, Crawford et al., 2002). However, research to date examining loneliness and health behavior has predominantly employed cross-sectional measures (e.g. UCLA Loneliness Scale; Russell, Peplau, & Cutrona, 1980), therefore failing to capture more fluctuating experiences of and responses to loneliness which may signify maladaptive patterns of coping behavior (Hawkley, Burleson, Bernston, & Cacioppo, 2003; Shankur, McMunn, Banks, & Steptoe, 2011). The purpose of this present study was to examine responses to daily loneliness (i.e. social and solitary alcohol consumption) as a function of social integration and gender, through a secondary analysis of data collected in a larger daily process study. Results indicated that daytime loneliness predicted evening increases in solitary consumption and decreases in social consumption. Further, these within-person effects were influenced by gender and social integration. These findings provide a unique understanding of specific processes by which social relationships, or the perceived lack thereof, influence health and more specifically, mood-related health behavior.

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Perceived isolation, social integration, and health behavior: A daily process examination
of responses to loneliness

It is widely known that supportive social relationships are vital elements of human flourishing and well-being. Various theorists have argued that human relationships satisfy a fundamental human need, and that the desire to develop and maintain relationships is an essential human motivation (Deci & Ryan, 2000; Baumeister & Leary, 1995). In their theory of self-determination, Deci and Ryan (2000) maintain that human beings are intrinsically motivated to fulfill the basic need of interpersonal relatedness, or feelings of closeness and connectedness with others. Reis, Shaver, and Gable (2000) demonstrate that on a daily level, such needs are best fulfilled when an individual feels unconditionally cared for and supported, which results in greater feelings of intimacy, self-esteem, vitality, and positive affect (LaGuardia & Patrick, 2008). Overall, relatedness needs satisfaction, particularly in adolescent development, has been shown to relate to greater positive affect and well-being, whereas low relatedness and interpersonal connectedness result in various psychological and behavioral consequences, such as anxiety, depression, alienation and risk behavior (e.g. alcohol and marijuana use, early sexual activity, etc.; Deci & Ryan, 2000; Heinrich, Brookmeyer, Shrier & Sarah, 2006; Resnick et al., 1997).

Very similar in theory to the self-determination perspective, Baumeister and Leary (1995) propose that human beings have a pervasive drive to form and maintain lasting, positive, and significant interpersonal relationships. According to their *need to belong* hypothesis, the universal tendency to form social relationships is a fundamental motivation, in that it has affective consequences; results in pathological outcomes

(psychological and behavioral) when thwarted; and elicits goal-directed behavior (Baumeister & Leary, 1995; Sheldon & Gunz, 2009). Recent research has explored connection-seeking behavior as a function of the thwarted need to belong (Maner, DeWall, Baumeister, & Schaller, 2007). For example, Sheldon and Gunz (2009) conducted a series of studies examining psychological need deficiencies and relevant motivations. Their findings demonstrated that perceived deficits in interpersonal relatedness predicted greater motivation to develop interpersonal connection. Similarly, Maner et al. (2007) demonstrated that the experience of social exclusion increased respondents' desire to form social bonds with others and resulted in a tendency to view potential partners as more optimistic and friendly. Furthermore, in a controlled laboratory manipulation of social rejection and ostracism, Baumeister and DeWall (2005) discovered significant impairments in cognitive ability, memory retrieval, logical reasoning, and self-regulation among those who had received messages of social exclusion and rejection. It is clear, then, that the need, desire, and motivation to form social relationships plays a large role in shaping human emotion, cognition, and behavior, all of which have important implications for physical health and well-being.

Theorists have also examined the need-based perspective of social relationships through theories of *symbolic interactionism*, which suggest that social interaction provides for optimal human development through the formation of the social self (Mead, 1934; Thoits, 1983). Central to this perspective is the argument that it is through social interactions that individuals come to view themselves as a “meaningful social entities [within] meaningful social categories,” identities, or social roles (Thoits, 1983, p. 17).

This sense of meaning is achieved through the internalization of “role-identities”, or behavioral expectations attached to occupied social roles and positions. Within these different social identities, individuals achieve a sense of meaning, identity, purpose, and self-esteem. Further, having a variety of social identities is also thought to increase feelings of security, a sense of personal worth and protect against identity loss, feelings of alienation, and social isolation (Reitzes & Mutron, 1994; Thoits, 1992).

Interestingly, the symbolic interactionist perspective also posits that social roles regulate behavior by providing a set of norms and expectations (Thoits, 1992). Such norms and expectations facilitate healthy behavior (e.g. exercise) and inhibit risk behaviors (e.g. alcohol consumption) to the extent that group norms are health-promoting (Cohen et al., 2000). It is important to note that social ties endorsing negative health behaviors, such as excessive substance use, are detrimental to individual health, despite the sense of belongingness such ties may provide (Uchino, 2006). For example, research examining the social networks of recovering alcoholics and/or and the effects of social ties on smoking cessation demonstrates low recovery and cessation rates for individuals with a high percentage of drinkers or smokers in their social networks (Cohen, Lichtenstein, et al., 1988; Havassy, Hall, & Wasserman, 1991; Latkin, C.A., Knowlton, A. R., Hoover, D., Mandell, W., 1999; Mohr, Averno, Kenny, & DelBoca, 2001).

Social relationships may also be the source of relational stress and interpersonal conflict. Indeed, much research has provided evidence that interpersonal conflict and negative social contacts are commonly reported as the most distressing daily events (Bolger, DeLongis, Kessler, & Schilling, 1989), and that interpersonal conflict and

problematic social ties significantly diminish both global and daily psychological well-being (Rook, 1984/2001). Daily negative social contacts and interpersonal conflict have also been related to increased maladaptive coping behavior such as alcohol consumption. For example, in a study of daily social contacts and college student drinking, Mohr et al. (2005) demonstrated that increases in negative social contacts predicted increased drinking at home and increased solitary consumption. Interestingly, Mohr and colleagues (2003) also demonstrated that women were particularly reactive to such negative social contacts, and that the effects of these negative interpersonal experiences carried over within and across days. Though social relationships have the potential to be the source of some negativity, research suggests that positive (i.e. intimacy, social support) and negative (i.e. interpersonal conflict) aspects of relationships are functionally independent systems (Reis & Gable, 2003); therefore validating the continued exploration of well-being effects of close relationships. In line with this, the majority of research continues to suggest that being well-integrated in a network of diverse social ties is primarily related to greater psychological health and physiological well-being, as well as inversely related to risk behavior (Berkman & Breslow, 1983; House, Landis, & Umberson, 1988b; Reynolds & Kaplan, 1990)

Social Relationships and Health

Psychological well-being, defined as the presence of positive affect and relatively lower levels of negative affect, has for some time been examined as an operationalization of positive human functioning, happiness, and human flourishing (Snyder, Lopez, & Pedrotti, 2011). Researchers have examined the association between interpersonal

relationships and psychological health, providing evidence that feelings of connectedness to others can have both global and daily effects on well-being (Reis et al., 2000), and that a lack of connectedness to others predicts anxiety, depression, and the development of various mood disorders (Baumeister & Leary, 1995; DeLongis, Folkman, & Lazarus, 1988; Sarason et al., 2001). Additionally, failure to maintain lasting, positive interpersonal relationships results in a sense of deprivation, anger, and loneliness (Cacioppo et al., 2000; Heinrich & Gullone, 2006).

Much of the literature on social relationships and well-being stems from the seminal work of sociologist Emile Durkheim (1857/1951), who proposed that a lack or breakdown of family, friend, and community ties has severe pathological outcomes, specifically suicide. He theorized that a lack of social ties leads to a loss of social resources, particularly those providing support and defining social roles and norms (Durkheim, 1951; Cohen et al., 2000). Since the work of Durkheim, research has continuously shown that social connectedness is related to numerous health outcomes such as morbidity, mortality, immune system functioning, and health behavior (e.g. alcohol consumption; Berkman & Breslow, 1983; Cohen, 1991; House et al., 1988b). Some of the most provocative evidence for these associations has been found in studies examining social integration, or the diversity of social ties in an individual's social network (Uchino, 2004). Other researchers have defined social integration as having multiple social identities (Thoits, 1983); the existence or quantity of social ties or relationships with which an individual has frequent contact (House et al., 1988b); and, in more sociologic terms, as the inverse of social isolation (Seeman, 1996). Derived from

Barnes' (1954) study of social networks, this component of social relationships refers to the presence of social ties, though not necessarily the supportive functions they provide (Cohen & Wills, 1985). Very generally, social integration is thought to influence the availability of supportive resources, health-relevant information, along with an individual's behavioral and emotional responses to experiences within his/her network of relationships (Berkman, Glass, Brissette, & Seeman, 2000).

Social integration and health outcomes. The most well-cited evidence linking social integration to health outcomes is found in the work of Berkman and Syme (1979) and Berkman and Breslow (1983), who examined the associations between social connectedness and mortality in a prospective population study of Alameda County, CA. Using a stratified sample of 6,928 community adults, Berkman and colleagues (1979/1983) collected surveys assessing four specific types of social ties (i.e. marital status, contacts with friends and relatives, church membership, and informal and formal group associations), health practices such as alcohol consumption and physical activity, as well as mortality and morbidity outcomes. Follow-up data was collected in the nine years following the initial 1965 data collection, and death records were compiled using the California Death Registry. Findings revealed that overall, women had lower mortality rates than men; that those who were married had lower mortality rates than the non-married; those who reported having few friends and relatives and having infrequent contact with these friends/relatives had higher mortality rates than those who reported more friends and relatives; those who belonged to religious or volunteer organizations had lower mortality rates than those who did not; and that these associations were greater

for men than they were women (Berkman & Syme, 1979). In sum, high social integration was related to better health outcomes, while low integration or social isolation was predictive of shorter life-span.

In regards to health practices, findings indicated that the less socially integrated reported greater alcohol and cigarette consumption, less physical activity, greater obesity, and less frequent use of medical services (Berkman & Breslow, 1983; Berkman & Syme, 1979). More recent research has continued to support these findings, demonstrating that low social integration is related to greater mortality; alcohol consumption and cigarette use; disease onset; poor immune system functioning; as well as increased risk of dying from heart disease, cancer, and circulatory disease (Berkman et al., 2000; Cohen, 1988; Cohen & Lemay, 2007; House, Landis, & Umberson, 1988a; Kuntsche, Knibbe, Gmel, 2009; Pressman, Cohen, Miller, & Rabin, 2005; Reynolds & Kaplan, 1990).

Through their Alameda County study and further research, Berkman and Syme (1979) developed a Social Network Index (see Appendix A) to reflect the key dimensions of social integration, that is the participation in a diversity of social relationships (i.e. Social Network Index, SNI; Berkman & Syme, 1979). This measure is frequently employed throughout the social relationships and health literature and notably, was used in this current study. As a self-report measure, the SNI requires respondents to record participation in a variety of social roles and relationships, including that of spouse, parent, work-related relationships, as well as involvement in religious and volunteer organizations (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). Additionally respondents note the frequency of interaction (in person or not in person) with other

people in each type of role/relationship. In assessing both the number of social ties and the relative frequency of contact with each tie, the SNI provides information beyond social network size or number of social ties. Importantly, this measure also weights the relative importance of specific ties (i.e. intimate ties are weighted more heavily) enabling researchers to explore how different types of social relationships (weak versus strong/intimate) differentially influence health.

Of particular interest to this current study is the differential health behavior of integrated versus less integrated individuals. Though such health risk behaviors as alcohol and cigarette consumption are often included as control variables in social epidemiological research, they still explain much of the variance (e.g. 20%; Berkman et al., 2000b) in social integration and health outcomes. Research has also indicated that health behaviors play a vital role in predicting health status. Specifically, Hamburg, Elliot, and Parron (1982) estimated that nearly 50% of all mortality is caused by negative health behaviors. In a study of social networks and quality of life among older adults, Michael and colleagues (1999) found similar evidence that individual health behaviors (e.g. smoking, alcohol consumption, sedentary behavior, and being overweight), were significantly related to levels of physical functioning, such that an increase in risk behavior predicted a decline in physical functioning and health-related quality of life (Michael, Colditz, Coakley, & Kawachi, 1999). Furthermore, recent statistics have shown that nearly half of the top ten leading causes of death in developed countries are caused by preventable factors including risk behaviors such as tobacco and alcohol use, physical inactivity, unhealthy diet, and risky sexual behavior (Gray, 1993). Given that

these behaviors are inversely related to social integration, and play a large role in determining health status, theorists have described health behaviors as a potential pathway through which social connectedness affects mortality and morbidity.

Social integration and social support. Aside from health behavior, the associations between social integration and health have been traditionally explained by different models and definitions of social support. Generally defined as the actual content of social relationships, including the provision of psychosocial resources (Cohen & Wills, 1985), support has been described in terms of function and structure. While functional support refers to the extent to which social ties provide specific social resources, structural support refers to the organization of relationships within a social network (Cohen, 1991) and is thus typically assessed via measures of social networks, including Berkman and Syme's (1979) Social Network Index (Berkman, Glass, Brissette, & Seeman, 2000a). Broadly, structural support refers to quantitative elements of social ties, including social integration; the frequency of social contact; the density of social ties, or the extent to which network members interact with each other; homogeneity, or the extent to which network members are characteristically similar; and reciprocity, or the extent to which social resources and support is both given and received in a relationship (Heaney & Israel, 1997). Together, social integration and social network variables (i.e. density, homogeneity, etc.) are thought of as "the most distal determinants of social support" in that they provide information about channels through which supportive resources can, but need not flow (Stroebe & Stroebe, 1996, p. 600).

Drawing from different definitions of social support, Weiss (1973/1974) conceptualized a theory of relationship provisions (Stroebe & Stroebe, 1996). Arguing that all individuals are characterized by a “fund of sociability...a readiness and need to interact with others,” Weiss (1974) maintained that social relationships are vital in that they provide six primary resources: intimacy, social integration, reassurance of worth, opportunity for nurturing behavior, assistance, guidance, and advice (p. 17). Central to Weiss’ (1974) theory is the hypothesis that different types of relationships (e.g. spouse, friend, co-worker, etc.) provide for each of the six social provisions. In example, friendships provide a sense of social integration; intimate relationships a sense of attachment; and work relationships reassurance of worth (Cutrona & Russell, 1987). Also key to Weiss’ (1973) typology of relational provisions is the idea that a deficit in any one provision results in the distressing experience of loneliness. Because different relationships tend to provide for and serve different functions, Weiss (1973) argued that a variety of relationships is necessary in order to avoid loneliness. Furthermore, such a diversity of relationships and social participation (social integration) may provide for a sense of belonging, guidance, and advice (Rokach & Brock, 1998).

Researchers have further specified distinct pathways through which the general structure or organization of social relationships, as well as the mere presence of others, have such powerful health outcomes. Specifically, Cohen (1991) outlined stress-centered/stress-buffering and psychosocial models, providing a number of potential processes through which networks of relationships may influence individual health, health behavior, and overall well-being.

Stress-centered models of influence: Stress-buffering model. One important psycho-social pathway linking social integration to health is through the provision of supportive social resources (House, et al., 1988b). On a basic level, social networks are thought of as “morphological structures within which confiding relationships may emerge” (Lin, 1986, p. 20); therefore, integration is thought to influence the receipt of various kinds of support (e.g. informational, instrumental, emotional, etc.), thus promoting perceptions of support availability (Thoits, 1995). In support of this assumption, Cohen and Lemay (2007) reported a moderate correlation ($r = .21, p < .05$; Cohen & Lemay, 2007) between social integration and perceived social support, such that more diverse networks were associated with greater perceptions of support availability. Stress-centered models of influence focus on such social resources, or social supports, as a function of relationships, which may buffer the negative effects of stress and negativity. Such effects are known as the *stress-buffering hypothesis* (Cassel, 1976; Cobb, 1976; Cohen & Wills, 1985), proponents of which argue that social support is beneficial primarily for individuals under stress. Subsequent research has provided ample evidence that perceptions of support availability reduce behavioral and biological responses to stress. In this model, perceptions of support availability are thought to facilitate adaptive coping behavior; increase an individual’s perceived ability to cope; reduce negative emotional reactions to the stress; or directly removing the source of stress itself (Cohen et al., 2000b).

Psycho-social processes of social networks: Main effect hypotheses. While stress-buffering models posit that social networks and social support are beneficial

primarily for persons under stress, psycho-social process models refer to a variety of processes through which social integration more directly influences health. Such models focus on the *main effects* of social relationships, which provide evidence that social networks influence individual behavior, health, and well-being irrespective of stress levels (Cohen, 1988; House et al., 1988a). In their original conceptualization of this model, Cohen and Wills (1985) proposed that being connected to a large social network (composed of friend, family, and distant ties) provides for a sense of identity, self-esteem, sense of control; increases levels of received and perceived support; and provides consistent opportunity for positive social interactions. Primarily assessed through measures of social integration, the main effects of social support are thought to influence health through a variety of psycho-social processes (Cohen, 1988). More specifically, social integration is thought to affect mortality, morbidity, and psychological well-being through its influence on the social control of health behaviors, the receipt of health-relevant information, and through psychological affect or moods (Cohen et al., 2000b; Uchino, 2006). Given that social integration is such a primary component of my proposed study, I will be focusing my hypotheses and statistical analyses on the primary theoretical pathways of influence as diagrammed and described below. Specifically, I will describe generic pathways of influence through health behaviors; information-based models describing social ties as sources of health-relevant information and learned behavior; and of greatest relevance to my proposed study, models of identity, self-esteem, and psychological state/affect, which emphasize the affective influence of social relationships.

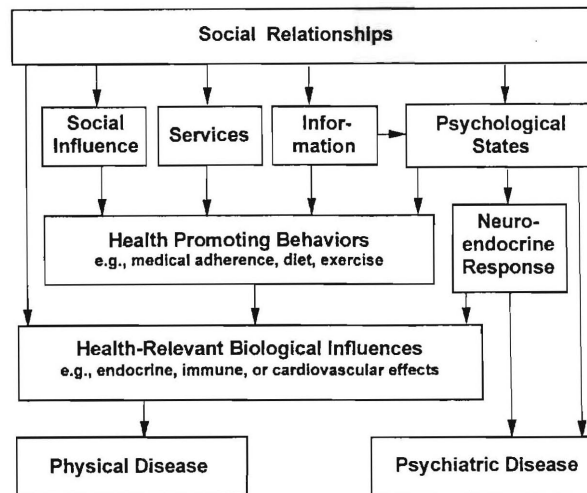


Figure 1.1. Pathways through which social relationships can have direct (main) effects on psychological and physical health. Paths are all drawn in one direction for simplicity but feedback loops are possible.

Generic models of influence: Social control theory. At the most general level, it has been suggested that social network ties influence illness, mortality, morbidity, and well-being through their influence on health behaviors (e.g. alcohol consumption, physical exercise, etc.) which increase or decrease the risk of disease (Cohen, 1988), or through behaviors that are protective of health in the face of stress (e.g. physical exercise; adaptive coping behavior; House, Umberson, & Landis, 1988). In support of this pathway are theories of *social control* (Lewis & Rook, 1999; Rook, Thuras, & Lewis, 1990), which propose that significant others directly and indirectly influence individual behavior by discouraging unhealthy behavioral practices; facilitating health-promoting behaviors; as well as through an individual's commitment and responsibility to achieved social roles (Umberson, 1992). In line with traditional theories of symbolic interactionism (Thoits, 1983), theories of social control suggest that social relationships exert normative control over individual behaviors through the "internalization of norms

for conventional behavior...and [through] sanctions for behavior defined as unconventional or deviant” (Umberson, 1987, p. 309). More specifically, an individual may control his/her health behaviors out concern for his/her roles and responsibilities within close relationships. Additionally, spouses or children may remind the individual to engage in healthy behaviors and avoid unhealthy behaviors.

Traditionally, researchers have assessed social control by relating marital and/or parenting status to risk-taking behavior. For example, Umberson (1987) examined marital status and parenting roles in relation to lifestyle measures assessing substance use and abuse, including the use of alcohol as a coping technique. Findings indicated that parenthood was significantly associated with less substance use, particularly for those parents with children living in the same residence. Also, divorced and widowed participants were more likely to engage in negative health behaviors than those who were married. In line with these findings, Rook, Thuras, and Lewis (1990) examined social control and health risk-taking in a sample of older adults, demonstrating that individuals reporting frequent “positive regulatory actions by others” (p. 333) not only reported less risk behavior (e.g. cigarette consumption), but also less loneliness and greater relationship satisfaction.

Umberson (1992) similarly demonstrated that divorce was associated with more alcohol consumption, cigarette smoking and less physical activity; having children under the age of sixteen was associated with less alcohol consumption for men and women; and having adult children was related to less alcohol consumption and more physical activity for women. In this same study, Umberson (1992) examined sources of social control,

finding that married individuals were more likely to report a spouse, parent figure, or child as the instigator of social control. More recently, Lewis and Rook (1999) examined social control attempts by particular network members finding that social control within close relationships was associated with positive health behavior change (e.g. decrease in substance use).

Information-based models: Social learning theory. In addition to providing social resources, social ties are also thought of as integral sources of health-relevant information and learned behavior (Hussong, Hicks, & Levy, 2001). Theory suggests that having a diversity of social ties provides for multiple sources of information, therefore increasing the probability that an individual will have access to a health-promoting information source (Cohen, et al., 2000b). Such information could help an individual to avoid potentially stressful events, or include information about adaptive ways of coping with stressful events if they should occur. Indeed, theories of *social learning* posit that social ties model adaptive coping strategies and coping behaviors (Heaney & Israel, 1997; House et al., 1988b).

Much research has provided evidence for social network resources as predictors of coping behavior (Fondacaro & Moos, 1987; Holahan & Moos, 1987), such that greater social resources (e.g. friendship, family, and financial support) increase the use of approach coping (i.e. drawing on social support resources) and decrease the use of avoidance coping (e.g. alcohol consumption; Moos, Brennan, Fondacaro, & Moos, 1990). Holahan and Moos (1987) provided clear evidence for this pathway in a study of personal and contextual determinants of coping strategies. Drawing from various theories of

social support, these researchers hypothesized that the availability of social resources would promote adaptive coping strategies (e.g. “talking with a friend/spouse/relative about the problem”) and discourage avoidance coping behaviors (e.g. “trying to reduce tension by drinking more...smoking more...taking more tranquilizing drugs”). Indeed, results indicated that avoidant coping was associated with fewer personal and environmental resources, while active-behavioral coping was positively associated with family support, environmental, and social resources. Moos et al. (1990) also examined avoidance and approach coping among a sample of problem drinkers. Their findings suggested that problem drinkers with more social resources (e.g. financial, spouse/partner, and friendship resources, as well as active participation in social and religious organizations) were more likely to use approach coping (i.e. “I talked with a friend about the problem”; “I made a plan of action and followed it”), than those without such social resources. Furthermore, approach coping was related to better functioning outcomes, including fewer physical symptoms and drinking problems, whereas avoidance coping was related to worse outcomes, such as greater number of drinking problems.

Of notable interest is related research by Krause (1987), which demonstrates that the greater availability of coping resources increases an individual’s feelings of control over a stressor and feelings of self-esteem, and that this perceived controllability elicits the use of problem-focused, or action-oriented coping behavior both for the support receiver and provider (i.e. specific attempts to change or eliminate the source of stressful events; Cutrona & Suhr, 1992). In a similar light, researchers and theorists posit that social integration influences feelings of “self-worth, predictability, stability, and control”

(Rodriguez & Cohen, 1998, p. 539), in addition to self-esteem and a sense of mastery (Brissette, Cohen, & Seeman, 2000; Cohen, 1988; Cohen & Lemay, 2007). Given such feelings of mastery, control, and self-esteem, it is likely that the socially integrated individual would respond to stress and negativity differently than his/her less integrated counterpart. This breadth of research demonstrates that social support resources and social networks not only act as coping resources from which individuals can draw support in times of need, but also exert great influence in determining coping behavior.

Models of identity, self-esteem, and psychological affect: Loneliness model.

Another important, though less examined pathway linking social integration to health is through the affective influence of social support and social relationships. House and colleagues (1988b) proposed that, if there is a basic need for social connection, people feel better psychologically when that need is fulfilled. In line with this assertion, models of identity and self-esteem suggest that social integration increases positive affect, self-esteem, personal control, belongingness, as well as a stable sense of life meaning and purpose (Cohen, 1988/1991; House et al., 1988b; Thoits, 1985). Conversely, social isolation increases negative affect, sense of alienation, and decreases a sense of control (Cohen, 1988; Uchino, Cacioppo, & Kiecolt-Glaser, 1996).

Drawing from Weiss' (1973) theory of relationship provisions and models of identity and self-esteem, recent theorists have conceptualized the *loneliness model*, suggesting that social isolation (i.e. lack of integration) influences health above and beyond the positive effects of social integration through the distressing experience of loneliness (Cacioppo et al., 2002; Stroebe & Stroebe, 1996; Uchino, 2006). Though

various researchers have explored the influence of social integration and/or isolation on physical health and well-being, few have examined the potential role by which loneliness plays in these associations. More importantly, few researchers have attempted to unpack the *loneliness model*, exploring how social integration *and* loneliness (perceived isolation) simultaneously influence health and health behaviors (Cornwell & Waite, 2009; Penninx et al., 1997; Shankur, McMunn, Banks, & Steptoe, 2011).

Loneliness

Commonly defined as the perception of social isolation (Perlman & Peplau, 1984), or the perceived discrepancy in the quantity or quality of interpersonal relationships (Russell et al., 1980), loneliness is a commonly reported experience associated with feelings of dissatisfaction, unhappiness, anxiety, hostility, emptiness, boredom, and restlessness (Perlman & Peplau, 1982; Perlman & Peplau, 1984; Rook, 1984). One of the most basic models of loneliness is the cognitive model, which proposes that the basis of loneliness is a perceived discrepancy between desired and actual interpersonal relationships (Paloutzien & Janigian, 1987). This model describes loneliness as a subjective experience based on the perception and evaluation of relationship quality, thus distinguishing loneliness from objective social isolation (Peplau, 1985).

In line with the cognitive model of loneliness, which emphasizes the role of subjectivity in perceiving loneliness, research has demonstrated that perceived and objective social isolation (loneliness and social network size) are only moderately correlated (Cornwell & Waite, 2009; Shankur et al., 2011). That is, loneliness is not

synonymous with social isolation or lack of social integration, and the socially isolated should not be assumed to be among the lonely. However, researchers have identified social isolation, as measured by the quantity of social ties or lack of network diversity and participation, as a key though distal determinant of loneliness (e.g. Cutrona, 1986; Hawkey et al., 2008). For example, evidence suggests that those experiencing greater loneliness have smaller and less satisfying social networks; less frequent interactions with close friends and family; and engage in social activities less frequently than do non-lonely individuals (Jones & Moore, 1987; Wenger, Davis, Shahtahmasebi, & Scott, 1996).

Cutrona (1986) demonstrated various social correlates of loneliness in an examination of network characteristics, perceptions of social support and loneliness in an elderly sample of participants. Results indicated that the number of kin in a given social network significantly contributed to feelings of loneliness, such that more kin predicted less loneliness. Marital status and frequency of contact with kin were also significantly related to increased perceptions of support by a given network (Cutrona, 1986). In a similar vein, Bondevik and Skogstad (1998) provided evidence that low frequency of contacts with friends and neighbors was related to high levels of loneliness in a sample of aging adults. Likewise, Golden et al. (2009) examined loneliness, social support networks, mood and well-being in a sample of elderly adults. Findings demonstrated that living alone and having a non-integrated social network predicted a higher prevalence of loneliness. Therefore, lacking specific relationships, frequent positive interactions within

these relationships and, more generally, a diverse network of social ties is thought to predispose individuals to the distressing experience of loneliness

Researchers have also explored personality traits that may make it difficult for individuals to form and maintain satisfying relationships, therefore increasing the likelihood of loneliness. Such traits include shyness, poor social skills, low-self-esteem, low social competence, low social risk-taking, and self-consciousness in social situations (Peplau & Perlman, 1979). Though these individual characteristics are likely to contribute to the experience of loneliness, researchers suggest that loneliness is more “related to a broad range of interpersonal inadequacies rather than a deficiency of any one particular skill” (Marangoni & Ikes, 1989, pp. 99). Therefore, personality correlates of loneliness refer to a combination of psychosocial difficulties (i.e. poor social skills, low self-esteem, etc.) as opposed to any one particular personality dimension (Heinrich & Gullone, 2006).

Types of loneliness. Though the majority of research examines loneliness as a uni-dimensional construct, theorists have explored different typologies of this affective experience, describing each in terms of chronicity and stability. Drawing from his theory of relationship functions, Weiss (1973) defined two distinct forms of loneliness based on specific relationship deficits. He specified social loneliness as resulting from a lack of social integration, and emotional loneliness as resulting from the lack of an intimate attachment relationship (Russell, Cutrona, Rose, & Yurko, 1984; Weiss, 1973). Jones (1987) further distinguished between state loneliness and more stable experiences of loneliness, arguing that state loneliness involves momentary feelings of isolation usually

resulting from an immediate interpersonal deficit, while more enduring experiences of loneliness are more trait-like and thus persist over time. Young (1982) similarly differentiated chronic, situational, and transient loneliness, defining chronic loneliness as the pervasive experience of being unable to develop and maintain satisfying relationships; situational loneliness as the distressing feeling of isolation following major life stress events, such as the death of a spouse or relocating to a new city; and transient loneliness as the everyday, shorter bouts of feeling lonely experienced by most people throughout daily life.

In support of the above typologies of loneliness, researchers have examined how experiences of loneliness change over time based on different stages of life development (adolescent vs. elderly); changes in social networks (e.g. loss of a loved one); and major life events (e.g. marriage, retirement, etc.; Akerlind & Hornquist, 1989). Additionally, recent research has provided evidence that loneliness fluctuates within and between days as a function of social context and social contacts (Gross, Juvenon, & Gable, 2002; Larsen, 1999). For example, Larsen (1999) assessed momentary experiences of loneliness in a sample of young teens, and examined these reports in different social contexts (e.g. alone, home, or at school). Results indicated that loneliness varied across contexts, and that participants reported greater loneliness when alone than with others, somewhat greater loneliness at home, and less loneliness at school and in public locations. Other experience sampling studies have found similar trends using samples of older adolescents and young adults (Larsen, Csikszentmihalyi, & Graef, 1982). Not

surprisingly, solitude-loneliness mood associations for both groups were of greater magnitude when individuals were home alone on Friday or Saturday evenings.

Responses to loneliness. Research has also elucidated a diversity of behavioral strategies which people use in coping with feelings of loneliness (Rubenstein & Shaver, 1982; Perlman & Peplau, 1979/1981). Generally, these responses fall into one of four main categories: *active solitude*, referring to behaviors such as studying or working, listening to music, exercising, walking, reading, etc.; *spending money*, or going out and spending unnecessarily; *social contact*, which includes calling or visiting a friend; and *sad passivity*, which refers to crying, sleeping, overeating, drinking, and doing drugs (Heinrich & Gullone, 2005; Rubenstein & Shaver, 1982). Perlman and Peplau (1979/1981) specified three similar responses to loneliness, including changing the desired level of social contact; achieving higher levels of social contact by meeting new friends or making fuller use of an existing network; and minimizing loneliness by suppressing emotional reactions or engaging in behaviors designed to alleviate the negative impact of loneliness (e.g. alcohol or drug use). Rokach and Brock (1998) also distinguished between three conceptual clusters of loneliness coping strategies. Similar to the categories of Peplau and Perlman (1979), responses included reflection and resource development, or the increased awareness of loneliness and reflecting on the experience in solitude; the rebuilding of social bridges/networks, or the participation in social activities and an increased effort to build social ties; and distancing and denial, or the need to deny feelings of loneliness and avoid this distressing experience through casual sex and substance use.

Rokach and Brock (1998) further examined these categories as a function of gender and marital status. Findings indicated that females were more likely to describe reflection and resource development as a useful strategy, whereas men were more likely to report participation in social activities. Married individuals were more likely to report relying on their social networks and reflection/acceptance as beneficial responses to loneliness. Conversely, single, divorced, and widowed individuals were more likely to report distance and denial (e.g. casual sex, substance use) as a common, though helpful, response to loneliness. Various other factors contribute to these coping responses, including but not limited to an individual's attributions for the causes of loneliness (e.g. unchangeable personal characteristics versus changeable personal or situational factors; Peplau, Miceli, & Morasch, 1982). Specifically, those with internal attributions for loneliness (e.g. deficit in personal character) tend to respond more passively, whereas individuals who attribute their loneliness to external events (e.g. loss of a loved one, isolating living conditions, etc.) are typically more likely to seek out social support and solutions to their loneliness.

Though individual attributions for loneliness are viable predictors of coping strategies, these coping responses are more often related to the frequency, or chronicity of loneliness. In general, evidence suggests that chronically lonely individuals tend to employ more avoidance-related coping, such as alcohol consumption, whereas the less lonely utilize more active strategies such as talking to friends and family (Cacioppo et al., 2000). For example, Rubenstein and Shaver (1982) examined reactions to loneliness via a questionnaire distributed through six American newspapers. The survey included the

question: “When you feel lonely, what do you usually do about it?” followed by 24 responses to loneliness and a measure of the frequency of loneliness. A factor analysis of the most commonly reported responses revealed four primary categories, each correlating with either chronic or transient states of loneliness. Specifically, responses in the sad passivity category (e.g., crying, sleeping, overeating, drinking or “getting stoned”) were related to greater frequency of loneliness, while active solitude (e.g. writing or listening to music, reading), spending money, and increased social contact (e.g. calling a friend) categories were related to more transient states of loneliness. Wilson and Moulton (2010) similarly examined responses to loneliness in a sample of chronically lonely and non-lonely adults. Results indicated that chronically lonely people are more likely to cope with feelings of loneliness by watching television, going out by themselves, smoking, eating, drinking, sleeping, and surfing the internet. In contrast, those experiencing shorter bouts of loneliness were more likely to cope with feelings of loneliness by attending religious services, going out with family or friends, or talking to a friends or relatives (Wilson & Moulton, 2010).

Indeed, evidence suggests that the chronically lonely are less likely to make use of social capital/social resources and less likely to use active coping strategies (e.g. reaching out or seeking emotional support from others), and that these responses depend on factors such as attributions for and chronicity of loneliness. As previously discussed, the availability of social resources is thought to play a large role in influencing coping behaviors. However, research examining predictors of different responses to loneliness

has yet to explore such social resource variables (e.g. social integration) as potential moderators of loneliness-response associations.

Further, though researchers have examined the role of gender in influencing responses to loneliness showing that women are more likely to use strategies such as acceptance and self-reflection while men tend to increase social activity (e.g. Rokach & Brock, 1998) such research typically relies on retrospective reports of experiences of loneliness and associated behavioral responses. Further, gender differences in specific behavioral responses such as alcohol consumption have not been examined. Therefore potential gender differences in actual responses to daily loneliness are in need of further exploration. The previous stress and coping literature describes gender as playing a large role in the regulation and management of daily stress, moods, and emotion. In particular, Bolger, DeLongis, Kessler, and Schilling (1989) examined the effects of interpersonal conflict on daily mood in a sample of 166 married couples. Findings indicated that the effects of stress on mood were stronger for women than men. However, research by Gottman and Levenson (1988) provides evidence that men have stronger physiological reactivity to stress and emotions than women. Similarly, in her exploration of gender differences in stress reactivity, Taylor et al. (2000) argued that women respond to stress through the creation and maintenance of social ties (i.e. “tend-and-befriend”), whereas men respond to stress through withdrawal, aggression, or hostility (i.e. “fight-or-flight”). To the extent that loneliness is a stressful, negative emotional experience, it would be important to consider these known gender differences when examining daily responses to loneliness.

Outcomes of loneliness. Given that loneliness reflects deficits in interpersonal relationships, it is not surprising that it is related to similar health outcomes as the lack of social integration, or social isolation. Researchers have examined the joint effects of loneliness and social isolation on mortality, demonstrating that individuals with a large social network and those reporting less loneliness were less likely to die at follow-up than those with small networks and more loneliness (Penninx et al., 1997). Other studies have found that loneliness, as assessed by the UCLA Loneliness scale, is associated with poorer self-reported physical health (e.g. physical health status, symptoms, function, and health behaviors; Cornwell & Waite, 2009), low immune system functioning (Glaser, Kiecolt-Glaser, Speicher, & Holliday, 1985), and diminished cardiovascular health and systolic blood pressure (Hawkley, Burleson, Bernston, & Cacioppo, 2003; Hawkley, Masi, Berry, & Cacioppo, 2006). Additionally, one of the most commonly researched psychopathological outcomes of loneliness is depression (Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006), which is thought to develop over time among severely isolated individuals. Recently, researchers have also begun to examine *daily* experiences of loneliness, as predictive of outcomes such as daytime functioning and sleep duration (Hawkley, Preacher, & Cacioppo, 2010), daily cortisol production (Doane & Adam, 2010; Pressman et al., 2007), and internet use (Caplan, 2002/2005; Gross, Juvenon, & Gable, 2002). Specifically, daily loneliness is related to increased cortisol production and decreased quality of sleep and daytime functioning.

Generally, research has found that loneliness is also related to fewer health-promoting behaviors, such as less exercise and poor nutrition (Heinrich & Gullone,

2006). However, studies examining associations between loneliness and negative health behaviors are less conclusive. Cacioppo et al. (2002) and Hawkley et al. (2003) demonstrated that chronically lonely and non-lonely individuals do not differ in daily alcohol, tobacco, or caffeine consumption, though lonely individuals reported greater recreational drug use. Conversely, Shankur et al. (2011) and Lauder et al. (2006) provided evidence that loneliness is related to increased smoking and less physical activity, in addition to slightly more alcohol consumption. Similarly, Akerlind and Hornquist (1992) associated the ongoing experience of loneliness with the development of alcohol abuse and dependence problems. Such findings suggest both comparable and differential patterns of behavior (e.g. alcohol consumption, cigarette use, physical activity) for lonely and non-lonely individuals. However, much of the research examining loneliness and health behaviors (e.g. alcohol consumption, physical activity, etc.) employs cross-sectional measures of loneliness and health behaviors (e.g. UCLA Loneliness Scale; Russell et al., 1980), therefore limiting findings to the more stable, chronic experiences of loneliness. Such measures also fail to capture the fluctuating, state-like (i.e. transient) experiences of loneliness which may be related to various patterns of daily health behavior. Given that loneliness, particularly transient loneliness, is a commonly reported experience, and is known to fluctuate within-person and across days (Gross et al., 2002; Larsen, 1999), examining within-person associations between daily loneliness and health behavioral responses would seem a logical next step in further unpacking a behavior-focused model of this negative affective experience. Additionally,

such research would provide a greater understanding of transient loneliness as a unique negative affective experience.

Daily Process Methods

Whereas much research has examined loneliness and related health outcomes through the use of cross-sectional measures (e.g. Hawkley, et al., 2003; Lauder et al., 2006; Shankur et al., 2011), less research has examined the state-like fluctuations in loneliness. Methodological designs, such as daily process research, which employ assessments multiple times per day per participant, would allow for the examination of these fluctuating mood experiences and subsequent behavioral outcomes. Not only do such research designs minimize retrospective bias (Cooper, Frone, Russell, & Mudar et al., 1995), but they also allow the researcher to examine antecedents, correlates, and consequences of daily experiences, individual differences in these associations, as well as the sources of these differences (Bolger, Davis, & Refaeli, 2003). Such daily methods would be particularly beneficial for loneliness research, as they would capture the diurnal and day-to-day variability in loneliness and behavioral responses, as previously described.

Daily loneliness and health outcomes. Despite the various benefits of daily process design, researchers are only slowly beginning to explore momentary, transient experiences of loneliness and subsequent behavioral responses through daily process and experience sampling research methods. In example, Doane and Adam (2010) examined daily and momentary state variations in loneliness and changes in cortisol production. Results indicated that prior day feelings of loneliness were associated next morning

increases in cortisol, and that momentary experiences of loneliness throughout the day were associated with momentary increases in cortisol, particularly for those with high interpersonal stress. Hawkley, Preacher, and Cacioppo (2010) similarly examined daily loneliness, though in relation to daytime functioning and sleep duration. Using a diary method to capture daily sleep, fatigue, low energy, sleepiness, loneliness, physical symptoms, and depressed affect, Hawkley and colleagues revealed that daily loneliness predicted subsequent daytime sleepiness, fatigue, and low energy, even when depressed affect was held constant. These studies are novel, as they demonstrate that daily loneliness is indeed consequential to health. However, though such studies assess daily health outcomes (e.g. health dysfunction, sleep, and cortisol production) they do not examine the associations between daily loneliness and daily health behaviors.

As a part of a larger study examining daily loneliness and immune system functioning, Pressman and colleagues (2005) did examine differential daily health practices (e.g. sleep, smoking, alcohol consumption, and exercise) as a function of daily loneliness. Over a period of 13-days participants recorded loneliness and affect four times a day and health practices once a day, when alerted to respond by a handheld electronic computer. Diary responses for loneliness and mood were averaged across the four daily assessments, creating daily loneliness scores; health behaviors were averaged across the thirteen days. Results indicated that loneliness was not associated with physical activity, smoking, alcohol consumption, or sleep duration, as assessed by the daily diaries. Loneliness was, however, associated with higher sleep loss and poorer sleep quality over the 13-day diary period. Though Pressman and colleagues (2005)

clearly assessed the associations between daily loneliness and health practices, including alcohol consumption, they were examining average daily loneliness as predicting average daily health behaviors, rather than the within-person associations between variations in loneliness and subsequent health behavior. Further, Pressman and colleagues did not explore these health behaviors as potential responses to loneliness. Previous daily process research has specifically examined alcohol consumption as a common health-related response to negative affect (e.g. Cooper, Russell, & Frone, 1995; Mohr et al., 2001a). Considering that alcohol consumption is one known response to loneliness, examining the within-person, time-contingent associations between loneliness and subsequent drinking behavior would provide a greater understanding of transient loneliness as well as associated patterns of responses.

Motivational models of alcohol consumption. Various researchers have explored alcohol consumption as a risk behavior, the practice of which is largely related to daily stress, social contacts, and interpersonal events (Hussong et al., 2001; Mohr et al., 2001; Mohr et al., 2005). Through the use of daily process methods, researchers have unlocked various mysteries about alcohol consumption. Specifically, researchers have discovered that negative mood is a primary motivation for alcohol consumption, leading to the development a variety of motivational models of consumption. Central to these motivational models is Conger's (1956) *tension reduction hypothesis*, which suggests that alcohol consumption reduces stress, therefore reinforcing alcohol use as a coping behavior and creating a problematic cycle of consumption associated with heavy drinking and alcohol dependence and/or abuse. According to this hypothesis and subsequent

research, daily moods, interpersonal exchanges, and daily stress are associated with subsequent increases in alcohol use (Cooper, Frone, Russell, & Mudar, 1995; Hussong, Hicks, Levy, & Curran, 2001; McCreary & Sadava, 1998; Moos et al., 1990).

Drawing from Conger's theory, Cooper and colleagues (1995) conceptualized a *drinking-to-cope hypothesis*, which argues that the regulation of negative mood is a primary motive for alcohol consumption. Previous research examining mood-motivated consumption has provided evidence that such drinking-to-cope behavior is related to maladaptive forms of emotion-focused coping, which aims to reduce the aversive experience of negative mood, and that such patterns consumption may contribute to the further development of alcohol dependence (Cooper et al, 1995). Cooper and colleagues (1992) have also identified *social drinking motives* (e.g. drinking to be sociable; drinking to make a social gathering more enjoyable) and *enhancement motives* (e.g. drinking to prolong or enhancement of positive moods), and *conformity motives* (e.g. drinking in response to social pressures) which have similarly been shown to play a large role in determining drinking behavior (Carey & Correia, 1997; Cooper, Russell, Skinner, & Windle, 1992). Cooper's (1994) four-factor model of motives (i.e. drinking-to-cope, social, enhancement, and conformity motives) provides evidence that alcohol consumption is a very normative behavior associated with a variety of different motivational antecedents.

In examining different motives for alcohol consumption, Cooper and colleagues have also explored drinking context (i.e. social versus solitary consumption), demonstrating that consumption in social and solitary contexts represent distinct drinking

behaviors. Further research has provided evidence that drinking motives, particularly drinking-to-cope, uniquely relate to consumption in specific contexts (Cooper, 1994). In example, Mohr and colleagues (2001a) examined the tension reduction and drinking-to-cope hypotheses in a study of interpersonal experiences, social context, and alcohol consumption. Unique to this study was the examination of consumption in social versus solitary contexts following positive and negative interpersonal events. Each day for 30-days, participants reported drinking behavior and social context on a handheld electronic computer, followed by nightly assessments of positive and negative interpersonal exchanges. Results indicated that participants engaged in more solitary drinking on days with more negative social contacts, and more social consumption on days with more positive social contacts. In a similar study, Mohr and colleagues (2005) examined daily social contacts, moods and drinking in different contexts among a sample of college students. Findings indicated that participants drank more at home on days with more negative interpersonal exchanges and negative moods, and more away from home on days with more positive interpersonal exchanges positive moods. Furthermore, these associations were moderated by drinking motivations (i.e. drinking to cope), and time spent with friends. Those endorsing high drinking-to-cope motivations drank more at home following negative social contacts and negative moods and, as time spent with friends increased, the effects of negative contacts and moods on drinking at home decreased. These findings are in line with those of Cooper's (1994) study, which demonstrated that drinking-top-cope typically occurs in solitary contexts. Interestingly, research examining drinking contexts as related to social and enhancement motives is less

conclusive, providing evidence that such drinking occurs in both social and solitary contexts (e.g. Mohr et al., 2001a).

Previous daily process research has provided ample evidence of negative mood-related consumption, yet no research to date has examined daily experiences of loneliness in the context of tension reduction and drinking-to-cope hypotheses. Furthermore, previous research exploring loneliness and drinking behavior has primarily examined average consumption across contexts, therefore not distinguishing between social and solitary drinking experiences. This is problematic, as research exploring motivational models of alcohol consumption reveals that context does matter (i.e. drinking to cope as related to solitary consumption). Additionally, research has provided evidence that differential responses to loneliness occur in both social and solitary contexts. For example, sad passivity responses are known to include solitary drinking behavior, thus relating to drinking-to-cope and solitary consumption; whereas more active responses, such as social contact, involve seeking increased participation in social activities (Heinrich & Gullone, 2005; Rubenstein & Shaver, 1982). Such social contact, however, could potentially be in a drinking context, therefore relating to social contexts of consumption and social enhancement motives. Given existing alcohol research providing evidence of motivational and contextual patterns of drinking behavior, examining loneliness-related consumption in both social and solitary drinking contexts would make a large and unique contribution to the current loneliness literature.

Stress-vulnerability models of alcohol consumption. In addition to negative mood-related drinking, daily process research has also examined *stress-vulnerability*

models of alcohol consumption, which propose that certain individuals are particularly vulnerable to affect-motivated drinking patterns (Armeli et al., 2000). Various researchers have tested these stress-vulnerability models by examining the moderating influence of variables including gender, alcohol expectancies, drinking motivations, and (of greatest relevance to this current study) social support, on negative mood-related drinking associations (Hussong et al., 2001; Mohr et al., 2001a; Mohr et al., 2005; Steptoe et al., 1995).

In example, Armeli and colleagues (2000) examined how within-person associations between stress, alcohol use, and desire to drink varied as a function of gender, alcohol expectancies, and coping style. Using a sample 88 adults, the researchers administered a daily diary methodology, through which participants recorded daily events, stress, alcohol consumption, and desire to drink once a day for 60 days. Results indicated that men reported more alcohol consumption overall, and that men who predicted positive effects of alcohol (e.g. positive alcohol expectancies) drank more on stressful days, and men who predicted negative effects of alcohol drank less on stressful days. Interestingly, these effects did not hold for women. These results suggest that gender and alcohol expectancies play a unique role in influencing within-person stress and drinking associations.

In a similar study, Hussong et al. (2001) explored daily negative moods, context (weekend versus weekday drinking), and drinking behavior in a sample of college students, in addition the moderating influence of gender and social support on these associations. Results indicated that, for both men and women, weekday drinking was

associated with increased sadness over the following weekend. For men, increased sadness during the week predicted less weekend drinking. Further, both men and women low in social support were more likely to drink on weekdays following weekends with sadness, and these weekend experiences of drinking predicted increases in sadness over the following week. While those high in social support also showed patterns of increased consumption following negative moods, drinking was not related to subsequent increases in negative moods for these individuals. Interestingly, Hussong et al. (2001) also demonstrated that for those individuals with high social support, drinking-to-cope may have been an effective means of reducing negative affect. That is, these individuals had supportive others who provided alternative means of coping besides drinking behavior.

Though individual differences in social support have been examined within the context of the stress-vulnerability model of alcohol consumption (e.g. Armeli et al., 2000), researchers have yet to examine the moderating influence of social integration (diversity of network ties and participation) on specific mood-related patterns of consumption. In a recent study, however, Cohen and Lemay (2007) examined the moderating influence of social integration on the association between daily social interactions and health behavior (i.e. smoking and alcohol consumption) over a 14-day period via daily process methods. Results indicated that greater social integration was associated with more daily social interactions, as well as reduced alcohol and cigarette consumption. Further, the more social interactions participants reported during the day, the greater their alcohol and tobacco consumption. However, these associations were attenuated by higher levels of social integration. Specifically, the effects of number of

interaction partners on daily alcohol and cigarette consumption were greater for the less socially integrated. Social integration also significantly moderated the effects of daily interactions on affect, such that those high in SI reported high levels of positive affect regardless of number of interaction partners, whereas affect significantly increased with the number of interaction partners for those low in social integration.

In discussing the above results, Cohen and Lemay (2007) suggested the possibility of social integration indirectly influences health behavior through the experience of loneliness (e.g. loneliness model; Cacioppo et al., 2003; Stroebe & Stroebe, 1996; Uchino, 2006). Based on this research, along with known motivational models of alcohol consumption, and the relative dearth of research examining loneliness-related alcohol consumption in different contexts, I propose an in-depth examination of within-person patterns of daily loneliness and subsequent social and solitary drinking behavior. Further, based on stress-vulnerability models of consumption, as well as the preliminary work of Cohen and Lemay (2007), I propose to examine how these associations differ as a function of social integration.

Gaps In The Literature

In sum, various researchers have provided evidence linking social integration and loneliness to psychological well-being (e.g. positive and negative affect), physical health (e.g. mortality, morbidity), health behavior (e.g. alcohol consumption) and coping behavior (Berkman & Breslow, 1984; Cacioppo et al., 2000; Cacioppo et al, 2003; Fondacaro & Moos, 1987; Holahan & Moos, 1987; Wilson & Moulton, 2010). Furthermore, though social isolation is known to predispose individuals to experiences of

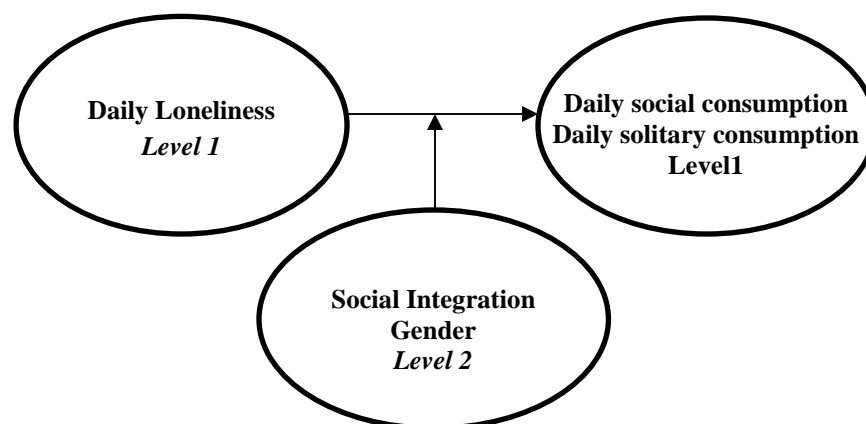
loneliness, few researchers have explored the combined effects of social integration and loneliness on health and health behavioral outcomes. Moreover, existing research comparing health behaviors of lonely and non-lonely individuals is inconclusive, showing differential and comparable patterns of risk behavior for lonely and non-lonely individuals. However, such research predominantly employs cross-sectional measures of chronic loneliness, therefore revealing little about fluctuating, transient experiences of loneliness and subsequent health behavioral responses. Given relatively recent research which suggests strong associations between daily events, negative moods, and alcohol consumption (e.g. Hussong et al., 2001; Mohr et al., 2001a; Mohr et al., 2005), as well as theory and research linking loneliness to sad passivity responses such as alcohol consumption (e.g. Heinrich & Gullone, 2005; Rubenstein & Shaver, 1982), it would be useful to explore daily loneliness in the context of mood-related drinking behavior.

In addition, previous daily process research has examined negative moods as predictors of drinking in different contexts (i.e. social versus solitary); similarly, categories of coping responses to loneliness also relate to distinct contexts. Specifically, sad passivity responses are associated with solitary behavior, while more active responses such as social contact are related to increased social participation. However, no study to date has examined daily social and/or solitary responses to loneliness through the use of daily process methodology. Further, though existing research exploring stressor-vulnerability models of consumption has included social support as a moderating variable, no study to date has examined negative mood-drinking associations as a function of social integration. Lastly, though gender is known to moderate the

associations between stress, negative mood, and alcohol consumption (e.g. Armeli et al., 2000; Bolger et al., 1989), few have considered the influence of gender on behavioral responses to loneliness. Therefore, investigating the within-day variability of the aforementioned constructs, as well as the moderating influence of social integration and gender on loneliness—consumption associations, is a critical step in further understanding the powerful effects of social relationships on health behavior.

Present Study

In this study, I examined the within-person associations among daily experiences of loneliness and subsequent social and solitary alcohol consumption. In line with previous social integration-health literature and theories of social control, which suggest that being more integrated in a network of social ties is related to reduced risk behavior (e.g. Berkman & Syme, 1979; Umberson, 1992), and that the availability of social resources and gender are known to influence coping strategies and reactivity to daily stress, I explored how associations between daily loneliness and alcohol consumption differ as a function of social integration and gender.



Specifically, I explored the following research questions: Do individuals report more evening solitary consumption, relative to their typical levels of solitary consumption, on days with more reported loneliness? Do individuals report more evening social consumption, relative to their typical levels of social consumption, on days with more reported loneliness? Furthermore, do these associations vary based on individual differences in social integration and gender?

Hypotheses

It is important to note that in all of my analyses, I controlled for age and mean 30-day loneliness. The decision to control for these variables was based on previous social integration and health literature, as well as previous research and theories of loneliness. Further, including average loneliness over the 30-day study allowed for a comprehensive examination of the isolated effects which changes in daily loneliness have on alcohol consumption, controlling for average levels of loneliness

Hypothesis 1a and research question #1 (within-person loneliness—social and solitary consumption associations)

Hypothesis 1a: Consistent with the tension-reduction hypothesis and sad-passivity responses to loneliness (**a**) I hypothesized a significant within-person association between loneliness and subsequent solitary alcohol consumption. Specifically, I predicted that at times with more loneliness, people would report greater subsequent solitary alcohol consumption relative to times when they reported less loneliness.

Though previous daily process research has explored social drinking contexts in relation to negative mood-related consumption, findings are less consistent than for

solitary drinking. However, loneliness—social consumption associations would be useful to explore, as social drinking could reflect more active responses to loneliness (e.g. seeking social contact). Therefore, I explored the following research question:

Research Question #1: Is there a significant within-person association between loneliness and subsequent social consumption?

Hypothesis 2a-d (associations of mean social and solitary consumption with social integration): Previous research examining social integration and health risk behavior has demonstrated that those reporting greater social integration lead significantly healthier lifestyles (e.g. appropriate use of alcohol) and that increases in social isolation predict greater alcohol and cigarette consumption (e.g. Berkman & Breslow, 1973/1983; Berkman et al., 2000; Cohen, 1991).

Hypothesis 2a-b (association of mean social and solitary consumption with gender): Therefore, I hypothesized that social integration would significantly and negatively predict mean daily solitary alcohol consumption, such that **(a)** those who are higher in social integration would report lower levels of average daily solitary consumption. I also predicted that **(b)** social integration would significantly and positively predict social consumption, such that those higher in social integration would report greater levels of social consumption than those lower in social integration (potentially more friends to drink with).

Hypothesis 2c-d (associations of mean social and solitary consumption with gender): Previous research has provided evidence that men typically report higher levels

of consumption than women. Therefore, I predicted that men would report higher mean levels of (c) social and (d) solitary consumption than women.

Hypothesis 3a-d (cross-level associations): Research has provided evidence for an association between social support, loneliness, and coping strategies (Cacioppo & Hawkley, 2003; Holahan & Moos, 1987). Specifically, recent daily process research examining mood-related alcohol consumption demonstrates weaker negative mood-drinking associations for individuals with greater environmental, friend, and family support resources (Hussong et al., 2001; Mohr et al., 2005; Holahan & Moos, 1987; Steptoe et al., 1996). Research has also demonstrated that individuals with more socially supportive resources and those who are less lonely tend to employ more active, problem-focused coping strategies (e.g. support seeking, and drawing on social capital); whereas more isolated individuals and those experiencing more enduring loneliness are more likely to employ avoidance coping strategies (e.g. alcohol consumption).

Hypothesis 3a-b: Consistent with this research, (a) I hypothesized that social integration would moderate the association between daily loneliness and solitary consumption, such that those lower in social integration would report stronger loneliness—solitary consumption associations than those who are more integrated. (b) I also predicted that social integration would moderate the association between loneliness and social consumption, such that those higher in social integration would report a stronger loneliness—social consumption associations than those lower in social integration, as those higher in social integration may have more opportunity to drink with others.

Hypotheses 3c-d: Previous research suggests that men and women show different patterns of negative mood-related consumption (Mohr et al., 2001a). Specifically, evidence suggests that not only do men report typically higher levels of alcohol consumption, but also that men are more likely to externalize distress through drinking than women (Hussong et al., 2001). Further, research and theory suggests that women are more likely than men to draw on social support in times of need (Taylor et al., 2000). Therefore, I hypothesized that gender would moderate the associations between **(c)** solitary and **(d)** social consumption, such that men would report stronger within-person associations between loneliness and subsequent social and solitary consumption than women.

Methods

Overview

To address these research questions, I conducted a secondary analysis of data collected through a larger study examining daily alcohol use and emotion regulation, originally directed by Cynthia Mohr, Ph.D. Using daily process methodology, this research investigated daily positive and negative social interactions, stress, positive and negative moods, and health behaviors for a group of 49 community-dwelling adults. Participants were recruited through internet postings, flyers and local newspapers dispersed through the greater Portland Metropolitan area. Those who met criteria for current or lifetime alcohol dependence and/or abuse within five years of the interview were excluded from this study, therefore limiting the sample to moderate and heavy drinkers. Eligible and interested participants completed a variety of initial assessment measures, followed by a 30-day daily diary, completed via a handheld electronic diary. Participants were alerted three times a day (mid-morning, late afternoon, and evening) to complete a three minute survey via the electronic diary.

Participants

This sample included a total of 49 community-dwelling adults, composed of 25 men and 24 women (47 participants with usable data). Given exclusion criteria of alcohol abuse/dependence, this sample included only moderate to heavy drinkers. Mean age of participants was 37 (SD = 16.77), and ages ranged from 21 to 88 years. Ninety percent of participants were Caucasian, 2% were African-American, and 6% were Hispanic/Latino/Spanish. Thirty-six percent of participants were married or cohabitating,

45% single or never married, 16% divorced/widowed. Ninety percent identified as heterosexual; 4% as bisexual; 6% as gay or lesbian. Fifteen percent had a high school diploma or GED; 36% had completed some college or bachelors degree; 15% had a graduate or professional degree. Additionally, 77% percent held a full time job; 57% had an income less than \$44,000, and 25% made between \$44,000-\$77,000 a year.

Initial Assessment

Eligible and interested participants were invited to partake in further screening. At this screening, trained research assistants administered the Computerized Diagnostic Interview Schedule IV (C-DIS; Robins, Cottler, Bukholz, & Compton, 2000), a measure of general mental health including current and past alcohol dependence or abuse. Participants who did not meet the criteria for current or past dependence or abuse (within the past 5 years), completed informed consent and initial baseline assessment measures. For the purpose of this study, I will describe only those measures relevant to my hypotheses and data analyses.

Social Network Index. Participants completed a 12-item Social Network Index, SNI (Berkman & Syme, 1979; Cohen et al., 1997), which assesses participation in 12 types of relationships (e.g. relationships with spouse, parents, friends, workmates, school-mates, fellow volunteers, etc.). The items included questions such as: “How many children do you have?”, “How many close friends do you have?” and “How many of these friends do you see or talk to at least once every two weeks?” Participants were asked to rate the number that is most true for them on an 8-point scale, ranging from 0 to 7 or more. Other items included questions such as “Are you currently employed either

full time or part-time (if not, check ‘no’ and skip to question 10)...” (if yes) “How many people do you supervise?”; “Are you currently involved in regular volunteer work? (‘Yes’ or ‘No’). Based on previous research utilizing this measure (Cohen et al., 1997; Cohen & Lemay, 2007), I computed social integration by assigning one point for each relationship in which participants reported speaking to someone at least once every 2 weeks. The highest possible score on this measure is a 12, with higher scores indicating greater social integration (see Appendix A). Typically, internal consistency of the social network index cannot be calculated because it is not a scale but a summary measure (Melchior, Berkman, Niedhammer, Chea, & Goldberg, 2003).

Demographic variables of interest. Participants also answered a basic demographic questionnaire including information on age, gender, educational attainment, income, ethnicity, and personality assessments etc.; of interest to this proposed study are gender and age.

Researchers taking a life-stage perspective of loneliness have provided evidence of age differences in experiences of loneliness; specifically, loneliness is highest in young adults, tends to decline in mid-life, and modestly increases with old age (Perlman, 1990). Further, research examining the health and health behavioral effects of social integration typically includes age as a covariate. Therefore, I have chosen to include age as a control variable in all of my analyses. Lastly, as described in my hypotheses, I will be examining the moderating effects of gender on loneliness—drinking person associations

Daily Diary Protocol

Following initial assessment surveys, participants were trained on handheld electronic interviewing devices. Participants were instructed that they would receive alerts three times a day for thirty days (mid-morning, afternoon, and evening), signaling them to complete a three minute self-report survey (see Appendix B). The following variables were assessed on this survey, though I have included only the ones relevant to the current study.

Daily loneliness. At each daily measurement point (morning, afternoon, and evening) participants completed a mood assessment adapted from the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). Previous research has demonstrated that the PANAS is a reliable measure of positive and negative affect, with alphas ranging from .86-.90 for positive affect and .84-.87 for negative affect. For the purpose of this study, daily loneliness was assessed as one of the negative affect items on the PANAS. Participants were asked to indicate how lonely they felt since the last interview, based on a 5-point Likert-type scale, with responses ranging from 0 (not at all) to 4 (extremely). I included daily loneliness as a level-1 predictor variable and average loneliness over the 30-day study as a control variable.

Daily alcohol consumption. Participants recorded alcohol consumption at each time point by indicating the number of alcohol beverages consumed since the previous interview. It is important to note that the morning interview assessed drinking which occurred during the previous evening; the afternoon interview assessed drinking which occurred during the day; and the evening interview captured drinking which had occurred

since the last (e.g. afternoon) interview. Participants were trained at initial assessment to recognize standard drink sizes, based on the NIAAA (National Institute on Alcohol Abuse and Alcoholism) criteria (i.e. one drink is defined as one 12 oz. can/bottle of beer, 8 oz. malt liqueur, 5 oz. glass of wine, one 12 oz. bottled wine cooler, or 1.5 oz. of straight liquor or in a mixed drink).

Drinking context. Following the assessment of daily consumption, participants were asked to indicate whether drinking had occurred at *home* or *away from home*, and whether they were “alone,” “interacting with others who were drinking,” “interacting with others who were not drinking,” “not interacting and not drinking,” or “not interacting and others were drinking” (check all that apply). Participants were then asked to indicate how many drinks were consumed in each context (0 to > 12). To reduce the number of context specific categories, I focused my analyses on drinking which occurred at *home alone* (e.g. drinking home alone; solitary consumption) and *away from home while interacting with others who were also drinking* (e.g. drinking with others; social consumption). Previous daily process research has used similar categorizations in representation of social and solitary consumption (e.g. Mohr et al., 2001a).

Data Analysis

Before exploring the hypothesized within-person associations and cross-level interactions, it was necessary to go through a series of steps to prepare the data for statistical analyses. The following sections discuss this process, specifically variable creation and centering; participant compliance; missing data; checking of distributional assumptions; as well as day of the week and time of day trends for consumption and loneliness variables. I will also provide descriptive information and correlational statistics for the data, and present results of the hierarchical data analyses.

Variable Creation

Drinking outcome variables. In order to assess associations between loneliness and different drinking outcomes (i.e. social and solitary consumption), it was necessary to create two different variables based on reports of consumption and drinking context, as recorded in the daily survey. For each survey time point I summed the number of drinks consumed at *home alone* to create the solitary consumption variable. To create the social consumption variable, I summed the number of drinks consumed *away with others*. Previous research with this data set has shown that these particular combinations of drinking variables provide accurately capture daily solitary and social consumption.

Daily loneliness variable. Daily loneliness was assessed using a single item on the PANAS mood measure. To create the daily loneliness variable, I isolated the loneliness item from the negative affect subscale and created a single column in SPSS to represent loneliness at each time point (i.e. intervals 1-3 per day). Loneliness was rated

on a Likert-type scale of 0 (“not at all”) to 4 (“extremely”), in response to the question “How lonely have you felt since the last interview?”

Lagged variables. To account for temporal ordering of the daily diary data, I lagged the person-centered loneliness variable by participant ID (recall that morning interviews assessed late evening consumption for the previous day). Lagging the loneliness variable allowed me to predict evening consumption from daytime loneliness, or drinking at time point two from loneliness at a previous time point. I created the lagged loneliness variable using SPSS syntax, which shifted raw scores for daily loneliness down by one cell.

Between-person variables. Between-person variables of relevance to this study were gender, age, mean 30-day loneliness, and social integration. Age and gender (men=0, women=1) were assessed via a basic demographics survey administered during initial assessment. I created the mean 30-day loneliness variable by using the aggregate function in SPSS to compute within-person means of the daily loneliness scores across the 30 days of the study. Age and mean 30-day loneliness were included as control variables in all of my analyses.

Social integration was computed as per the instructions Cohen and colleagues (1997). The number of social ties and the frequency of contact with these ties were obtained using the Social Network Index (Cohen et al., 1997). Items pertaining to family (e.g. marital status, number of children, parents, in-laws, etc.), friend, neighbor, and coworker ties, as well as participation in church/religious organization, volunteer organizations, were summed to compute a total social integration score for each

participant. Higher scores indicated greater levels of social integration (i.e. greater diversity of social ties). Because social integration was assessed via a summary, or count measure (Social Network Index; Cohen et al., 1997), it was not appropriate to assess internal consistency.

Centering. To aid in interpretation and to prevent potential problems with multicollinearity, I centered all of my predictor variables (i.e. daily loneliness, gender, social integration) and covariates (i.e. age, mean 30-day loneliness), as per the suggestion of Tabachnick and Fidell (2007). Because I was interested in examining how shifts from average levels of daily loneliness predict subsequent daily drinking outcomes, I person-centered the daily loneliness variable by subtracting each participants' mean loneliness from his/her raw daily scores. Therefore, the Level 1 intercept can be interpreted as the predicted level of social and solitary consumption at each person's average level of daily loneliness. I also grand mean centered all Level 2 predictors (i.e. social integration, age, gender), by subtracting the mean of these variables across participants from each individual's raw score. This allowed me to interpret the Level 1 intercept as the expected amount of social and solitary alcohol consumption at mean levels of social integration, age, and gender.

Dummy codes for day of the week and time of day. Prior daily process research has elucidated day of the week and time of day trends of alcohol consumption and loneliness (e.g. Armeli et al., 2000; Larson, Csikszentmihalyi, & Graef, 1982; Mohr et al., 2001a). Therefore, I created six dummy coded day of the week variables (Tuesday used as a contrast), and one time of day dummy coded variable (evening interview as the

contrast) to control for these effects. Day of the week and time of day variables were modeled as fixed effects, as per suggestion of Bryk and Raudenbush (1992). Day of the week and time of day trends for alcohol consumption and loneliness will be discussed in further detail in the results section.

Missing Data

Given that daily process methodology requires significantly more time and effort from participants than a single cross-sectional survey, missing data, compliance, and attrition are frequent occurrences. Further, missing data may be particularly problematic in daily process research, as it causes unbalanced data and may be of cost to power (Engel & Diehr, 2003; Raudenbush & Bryk, 2002, West & Hepworth, 1991). Therefore, it was important to conduct a thorough examination of potential trends in missing data to ensure that this data was truly missing at random. To do this, I first computed the overall compliance of participants on the daily surveys. Compliance was determined by the number of completed survey days (completed loneliness assessment) out of 30 divided by the total possible amount of survey observations (47 participants*3 surveys a day*30 days=4,230 possible observations). Participants completed a total of 3,329 surveys, resulting in compliance of 78%, which is comparable to compliance in previous daily diary studies (e.g. Mohr et al., 2005).

To examine potential trends in missing data, I aggregated the number of missing daily surveys within participants and then used a series of multiple regressions and t-tests to look for differences in missing data based on social integration, gender, age, mean loneliness, education, income, and marital status. Results indicated that there were no

significant differences in missing data based on gender, age, social integration, mean loneliness, education, income, marital status. Therefore, I concluded that data was truly missing at random.

It is important to note that, following my examination of potential trends in missing data, I eliminated participants who were missing between-person variables of interest, specifically gender and social integration (between-person). Three participants were missing social integration scores, therefore my final sample size for the Level 2 between-person data file was 44 (22 males, 22 females), while the Level 1 within-person data file included daily survey information from 47 participants (25 males, 24 females).

Distributional Assumptions

In preparing for hierarchical data analysis, it was necessary to examine my predictor and outcome variables to confirm that basic distributional assumptions of regression analyses had been met. Therefore, I conducted a thorough exploration of frequencies, histograms, and descriptive information for all continuous predictor and outcome variables. Further, I examined standardized scores, as well as Mahalanobis distances for combinations of predictor and outcome variables, to screen for univariate and multivariate outliers.

Distribution of predictor variables. Examination of histograms revealed that reports of social integration followed a normal distribution ($M=5.96$, $SD=1.89$), while mean loneliness ($M=1.39$, $SD=.47$), age, and daily loneliness ($M=1.38$, $SD=.72$) were positively skewed. Given that I was not making statistical inferences about these predictors, the positive skew of these variables was not of much concern and no data

transformations were required. However, I did log transform mean loneliness when I was testing for gender differences in this variable, as well as daily loneliness when exploring day of the week and time of day trends. Gender differences and data trends are described in the results section.

Distribution of outcome variables. Examination of histograms for social and solitary consumption revealed that both variables were very positively skewed; this is common, given that the drinking survey questions yielded count data. Specifically, the majority of drinks recorded per context per day were zero; therefore, the drinking variables can be classified as following a non-normal distribution. As in previous daily diary research with a non-normal distribution of the outcome variable (e.g. Bryk, Raudenbush, & Congdon, 1996; Gagnon, Doron-LaMarca, Bell, O'Farrell, & Taft, 2008), I decided to model the data as a Poisson distribution. Previous researchers have suggested that count data follow a Poisson distribution, particularly for zero-inflated distributions (Reis & Judd, 2009, p. 408-409).

Time of day comparisons for the drinking variables also revealed very low rates of social ($M=.08$, $SD=.49$) and solitary ($M=.02$, $SD=.17$) consumption reported during the afternoon interview. Further exploration of afternoon consumption revealed significant differences between afternoon consumption with morning and evening consumption for both solitary (afternoon vs. evening, t -ratio = -6.03 , $p < .001$; afternoon vs. morning, t -ratio = -5.61 , $p < .001$) and social consumption (afternoon vs. evening, t -ratio = -5.692 , $p < .001$, afternoon vs. morning, t -ratio = -6.97 , $p < .001$) such that participants reported less consumption in the afternoon compared to other times of the

day. An examination of means plots confirmed these differences, showing that consumption during the afternoon interview was near zero. Therefore, I limited my analyses to the morning and evening interviews for both drinking outcomes, representing late last night's and early evening consumption. Following the removal of the second interview, I reexamined the distributions of social and solitary consumption to confirm that these variables still followed a non-normal distribution. Histograms confirmed that both drinking outcomes were still positively skewed, therefore it was necessary to model the data using a Poisson distribution.

Screening for outliers. Examination of standardized scores for predictor and outcome variables revealed non-extreme values (e.g. z-scores less than 3.30) for social integration, mean loneliness, daily loneliness, and social and solitary consumption. One potential outlier was flagged within the age variable (i.e. 88 year old). However, in visually inspecting the data I could see that this individual's responses to social integration, consumption, and loneliness variables did not stand out in comparison to the other participants. Further, I created an alternative data set excluding this participant's data, and reran all of my analyses in HLM using this new data set. Results were nearly identical to my previous analyses; therefore, it was safe to include this participant's data in subsequent analyses.

Mahalanobis distances were also computed for combinations of predictor and outcome variables to screen for multivariate outliers (Tabachnick & Fidell, 2007). These values were then compared to a chi-square critical value of 22.46 (degrees of freedom=6). With a maximum just above the chi-square critical value (23.24), this test of

Mahalanobis distances indicated a potential multivariate outlier. Though screening for multivariate outliers is crucial, it is possible that outliers are artifacts of a non-normal distribution, or of a particular sample of the target population. In such cases, outliers can remain in the distribution and the data can be transformed to reduce their impact (Tabachnick & Fidell, 2007, p. 76-77). Because I had already decided to use a Poisson distribution to account for the non-normal distributions of my outcome variables, these potential multivariate outliers were not of much concern to my analyses.

Data Structure

In this study, participants completed surveys three times a day for 30 days (90 interviews per person), giving a possible total of 4,230 daily interviews (Level 1) nested within 47 participants (Level 2). However, I limited my data analyses to the first and last daily interview, given the low rates of alcohol consumption reported during the afternoon survey assessment; this gave me total of 2,820 survey observations. Kreft and De Leeuw (1998) argue that 30 observations per 30 participants, yielding 900 person observations, provide sufficient power to test within-person associations and cross-level interactions. Based on these criteria, I had sufficient power to test my hypothesized effects.

Due to the nested nature of daily process data (daily assessments nested within person), I conducted a series of multi-level regression analyses to examine within-person and between-person effects. Due to the unbalanced number of observations per individual, resulting from unequal amounts of missing data per participant, I conducted all of my analyses using Hierarchical Linear Modeling software (HLM, v.6.0; Raudenbush, Bryk, Cheong, & Congdon, 2000), which was designed to deal with

unbalanced data. Such analyses and statistical software allowed me to test a two-level model composed of (Level-1) within-person effects of daily loneliness on daily alcohol consumption in different drinking contexts, as well as the moderating influence of (Level-2) social integration and gender on daily loneliness, social and solitary drinking associations.

Using this two-level model, I modeled within-person outcomes (e.g. social and solitary consumption) as a function of within-person predictors (i.e. daily loneliness; Level-1). In the Level-2 equation, I modeled these Level-1 associations (slopes and intercepts; i.e. associations between daily loneliness and subsequent alcohol use) as outcomes of between-person predictors (i.e. social integration and gender). It is important to note that I modeled the intercepts and the daily loneliness slope as random, allowing them to vary within participants. Further, I modeled the day of the week and time of day covariates as fixed, as per the suggestion of Bryk and Raudenbush (1992). This model allowed me to examine how the associations between daily loneliness and subsequent alcohol consumption differ at different levels of social integration and by gender, controlling for day of the week and time of day.

Results

Descriptive Statistics

Prior to running hierarchical data analyses, I examined relevant descriptive and correlational statistics for my variables of interest. Specifically, I explored gender differences in each of my study variables (i.e. social integration, age, mean 30-day loneliness, daily loneliness, social consumption, solitary consumption), examined demographic correlates of social integration, correlational statistics among all variables of interest, and explored day of the week and time of day trends for loneliness and alcohol consumption.

Results of an independent samples t-test revealed that men and women did not differ in social integration, age, mean loneliness, daily loneliness, or average social and solitary consumption over the course of the 30-day study. There were, however, significant gender differences in daily solitary consumption ($t(21629.10) = -3.26$, $p = .001$), and differences trending towards significance in social consumption ($t(2149.67) = -1.64$, $p = .100$), such that men consumed more alcohol in both contexts.

On average, participants reported mid-range levels of social integration ($M = 5.95$, $SD = 1.89$) as assessed by the Social Network Index (Berkman & Syme, 1979; Cohen et al., 2007; highest social integration score possible on the SNI is 12). Interestingly social integration did not correlate with any demographic variables, including education, income, marital status, age, or gender, nor did it significantly correlate with average 30-day loneliness, social or solitary consumption. Participant age was significantly and negatively correlated with average 30-day loneliness and social consumption, such that

older individuals reported lower average daily values for each of these variables. There was also a marginally significant correlation between average daily loneliness and average daily solitary consumption, such that greater loneliness was associated with greater average solitary consumption. These correlations, in addition to those for other variables of interest (e.g. gender, age, mean loneliness, etc.) can be found in Table 1. Though the above correlational statistics provide general descriptive information about this sample, bivariate correlations do not account for issues related to missing data or hierarchical data structure. Mean-level associations among variables of interest (e.g. gender, social integration, drinking outcomes, and loneliness), as computed in HLM (which accounts for unbalanced diary data hierarchical data structure) would provide more appropriate and reliable descriptive information for this particular sample. Therefore, I refer the reader to Table 3, wherein I display mean-level associations between study variables of interest, as examined in hypotheses 2a-d.

Following my examination of descriptive and correlational statistics, I explored day of the week and time of day trends for loneliness and alcohol consumption. I examined potential day of the week and time of day effects by regressing daily social consumption, solitary consumption, and loneliness on day of the week and time of day dummy codes; as a reminder, Tuesday was used as a contrast in the day of the week comparisons, as was the evening interview in the time of day comparisons. Results indicated that there were significant positive associations between days of the week and social consumption, specifically for Friday ($t(1974) = 4.94, p < .001$), Saturday ($t(1974) = 4.42, p < .001$), and Sunday ($t(1974) = 2.95, p = .004$). On average, participants

reported greater social consumption on the weekend (e.g. Friday, Saturday, Sunday) compared to other days of the week (i.e. Tuesday). There were also significant negative associations between days of the week and loneliness, specifically for Thursday ($t(1999) = -2.34, p = .02$), Friday ($t(1999) = -2.107, p = .04$), and Sunday ($t(1999) = -2.42, p = .02$). On these days, participants tended to report significantly less loneliness relative to other days of the week. Additionally, time of day comparisons revealed that participants reported greater loneliness during the evening compared to the morning interview ($t\text{-ratio} = 2.08, p = .04$). As previously described, participants reported significantly less social and solitary consumption during the afternoon interview compared to other times of day. Therefore, it was reasonable to eliminate drinking data from this time point, as values of consumption were near zero.

Hypothesis Testing

In this study, I was interested in exploring within-person associations between daily loneliness and subsequent social and solitary alcohol consumption. Further, I examined the extent to which these within-person patterns of behavior varied as a function of social integration and gender. To examine these within-person and between person effects, I used HLM v6.0 statistical software to run a series of multi-level regression equations. Using this method, I modeled Level-1 intercepts and loneliness slopes as random, allowing them to vary within-person; day of the week and time of day dummy codes, as well as age and mean loneliness covariates, were modeled as fixed effects. What follows is a description of results from my hierarchical data analysis, along with an interpretation of the estimated coefficients. Given a Poisson distribution was

used to model the outcome variables, log-estimated coefficients were exponentiated to obtain interpretable results.

In the following models, $SolitaryConsumption_{it}$ and $SocialConsumption_{it}$ represent person i 's late night solitary or social consumption on day t ; b_{0i} is person i 's estimated solitary consumption or social at average levels of loneliness; b_{1i} is the estimated change in solitary or social consumption for a one-unit increase in daily loneliness; $Loneliness_{it-1}$ represents person i 's reported loneliness at the previous time point $t-1$; γ_{00} represents the mean values of social and solitary consumption; and γ_{01} , γ_{02} , γ_{03} , and γ_{04} represent the effects of age, mean 30-day loneliness, social integration, and gender on social and solitary consumption.

Hypothesis 1a and research question #1. First, I examined within-person associations between daily loneliness and subsequent social and solitary alcohol consumption, as modeled in Equations 1 and 2. Separate multi-level regressions were conducted for social and solitary consumption. Table 2 shows the within-person associations between daily loneliness and solitary and social consumption, controlling for age and mean 30-day loneliness.

Hypothesis 1a. Daily solitary consumption was regressed on loneliness, as shown in Equation 1 below. In line with existing motivational models of alcohol consumption and tension reduction (i.e., drinking to cope) hypotheses, I hypothesized that there would be a significant within-person association between loneliness and subsequent alcohol consumption.

$$\text{SolitaryConsumption}_{it} = b_{0i} + b_{1i}(\text{Loneliness}_{it-1}) + b_{2it}(\text{Mon}) + b_{3it}(\text{Wed}) + b_{4it}(\text{Thurs}) + b_{5it}(\text{Fri}) + b_{6it}(\text{Sat}) + b_{7it}(\text{Sun}) + b_{8it}(\text{Time-of-day}) + e_{it} \quad (1)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{Age}) + \gamma_{02}(\text{AvgLonely}) + \gamma_{03}(\text{SI}) + \gamma_{04}(\text{Gender}) + u_{0i}$$

$$b_{1i} = \gamma_{10} + u_{1i}$$

As expected, there were significant within-person associations between daily loneliness and subsequent solitary consumption ($b=.44, p<.001$), such that participants reported greater solitary consumption on days with higher levels of loneliness relative to days when they experienced less loneliness. To facilitate in the interpretation of these results, I exponentiated all of the log-estimated coefficients as obtained through a Poisson distribution (raising e to the value of the coefficient). Therefore, it can be said that holding all else constant, a one-unit increase in loneliness was associated with an increase in solitary consumption by 44%, or by 1.55 drinks ($e^{.44}$).

Research Question #1. Next, I was interested in exploring within-person associations between loneliness and subsequent social consumption. To examine this association, I regressed social consumption on loneliness, as shown in Equation 2 below.

$$\text{SocialConsumption}_{it} = b_{0i} + b_{1i}(\text{Loneliness}_{it-1}) + b_{2it}(\text{Mon}) + b_{3it}(\text{Wed}) + b_{4it}(\text{Thurs}) + b_{5it}(\text{Fri}) + b_{6it}(\text{Sat}) + b_{7it}(\text{Sun}) + b_{8it}(\text{Time-of-day}) + e_{it} \quad (2)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{Age}) + \gamma_{02}(\text{AvgLonely}) + \gamma_{03}(\text{SI}) + \gamma_{04}(\text{Gender}) + u_{0i}$$

$$b_{1i} = \gamma_{10} + u_{1i}$$

Results indicated that there was a significant inverse relationship between daily loneliness and social consumption ($b=-.33, p=.002$). Specifically, participants reported less social consumption on days with greater loneliness relative to days with less

loneliness. Otherwise stated, holding all else constant, a one unit increase in loneliness was associated with a decrease in social consumption of 33%, or by .72 drinks.

Hypothesis 2a-d. Next, I examined mean level associations of social integration and gender with **(a/c)** social and **(b/d)** solitary alcohol consumption controlling for day of the week, time of day, age, and mean 30-day loneliness (Table 3).

Hypothesis 2a-b: Mean levels of social and solitary consumption were regressed on social integration, as demonstrated in Equations 3-4. I predicted that social integration would significantly and negatively predict mean daily solitary consumption, such that those who were higher in social integration would report lower levels of average daily solitary consumption. I also predicted that social integration would significantly and positively predict social consumption, such that those higher in social integration would report greater levels of average daily social consumption compared to those lower in social integration.

$$\text{SocialConsumption}_{it} = b_{0i} + b_{1it}(\text{Mon}) + b_{2it}(\text{Wed}) + b_{3it}(\text{Thurs}) + b_{4it}(\text{Fri}) + b_{5it}(\text{Sat}) + b_{6it}(\text{Sun}) + b_{7it}(\text{Time-of-day}) + e_{it} \quad (3)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{SI}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

$$\text{SolitaryConsumption}_{it} = b_{0i} + b_{1it}(\text{Mon}) + b_{2it}(\text{Wed}) + b_{3it}(\text{Thurs}) + b_{4it}(\text{Fri}) + b_{5it}(\text{Sat}) + b_{6it}(\text{Sun}) + b_{7it}(\text{Time-of-day}) + e_{it} \quad (4)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{SI}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

As predicted, there was a significant inverse relationship between social integration and solitary consumption ($b = -.18, p = .006$), such that greater social integration was related to less solitary consumption. Unexpectedly, social integration was

also inversely related to social consumption, ($b = -.11, p = .024$), such that those with greater social integration reported less social consumption.

Hypothesis 2c-d. Mean levels of solitary and social consumption were regressed on gender, as demonstrated in equations 5-6. I hypothesized that males would report higher mean levels of both social and solitary consumption.

$$\text{SocialConsumption}_{it} = b_{0i} + b_{0i} + b_{1it}(\text{Mon}) + b_{2it}(\text{Wed}) + b_{3it}(\text{Thurs}) + b_{4it}(\text{Fri}) + b_{5it}(\text{Sat}) + b_{6it}(\text{Sun}) + b_{7it}(\text{Time-of-day}) + e_{it} \quad (5)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{Gender}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

$$\text{SolitaryConsumption}_{it} = b_{0i} + b_{0i} + b_{1it}(\text{Mon}) + b_{2it}(\text{Wed}) + b_{3it}(\text{Thurs}) + b_{4it}(\text{Fri}) + b_{5it}(\text{Sat}) + b_{6it}(\text{Sun}) + b_{7it}(\text{Time-of-day}) + e_{it} \quad (6)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{Gender}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

As predicted, there was a significant association between gender and solitary consumption, such that men reported greater mean solitary consumption ($b = -1.01, p = .021$). Mean associations for social consumption were marginally significant, such that men also reported greater social consumption during the course of the study ($b = -.45, p = .078$).

There was also a significant association between age and social consumption. Specifically, there was a significant inverse association between age and social consumption, such that older participants reported less social consumption ($b = -.029, p < .001$). Additionally, there was a marginally significant positive association between mean loneliness and solitary consumption, such that participants with greater mean 30-day loneliness tended to drink more over the course of the study ($b = .74, p = .05$).

Hypothesis 3a-d (cross-level interactions). I then examined the extent to which within-person associations between loneliness, social consumption and solitary consumption differ as a function of social integration and gender. Otherwise stated, I examined the moderating effects of social integration and gender on loneliness-drinking associations. Table 4 displays the log-estimated coefficients of main effects and cross-level interactions, as modeled in Equations 7-10.

Hypothesis 3a-b. To examine the moderating effects of social integration on loneliness-drinking associations, I regressed Level-1 intercepts and slopes on social integration for social and solitary consumption, controlling for day of the week, time of day, age, and mean 30-day loneliness. I predicted that social integration would moderate the effects of loneliness on social and solitary consumption. Specifically, I hypothesized that individuals with less social integration would report stronger loneliness-solitary consumption associations, and that those with greater social integration would report stronger loneliness-social consumption associations.

$$\text{SolitaryConsumption}_{it} = b_{0i} + b_{1i}(\text{Loneliness}_{it-1}) + b_{2it}(\text{Mon}) + b_{3it}(\text{Wed}) + b_{4it}(\text{Thurs}) + b_{5it}(\text{Fri}) + b_{6it}(\text{Sat}) + b_{7it}(\text{Sun}) + b_{8it}(\text{Time-of-day}) + e_{it} \quad (7)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{SI}) + \gamma_{02}(\text{Gender}) + \gamma_{03}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

$$b_{1i} = \gamma_{10} + \gamma_{11}(\text{SI}) + u_{1i}$$

$$\text{SocialConsumption}_{it} = b_{0i} + b_{1i}(\text{Loneliness}_{it-1}) + b_{2it}(\text{Mon}) + b_{3it}(\text{Wed}) + b_{4it}(\text{Thurs}) + b_{5it}(\text{Fri}) + b_{6it}(\text{Sat}) + b_{7it}(\text{Sun}) + b_{8it}(\text{Time-of-day}) + e_{it} \quad (8)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{SI}) + \gamma_{02}(\text{Gender}) + \gamma_{03}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

$$b_{1i} = \gamma_{10} + \gamma_{11}(\text{SI}) + u_{1i}$$

Given that there were significant main effects of social integration on solitary ($b = -.17, p = .006$) and social ($b = -.19, p = .004$) consumption, it was reasonable to proceed in examining a moderation, or the interaction of daily loneliness with social integration. To do this, I included social integration in my Level-2 loneliness slope equations for both drinking outcomes. This allowed me to examine the effect of social integration on the loneliness-solitary consumption and loneliness-social consumption associations. Results indicated a marginally significant moderating effect of social integration on loneliness-solitary consumption associations ($b = .061, p = .095$), such that those with greater social integration reported stronger loneliness-solitary consumption associations. Examination of an interaction graph (Figure 1), and tests of simple slopes revealed significant slopes at both high and low levels of social integration (high SI, $t(37) = 4.76, p < .001$; low SI, $t(37) = 3.66, p = .001$), though those reporting more social integration showed stronger loneliness-solitary consumption associations at the highest levels of loneliness than those reporting less social integration. Contrary to expectations, there was no significant moderating effect of social integration on loneliness-social consumption associations.

Hypothesis 3c-d. I then examined the moderating effects of gender on these loneliness-consumption associations by regressing Level-1 intercepts and slopes on gender for social and solitary consumption, controlling for day of the week, time of day, age, and mean 30-day loneliness. I predicted that gender would moderate the effects of loneliness on social and solitary consumption, such that men would report stronger loneliness-drinking associations for both social and solitary consumption.

$$\begin{aligned} \text{SolitaryConsumption}_{it} = & b_{0i} + b_{1i}(\text{Loneliness}_{it-1}) + b_{2it}(\text{Mon}) + b_{3it}(\text{Wed}) + \\ & b_{4it}(\text{Thurs}) + b_{5it}(\text{Fri}) + b_{6it}(\text{Sat}) + b_{7it}(\text{Sun}) + b_{8it}(\text{Time-of-day}) + e_{it} \end{aligned} \quad (9)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{SI}) + \gamma_{02}(\text{Gender}) + \gamma_{03}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

$$b_{1i} = \gamma_{10} + \gamma_{11}(\text{Gender}) + u_{1i}$$

$$\begin{aligned} \text{SocialConsumption}_{it} = & b_{0i} + b_{1i}(\text{Loneliness}_{it-1}) + b_{2it}(\text{Mon}) + b_{3it}(\text{Wed}) + \\ & b_{4it}(\text{Thurs}) + b_{5it}(\text{Fri}) + b_{6it}(\text{Sat}) + b_{7it}(\text{Sun}) + b_{8it}(\text{Time-of-day}) + e_{it} \end{aligned} \quad (10)$$

$$b_{0i} = \gamma_{00} + \gamma_{01}(\text{SI}) + \gamma_{02}(\text{Gender}) + \gamma_{03}(\text{Age}) + \gamma_{03}(\text{AvgLonely}) + u_{0i}$$

$$b_{1i} = \gamma_{10} + \gamma_{11}(\text{Gender}) + u_{1i}$$

Significant and marginally significant main effects of gender on solitary ($b = -1.07, p = .014$), and social ($b = -.43, p = .079$) consumption validated the examination of gender as a moderator in loneliness-drinking outcome associations. To test for moderation, I included gender in the Level-2 loneliness slope equations for both drinking outcomes. This allowed me to examine the effects of gender on the loneliness-consumption associations. Results indicated significant moderating effects of gender on loneliness-solitary consumption associations ($b = .44, p = .004$; Figure 2). Simple slopes analyses revealed that females exhibited stronger loneliness-solitary consumption associations ($t(37) = 4.65, p < .001$) relative to males ($t(37) = 4.48, p < .001$), at the highest level of loneliness. Though both men and women reported increases in solitary consumption following times of greater loneliness, women reported stronger loneliness-solitary consumption associations than men.

There were also marginally significant moderating effects of gender on loneliness-social consumption associations ($b = .33, p = .079$; Figure 3). Tests of simple

slopes revealed significant slopes for men only ($t(37)=3.71, p=.0007$), while slopes for women were not significant ($t(37)=-1.15, p=.258$). Otherwise stated, men reported significant decreases in social consumption following times with greater loneliness, while women did not.

Discussion

The purpose of this study was to examine within-person patterns of drinking behavior in response to daily experiences of loneliness, and to explore the moderating effects of social integration and gender on these associations. Previous researchers have provided ample evidence in support of social relationships as strong predictors of health and health behavior (e.g. Berkman & Syme, 1979; Durkheim, 1951). Specifically, research has shown that being more integrated in a diverse network of social ties is related to greater mortality, healthier lifestyle (e.g. exercise), and reduced risk behavior (e.g. alcohol consumption; Berkman & Breslow, 1983; Cohem & Lemay, 2007), and that the availability of social resources is known to influence coping strategies and reactivity to daily stress (Cobb, 1976; Cutrona, 1987). Conversely, loneliness, or perceived social isolation, has been associated with low immune system functioning, cardiovascular disease, and increased risk behaviors, such as alcohol consumption and substance use (Caccioppo et al., 2002; Hawkey et al., 2003; Hawkey et al., 2006).

Though various researchers have examined health behavioral correlates of loneliness, the majority of research to date utilizes cross-sectional assessments and retrospective reports of health behaviors, therefore failing to capture more fluctuating experiences and responses to loneliness which may be indicative of maladaptive patterns of coping behavior. Such within-person, daily mood-behavior associations are best captured using daily process methodology, which requires multiple assessments per day per participants (Bolger et al., 2003; Cooper et al., 1995). Because data is collected in real time, such methodology cuts back on retrospective bias, thus allowing a more

accurate examination of fluctuating mood experiences and subsequent behavioral outcomes. Through a secondary analysis of data collected via daily process methodology, this thesis provides a very unique understanding of specific processes by which social relationships, or the perceived lack thereof, influence health and more specifically, mood-related health behavior.

In the following sections I will discuss my findings in light of existing literature and theory of social relationships and health, loneliness, and motivational models of alcohol consumption. Specifically, I will discuss within-person associations between loneliness and drinking outcomes; mean-level associations between social integration, gender, social and solitary alcohol consumption; and the moderating effects of social integration and gender on loneliness-drinking associations. I will then provide an overview of potential limitations to this study, followed by a discussion of the implications, contributions, and future directions of this research.

Loneliness-Drinking Associations

Loneliness and solitary consumption. In this thesis, I examined within-person associations between daytime loneliness and subsequent evening solitary consumption (Hypothesis 1a). Based on Cooper and colleagues' (1995) motivational models of alcohol consumption and drinking-to-cope hypotheses, I expected that participants would report greater solitary consumption on days with greater loneliness relative to days with less loneliness. As expected, results indicated that daytime loneliness significantly and positively predicted solitary consumption. These findings are in accordance with existing motivational models of alcohol consumption, which suggest that the regulation of

negative affect is a primary motive for alcohol consumption (e.g. drinking to cope, tension reduction; Conger, 1956; Cooper et al., 1995). In this sample, increases in solitary consumption following time periods with more loneliness may be indicative of drinking to cope and tension reduction type behavior. Previous research has also provided evidence that such drinking-to-cope behavior, and more specifically negative-mood related consumption, tends to occur in solitary contexts (Cooper et al., 1994; Mohr et al., 2001a/2005). The findings of this thesis support this research, as results demonstrated increases in solitary consumption following experiences of loneliness.

The positive associations between loneliness and solitary consumption also speak to known responses to loneliness. Specifically, Rubenstein and Shaver (1982) described sad passivity responses to loneliness, which are characterized by solitary behaviors such as crying, sleeping, overeating, alcohol consumption, and substance use. Perlman and Peplau (1979/1981) identified the engagement in behaviors designed to alleviate the negative impact of loneliness, such as alcohol consumption or drug use, as a common response to loneliness. And similarly, Rokach and Brock (1980) described the need to reduce feelings of loneliness through behaviors such as sexual intercourse and substance use. Sad passivity behaviors are thought of as maladaptive coping responses as such behaviors do not actively address the source of loneliness. In light of this research, it is possible that the positive associations between daytime loneliness and evening solitary consumption, as found in this thesis, reflect sad passivity loneliness response categories.

It is also possible that increases in solitary consumption relate to another category of responses to loneliness, active solitude, in which individuals spend time reflecting on

their loneliness through solitary activity (Perlman & Peplau 1979/1981; Rubenstein & Shaver, 1982). A key component of this active response to loneliness is the idea that solitude can be healthy and productive, in that it is related to self-reflection, contemplation, creativity, and spirituality (Long & Averill, 2003). Further, though negative mood-related solitary consumption has been associated with the development of alcohol abuse and dependence, recent research suggests that such drinking-to-cope behaviors may be an effective means of reducing negative affect, particularly for those with alternative coping resources (Hussong et al., 2001; Mohr, Brannan, Wendt, Jacobs, & Wright, 2010). Therefore, though loneliness-related solitary consumption may be indicative of sad passivity responses to loneliness, it is also likely that individuals are engaging in active solitude, taking time to reflect on and understand their experience of loneliness. In light of this interpretation, however, it is important to note current research examining alcohol myopia, or the restricting effects of alcohol consumption on cognitive functioning (e.g. Steele and Joseph, 1988). Such research has demonstrated that alcohol impairs the ability to attend to environmental cues, information, and stimuli, and thus limits attention to more salient aspects of the environment. Research examining these effects has found that stress-related social consumption results in the greatest stress-dampening effects, as individuals are distracted from thoughts of the days' stressful/negative events. Conversely, solitary consumption has been shown to actually exacerbate the effect of stress on mood, as individuals are more prone to focusing in on a particular stressor or daily event, thus increasing stress and negative mood (Armeli et al., 2003). According to this research, loneliness-related solitary consumption may be

counterproductive and result in greater loneliness, to the extent that the individual is not engaging in other behaviors (i.e. using the internet, watching TV, listening to music) which may distract from his/loneliness. It would be useful for future research to examine loneliness-relate daily consumption in the context of alcohol myopia, and explore the extent to which consumption in different contexts increases or decreases later experiences of loneliness.

Given that solitary consumption has been described as both an adaptive and maladaptive coping response to loneliness (sad passivity vs. active solitude), it is important to consider what differentiates individuals for whom this behavior is high risk versus effective (as a coping strategy). As mentioned above, recent research has suggested that drinking to cope can be an effective coping strategy, for those with alternative coping resources. For those individuals with alternative support systems in place, perhaps solitary consumption is a form of active solitude. Conversely, solitary consumption may be less adaptive for those who are truly socially isolated, and therefore lacking in supportive ties to turn to in times of need. Therefore, it is possible that perceived control of solitude plays an important role in differentiating the adaptiveness of solitary responses to loneliness. Specifically, it would be important to consider whether individuals are choosing to drink alone (active solitude), versus having no other option.

Loneliness and social consumption. In addition to sad passivity and active solitude responses, researchers have identified a variety of social behaviors which individuals use to cope with feelings of loneliness. In particular, Rubenstein and Shaver (1982) describe seeking social contact as a more active response to loneliness. Such

behavior includes calling or visiting a friend, engaging in social activities, or putting forth an increased effort to build social ties. Further, recent research has shown that social and solitary alcohol consumption represent two very different drinking behaviors associated with different motivations for consumption (e.g. Cooper, 1994). Given that responses to loneliness occur in both social and solitary contexts, and that social consumption represents a distinct drinking behavior, it was important to assess loneliness-related social consumption, as this may be reflective of more active responses to loneliness as described above.

In this thesis, I explored the within-person associations between loneliness and subsequent social consumption (Research Question #1). In contrast to the results for solitary consumption, there was a significant inverse relationship between loneliness and social participations such that participants reported less evening social consumption following times of greater loneliness. These findings are important, as they demonstrate how social and solitary contexts lend to very different mood-related behaviors (Mohr et al., 2001a). Further, they are in line with literature which suggests that loneliness is strongly related to fear of rejection and social withdrawal type behavior (Cacioppo, Hawkley, et al., 2006; Jones, Rose, & Russell, 1990). More specifically, though loneliness serves as a reminder of the need to belong, it is often associated with an increased sensitivity to social threats. Therefore, though seeking social contact may help to alleviate feelings of loneliness, individuals are often likely to withdraw from social behavior out of fear for potential rejection.

However, decreases in social consumption are not necessarily indicative of withdrawal from social behavior. It is important to consider that individual may be engaging in other kinds of social activities in non-drinking contexts (e.g. going on a walk or out to coffee with a friend or family member). Additionally, there are a variety of solitary behaviors which are still innately social, such as talking on the phone, emailing, or using social network sites and internet chat rooms. Therefore, it is impossible to conclude that decreases in social consumption are indicative of decreases in social behavior. Future research should examine associations between daily loneliness and other types of social behaviors, including those that may be in a solitary context (e.g. chat rooms, etc.).

Individual Differences in Alcohol Consumption and Loneliness

Previous research within the health behavior and addictions literature has revealed a variety of individual difference variables which influence levels of alcohol consumption (i.e. gender, age, drinking motives, etc.). In this thesis, I explored the influence of gender and age on mean levels of social and solitary consumption (Hypothesis 2a-d). Results indicated that men reported greater average social and solitary consumption. Additionally, older participants reported less average solitary consumption. Previous research has shown that men typically report greater frequency and quantity of alcohol consumption (e.g. Hussong et al., 2001; Mohr et al., 2001a). Further, existing epidemiological data demonstrates that alcohol consumption declines with age (Filmore, Hartka, Johnstone, Leino, Motoyoshi, & Temple, 1991; Midanik, 1992). The alignment of my findings with previous literature speaks to the generalizability of this sample, in

terms of normative gender and age-related drinking behaviors. These findings also demonstrate the importance of differentiating between distinct drinking contexts. While there was a significant association between age and social consumption, age did not predict solitary consumption. Therefore, assessing social and solitary consumption separately gives a very unique perspective of drinking behavior, which may have been lost if drinking context were not assessed separately.

Research and theory within the realm of social relationships and health has described how individual differences in social integration influence health and health behavior. Specifically, theories of symbolic interactionism and social control posit that social relationships and more specifically, social integration (i.e. having a diversity of social ties), influence engagement in health behaviors through behavioral norms and expectations which social roles and identities provide (e.g. Thoits, 1983; Lewis & Rook, 1999). Similarly, theories of social support and social networks posit that having a diverse network of social ties influences health behaviors through increased access to health-promoting information, and through social ties which may sanction risky health behavior and provide alternative coping resources in times of need. Drawing from these theories, various researchers have shown that low social integration, or social isolation, is associated with greater alcohol and cigarette use; low physical exercise; low use of medical resources; and poor diet (Berkman et al., 2000; Cohen, 1988; Cohen & Lemay, 2007; House, Landis, & Umberson, 1988; Kuntsche, Knibbe, Gmel, 2009; Pressman, Cohen, Miller, & Rabin, 2005; Reynolds & Kaplan, 1990). Conversely, high social integration has been shown to relate to healthier lifestyle (e.g. greater exercise, healthy

diet), as well as increased use of approach-oriented coping behavior (i.e. drawing on social support resources) and decreased use of avoidance coping behaviors through substance use (e.g. Moos, Brennan, Fondacaro, & Moos, 1990).

Given the well-known influence of social integration on health behavior and coping strategies, it was important to consider this variable in the context of daily loneliness. The strong associations between social network diversity/structure and health behavior may not only influence the nature of responses to loneliness, but also the context of these responses (i.e. social versus solitary alcohol consumption). In this thesis, I predicted that greater social integration would be related to less solitary and greater social consumption, with the assumption that those reporting greater social integration would have more opportunity to drink with others. Indeed, past research has shown that high social integration is related to a greater number of daily interaction partners (e.g. Cohen & Lemay, 2007). However, findings indicated that greater social integration was related to less alcohol consumption in both social and solitary contexts. These findings are actually more consistent with the broader social relationships and health literature by showing that greater social integration is related to less health risk behavior. Further, no study prior to this thesis had explored the association between social integration and drinking behavior in different contexts. Therefore, these particular findings make a unique contribution to the existing body of social relationships, social integration, and health research. Future research should continue to explore associations between social integration and health behaviors (e.g. exercise, eating behaviors, etc.) differentiating between social and solitary contexts.

Previous research has also explored cross-sectional associations between chronic loneliness, alcohol consumption, and alcohol abuse, demonstrating that loneliness, as assessed by the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980), typically relates to greater alcohol consumption and risk behavior (Cornwell & Waite, 2009). In this thesis, mean 30-day loneliness was significantly predictive of average daily solitary consumption, such that participants with greater mean-levels of loneliness reported greater solitary consumption. It is interesting to note that not only did individuals drink more in solitary contexts at times with greater loneliness, but individuals who were lonelier tended to exhibit greater solitary consumption in general. Such findings are in line with previous research relating loneliness with withdrawal type behavior and fear of rejection (e.g. Cacioppo, Hawkey, et al., 2006; Jones, Rose, & Russell, 1990). Further, though a more comprehensive measure of loneliness, (e.g. UCLA Loneliness Scale; Russell, Peplau, & Cutrona, 1980) was not included in this study, the mean-level measure of daily loneliness yielded results in the expected direction of existing cross-sectional research examining loneliness and alcohol consumption. This thesis, then, provides a unique understanding of how greater average daily loneliness and associated patterns of consumption relate to more cross-sectional assessments loneliness, and may be reflective of more enduring experiences of chronic loneliness.

Loneliness-Related Consumption as a Function of Social Integration and Gender

Previous researchers and theorists have conceptualized stress-vulnerability models of consumption, proposing that certain individuals are particularly vulnerable to adopting patterns of negative mood-related alcohol consumption (Armeli et al., 2000).

Within this framework, researchers have examined the moderating influence of such variables as perceived social support on mood-drinking associations (e.g. Hussong et al., 2001; Mohr et al., 2001a; Mohr et al., 2005; Steptoe et al., 1995), providing evidence that those with low perceived support exhibit stronger negative mood-drinking associations. Though recent researchers have explored the moderating effect of social integration on associations between social interactions and health behaviors (i.e. Cohen & Lemay, 2007), no research prior to this thesis had examined the influence of social integration on negative mood-drinking associations.

Moderating effect of social integration on loneliness-solitary consumption associations. In this study, I examined the moderating influence of social integration on within-person associations between loneliness and drinking outcomes (e.g. social and solitary consumption; Hypothesis 3a-b). In accordance with my hypotheses, results indicated marginally significant moderating effects of social integration on loneliness-solitary consumption associations. Though I had predicted that participants who reported less social integration would report stronger loneliness-solitary consumption associations, examination of simple slopes revealed that it was those with greater social integration who exhibited somewhat stronger loneliness-solitary consumption relationships. These results appear to contradict existing stress-buffering models of social support, which assert that the social supports provided by interpersonal ties attenuate the negative effects of stress and negative mood (Cassel, 1976; Cobb, 1976; Cohen & Wills, 1985). However, such stress-buffering effects are generally found for perceptions of support availability, and less frequently for structural measures of social support, such as social integration.

Therefore, it is possible that perceptions of support availability, rather than social integration, would have had more of an attenuating effect on loneliness-drinking associations.

Interestingly, there were no significant moderating effects of social integration on loneliness-social consumption associations, despite highly significant variation in loneliness-social consumption slopes ($p=.002$). Such findings suggest that alternative individual difference variables may be influencing these associations, such as perceptions of support, perceived control, or drinking motives (e.g. coping motives, social motives, enhancement motives, etc.). More importantly, significant variation in loneliness-drinking slopes reveals that though on average participants changed their behavior in response to loneliness by decreasing social consumption, some individuals within this sample did not. It is possible that those reporting decreases in social consumption were engaging in non-drinking behaviors (social or solitary) instead, such as going on a walk, talking on the phone with friends/family, reading a book, journaling, etc. Conversely, for those who did not report decreases in social consumption, it is likely that social consumption was less related to the experience of loneliness. In light of this, it is important to note that the most frequently reported social integration score in this sample was 7 (out of a 12-point scale), which is indicative of a fairly healthy social network (Berkman & Syme, 1979). Previous literature has described social integration as predictive of “self-worth, predictability, stability, and control” (Rodriguez & Cohen, 1998, p. 539), as well as self-esteem and a sense of mastery (Brissette, Cohen, & Seeman, 2000; Cohen, 1988; Cohen & Lemay, 2007). Further, social integration has been linked

to a greater diversity of coping resources and coping strategies. Therefore, it is possible that many of the participants in this sample were finding alternative ways to utilize their support networks following times with more loneliness as opposed to going out and drinking with others.

It is also possible that there was simply not enough power to detect a cross-level interaction of social integration and daily loneliness, given the high power requirements for detecting moderation in hierarchical data analysis. Hox (2010) argues that having 100 to 200 groups with approximately 10 cases per group is necessary to have sufficient power for testing cross-level interactions. In line with this, Scherbaum and Ferreter (2009) suggest that increasing the number of observations at the highest level of analysis (i.e. number of groups) is a good strategy for obtaining enough power to detect cross-level interactions. Though I included 3,329 person-day observations (Level-1) in my analyses, research has shown that, for multi-level models, power and accuracy depend more so on the number of groups (Level-2) than on the number of individuals per group (Hox, 1998). Therefore, it is likely that increasing the number of participants in this study would provide the statistical power needed to detect this cross-level interaction.

Moderating effect of gender on loneliness-solitary consumption associations.

Previous research has shown that men and women tend to differ in the strategies they describe as useful for coping with loneliness. In particular, work by Rokach and Brock (1998) demonstrated that women were more likely endorse the use of coping strategies such as acceptance and self-reflection, while men were more likely to describe increasing their social activity. The stress and coping literature also identifies gender differences in

the regulation of daily mood, stress, and social interactions. Specifically, men have been shown to be more likely to externalize stress through drinking (e.g. Husson et al., 2001), and women are more likely to actively cope by seeking social ties for emotional support, also known as “tending and befriending” (Taylor et al., 2000). In light of this research, and the relative dearth of research examining gender differences in daily responses to loneliness, it was important to consider the role of gender in daily responses to loneliness.

In this thesis, I examined the moderating influence of gender in loneliness-drinking associations (Hypothesis 3c-d). Results indicated that gender significantly moderated the positive association between daytime loneliness and subsequent solitary consumption, such that women exhibited stronger increases in solitary consumption than men on days with greater loneliness. Though such findings do contradict research describing men as more likely to report drinking to cope with negative emotions (Cooper, Russell, Skinner, Frone, & Mudar, 1992), they are very much in line with recent findings in the self-medication and daily process literature. For example, in a cross-sectional study of problem drinking, gender, coping, and loneliness, Bonin, McCreary, and Sadava (2000) found that when loneliness was high, women were more likely to report greater frequency of intoxication than men. Similarly, Griffin, Mirin, and Weiss (1992) found that women were more likely to use drugs in self-medicating depression than men. Therefore, while research has traditionally shown that men are more likely to report drinking to cope behavior, recent evidence suggests that women are just as likely, and in some circumstances more likely, to actually exhibit this behavior.

These findings are also in accordance with previous research describing gender differences in reactions to daily interpersonal conflict. Such research has shown that women tend to experience greater negative affect following interpersonal conflict (Bolger et al., 1989). Further, Mohr and colleagues (2003) argue that women may be more vulnerable to experiencing the negative effects of daily experiences and distress and are also more likely to continue experiencing negative mood from one time point to the next (e.g. rumination). Given that loneliness can be considered a form of interpersonal stress, the findings of this thesis strongly support the previous literature as described above. Specifically, women in this sample reported greater increases in loneliness-related solitary consumption than men; such findings reflect the gender differences in reactivity to daily experiences of loneliness. Additionally, research exploring gender differences in responses to loneliness describes women as more likely to endorse the use of acceptance and self-reflection, and while men as more likely to increase social activity (Rokach & Rock, 1998). Though both men and women increased solitary consumption, women reported greater solitary consumption following times of greater loneliness. To the extent that solitary consumption is a venue for self-reflection and acceptance of loneliness (i.e. active solitude), this finding is in line with previous research.

Lastly, it is important to note that while women showed stronger loneliness-drinking associations for solitary consumption, men also reported significant increases in solitary consumption on days with greater loneliness. These effects are in line with existing motivational models of alcohol consumption (i.e. regulation of negative mood as a primary motive for alcohol consumption), and more specifically the work of Cooper

(1994) and Mohr (2001a/2005) which shows that negative mood-related consumption tends to occur in solitary contexts.

Moderating effects of gender on loneliness-social consumption associations.

In addition to solitary consumption, I examined the influence of gender on loneliness-social consumption associations. Results indicated that there was a marginally significant moderation of gender on the negative loneliness-social consumption associations, such that men showed decreases in social consumption on days with greater loneliness, while women did not show significant decreasing slopes. These findings seem to contradict known gender differences within the stress and coping literature, and more specifically, Taylor et al.'s (2000) "tend-and-befriend" hypothesis. According to this hypothesis, women typically respond to stress through the creation and maintenance of social ties (i.e. "tend-and-befriend"), whereas men are likely to respond through withdrawal, aggression, or hostility (i.e. "fight-or-flight"). It is possible, however, that women are engaging in more active types of responses to loneliness in non-drinking contexts. As noted earlier in this discussion, social consumption is not the only possible social-oriented response to loneliness. Though the women in this sample did not explicitly increase their levels of social consumption in response to loneliness, perhaps they did increase participation in other social activities, such as calling a friend, spending time with friends and family, etc.

Lastly, given the lack of decline in social consumption for women, it is also possible that the nature of drinking behavior differs for men and women. For example, drinking for men may be more socially-oriented behavior for men versus women.

Indeed, research has shown that males are more likely to endorse social motives for consumption than women (Cooper, et al., 1992; Kuntsche, Knibbe, Gmel, & Engels, 2006). Additionally, women, particularly young women, frequently endorse coping motives (Cooper, 1994). Therefore, the lack of loneliness-social consumption association for women could be an artifact of gender differences in drinking motives, such that consumption for men tends to be more socially motivated. Further, given research which suggests that loneliness is strongly related to fear of rejection and social withdrawal type behavior, as described above (e.g. Cacioppo, Hawkley, et al., 2006; Jones, Rose, & Russell, 1990), it is possible that for men and women, social consumption is not a useful medium for dealing with transient experiences of loneliness. Indeed, loneliness has been related to emotions such as boredom, sadness, negativity, and anxiety, emotions which are not conducive to active participation in a social setting.

Limitations

There are several methodological limitations in this study which may limit the strength and generalizability of my findings. First, single item measurements of loneliness were employed in the current study, though multiple items are typically preferred when assessing moods and related constructs. However, a number of studies have shown that constructs are reliably measured with single items (e.g. Burisch, 1984; Mohr et al., 2003; Myers & Diener, 1995), which have the advantage of brevity, therefore curbing participant response fatigue (Larsen & Fredrickson, 1999). Furthermore, studies have validated the use of single item measures of loneliness against the traditional well-validated UCLA Loneliness Scale (e.g. Doane & Adam, 2010; Hawkley et al., 2010;

Pressman et al., 2007). Typically, within-person correlations between these single-item and cross-sectional measures consistently reveal positive and significant associations, suggesting that levels of daily loneliness (negative mood) are related to more global feelings of isolation ($r=.49$; Pressman et al., 2007).

Another limitation is the concurrent assessment of previous evening consumption with morning mood assessments. Specifically, participations reported the amount of alcohol consumed in the previous evening and drinking context for the previous evening during the morning daily diary, within which current moods were also assessed. In light of this design, it is important to consider how current moods may have influenced retrospective reports of previous drinking behavior, and that remembering the previous evening's events may have influenced current mood (e.g. shared method bias; Ghiselli, Campbell, & Zedeck, 1981). I addressed these potential issues in my analyses by lagging the daily loneliness variable, enabling me to predict evening social and solitary consumption from daily loneliness. Further, though one of the benefits of daily process methodology is reduction in retrospective bias, all of the survey data is still self-report. However, Perrine and colleagues (1995) show that self-reports of alcohol use, within 24-hours of consumption, are highly correlated with objective measures of use. Therefore, daily consumption, as captured in this study, can be assumed to be a reliable assessment of drinking behavior.

Of some concern is also the evaluation of drinking context. Though there was a measure of solitary and social consumption, a measure of normative drinking context was not included in this study. That is, there is no distinct indicator of whether an individual

predominantly drinks with others or alone. Research and theory suggest that social integration is health promoting to the extent that the majority of group norms within a specific network encourage health-promoting behavior (Berkman et al., 2000; Cohen et al., 2000b). Therefore, drinking norms within an individual's social network, which were not measured, may also be at play, given the scenario that a particular individual is embedded in a social network wherein drinking is a normative behavior. In such a scenario, he/she is not lonely, but may be consuming more alcohol than another individual who has no friend group with which to participate in this behavior.

It is also important to consider the question of directionality for loneliness and drinking associations. Specifically, does loneliness predict solitary consumption, or does solitary consumption predict subsequent loneliness? I addressed this issue of directionality through the use of time contingent, daily process data and subsequent data analytic procedures (i.e. multi-level modeling). Further, because I controlled for average levels of loneliness, I was able to specify that these lagged loneliness-drinking associations represented the effect of changes in daily loneliness on consumption, controlling for average levels of loneliness.

Contributions and Future Directions

Findings from this study make numerous contributions to the social relationships, loneliness, and health literature. Though previous researchers have explored health behavioral correlates of loneliness and social integration, the majority of existing research employs cross-sectional measures of loneliness and retrospective reports of health behavior. Such research reveals very little about fluctuating experiences and responses to

loneliness which may differ as a function of individual difference variables, such as gender. Further, no previous research examining loneliness-related alcohol consumption has examined drinking context (e.g. social versus solitary consumption). In this research project, I specifically examined within-person associations between daily loneliness and subsequent alcohol consumption in both social and solitary contexts, documenting different patterns of drinking behavior in each.

More specific contributions of this study relate to the significant findings for the hypothesized within-person associations and cross-level interactions. The within-person associations between loneliness and solitary consumption demonstrate that patterns of negative-mood-related solitary consumption (e.g. drinking to cope), which have been previously associated with the development of abuse and dependence, are exhibited in responses to loneliness. Findings relating to the negative within-person associations between loneliness and social consumption also contribute to the current loneliness literature, which posits that loneliness is broadly related to subsequent fear of rejection, social withdrawal type behaviors, and social anxiety (e.g. Cacioppo, Hawkley, et al., 2006; Jones, Rose, & Russell, 1990). Though it is possible that participants in this study were doing other social activities in a non-drinking context, these findings show that the majority individuals reacted to loneliness through solitary behavior.

The moderating effects of gender and social integration, as examined in this study, provide a unique picture of specific individual difference variables which play a role in determining responses to daily loneliness. In particular, gender differences in loneliness-drinking associations contribute to existing stress-vulnerability models of

consumption, in showing that women exhibit stronger drinking-to-cope type behavior than men in relation to daily loneliness. These findings also provide strong support for the stress and coping literature, which shows that women are more reactive to and negatively influenced by interpersonal distress (e.g. Bolger et al., 1989). Further, no study to date has examined gender differences in responses to loneliness at this level of analysis.

The lack of significant moderating effects for social integration suggests that more structural aspects of social support, such as social integration, do not have as strong of an influence in attenuating the negative effects of stress and negative mood (i.e. stress-buffering effects of social support). Rather, it is likely that social integration is playing an alternative role by more directly influencing engagement in non-drinking coping responses to loneliness (e.g. going out and spending quality time with friends and family, exercise, etc.) given that this variable is generally related to healthier lifestyle and more adaptive coping strategies. Also, within this sample, individuals high in social integration reported significantly less alcohol consumption and somewhat lower rates of loneliness than their less socially integrated counterparts. As a result, these individuals had less loneliness to manage and to which others may have been responding through alcohol consumption. Future research should continue to explore the influence of social integration on loneliness-related health behaviors, including those not related to alcohol consumption (e.g. exercise, sleep, hours of internet/TV use, etc.)

Lastly, in discussing the implications and contributions of this research project, it is important to consider the cultural values and societal norms surrounding alcohol use.

Though alcohol use is termed a “risk behavior” within the addictions and health literature, alcohol consumption is actually a very normative behavior which, when consumed safely and in moderation, can be a potentially psychologically healthy behavior (e.g. Peele & Brodsky, 2000). In fact, the culture which surrounds healthy alcohol consumption is one that facilitates social interaction, a useful antidote to the experience of loneliness. Further, recent research has suggested that negative mood-related consumption (i.e. drinking to cope) may actually be an effective coping strategy for those with alternative supports systems in place (e.g. Hussong et al., 2001). It is important to keep such research in mind when interpreting the strong within-in person associations between loneliness and solitary consumption, as demonstrated in this thesis. That is, for those with supportive social resources in place and/or high perceptions of control over the experience of aloneness, solitary consumption may be a useful strategy for coping with loneliness, such that it provides a sense of solitude and opportunity for self-reflection. Future research, then, should also explore the benefits of solitude in response to daily loneliness, and how perceptions of control over being alone contribute to the adaptiveness of this coping response.

Conclusion

Social relationships have long been thought of as vital to well-being and human flourishing, the deficit of which can have severe consequences including depression, suicide, and substance use (Berkman & Breslow, 1984). The negative affective experience of loneliness is a common indicator of relationship deficits, and has been linked to outcomes including alcohol consumption and substance use (Cacioppo et al., 2002). Though ample research has explored health and behavioral correlates of loneliness, the majority of research has employed cross-sectional measures of chronic loneliness therefore revealing little about fluctuating experiences of daily loneliness and subsequent behavioral responses (e.g. alcohol consumption). Further, prior to this study, no research had examined daily responses to loneliness in different behavioral contexts (i.e. social versus solitary). In this thesis, I examined within-person associations between daytime loneliness and evening alcohol consumption in social and solitary drinking contexts, through the use of daily process methodology. Lastly, I explored how these within-day relationships varied as a function of social integration and gender. Given the within-person level of analysis and the differentiation of drinking context, the findings of this study make a substantive contribution to existing bodies of research relating to social relationships and health, stress and coping, and loneliness. Most importantly, this thesis provides a unique picture of specific pathways by which social relationships, and the perceived lack thereof, may come to influence daily health and health behavior.

Table 1
Correlations Among Aggregate Study Variables

Variable	N	M	SD	1	2	3	4	5	6
1. Daily Solitary Consumption	47	.30	.30	1					
2. Daily Social Consumption	47	.16	.35	-.01	1				
3. Daily Loneliness	47	1.43	.48	.22	.17	1			
4. Social Integration	44	5.95	1.89	-.11	-.15	-.18	1		
5. Gender	44	.50	.51	-.21	-.18	-.01	-.12	1	
6. Age	44	36.82	16.20	-.08	-.32*	-.32*	-.02	-.14	1

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2

Hypothesis 1a and research question #1 (within-person associations between loneliness and subsequent alcohol consumption)

Predictors	Evening Solitary Consumption B	Evening Social Consumption B
<i>Intercept Model</i>		
Social Integration	-.17**	-.11*
Age	-.00	-.03***
Gender	-1.05*	-.41†
Mean Loneliness	.82*	.08
<i>Slopes Model</i>		
Daytime Loneliness	.44***	-.34**
Variance of Slopes ¹	.15†	.34**

Note: Analyses controlled for day of week, time of day, age, and mean 30-day loneliness; gender was coded as men=0, female=1

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

¹ Variance components were estimated by HLM software through a χ^2 test of significance.

Table 3

Hypothesis 2a-d (mean-level associations of gender and social integration with drinking outcomes)

Predictors	Evening Solitary Consumption B	Evening Social Consumption B
<i>Intercept Model</i>		
Social Integration	-.18**	-.11*
Age	-.00	-.03***
Gender	-1.01*	-.47†
Mean Loneliness	.74†	.05

Note: Analyses controlled for day of week, time of day, age, and mean 30-day loneliness; gender was coded as men=0, female=1

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4

Hypothesis 3a-d (cross-level interactions of social integration and gender on loneliness-drinking associations)

Predictors	Evening Solitary Consumption B	Evening Social Consumption B
<i>Step One</i>		
<i>Intercept Model</i>		
Social Integration	-.19**	-.11*
Gender	-1.07*	-.43 [†]
<i>Slopes Model</i>		
Daytime Loneliness	.42***	-.32**
Variance of Slopes	.15 [†]	.37**
<i>Step Two:</i>		
<i>Intercept Model</i>		
Social Integration	-.19**	-.11*
Gender	-1.07	-.43 [†]
<i>Slopes Model</i>		
Daytime Loneliness	.42***	-.32**
Social Integration X Loneliness	.06 [†]	-.00
Gender X Loneliness	.44**	.33 [†]

Note: Analyses controlled for day of week, time of day, age, and mean 30-day loneliness; gender was coded as men=0, female=1

[†] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Fig. 1: Cross-level interaction of social integration on loneliness-solitary consumption association.

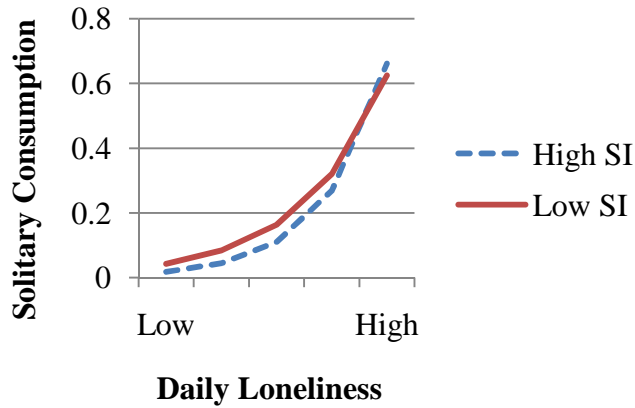


Fig. 2: Cross-level interaction of gender and loneliness on solitary consumption.

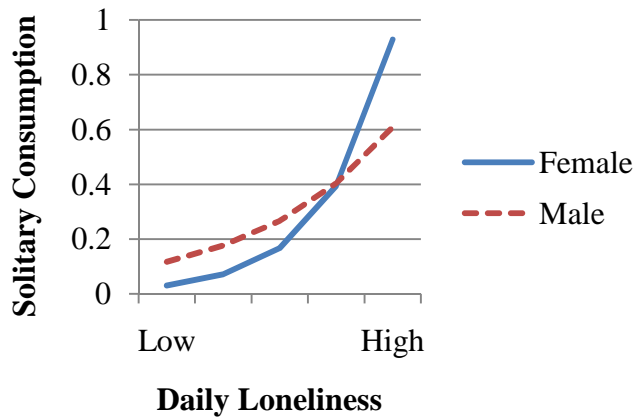
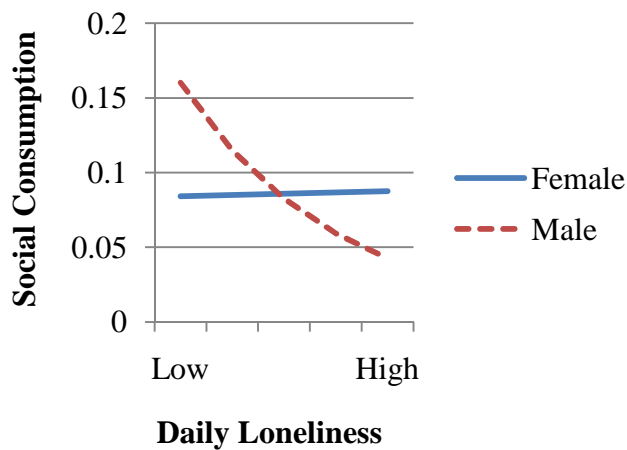


Fig 3: Cross-level interaction of gender on loneliness-social consumption association.



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Appendix A
Social Network Index

Instructions: This questionnaire is concerned with how many people you see or talk to on a regular basis including family, friends, workmates, neighbors, etc. Please read and answer each question carefully. Answer follow-up questions where appropriate.

1. Which of the following best describes your marital status?

___ (1) currently married & living together, or living with someone in marital-like relationship

___ (2) never married & never lived with someone in a marital-like relationship

___ (3) separated

___ (4) divorced or formerly lived with someone in a marital-like relationship

___ (5) widowed

2. How many children do you have? (If you don't have any children, check '0' and skip to question 3.)

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

2a. How many of your children do you see or talk to on the phone at least once every 2 weeks?

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

3. Are either of your parents living? (If neither is living, check '0' and skip to question 4.)

___ (0) neither ___ (1) mother only ___ (2) father only ___ (3) both

3a. Do you see or talk on the phone to either of your parents at least once every 2 weeks?

___ (0) neither ___ (1) mother only ___ (2) father only ___ (3) both

4. Are either of your in-laws (or partner's parents) living? (If you have none, check the appropriate space and skip to question 5.)

___ (0) neither ___ (1) mother only ___ (2) father only ___ (3) both ___ (4) n/a

4a. Do you see or talk on the phone to either of your partner's parents at least once every 2 weeks?

___ (0) neither ___ (1) mother only ___ (2) father only ___ (3) both

5. How many other relatives (other than your spouse, parents & children) do you feel

close to? (If '0', check that space and skip to question 6).

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

5a. How many of these relatives do you see or talk to on the phone at least once every 2 weeks?

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

6. How many close friends do you have? (people that you feel at ease with, can talk to about private matters, and can call on for help)

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

6a. How many of these friends do you see or talk to at least once every 2 weeks?

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

7. Do you belong to a church, temple, or other religious group? (If not, check 'no' and skip to question 8.)

___ no ___ yes

7a. How many members of your church or religious group do you talk to at least once every 2 weeks? (This includes at group meetings and services.)

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

8. Do you attend any classes (school, university, technical training, or adult education) on a regular basis? (If not, check 'no' and skip to question 9.)

___ no ___ yes

8a. How many fellow students or teachers do you talk to at least once every 2 weeks? (This includes at class meetings.)

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

9. Are you currently employed either full or part-time? (If not, check 'no' and skip to quest. 10.)

___ (0) no ___ (1) yes, self-employed ___ (2) yes, employed by others

9a. How many people do you supervise?

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

9b. How many people at work (other than those you supervise) do you talk to at least once every 2 weeks?

___0 ___1 ___2 ___3 ___4 ___5 ___6 ___7 or more

10. How many of your neighbors do you visit or talk to at least once every 2 weeks?
____0 ____1 ____2 ____3 ____4 ____5 ____6 ____7 or more

11. Are you currently involved in regular volunteer work? (If not, check 'no' and skip to question 12.)
____ no ____ yes

11a. How many people involved in this volunteer work do you talk to about volunteering-related issues at least once every 2 weeks?
____0 ____1 ____2 ____3 ____4 ____5 ____6 ____7 or more

12. Do you belong to any groups in which you talk to one or more members of the group about group-related issues at least once every 2 weeks? Examples include social clubs, recreational groups, trade unions, commercial groups, professional organizations, groups concerned with children like the PTA or Boy Scouts, groups concerned with community service, etc. (If you don't belong to any such groups, check 'no' and skip the section below.)
____ no ____ yes

Consider those groups in which you talk to a fellow group member at least once every 2 weeks. Please provide the following information for each such group: the name or type of group and the total number of members in that group that you talk to at least once every 2 weeks.

Total number of group members

Group that you talk to at least once every 2 weeks

-
- 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
-

This scale was used for the following journal article:

Cohen, S., Doyle, W. J., Skoner, D. P., Rabin, B. S., & Gwaltney, J. M. Jr. (1997). Social ties and susceptibility to the common cold. *Journal of the American Medical Association*, 277, 1940-1944.

Appendix B
Example daily diary questions (morning)

How much does each of the following words describe your mood right now?

	Not at all	Slightly	Moderately	Very much	Extremely
1. Enthusiastic	0	1	2	3	4
2. Nervous	0	1	2	3	4
3. Angry	0	1	2	3	4
4. Happy	0	1	2	3	4
5. Lonely	0	1	2	3	4
6. Relaxed	0	1	2	3	4
7. Sad	0	1	2	3	4
8. Disappointed	0	1	2	3	4
9. Bored	0	1	2	3	4
10. Stressed	0	1	2	3	4

This section concerns your activities from LAST NIGHT. Specifically, what happened AFTER you completed your last interview (or if it is your first day, after 8:00 p.m. yesterday) until you went to sleep?

For the following activities, how many hours did you spend doing each last night? (Remember, last night refers to after your last interview until you went to bed.)

1. Watching TV?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs
2. Light exercise?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs
3. Moderate or vigorous exercise?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs
4. Interacting with friends or family?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs
5. Working or doing housework?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs
6. Using the internet?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs
7. Sleep?	0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	>8 hrs

How many alcoholic drinks did you have at home last night?

0	1	2	3	4	5	6	7	8	9	10	11	12	>12
---	---	---	---	---	---	---	---	---	---	----	----	----	-----

If you had 1 or more drinks at home last night, were you? (click all that apply):

- Alone
- Interacting with others who were drinking
- Interacting with others who were not drinking
- Not interacting and others were not drinking
- Not interacting and others were drinking

How many drinks did you have in each situation?

Alone

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Interacting with others who were drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Interacting with others who were not drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Not interacting and others were not drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Not interacting and others were drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

How many alcoholic drinks did you have away from home last night?

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

If you had 1 or more drinks away from home last night, were you? (click all that apply):

- Alone
- Interacting with others who were drinking
- Interacting with others who were not drinking
- Not interacting and others were not drinking
- Not interacting and others were drinking

How many drinks did you have in each situation?

Alone

0 1 2 3 4 5 6 7 8 9 10 11 12 >12

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Interacting with others who were drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Interacting with others who were not drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Not interacting and others were not drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12

Not interacting and others were drinking

0 1 2 3 4 5 6 7 8 9 10 11 12
>12