INTERPERSONAL RISK AND PROTECTIVE FACTORS FOR ALCOHOL MISUSE AMONG ARMY RESERVE AND NATIONAL GUARD SOLDIERS

by
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ABSTRACT

Background: Alcohol use is common in the military, and is associated with socializing and coping with military stressors. Military research has focused on individual predictors of alcohol use, and research is needed to understand the effects of interpersonal predictors such as support and influence. In relation to alcohol misuse, this dissertation aimed to investigate: (a) the protective effects of deployment-related support, (b) the influence of personnel's social ties and networks, and (c) the effects of military peers as both protective and risk factors.

Methods: Data come from Operation: SAFETY, a study of Army Reserve and National Guard soldiers. Aim 1 used latent profile analysis (LPA) to classify deployment-related support and regression to estimate the association between deployment support and soldiers' hazardous alcohol use. Aim 2 used egocentric social network data to quantify the associations between social network characteristics and soldiers' alcohol use. Aim 3 used multilevel modeling to examine associations between social tie and social network characteristics and soldiers' frequency of drinking with social ties.

Results: Aim 1's LPA indicated a three-profile solution for deployment support, with profiles characterized as High Social Support, Low Social Support, and High Overall Support. Membership in the High Social Support profile was associated with lower likelihood for hazardous alcohol use. Aim 2 showed that social networks with more drinking buddies and ties who were heavy-drinkers were associated with increased soldier alcohol use, and networks with more military peers were protective against alcohol use for deployed soldiers. Aim 3's multilevel results further indicated that ties who were drinking buddies and ties who were heavy-drinkers were both associated with

more frequent social drinking between soldiers and ties; similar findings were observed for social networks with greater proportions of both characteristics. Military-affiliated networks were associated with more frequent social drinking among deployed soldiers. **Conclusions:** Findings contribute to the understanding of modifiable interpersonal-level factors that may affect the alcohol misuse in the military. Military leaders might use existing programs to emphasize the importance of social support during deployment. Interventions should also focus on leveraging military peer support and alcohol-free social opportunities to reduce soldier alcohol use.

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Chapter 1. Introduction

1.1 Statement of the problem

Alcohol misuse is common in the military and is influenced by military alcohol culture, which includes ritualized drinking and recreational use as a way to relax, cope with military stressors, and bond with peers (Ames, Cunradi, Moore, & Stern, 2007; Ames, Duke, Moore, & Cunradi, 2009). Reserve and National Guard (R/NG) personnel are of particular interest in relation to alcohol misuse, given that they endure unique stressors as a result of being in the military while primarily living as civilians (Griffith, 2010; Vest, 2013). Specifically, R/NG personnel may be more likely to develop alcohol use disorders than Active Duty personnel, and may be more likely to have persistent alcohol problems after returning from deployment than post-deployment Active Duty personnel (Cohen, Fink, Sampson, & Galea, 2015; Thomas et al., 2010).

Previous research has established a number of personnel-level predictors of alcohol misuse, including being younger, male, enlisted, and single; deployment factors include combat exposure as well as resulting posttraumatic stress disorder (PTSD) symptoms and traumatic brain injury (Bray, Brown, & Williams, 2013; Grossbard et al., 2017; Institute of Medicine, 2013; Jacobson et al., 2008; Mattiko, Olmsted, Brown, & Bray, 2011; Wilk et al., 2010). Research on alcohol use in the military has rarely addressed interpersonal factors, although the social-ecological framework indicates that individual-level factors are nested within family and peer environments (Bronfenbrenner, 1994; Sudhinaraset, Wigglesworth, & Takeuchi, 2016). Given the social nature of alcohol culture in the military and the unique stressors of R/NG personnel's military

experience, interpersonal support and influence represent modifiable factors that should be examined further to understand their effects on alcohol misuse outcomes.

Regarding interpersonal support, military-related support may include pre-deployment training and preparation and unit support, whereas non-military-related support predominantly includes support from family and friends. Soldiers' perceptions of having adequate training and preparation may help soldiers feel as though they have the right skills and understand what to expect of the deployment experience (Renshaw, 2011; Vogt, Smith, King, & King, 2012). Unit cohesion and trust of leadership during deployment may reduce the likelihood of post-deployment mental health problems (Armistead-Jehle, Johnston, Wade, & Ecklund, 2011; King, King, Vogt, Knight, & Samper, 2006) and challenges with reintegration (Griffith, 2015). Social support from family and friends may serve as a buffer against deployment stressors and has been shown to protect against PTSD and depression (Goldmann et al., 2012; Han et al., 2014; Holmes, Tariot, & Cox, 1998; King et al., 2006). Research is needed to understand overall patterns of deployment-related support and their associations with alcohol misuse.

Interpersonal influences on soldiers' alcohol misuse may come from military and non-military peers. Research in other populations, such as college students and adolescents, has shown linkages between peer drinking behaviors and an index individual's drinking behaviors (Hawkins, Catalano, & Miller, 1992; Leung, Toumbourou, & Hemphill, 2014; Rinker, Krieger, & Neighbors, 2016; Wood, Read, Palfai, & Stevenson, 2001), although such associations have yet to be investigated in a military context. A peer being military-affiliated may also be influential on drinking, given the military's alcohol culture (Hatch et al., 2013). However, prior studies also

suggest that military-affiliated peers can be beneficial supports in light of reintegration stress and mental health problems (Ahern et al., 2015; Goldmann et al., 2012; Griffith, 2015; Hinojosa & Hinojosa, 2011). The research conducted as part of this dissertation examines social influence on alcohol misuse and seeks to clarify the multiple roles that military peers may serve in relation to influence.

1.2 Specific aims

The broad purpose of this dissertation is to investigate the risk and protective effects of military and non-military sources of support and influence on alcohol misuse by Army R/NG soldiers. All three aims included secondary data analysis using cross-sectional data from the Operation: SAFETY (Soldiers and Families Excelling Through the Years) study. Operation: SAFETY is a longitudinal cohort study of the health and wellbeing of 411 Army R/NG soldiers and their partners. Findings help to elucidate interpersonal-level associations with alcohol misuse use among R/NG soldiers. Conclusions from this work may inform prevention and intervention efforts, especially related to creating and bolstering support opportunities, as well as informing potential interventions to curb alcohol influence.

Based on a sample of Army R/NG soldiers, the specific aims for this dissertation are:

Study Aim 1: To identify and describe profiles of deployment support and examine the relationship between deployment support profile and soldiers' hazardous alcohol use.

Study Aim 2: To describe characteristics of soldiers' social networks, including drinking behaviors and military affiliation, and examine relationships between social network characteristics and soldier's alcohol use.

Study Aim 3: To examine the associations of social tie and social network characteristics with frequency of soldiers' social drinking with their ties.

The investigation of these aims begin to fill gaps in military literature by: (a) focusing research specifically on R/NG personnel, (b) examining interpersonal risk and protective factors related to alcohol misuse, and (c) focusing on the dual roles of military peers.

1.3 Dissertation outline

This dissertation contains eight chapters. This first chapter (Chapter 1) included a summary of the problem of alcohol misuse in the military and established that there is limited information on interpersonal risk and protective factors associated with military alcohol misuse. Chapter 2 provides background information on the military to provide context for the study, and consists of an overview of the U.S. military and a description of the unique experience of R/NG personnel. Chapter 3 contains a review of the literature on alcohol misuse in the military, deployment, and interpersonal predictors of interest (support and influence), and Chapter 4 provides a detailed description of the Operation: SAFETY study. Chapters 5, 6, and 7 present the three study aims outlined above. The final chapter, Chapter 8, includes an overall discussion of the findings for all aims, a synthesis of findings, research and practical implications, and a summary of the limitations, strengths and public health significance of this work.

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Chapter 2. Military Background

2.1 Introduction to the U.S. military

The total United States military force is comprised of two main components. The Active Component has full-time Active Duty military personnel who receive full military pay, and the Reserve and National Guard (R/NG) is comprised of personnel who typically have full-time civilian occupations and spend limited time involved in military roles (Carafano, 2005). The R/NG, which is of particular interest in this dissertation, is comprised of seven branches (Army Reserve, Army National Guard, Navy Reserve, Marine Corps Reserve, Air Force Reserve, Air National Guard, and Coast Guard Reserve) and accounts for approximately 31% of all United States military personnel. Of all R/NG branches, the Army Reserve and Army National Guard have the largest presence, making up 60% of the total R/NG (Department of Defense, 2017).

2.2 Reserve and National Guard

2.2.1 Unique civilian-military experience

R/NG personnel warrant attention in behavioral health research, not only because they comprise one-third of the total U.S. military force but also because of their unique military experiences that may negatively affect health outcomes. With few exceptions, the military experience of R/NG personnel is limited to participating in mandatory training, or "drill," one weekend per month at an assigned military installation and for two weeks during the summer (La Bash, Vogt, King, & King, 2009). Outside of military obligations, R/NG personnel spend most of their time in civilian roles, typically having civilian-based primary occupations. Schedules for drill weekends are variable and may range from an eight-hour day of training sessions and equipment maintenance to an

extended full day of training in the field (M.E. Lane, personal communication, October 12, 2018). Compared to Active Duty personnel who live on or near their assigned military installation, R/NG personnel are more geographically separated from their installation and from one another (Patzel, McBride, Bunting, & Anno, 2013). Most R/NG personnel live in the same area as their civilian jobs, and may travel long distances to get to their assigned installation for drill weekends.

Balancing dual civilian and military roles can create challenges for R/NG personnel and their families that may ultimately lead to stress and negative health outcomes (Griffith, 2010; Riviere, Kendall-Robbins, McGurk, Castro, & Hoge, 2011; Vest, 2013). The geographic distance between home life and assigned installation may limit access to and utilization of medical treatment and other support resources provided by the military such as family readiness programs (Anderson Goodell, Homish, & Homish, 2018; Harris et al., 2014). R/NG personnel and their families are also less likely to live near military peers and families, which may limit how often they are able to engage with others who understand the military experience (Greden et al., 2010; Lapp et al., 2010). Such geographic and social separation can have consequences; previous research suggests R/NG families tend to be less integrated into military life than Active Duty personnel and their families, and also that they are less likely and willing to access unit and formal support programs (Burrell, Durand, & Fortado, 2003).

2.2.2 Deployment

Although R/NG personnel spend relatively limited time engaging in military training and service, they are still eligible for deployment. Historically, the primary reason for deployment of R/NG personnel was to expand personnel capacity and

supplement Active Duty personnel. However, with more recent war engagements, R/NG personnel have served primary operational roles by actually replacing over-extended Active Duty personnel on missions and thus directly experiencing conflict and combat (Gouré, 2013). Post-9/11 conflict has resulted in increases in deployment of all military personnel, including the R/NG. According to the DoD's Defense Manpower Data Center Contingency Tracking System, from 2001 to 2010, R/NG personnel comprised one-third of all deployed personnel, with Army R/NG representing the largest portion (66.5%) of total deployed R/NG (Institute of Medicine, 2013). Not only are R/NG personnel eligible for activation and deployment overseas but they may also have similar rates of combat exposure to Active Duty personnel, around 67-70% (Milliken, Auchterlonie, & Hoge, 2007; Thomas et al., 2010).

2.2.3 Deployment-related stress

The deployment experience may cause unique stress for R/NG personnel, which may contribute to negative health outcomes. Leading up to deployment, R/NG personnel and families may experience reduced notice of an impending deployment and heightened stress to prepare for it (Lapp et al., 2010). R/NG families may feel financial strain during and after a deployment due to loss of income from an R/NG soldier's civilian job being put on hold (Greden et al., 2010; Griffith, 2015). Personnel and families may also deal with emotional stress while the military partner is deployed due to a number of reasons, including concern for the military partner's safety, inconsistent communication and disagreements from afar, the shift to the civilian partner being solely responsible for managing the household and child-rearing, and feelings of isolation due to lack of social support (Erbes, Meis, Polusny, & Arbisi, 2012; Institute of Medicine, 2013; Segal, 1986).

R/NG personnel and their families also encounter stress and strain upon reintegration from deployment as they readjust to civilian life. First, as with Active Duty personnel, there may be feelings of unfamiliarity and contrasting expectations from soldiers and their families in relation to deployment homecoming, resulting in strain with getting adjusted to home life once everyone is reunited (Ahern et al., 2015; Schuetz, 1945). Specifically for R/NG personnel, there may be concerns about returning to the civilian job in terms of getting reacquainted with a civilian mindset as well as basic concerns about job availability and security (Greden et al., 2010). R/NG personnel who have been deployed after November 1998 in support of Operation Iraqi Freedom, Operation Enduring Freedom, and Operation New Dawn are eligible for healthcare for up to five years after they return (U.S. Department of Veterans Affairs, 2018), but in most cases they are responsible for their own healthcare benefits thereafter. Thus, continued health benefits may be a concern due to the time-limited nature of full military benefits. In addition, even with healthcare benefits, the distance from home life to assigned installation and associated medical and psychiatric health care facilities may present a barrier to access (Greden et al., 2010). There also may be stress and feelings of disconnect due to reduced access to family support programs as well as peers with whom soldiers were deployed (Anderson Goodell et al., 2018; Greden et al., 2010; Lapp et al., 2010; Vest, 2014).

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Chapter 3. Literature Review

3.1 Military alcohol misuse

Alcohol misuse is a common health behavior in the military. Aside from the well-established physical health consequences, unhealthy drinking by military personnel poses risk for mental health comorbidity, workplace productivity loss, reduced military readiness, and relationship problems (Blow et al., 2013; Institute of Medicine, 2013; Jonas et al., 2010; Mattiko, Olmsted, Brown, & Bray, 2011). Recent research examining the prevalence of alcohol use behaviors shows that 40-47% of Active Duty and Reserve and National Guard (R/NG) military personnel report past 30-day binge drinking, and 17-20% report binge drinking at least weekly in the past month (Bray, Brown, & Williams, 2013; Hourani et al., 2007).

3.1.1 R/NG personnel and alcohol misuse

R/NG personnel are of particular interest for alcohol misuse as a behavioral health issue given their unique experience and stressors discussed in Chapter 2. R/NG personnel may be more likely to develop alcohol use disorders compared to Active Duty personnel (14.5% vs 11.7%), even though the two groups do not appear to differ in their experience of PTSD and depression (Cohen, Fink, Sampson, & Galea, 2015). Approximately 15% of R/NG personnel report post-deployment problem alcohol use, and about 36% report meeting Alcohol Use Disorders Identification Test (AUDIT) criteria for hazardous alcohol use (Burnett-Zeigler et al., 2011; Milliken, Auchterlonie, & Hoge, 2007). In addition, while Active Duty personnel's rate of problem alcohol use appears to stay stable over time after return from deployment, the rate for R/NG personnel's problem use may increase over the course of the year after return (Thomas et al., 2010).

R/NG personnel also experience stressors associated with civilian life. A previous study examining the effect of such stressors showed greater risk for alcohol use disorder due to issues with civilian employment and disruptions with health insurance when controlling for deployment and related trauma (Cerdá et al., 2014). Alcohol misuse among R/NG personnel may be the result of a unique military experience, and investigation into risk and protective factors in relation to alcohol misuse is warranted.

3.1.2 Military alcohol culture

Previous research has described the social nature of military alcohol culture, with different motives for drinking alcohol being enjoyment and coping (Ames, Cunradi, Moore, & Stern, 2007; Mohr, McCabe, Haverly, Hammer, & Carlson, 2018). Military alcohol culture through communal and ritualized drinking and recreational use is viewed as a way to let loose from the stresses of military life and promote bonding (Ames et al., 2007). In addition, drinking alcohol is also viewed as an outlet for coping with deployment- and combat-related trauma as well as difficulty with reintegration; this form of coping is done in groups as a way of bonding over mutual experiences (Adler, Britt, Castro, McGurk, & Bliese, 2011; Jones & Fear, 2011; Mohr et al., 2018; Poehlman et al., 2011; Young, Pedersen, Pearson, & Neighbors, 2018). One qualitative study examining personnel's perspectives of the military drinking climate shows that, in addition to drinking for social or recreational reasons, there is a subset of individuals who drink to cope with stress, sometimes alone (Poehlman et al., 2011).

Social norms and physical environment are two factors that contribute to military alcohol culture. Military personnel often perceive that their military-affiliated peers drink more than they actually do and more than civilians, indicating the normalization of

alcohol misuse in the military (Pedersen, Marshall, Schell, & Neighbors, 2016). As has been observed for the drinking environment of college students, there may be more socially permissive norms surrounding drinking in the military (Scott-Sheldon, Carey, & Carey, 2008; White et al., 2006). Alcohol is also widely physically available to soldiers. In the military setting, alcohol is easy to access due to high concentrations of bars and liquor stores on and near military bases and specially discounted alcohol prices meant to acknowledge personnel for their military service. Such factors in the social environment for drinking contribute to alcohol misuse (Woodruff, Hurtado, & Simon-Arndt, 2018; Woodruff, Hurtado, Simon-Arndt, & Lawrenz, 2018).

3.2 Personnel-level predictors of alcohol misuse

A large body of research has identified individual-level factors that are associated with alcohol use among military personnel.

3.2.1 Sociodemographic characteristics

Individuals who are male, younger in age, and enlisted rank are at higher risk for unhealthy or disordered alcohol use (Bray et al., 2013; Brown, Bray, & Hartzell, 2010; Grossbard et al., 2017; Institute of Medicine, 2013; Mattiko et al., 2011). Although single personnel are more likely to engage in alcohol use and misuse, married military personnel have high rates of alcohol use. Approximately 35% of married military personnel report heavy drinking in the past 30 days (Bray et al., 2009), a rate that is higher than the 13% of married civilians that report past 30-day heavy drinking (Paul, Grubaugh, Frueh, Ellis, & Egede, 2011).

3.2.2 Deployment-related characteristics

Deployment and associated combat exposure have been examined as predictors of alcohol misuse (Institute of Medicine, 2013; Jacobson et al., 2008; Wilk et al., 2010). Conceptually, stressful combat experiences negatively impact mental wellbeing and increase vulnerability for alcohol problems. For example, direct and indirect exposure to traumatic events, such as blasts, injuries, and casualties, have been linked to post-deployment incident heavy drinking and alcohol problems (Adams, Nikitin, Wooten, Williams, & Larson, 2016; Jacobson et al., 2008). These findings have been reflected in work focusing on R/NG personnel and associations with frequent heavy drinking (Vest, Heavey, Homish, & Homish, 2018). Combat exposure is also linked to PTSD and traumatic brain injury, both of which are associated with negative alcohol use outcomes (Adams, Larson, et al., 2016; Kehle et al., 2012; Marshall et al., 2012; Nickerson et al., 2017; Thomas et al., 2010). In addition to dealing with effects of combat exposure, R/NG personnel also have a particularly difficult time with reintegration from deployment, which may result in stress and coping with alcohol (Kline, Ciccone, Falca-Dodson, Black, & Losonczy, 2011).

3.3 Ecological influence on alcohol misuse

The social-ecological framework conceptualizes influences on health outcomes based on increasingly broad levels of society, spanning from the individual level to the societal level. It frames individual behavior as nested within a larger microsystem that includes interpersonal influences, such as family and peer environments (Bronfenbrenner, 1994). This framework is useful for understanding the spectrum of broader-level factors that affect alcohol misuse among military personnel (Sudhinaraset, Wigglesworth, &

Takeuchi, 2016). Military-focused research has primarily centered on individual-level predictors of alcohol outcomes, with little emphasis on the impact of factors at the interpersonal level (Sudhinaraset et al., 2016). A more comprehensive understanding of social factors that affect alcohol misuse is needed, given the phenomenon of alcohol culture in the military and R/NG personnel's stressors in relation to being civilian soldiers and engaging in military service and deployment. Interpersonal support and influence represent modifiable factors that should be examined further to understand their effects on alcohol misuse outcomes.

3.4 Interpersonal support

Military and deployment experiences can create stress that worsens behavioral health in general, and alcohol misuse in particular (Pearlin, 1989; Pearlin, Menaghan, Lieberman, & Mullan, 1981). Resources such as social support may aid with coping and protect against negative alcohol outcomes (Berkman & Glass, 2000). Social support may be defined as interpersonal relationships where an individual is valued and cared for, thus, positively affecting wellbeing and protecting health (Cassel, 1976; Cobb, 1976; Wills & Ainette, 2012). It has been modeled as a buffer in the presence of stress or trauma and may be helpful in mitigating negative effects of stress, thereby protecting against mental health problems (Cohen & Wills, 1985). In the current work, social support in conceptualized as a buffering aspect in the face of deployment-related stressors and combat exposure; support from perceived adequate military training, fellow military personnel, and family and friends may enable military personnel to interpret stress as manageable and less threatening (Cohen, 1988).

Social support has been studied over many years and conceptualized in a variety of ways, with several of these theories relevant to the current work. Social support can be thought of as functional in nature (Berkman, Glass, Brissette, & Seeman, 2000; Uchino, 2006). Functional social support is focused more on functions of the social relationships to the individual, especially regarding whether these relationships are adequate in their provision of support and what types of support are provided. Functional social support can be conceptualized as either perceived or received support, where the former is based on perceptions of availability or adequacy of necessary support and the latter is based on actual receipt of support (Dunkel-Schetter & Skokan, 1990). Whether or not an individual perceives that support is available or adequate has been linked with positive health outcomes, including lower alcohol consumption (Steptoe, Wardle, Pollard, Canaan, & Davies, 1996; Uchino, 2009). Functional perceived support from different sources, both military and non-military, over the course of deployment might be considered modifiable influences in light of alcohol misuse.

3.4.1 Military support: training and unit support

Different types of military-specific support may be useful in mitigating issues with alcohol misuse. One such type of support is training and preparation prior to deployment, which may be especially important because R/NG personnel spend limited time training at their assigned military installation but can still be activated for deployment. Perceptions of adequate training and preparation is a modifiable factor that may help soldiers feel like they have the right skills and understand what to expect of the deployment experience, mission roles, and potential trauma (Renshaw, 2011; Vogt, Smith, King, & King, 2012). Training and preparation have also been linked to accurate

risk perceptions of combat experiences and may be protective of subsequent mental health problems like PTSD (Goldmann et al., 2012; Renshaw, 2011) and incident alcohol abuse or dependence (Orr et al., 2014).

Unit support reflects the assurance of being able to rely on fellow service members and leaders. Previous research has shown that unit cohesion and trust of leadership during deployment may reduce the likelihood of post-deployment mental health issues (Armistead-Jehle, Johnston, Wade, & Ecklund, 2011; King, King, Vogt, Knight, & Samper, 2006) and reintegration issues (Griffith, 2015). In addition to being protective against negative outcomes, unit cohesion may also be beneficial for encouraging positive outcomes such as military and job satisfaction, wellbeing, and unit performance (Oliver, Harman, Hoover, Hayes, & Pandhi, 1999). Unit support during deployment, rather than before or after, may be protective against negative outcomes because it may provide real-time buffering of warzone experiences that may otherwise seem too much to handle (Han et al., 2014).

3.4.2 Non-military support: family and friends

In addition to military preparation and unit support, adequate informal social support by family and friends during and after deployment may also be protective against alcohol misuse. Post-deployment social support has been shown by a variety of studies to be protective of mental health consequences such as posttraumatic stress disorder (PTSD) and depression in military personnel (Goldmann et al., 2012; Han et al., 2014; Holmes, Tariot, & Cox, 1998; King et al., 2006). In addition, perceived social support has also been shown to be protective against effects of higher risk alcohol use on work performance and satisfaction, specifically in R/NG personnel (Nelson et al., 2015).

Given the strong evidence of post-deployment social support being protective of negative health outcomes, further examination is warranted to see whether social support during deployment produces similar protective effects.

3.5 Social influence

Given the social nature of alcohol use in the military, identifying how social relationships shape soldier alcohol use can yield important insights that can be used to address problem drinking in the military (Link & Phelan, 1995). Social influence theory provides a framework to explain how individuals are influenced by their social network to conform to group-level behavior patterns (Turner, 1991). Social influence suggests that there are active and passive pathways of influence on alcohol use; active elements include direct offers to use alcohol, whereas passive elements focus on norms and modeling, such as observing drinking behaviors and perceived alcohol use norms (Graham, Marks, & Hansen, 1991; Wood, Read, Palfai, & Stevenson, 2001).

Social influence may be examined according to structural elements of an individual's social network and the characteristics of connections with those who are considered to be important to an individual. Social networks comprise a set of connections between an individual and his or her social ties (Scott, 1991; Wasserman & Galaskiewicz, 1994). Social network characteristics can include the number of relationships a person has and also how a person is integrated within a network, such as the number of family versus friends in a network. Social networks also provide sources of social norms that might influence engagement in health behaviors, both positive and negative (Valente, 2010).

Influences on alcohol misuse may come from multiple sources, including marital/relationship partners and peers. It is well established that partners influence one another through mirroring one another's drinking behaviors (Leonard & Das Eiden, 1999; Leonard & Homish, 2008). Alcohol use by civilian partners of military personnel may promote personnel's own use and could impede their military and civilian workplace readiness (Homish & Leonard, 2008; Robbins et al., 2000). In addition to influence on soldiers' drinking, partners' drinking habits may also cause difficulty for them to properly support treatment efforts of soldiers who are seeking care for issues with heavy drinking (Rodriguez, Osilla, Trail, Gore, & Pedersen, 2018).

In terms of peer influence, there is a strong body of research demonstrating associations between peers' drinking behaviors and an individual's drinking behaviors among college students (Rinker, Krieger, & Neighbors, 2016; Wood et al., 2001), adolescents (Hawkins, Catalano, & Miller, 1992; Leung, Toumbourou, & Hemphill, 2014), and civilian adults (Rosenquist, Murabito, Fowler, & Christakis, 2010). With that in mind, certain characteristics of social ties may increase the likelihood of alcohol misuse by the index individual. Alcohol misuse is more common among those whose social networks are comprised of peers who engage in heavy drinking (Delucchi, Matzger, & Weisner, 2008; Lau-Barraco & Collins, 2011), and among those whose social network includes people who are considered "drinking buddies," (i.e., people with whom an individual engages in alcohol-related outings at bars or clubs) (Homish & Leonard, 2008; Leonard & Mudar, 2003; Reifman, Watson, & McCourt, 2006).

3.6 Dual roles of military peers

Given the widespread acknowledgement of military alcohol culture as well as the possible protective effects of military peers in response to military stress, research is needed to understand the dual roles that military peers may play in relation to alcohol misuse. The concept of relationship "multiplexity" is considered here (Rudolph, Crawford, Latkin, & Lewis, 2017), with the idea that individual social relationships may play multiple, overlapping roles, such as providing emotional support but also influencing risk for alcohol misuse (Leonard & Mudar, 2000). As noted above, support from relationships with military peers may be helpful in terms of empathy with military situations but may also be influences in the context of alcohol use culture.

There is limited research in this area, although some studies provide initial insight. One study examining social network effects on mental health outcomes suggests that soldiers who report mostly socializing with military-affiliated peers may be more likely to report alcohol misuse (Hatch et al., 2013). In addition, research has shown that military-affiliated peers are viewed as essential support for coping with military stress because they more fully understand the unique aspects of the military experience (Ahern et al., 2015; Goldmann et al., 2012; Griffith, 2015; Hinojosa & Hinojosa, 2011). Thus, social support by military peers might be protective in light of alcohol misuse. Still other research has suggested that military peers may serve multiple roles, with alcohol misuse being a result of personnel seeking support from military peers through drinking (Ames et al., 2007; Browne et al., 2008). More specifically, military peers from the same unit may be helpful in dealing with post-deployment issues, especially when their units have previously experienced heavy combat exposure or a traumatic or violent event. Soldiers

who have experienced trauma may avoid talking about painful memories with people who were not involved or cannot understand. Thus, military members banning together is often a coping mechanism whereby spending time with others who can understand what happened may help with processing the event and avoiding feelings of emotional isolation (Greden et al., 2010; Hinojosa & Hinojosa, 2011). This dissertation involves work to understand whether military peers' serve risk or protective roles, and results will enhance our understanding of alcohol misuse and alcohol culture among R/NG personnel.

3.7 Summary

This chapter reviewed the scientific literature on R/NG alcohol misuse as well as personnel-level and possible interpersonal predictors. The social aspects of military alcohol culture and using alcohol to cope with military stresses highlight the importance of examining effects of micro-level factors (i.e., support and influence of family, friends, and peers). Because military literature is centered on personnel-level predictors, this work assesses interpersonal effects of two types of predictors: support and influence. It also takes into account the role of military-affiliated peers and the dual roles they may play in affecting personnel alcohol misuse.

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Chapter 4. Methods

4.1 Operation: SAFETY

4.1.1 Data source and sample

This dissertation uses data from a cohort study, Operation: SAFETY (Soldiers and Families Excelling Through the Years), which is broadly focused on the health and wellbeing of Army R/NG soldiers and their partners (Anderson Goodell, Homish, & Homish, 2018; Heavey, Homish, Goodell, & Homish, 2017; Hoopsick, Vest, Homish, & Homish, 2017; Kozlowski, Homish, & Homish, 2017). Operation: SAFETY is longitudinal and comprised of three waves of survey data: a baseline assessment and two yearly follow-ups. Baseline survey administration began in 2013, and all data collection was completed in spring of 2018. The Operation: SAFETY study contains a total of 411 heterosexual couples. This dissertation focuses specifically on soldier participants and uses cross-sectional data from the baseline assessment.

Table 4.1 provides a summary of baseline characteristics for male and female soldier participants. Because the study included 30 couples where both partners were in the military, the total number of soldiers was 441, of which 371 (84.1%) were male and 70 (15.9%) were female. The average age of participants was 31.4 years (standard deviation [*SD*] = 6.4), and males were slightly older than females (31.7 years vs 29.9 years, $p = .04$). The majority of the sample was non-Hispanic White (79.8%). Approximately 70% of soldiers had at least some college education, although significantly more women reported completing college (41.4% vs 28.6%, $p = .02$). Median household income for all soldiers was within the range of $50,000 and $69,999.

Male and female soldiers differed on military characteristics. Male soldiers had served in the military significantly longer than female soldiers, serving an average of 10 years compared to females' eight years ($p = .01$). A larger proportion of male soldiers had ever been deployed; 65% of male soldiers and 40% of female soldiers reported any deployment history ($p < .01$). Of the soldiers who had been deployed, females were marginally significantly more likely to report one previous deployment, whereas males were more likely to report multiple deployments ($p = .08$). None of the deployed female soldiers in the sample reported three or more deployments.

Demographic and military characteristics of the soldiers in the overall study are representative of Reserve and Guard soldiers nationally (Department of Defense, 2017). Although the majority of soldiers in the Operation: SAFETY study are male, the sex-specific estimates are similar to national estimates (females: 15.9% in study & 19.3% nationally). The overall soldier sample is diverse, with 18.3% of soldiers belonging to a racial or ethnic minority group, slightly less than the national estimate of 26%. Approximately 31% of soldiers have a four-year or advanced degree, slightly higher than the national estimate (24%). Approximately 61% of soldiers in the study have ever been deployed, which is consistent with national estimates of deployment history for Reserve and Guard soldiers (Institute of Medicine, 2010). Units were diverse in terms of soldier's military occupational specialties (MOS) and included combat, engineer, medical, logistics, and support roles.

Table 4.1 Characteristics of Operation: SAFETY Soldier Respondents, % (*n*) or *m* (*SD*)

Characteristics	Total (*N* = 441)	Males (*n* = 371; 84.1%)	Females (*n* = 70; 15.9%)	*p*
Age	31.4 (6.4)	31.7 (6.6)	29.9 (5.4)	.04
Race/Ethnicity				
Non-Hispanic White	79.8% (352)	79.8% (296)	80.0% (56)	
Non-Hispanic Black	5.2% (22)	5.7% (21)	2.9% (2)	
Hispanic	8.6% (38)	8.9% (33)	7.1% (5)	
Other[a]	4.5% (20)	4.0% (15)	7.1% (5)	.58
Education Level[b]				
≤High school	13.2% (58)	14.8% (55)	4.3% (3)	
graduation	56.2% (248)	56.6% (210)	54.3% (38)	.02
Some college	30.6% (135)	28.6% (106)	41.4% (29)	
College completion				
Income (median)	$50,000-69,999	$60,000-79,999	$50,000-69,999	.10
Years Served	9.5 (6.0)	9.9 (6.2)	7.8 (4.9)	.01
Ever Deployed	60.8% (268)	64.7% (240)	40.0% (28)	<.01
Number of Deployments				
1	58.2% (156)	57.5% (138)	64.3% (18)	
2	28.0% (75)	27.1% (65)	35.7% (10)	.08
3+	13.8% (37)	15.4% (37)	0.0% (0)	

Note. Totals within categorical variables may not equal column totals due to missing data. *SD* = standard deviation.
[a]Includes American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, more than one race, and other specified races. [b,c]"Some College" includes Trade school, Associate degrees, and other two-year technical degrees, and "College completion" includes four-year degrees and graduate degrees.

4.1.2 Recruitment and enrollment

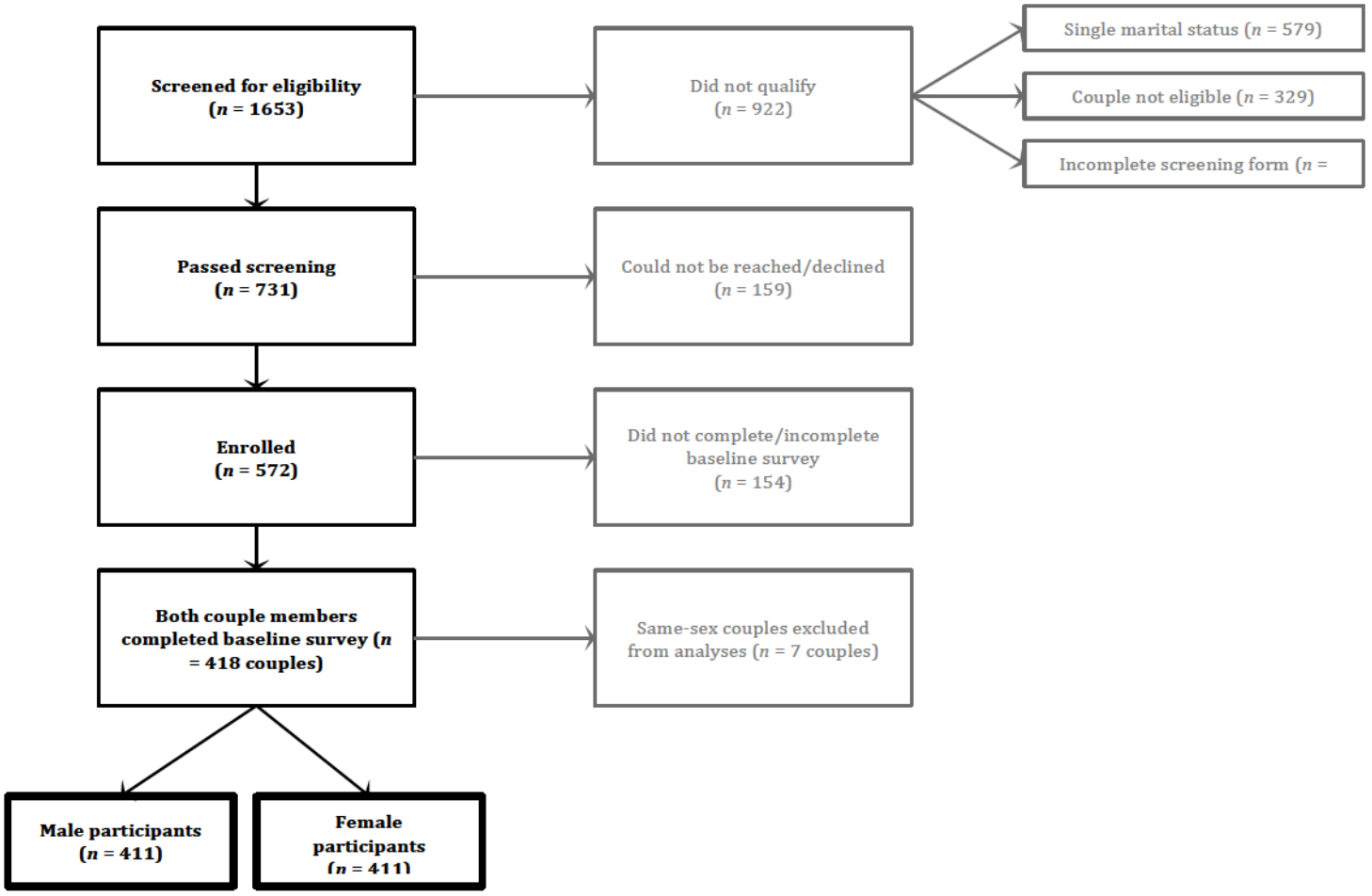
The Operation: SAFETY study recruited participants from 47 Army R/NG units in upstate New York over a 15-month period (Summer 2014-Fall 2015). During drill weekends, the study recruitment team provided 10-minute study overviews to explain project goals. Confidentiality procedures were discussed, including an assurance that the military would not know who participated and soldiers' partners would not learn of their responses. In addition, participants were informed that a certificate of confidentiality was obtained from the U.S. Department of Health and Human Services to protect participant

information from being disclosed in response to court or other legal orders. After all questions were answered, soldiers were invited to complete a one-page screening form to assess for the six eligibility criteria noted below. All soldiers were provided an information packet to take home and share with their partner to accurately explain the study. Following the in-person screening, all soldiers were contacted within one week regarding their eligibility status.

Eligibility for this study was based on the following six inclusion criteria: (a) the couple was married or living as if married, (b) one member of the couple was a current Army R/NG soldier, (c) the soldier partner was between the ages of 18 and 45, (d) both partners were able to speak and understand English, (e) both partners were willing and able to participate, and (f) both partners had at least one alcoholic beverage in the past year. Figure 4.1 displays how the final sample for Operation: SAFETY was derived.

A total of 1,653 soldiers completed screening forms during recruitment into the parent study, and 922 did not qualify (579 were single, 329 failed on one or more of the eligibility items, and 14 submitted incomplete forms). The resulting 731 soldiers were considered eligible for the study, and of those, 572 (78%) agreed to participate, with 472 couples (83% of those agreeing) completing at least a partial baseline survey. The study examines health and wellbeing of soldiers and partners separately as well as the interdependent impact of individuals' health behaviors on one another; thus, only couples where both partners completed the survey were included. A total of 411 heterosexual couples had both partners who completed baseline survey. We examined the differences between those that passed and enrolled versus those who passed and did not enroll. Couples where a civilian partner screened for the study (n = 11) were less likely to enroll

Figure 4.1 Sampling Frame for Operation: SAFETY



($p < .001$). No differences existed on the soldier health screening variables between those who enrolled and completed versus those who enrolled and did not complete.

4.1.3 Survey administration

After eligibility was determined and consent was obtained from both the soldiers and partners, participation involved completing three online surveys (baseline and two yearly follow-ups). Baseline surveys took approximately 2.5 hours to complete, and follow-up surveys lasted approximately 1.5 hours. Soldiers and their partners each received incentive checks for completed baseline and follow-up surveys.

As mentioned in Chapter 2, it is common for R/NG soldiers to live at a distance from their assigned installation, and it is also possible for soldiers to be deployed during the study. For these reasons, the surveys were administered through a secure HIPAA-compliant online survey programming software, which allowed for data encryption. Soldiers and partners who lived in western New York were invited to the State University of New York at Buffalo Center for Health Research to complete their online surveys. Couples could come in together or separately, and each partner was given a private room with a touchscreen computer to complete the survey. Informed consent was conducted with a research staff member before the survey was administered. For soldiers and partners located outside of western New York, separate login information was sent to each partners' email. Participants created their own unique password and then were given an online version of the same consent form. Once the participant completed the consent process, he or she could access the survey.

4.1.4 Ethical considerations

The State University of New York at Buffalo's Institutional Review Board and the Army Human Research Protections Office, Office of the Chief – Army Reserve, and the Adjutant General of the National Guard all approved and vetted the Operation: SAFETY protocol. This dissertation uses secondary data analysis of existing de-identified data from Operation: SAFETY. The author had no access to any identifying information from the original study participants, and the dataset contains no information from which participants could be identified. Because the data are de-identified, the potential risk to study participants of a breach of confidentiality is minimal. As such, the work described in this dissertation was designated as exempt by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

4.2 References

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Chapter 5. Profiles of deployment-related support and hazardous alcohol use among Army Reserve and National Guard soldiers

5.1 Abstract

Background: Deployment-related training and support for soldiers may mitigate risk for post-deployment alcohol misuse. Although prior work shows that post-deployment support is protective against mental health problems (e.g., PTSD and depression), there has been a limited focus on support before and during deployment and in relation to alcohol misuse. To address these gaps, we investigate whether pre- and peri-deployment training and support are protective against soldier hazardous alcohol use.

Methods: Analyses included 282 soldiers (248 males and 34 females) who had ever been deployed. For the male subsample, latent profile analysis (LPA) was used to model deployment-related support using three indicators: pre-deployment training and preparation, unit support during deployment, and social support during deployment. Logistic regression with a three-step Vermunt correction was used to examine associations between deployment support profiles and odds of current hazardous alcohol use. The final multivariable model was adjusted for sociodemographic characteristics, mental health comorbidity, marital satisfaction, and social drinking influence. Due to the small sample size and low prevalence of hazardous alcohol use for females, results were limited and based on descriptive analyses.

Results: Results from the LPA indicated a three-profile solution for deployment-related support as the most appropriate fit for the underlying data. The resulting profiles were described as High Social Support, Low Social Support, and High Overall Support. Posterior probabilities indicated that approximately 75% of male soldiers would be

expected to be in the High Social Support profile. Expected membership in the High Social Support profile compared to the Low Social Support profile was associated with reduced odds of hazardous alcohol use by 75%. No significant differences were observed between High Overall Support and Low Social Support in relation to the outcome. **Conclusions:** High levels of social support during deployment may be protective against hazardous alcohol use. These findings underscore the need to better understand what constitutes adequate social support in order to inform efforts to enhance soldiers' support experience during deployment. Information on related topics might also be highlighted through family readiness programs and social media group messaging.

5.2 Introduction

For military personnel, adequate deployment-related training and support may be protective against post-deployment alcohol misuse, which is a substantial behavioral health problem in the military (Thomas et al., 2010; Vest, Heavey, Homish, & Homish, 2018). Approximately 47% of military personnel report past-month binge drinking, having at least 5 drinks for men and 4 for women in one sitting, and 20% report past-month heavy drinking, characterized as binging at least once weekly (Bray, Brown, & Williams, 2013). After returning from deployment, approximately 12% of Active Duty and 15% of Reserve and National Guard (R/NG) personnel report problem alcohol use (Milliken, Auchterlonie, & Hoge, 2007). Deployment is a critical period that contributes to risk for post-deployment alcohol misuse through combat exposure (Jacobson et al., 2008; Russell et al., 2014; Wilk et al., 2010) and as a result of issues with posttraumatic stress disorder (PTSD), mental wellbeing, and reintegration (Adams et al., 2016; Kehle et al., 2012; Marshall et al., 2012). In addition, alcohol use is often seen as an acceptable

and accessible way of coping with deployment-related stress and trauma (Ames & Cunradi, 2004; Ames, Cunradi, Moore, & Stern, 2007; Ames, Duke, Moore, & Cunradi, 2009). Post-deployment drinking is attributable to difficulties faced during and following deployment, and adequate deployment support could help personnel cope more easily.

Alcohol Misuse Among Reserve and National Guard Personnel

Post-deployment alcohol misuse is a particular concern among R/NG personnel because they have a unique military situation that may contribute to the risk for alcohol misuse. In contrast to other military personnel, R/NG personnel are embedded in both the civilian and military worlds. They typically have full-time civilian jobs and limited military involvement (i.e., training once per month), but are still eligible to be deployed (Institute of Medicine, 2013a; La Bash, Vogt, King, & King, 2009). Combat exposure during deployments occurs approximately 70% of the time and has been associated with heavy drinking in R/NG personnel (Milliken et al., 2007; Vest et al., 2018). One recent study compared R/NG to Active Duty personnel, and R/NG personnel were more likely to develop alcohol use disorders, although the two groups did not appear to differ in their experience of other mental health outcomes, such as depression and PTSD (Cohen, Fink, Sampson, & Galea, 2015). R/NG personnel may also be more likely to relapse after remitting from problem drinking, compared to Active Duty personnel (Williams et al., 2015). Hypothesized reasons for the heightened risk for alcohol misuse in R/NG personnel include being less prepared for deployment (Jacobson et al., 2008; Milliken et al., 2007) and lack of unit support (Williams et al., 2015).

Types of Support

Different types of deployment support may be useful for mitigating issues with alcohol misuse. One such type of support is training and preparation prior to deployment, which may be especially important since R/NG personnel spend limited time training at their assigned military base but can still be activated for deployment. Adequate training and preparation is a modifiable factor that may help soldiers feel like they have the right skills and understand what to expect of the deployment experience, mission roles, and potential trauma (Renshaw, 2011; Vogt, Smith, King, & King, 2012). Training and preparation have been linked to accurate risk perceptions of combat experiences and may be protective of subsequent mental health problems like PTSD (Goldmann et al., 2012; Renshaw, 2011) and incident alcohol abuse or dependence (Orr et al., 2014).

Feelings of unit support may represent assurance of being able to rely on fellow service members and leaders. Previous research has shown that unit cohesion and trust of leadership during deployment may reduce the likelihood of post-deployment mental health issues (Armistead-Jehle, Johnston, Wade, & Ecklund, 2011; King, King, Vogt, Knight, & Samper, 2006) and reintegration issues (Griffith, 2015). In addition to being protective against negative outcomes, unit cohesion may also be beneficial for encouraging positive outcomes such as military and job satisfaction, wellbeing, and improved performance of the entire unit (Oliver, Harman, Hoover, Hayes, & Pandhi, 1999). In terms of timing, unit support during deployment, rather than before or after, may be protective against negative outcomes because it may provide real-time buffering of warzone experiences that may otherwise seem too much to handle (Han et al., 2014).

Thus, it is possible that unit support may also be protective against coping-related post-deployment alcohol misuse.

Finally, in addition to pre-deployment training and unit support during deployment, adequate social support by family and friends during deployment may be protective against alcohol misuse. Social support is important for buffering in the face of stress or trauma, and may be helpful in curbing effects of stress and negative mental health outcomes (Cohen & Wills, 1985). Social support has been shown by a variety of studies to be protective of mental health consequences such as PTSD and depression in military personnel (Goldmann et al., 2012; Han et al., 2014; King et al., 2006; Polusny et al., 2011). In addition, recent research on alcohol consumption trajectories in military veterans showed that higher social support was associated with recovery from excessive drinking (Fuehrlein et al., 2018).

Support and Mental Health Outcomes

Deployment-related support has been shown to be protective in light of post-deployment mental health consequences such as PTSD and depression (Goldmann et al., 2012; Holmes, Tariot, & Cox, 1998). A review of military research on vulnerability and support factors found that low unit support and social support after deployment were associated with greater likelihood of PTSD (Wright, Kelsall, Sim, Clarke, & Creamer, 2013). In addition, Goldmann and colleagues (2012) examined combinations of multiple types of support (i.e., training, unit support, and post-deployment social support), each categorized as low or high, and the effects of these combinations on PTSD. The study found that high levels of each support type were associated with lower likelihood of PTSD, and when examining combinations of support together, high social support

emerged as an important factor in reducing the odds of PTSD (Goldmann et al., 2012). Longitudinal research on risk and protective factors associated with PTSD has also shown similar findings with military preparedness and social support being protective of post-deployment PTSD (Polusny et al., 2011).

Previous research offers key insights into factors that are important for protecting against deployment-related mental health consequences, and the current study seeks to extend prior knowledge on deployment support. To expand the work of others that has focused primarily on PTSD, we examined the outcome of hazardous alcohol use. In addition, previous research has focused on the influence of social support after return from deployment (Goldmann et al., 2012; Polusny et al., 2011; Wright et al., 2013); thus, the current work examines social support as a peri-deployment factor, along with pre-deployment training and preparation and peri-deployment unit support. Finally, rather than examining each support type separately, we seek to gain a more succinct idea of overall deployment support by using data-driven latent mixture models to categorize continuous measurements of support into broader types, or deployment support profiles. The current research also uses updated versions of the Deployment Risk and Resilience Inventory (DRRI) scales that have been used in previous studies (King et al., 2006). The newer versions reflect renewed psychometric validity and contain additional questions that address an expanded set of interpersonal factors (Vogt et al., 2012).

The Current Study

There is evidence that multiple types of deployment support are effective at building resilience and protecting against mental health consequences. Thus, this study will (a) examine comprehensive support as a latent construct using latent profile analysis

to classify types of military and non-military support – pre-deployment training and preparation, peri-deployment unit support, and peri-deployment social support – into deployment support patterns; and (b) examine the relationship of deployment support with hazardous alcohol use among Army R/NG soldiers. We hypothesize that support typologies with overall higher levels of support, especially higher levels of social support, will have stronger protective effects on hazardous alcohol use.

5.3 Methods

5.3.1 Participants and procedure

Data are from the baseline assessment of Operation: SAFETY (Soldiers And Families Excelling Through the Years), an ongoing survey-based study that is focused on the health and wellbeing of Army R/NG soldiers and their partners (Anderson Goodell, Homish, & Homish, 2018; Heavey, Homish, Goodell, & Homish, 2017; Hoopsick, Vest, Homish, & Homish, 2017; Kozlowski, Homish, & Homish, 2017; Vest, Heavey, Homish, & Homish, 2017). The State University of New York at Buffalo's Institutional Review Board and the Army Human Research Protections Office, Office of the Chief – Army Reserve, and the Adjutant General of the National Guard all approved and vetted the Operation: SAFETY protocol. In addition, the study received a certificate of confidentiality from the U.S. Department of Health and Human Services to protect participant information.

Participants were recruited over a 15-month period (Summer 2014 to Fall 2015) from 47 Army R/NG units in upstate New York. During their training weekends, soldiers were presented with a study overview and confidentiality procedures, and then were invited to complete a brief screening form to assess whether they were eligible to

participate. After completing the screening, soldiers were provided with information to take home and share with their partner to accurately explain the study. Following the in-person screening, all soldiers were contacted within a week about whether they were eligible for the study. Eligibility for Operation: SAFETY was based on six inclusion criteria: (1) the couple is married or living as married; (2) one member of the couple is a current Army R/NG soldier; (3) the soldier is between the ages of 18 and 45; (4) both partners have had at least one alcoholic beverage in the past year; (5) both partners are able to speak and understand English; and (6) both partners are willing and able to participate.

A total of 731 couples were considered eligible for the study, and of those, 572 (78%) agreed to participate, with 83% of those (n = 472) completing at least a partial baseline survey. A final total of 418 couples had both partners who completed the entire baseline survey. Couples where a civilian partner screened for the study (n = 11) were less likely to enroll ($p < .001$). No differences existed on soldier eligibility criteria as well as other preventive health screening variables (e.g., routine physical and exercise frequency) between those who enrolled and completed versus those who enrolled and did not complete.

5.3.2 Measures

Outcome Variable: Current Hazardous Alcohol Use

Current hazardous alcohol use was assessed using the Alcohol Use Disorders Identification Test (AUDIT), a 10-item measure with each item measured on a 5-point Likert scale from 0 to 4. The summed scores range from 0 to 40 with greater scores indicating increased drinking severity (Cronbach's $\alpha_{male} = 0.76$, $\alpha_{female} = 0.80$; Babor &

Del Boca, 1992; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). A binary variable with a cut-point of 8 was used, with scores of 8 or greater indicating current hazardous or harmful alcohol use (Saunders et al., 1993). Research has examined the AUDIT's performance in assessing hazardous drinking in veteran populations, and, in line with civilian work, has suggested the cutoff of 8 as appropriate (Crawford, Fulton, Swinkels, Beckham, & Calhoun, 2013).

Support Indicator Variables

The three military and non-military support indicators were drawn from three subscales of the Deployment Risk and Resilience Inventory-2 (DRRI-2), which assesses risk and resiliency factors associated with military deployments and stressors (Vogt et al., 2012). The three subscales' items all pertain to the soldiers' perceptions of support that they experienced in relation to their most recent deployment.

Training and preparation. Perception of pre-deployment training and preparation was considered a type of military support in light of the limited military involvement and more embedded civilian lifestyles that R/NG personnel have on a regular basis (La Bash et al., 2009; Vest, 2013). The training and deployment preparation subscale (DRRI-2:H) is comprised of 10 items examining perceptions of preparedness. Sample items include *My unit was well prepared to operate as a team during deployment* and *The training I received taught me everything I needed to know for deployment*, and each item is measured using a Likert scale with five response options ranging from "strongly disagree" to "strongly agree." Individual item responses are scored between 1 and 5, and composite scores range from 10 to 50, with greater scores indicating greater perception of preparedness (Cronbach's $\alpha_{male} = 0.93$, $\alpha_{female} = 0.88$).

Unit support. Unit support during deployment was examined as a type of military support and was measured using a subscale of the DRRI-2 (DRRI-2:J) that focuses on support received from a soldier's unit and leadership during the most recent deployment. The DRRI-2:J contains 12 questions about the extent that soldiers agree with statements related to unit support by unit members and leaders. Sample items include *Members of my unit were interested in my well-being* and *I could go to unit leaders for help if I had a problem or concern*. The five associated response options range from "strongly disagree" to "strongly agree, " and total scores range from 12 to 60, with higher scores indicating a greater perceived support by unit members and leaders (Cronbach's α_{male} = 0.96, α_{female} = 0.97).

Social support. Social support was measured using a subscale (DRRI-2:I) that focuses on soldiers' receipt of support from family and friends during deployment (Vogt et al., 2012). The DRRI-2:I includes eight items that measure the extent that the respondent agrees with statements about feeling supported and being able to count on family and friends. Sample items include *…I was happy with the amount of support I received from people at home* and *…relatives or friends at home could be counted on to look out for the well-being of my family or other dependents (including pets)*, and the five response options range from "strongly disagree" to "strongly agree." Item responses are scored between 1 and 5, with total scores from 8 to 40 and greater scores indicating greater perceived support from family and friends (Cronbach's α_{male} = 0.95, α_{female} = 0.94).

Covariates

Sociodemographic characteristics. Sociodemographic characteristics for the soldier included age, education (high school or some college versus college completion), and annual income by ranges of $10,000.

Combat exposure. Combat exposure during deployment is a major influence on post-deployment alcohol misuse behaviors and associated problems (Bray et al., 2013; Jacobson et al., 2008; Wilk et al., 2010). Combat exposure was examined using a DRRI-2 subscale to measure exposure to stressful events or circumstances during the most recent deployment (Vogt et al., 2012). Examples of stressful or traumatic events include going on patrol, searching or disarming the enemy, encountering improvised explosive devices, being fired upon, and witnessing an ally or fellow unit member being injured or killed. The subscale contains 17 items that are scored from 1 to 6 according to the frequency of experiencing each, ranging from "Never" (1) to "Daily or almost daily" (6). Total scores range from 17 to 102, with greater scores indicating greater exposure to combat (Cronbach's $\alpha_{male} = 0.94$, $\alpha_{female} = 0.90$).

Posttraumatic stress disorder. Previous research has shown PTSD to be associated with initiation of problem drinking (Bensley et al., 2018; Kehle et al., 2012; Marshall et al., 2012) and alcohol use disorder (Kline et al., 2014). PTSD was measured according to past 30-day PTSD symptom severity using the PTSD Checklist (PCL-5). The PCL-5 is a 20-item instrument with scores ranging from 0 to 80 (Cronbach's $\alpha_{male} = 0.95$, $\alpha_{female} = 0.95$). Higher scores indicate greater symptom severity (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). The PCL-5 has been adapted from the original

PCL to map on to DSM-5 criteria (Bovin et al., 2015; Weathers, Litz, Herman, Huska, & Keane, 1993).

Peer alcohol influence. Peer alcohol use serves as an influential factor in relation to an individual's drinking behaviors (Leonard & Homish, 2008; Leonard & Mudar, 2000; Rosenquist, Murabito, Fowler, & Christakis, 2010). We used a social network inventory to assess alcohol use behaviors of individuals who soldiers deemed to be *important…in one way or another during the past year*, called social ties (Leonard & Homish, 2008). Peer alcohol influence was measured by the number of social ties that respondents considered to be "drinking buddies," according to who the respondent *got together with…on a regular basis to do activities that centered around drinking and/or going to bars or nightclubs* (Lau-Barraco & Collins, 2011). Based on the distribution of number of drinking buddies, the variable was categorized as 0 to 4+.

Marital partner's alcohol use. Significant others may be drawn to one another systematically in the early stages of a relationship because of similar levels of alcohol consumption, and may also influence one another's drinking behaviors while partnered (Leonard & Das Eiden, 1999; Leonard & Homish, 2008). Marital partner's alcohol use was measured using the continuous AUDIT score (Cronbach's $\alpha_{male} = 0.76$, $\alpha_{female} = 0.80$; Babor & Del Boca, 1992).

Marital satisfaction. Marital dissatisfaction is a strong influence on a variety of mental health outcomes, including hazardous drinking, in military partnerships (Foran, Smith Slep, & Heyman, 2011; Vest et al., 2017). Marital satisfaction was measured using the Marital Adjustment Test (MAT). The MAT is a 15-item scale (scored from 2 to 158) with higher scores indicating higher levels of satisfaction (Cronbach's $\alpha_{male} =$

0.76, $\alpha_{female} = 0.79$; Locke & Wallace, 1959). Items pertain to overall happiness with the current relationship and concordance between the respondent and their partner on matters such as finances, friends, sexual relations, leisure time, and handling of disagreements.

5.3.3 Statistical analyses

The current analyses are based on a cross-sectional subsample from the full study: 282 Army R/NG soldiers (248 males and 34 females) who had been deployed at least once. Due to the small sample size of female solders, they were included in a limited set of analyses, which involved examining descriptive statistics only. Males were included in all analyses for the current study. First, we conducted descriptive analyses for all variables of interest (i.e., means, frequencies, distributions, and intercorrelations). Next, we used latent profile analysis (LPA) to model deployment-related support in male soldiers.

LPA is an extension of latent class analysis that is appropriate for continuous indicator variables to identify profiles of similar patterns on indicators (Muthén & Muthén, 1998-2017; Nylund, Asparouhov, & Muthén, 2007). To identify profiles of deployment support, we used the three continuous support indicators: training and preparation before deployment, unit support during deployment, and family and friend support during deployment.

LPA assumes (a) conditional independence, where indicators are statistically independent, conditional on profile of deployment support; and (b) independence of observations within the sample (Vermunt & Magidson, 2006). To address the first assumption, we examined correlations between the three indicators of support (Table 5.1), and observed a high correlation between scores for training and preparation and

those for unit support (r = .50). We modeled this correlation explicitly, thus relaxing the conditional independence assumption, but constrained the correlation to be equal across profiles in the interest of parsimony. In addition, in examining distributions of scores for the three indicators, we observed negative skew of both training and preparation and unit support, and allowed for unequal variance between profiles for these two variables. For the assumption of independent observations, we assumed no clustering among participants in the current analyses. Recruitment efforts by R/NG base inevitably resulted in multiple participants being recruited from the same base, but there is no evidence of clustering of participants since there are multiple units per base. In addition, evidence suggests that at least one-third of R/NG personnel deploy without their regular unit, so it is possible that even if respondents from the same unit are included in the study, they may not have been deployed together (Ursano et al., 2018).

Table 5.1 Correlations Among Study Variables, Male Soldiers (n = 248)

	1	2	3	4	5	6	7	8	9	10	11	12
1 Hazardous alcohol use	1.00											
2 Training & preparation	-0.05	1.00										
3 Unit support	0.03	0.50	1.00									
4 Social support	-0.19	0.29	0.25	1.00								
5 Age	-0.10	-0.16	-0.03	-0.03	1.00							
6 Education	-0.07	0.02	-0.03	0.12	0.13	1.00						
7 Income	-0.01	-0.06	0.09	0.04	0.48	0.36	1.00					
8 Combat exposure	0.09	-0.06	0.10	-0.06	0.07	0.01	0.08	1.00				
9 PTSD symptoms	0.16	-0.20	-0.08	-0.19	0.05	-0.05	-0.07	0.31	1.00			
10 Drinking buddies	0.31	0.05	0.06	0.05	-0.18	0.00	-0.05	-0.01	0.09	1.00		
11 Partner alcohol use	0.21	0.04	0.06	0.04	-0.11	-0.04	-0.01	0.17	0.01	0.28	1.00	
12 Marital satisfaction	-0.15	0.13	-0.01	0.26	-0.12	0.04	-0.03	0.02	-0.32	0.01	-0.01	1.00

Note. PTSD = posttraumatic stress disorder.

We compared models with one to five profiles according to entropy and the goodness of fit parameters (Bayesian Information Criterion [BIC] and Lo-Mendell Rubin likelihood ratio test [LMR LRT]; Lo, Mendell, & Rubin, 2001; Nylund et al., 2007). Entropy measures uncertainty of individual profile membership and ranges from 0.0 to 1.0, with higher estimates indicating more certainty and a better fit of the data. BIC is generated from the model log-likelihood, with lower values indicating better model fit. LMR LRT is used to assess whether *k* profiles represent a significantly better fit compared to a model with *k*-1 profiles (Lo et al., 2001; Schwarz, 1978). The model with the greatest number of profiles with a significant LMR LRT *p*-value was considered the best fit of the observed data (Lo et al., 2001). Bootstrap LRT (BLRT) *p*-values were included in the results for the sake of comprehensiveness but were not examined as selection criteria since the BLRT is sensitive to asymmetrical data distributions and may be inconclusive in terms of significance (Kupzyk, 2011; Nylund et al., 2007). We also assessed the number of profiles according to interpretability and accounting for the number of individuals with most likely membership in each profile (Nylund et al., 2007).

After determining the optimal fit of the data, associations between deployment support profile and hazardous alcohol use were examined using logistic regression models. We used the three-step correction process developed by Vermunt and described by Asparouhov and Muthén (Asparouhov & Muthén, 2014; Vermunt, 2010). With profiles of deployment support as a categorical independent variable, logistic regression was used to estimate the odds of current hazardous drinking (AUDIT score of 8+). We examined separate unadjusted effects for deployment support and each covariate, and

then examined the multivariable model with deployment support and all covariates included together.

Due to small sample size (n = 34) and low prevalence of the hazardous use outcome, female soldiers were not included in the LPA and regression analyses. All data management and descriptive analyses were conducted using Stata 14.2, and the LPA, including model building and assessment of fit, and regression analyses were conducted in Mplus, version 8 (Muthén & Muthén, 1998-2017; StataCorp, 2015).

5.4 Results

The objectives were to assess whether aspects of support before and during deployment could be classified into overall deployment support types and then examine the relationship between deployment support and hazardous alcohol use. Although the majority of analyses focus on the male soldiers, descriptive results are also presented for female soldiers.

5.4.1 Descriptive statistics

Table 5.2 provides a summary of demographic characteristics and variables of interest for males and females. Soldiers' average age was 33.4 years (standard deviation [*SD*] = 6.0 years), and 81% of the sample was non-Hispanic White (n = 227). Most soldiers had at least some college education or a college degree, although significantly more females had attained college completion compared to male soldiers (47% vs 26%, p = .01). A majority of soldiers (72%) had at least one child in the home, and the median family income was between $60,000 and $79,000. Almost 85% ($n$ = 238) of soldiers were enlisted, with a higher prevalence of officers among male soldiers compared to female soldiers, and overall, soldiers had served an average of almost 12 years in the

military (m = 11.9, SD = 5.7). Approximately 41% of soldiers had been deployed two or more times (n = 116). None of the female soldiers reported three or more deployments, compared to 15% of male soldiers (p = .05).

As for variables of interest, male soldiers had a significantly higher average AUDIT score compared to females (5.1 vs 3.2, p = .01), indicating higher average alcohol use severity. Approximately 17% (n = 49) of soldiers had an AUDIT score of 8 or greater, indicating hazardous alcohol use, and male soldiers had a marginally significantly higher prevalence of hazardous use compared to females (19% vs 5%, p = .06). Concerning the three indicators of support, on average, respondents reported they "somewhat agreed" with the items that described each of the three indicators: training and preparation (m = 37.2, SD = 9.3), unit support (m = 45.3, SD = 11.6), and social support (m = 33.9, SD = 7.3). There were no significant sex differences on the three support indicators, although female soldiers reported marginally significantly lower scores on unit support compared to males (42.2 vs 45.7, p = .10). For covariates, compared to females, males reported greater combat exposure, more drinking buddies, and lower partner alcohol use severity.

Table 5.2 Study Sample Characteristics, % (*n*) or *m* (*SD*)

Characteristics	All Soldiers (*n* = 282)	Male Soldiers (*n* = 248)	Female Soldiers (*n* = 34)	*p*
Sociodemographic characteristics				
Age	33.4 (6.0)	33.4 (6.2)	33.2 (4.7)	.84
Race/Ethnicity				
Non-Hispanic White	80.5% (227)	81.1% (201)	76.5% (26)	.76
Other[a]	17.7% (50)	17.3% (43)	20.6% (7)	
Education level[b]				
High school or some college	71.6% (202)	74.2% (184)	52.9% (18)	.01
College completion	28.4% (80)	25.8% (64)	47.1% (16)	
Any children in the home[c]	71.6% (202)	71.0% (176)	76.5% (26)	.50
Family income (median)	$60,000-$79,000	$60,000-$79,000	$60,000-$79,000	.99
Military characteristics				
Rank				
Enlisted	84.4% (238)	84.7% (210)	82.4% (28)	.01
Officer	13.5% (38)	14.1% (35)	8.8% (3)	
Years served in military	11.9 (5.7)	11.9 (5.9)	11.3 (4.0)	.56
Number of deployments				
1	58.9% (166)	57.7% (143)	67.7% (23)	
2	27.7% (78)	27.0% (67)	32.3% (11)	.05
3+	13.5% (38)	15.3% (38)	0.0% (0)	
Alcohol misuse outcomes				
Alcohol use[d]	4.8 (3.9)	5.1 (4.0)	3.2 (3.0)	.01
Hazardous alcohol use[e]	17.4% (49)	19.0% (47)	5.9% (2)	.06

Table 5.2 Study Sample Characteristics, % (*n*) or *m* (*SD*), continued

Characteristics	All Soldiers (*n* = 282)	Male Soldiers (*n* = 248)	Female Soldiers (*n* = 34)	*p*
Deployment support				
Training and preparation	37.2 (9.3)	37.3 (9.5)	36.3 (8.0)	.54
Unit support	45.3 (11.6)	45.7 (11.3)	42.2 (13.5)	.10
Social support	33.9 (7.3)	33.9 (7.2)	33.3 (7.8)	.65
Covariates				
Combat exposure	31.1 (16.0)	32.2 (16.5)	23.4 (7.1)	<.01
PTSD symptoms	10.7 (12.1)	10.4 (11.8)	13.1 (13.6)	.21
Number of drinking buddies	0.8 (1.2)	0.9 (1.3)	0.3 (0.5)	<.01
Partner's alcohol use[d]	3.7 (3.5)	3.5 (3.4)	5.1 (4.1)	.02
Marital satisfaction	111.0 (27.4)	110.6 (28.4)	113.6 (19.1)	.56

Note. Categorical totals may not equal column totals due to missing data. *SD* = standard deviation; PTSD = posttraumatic stress disorder.
[a]Includes Non-Hispanic Black, Hispanic, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, more than one race, and other specified races. [b]"High school or some college" includes high school, trade school completion, Associate degrees, and other two-year technical degrees, and "College completion" includes four-year degrees and graduate degrees. [c]Includes biological, adopted, foster, and stepchildren. [d]Based on continuous AUDIT score. [e]Based on AUDIT score of 8 or greater.

5.4.2 Latent profile analysis

The LPA examined solutions for one to five distinct profiles of deployment-related support (Table 5.3). According to LMR LRT guidelines, the three-profile solution was ideal, with the significant p-value (p = .006) indicating that the three-profile solution fit the data significantly better than a solution with two profiles. The LMR LRT p-value for the four-profile solution was marginally significant (p = .048), indicating that the four-profile solution fit the data no better than three profiles. Although the BIC continuously decreased with the increasing number of profiles, the magnitude of decrease from two to three profiles (approximately 40 points) indicates a better fit of the three-profile solution. This conclusion is supported by work showing that even just a 10-point reduction in BIC may indicate 150:1 likelihood of a better fit (Raftery, 1995). The three-

profile solution also had the highest entropy (0.93), indicating excellent separation of profiles and high certainty of individuals' expected profile membership. Table 5.4 shows the average posterior probabilities for the three-profile model, indicating that probability of soldiers' membership in their expected profiles was high, with probabilities ranging from 0.93 to 0.98. The three profiles were also logical and substantively interpretable.

Figure 5.1 shows a plot of the three deployment support profiles. Because the support indicators were measured on different scales, the figure visualizes standardized mean indicator scores for interpretability and includes associated unstandardized mean scores for completeness. The results for the unstandardized means were used to name the three profiles, and names were based on relative levels of support type across profiles, such as a particularly high or low mean score in a given profile compared to that in another profile. The level of a mean score was based on its magnitude in relation to the range of possible scores on the associated DRRI-2 scale. Profile 1, which had an expected size of 186 soldiers, was described as High Social Support and was characterized by individuals with moderate levels of training and preparation and unit support and a high level of social support. The mean for social support in Profile 1 (m = 35.8) was considered "high" because to get such a score, individuals would have to endorse an average response of "agree" or "strongly agree" across all eight items of the social support scale. Profile 2 had an expected size of 33 soldiers and was called Low Social Support. Profile 2 was similar to Profile 1 on training and preparation and unit support, but was characterized by low scores on social support (m = 19.4). Profile 3 had an expected size of 29 soldiers, was called High Overall Support, and was described by high levels of all support indicators.

Table 5.3 Model Fit Statistics of the Latent Profile Analyses

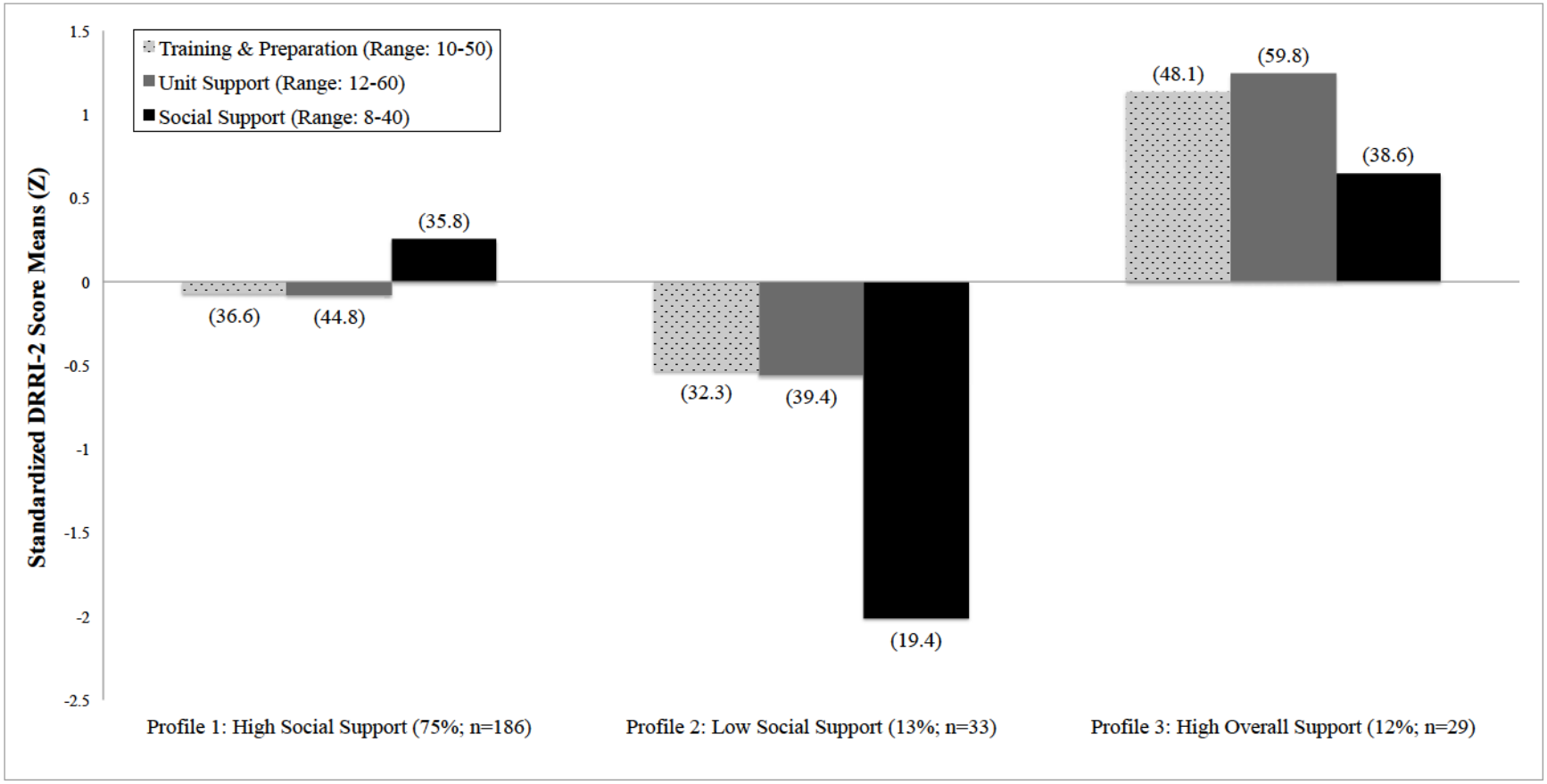
Number of profiles	Number of parameters	Log- likelihood	Entropy	AIC	BIC	LMR LRT *p*	BLRT *p*
1	6	5410.78	1.00	5422.78	5443.86	----	----
2	13	5252.35	0.92	5278.35	5324.02	<.001	<.001
3	19	5178.62	**0.93**	5216.62	5283.38	**.006**	<.001
4	23	5135.59	0.81	5181.60	5262.40	.048	<.001
5	27	5095.00	0.85	5149.01	**5243.87**	.214	.020

Note. Optimal models according to entropy, LMR LRT, and BIC are highlighted in bold. Other fit indices are reported for completeness. AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; LMR LRT *p* = *p*-values for the Lo-Mendell-Rubin likelihood ratio test for *K* versus *K*-1 profiles; BLRT *p* = *p*-values for the bootstrap likelihood ratio test for *K* versus *K*-1 profiles.

Table 5.4 Average Posterior Probabilities of Membership for the Three-Profile Model

Profile	*n* (%)	1	2	3
1	186 (75.0%)	0.975	0.015	0.000
2	33 (13.3%)	0.069	0.928	0.001
3	29 (11.7%)	0.001	0.001	0.929

Figure 5.1 Three-Profile Model of Deployment Support



Note. Support indicator mean scores were standardized to make visual interpretation of the profiles easier. Bars indicate direction of standardized means, and unstandardized means are noted in parentheses. Profile-specific percentages and sample sizes (noted at the bottom of the figure) are based on expected rather than actual membership.

5.4.3 Deployment support and hazardous alcohol use

Table 5.5 shows the results for the logistic regression models examining the unadjusted and adjusted relationships between deployment support profile and hazardous alcohol use. Unadjusted results show reduced odds of hazardous use when comparing the High Social Support profile to the Low Social Support profile (odds ratio [OR] = 0.30, 95% CI [0.13, 0.74], $p = .008$). High Overall Support was also marginally associated with reduced hazardous alcohol use (OR = 0.34, 95% CI [0.09, 1.22], $p = .097$). PTSD symptoms, number of drinking buddies, and partner's alcohol use were all positively associated with increased odds, and marital satisfaction showed an inverse relationship, with increasing satisfaction associated with lower odds of hazardous use.

When adjusting for the covariates of interest, the effect of High Social Support remained significant, indicating that expected membership in the High Social Support profile compared to the Low Social Support profile was associated with reduced odds of hazardous alcohol use by 75% (adjusted odds ratio [aOR] = 0.25, 95% CI [0.08, 0.78], $p = .02$). High Overall Support was no longer significant in its effect on hazardous alcohol use. In addition, for every additional social tie who was considered a drinking buddy, the odds of hazardous use increased by 92% (aOR = 1.92, 95% CI [1.43, 2.58], $p < .001$). Marital satisfaction continued to be inversely associated with hazardous alcohol use (aOR = 0.98, 95% CI [0.97, 0.99], $p = .01$).

Table 5.5 Associations of Deployment Support Profiles with Hazardous Alcohol Use, Male Soldiers (n = 248)

	Unadjusted		Adjusted	
Characteristics	OR	95% (CI)	OR	95% (CI)
Deployment support profiles				
Low Social Support		REF		REF
High Social Support	0.30	(0.13, 0.74)**	0.25	(0.08, 0.78)*
High Overall Support	0.34	(0.09, 1.22)+	0.32	(0.07, 1.51)
Covariates				
Age	0.94	(0.89, 0.99)*	0.93	(0.87, 1.01)+
Education level[a]	0.44	(0.19, 1.05)+	0.41	(0.15, 1.13)+
Income	0.91	(0.75, 1.11)	1.21	(0.92, 1.59)
Combat exposure	1.01	(1.00, 1.03)	1.01	(0.98, 1.03)
PTSD symptoms	1.04	(1.02, 1.07)**	1.03	(1.00, 1.07)+
Number of drinking buddies	1.72	(1.37, 2.16)***	1.92	(1.43, 2.58)***
Partner's alcohol use	1.11	(1.03, 1.20)**	1.07	(0.97, 1.18)
Marital satisfaction	0.98	(0.97, 0.99)**	0.98	(0.97, 0.99)*

Note. OR = odds ratio; CI = confidence interval; PTSD = posttraumatic stress disorder. The reference group for deployment support profile comparison is Low Social Support, noted by "REF."
[a]Reference was "high school or some college."
$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

5.5 *Discussion*

5.5.1 *Profiles of deployment support*

The purpose of this study was to understand patterns of deployment support and examine relationships between deployment support profiles and hazardous alcohol use. The LPA findings for male soldiers indicate that three distinct deployment-related support profiles emerge when examining pre-deployment training and preparation, unit support during deployment, and social support from family and friends during deployment. The three profiles can be described as High Social Support, Low Social Support, and High Overall Support, with three-quarters of soldiers reflecting expected membership in the High Social Support profile.

5.5.2 High social support

The results of the regression analyses suggest that individuals whose deployment support experience reflects that of the High Social Support profile may be less likely to report hazardous alcohol use, compared to individuals with support reflective of the Low Social Support profile. That is, individuals who have specifically higher social support from family and friends during deployment may be protected against hazardous alcohol use behaviors. These results align with previous studies, both civilian and military, that reflect the specific importance of adequate support by family and friends in relation to mental health outcomes (Goldmann et al., 2012; Han et al., 2014; Thoits, 2011). In the instance of deployment, social support may serve as a buffer to protect against coping with alcohol in the face of stressors by helping soldiers feel supported and interpret the stress as manageable and less threatening (Cohen, 1988).

Given the protective nature of social support, future research and practical efforts should pay special attention to optimizing soldiers' experience of social support during deployment. Research should qualitatively examine what constitutes adequate social support, whether it be emotional or tangible (Cohen, Mermelstein, Kamarck, & Hoberman, 1985), and what differences in effectiveness there might be when considering the source of support (e.g. family versus friends) (Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Focus should also be paid to working with soldiers, families, and other close social ties to establish knowledge and mutual expectations for what is considered adequate exchange of support. Information on related topics might also be highlighted through family readiness programs and social media group messaging.

Results from this study showed no significant difference in hazardous alcohol use when comparing expected membership in the High Overall Support profile to that in the Low Social Support profile. The most likely explanation is that higher levels of training and preparation and unit support were not as frequently endorsed, thus resulting in a smaller expected sample size for the High Overall Support profile. This smaller sample size may not have provided enough power to detect a difference between High Overall Support and Low Social Support. If the overall sample were larger or the analyses had resulted in a larger expected subsample in the High Overall Support profile, we might have seen a significant decrease in the likelihood of hazardous alcohol use comparing High Overall Support to Low Social Support.

With the above in mind, the findings speak to two important points in relation to the High Social Support profile. First, the largest emergent profile based on male soldiers' expected membership was one that reflected moderate levels of training and unit support and high levels of social support. This finding is important to consider in light of understanding what types and amounts of support R/NG personnel are actually experiencing. Second, the current research demonstrates that having high levels of all types of support may not be necessary to elicit beneficial effects on alcohol misuse outcomes. More specifically, high social support from family and friends during a soldier's deployment with average levels of other types of support may be sufficient to provide certain protective effects against hazardous alcohol use. Future work should examine whether high levels of other types of support taken together contribute to a significantly higher effect on hazardous alcohol use beyond that of high social support.

These two ideas, the large expected membership in the High Social Support profile and sufficiency of social support as a protective factor, align with the social identity of the R/NG soldier (Griffith, 2009; Tajfel, 1974). R/NG soldiers spend limited time in military roles when not activated for deployment, and they primarily interact with their civilian environments; as such, the limited social identity as a soldier may result in limited saliency of certain military-related experiences, such as pre-deployment training and unit support (Griffith, 2009). Adequate social support may be a more meaningful type of support for R/NG personnel who live predominantly as civilians with limited military identity. In addition, it is not that soldiers necessarily think they have inadequate training due to being in the R/NG, as none of the three profiles are categorized by low levels of training and preparation or unit support. Instead, there might be a limited expectation of these types of support beyond being considered acceptable or average. Such limited expectations are reflected by the small High Overall Support profile.

5.5.3 Females soldiers

For female soldiers, we were limited with analyses that could be performed in comparison to what was done using data for male soldiers. The low prevalence of hazardous alcohol use by females as well as the significantly lower AUDIT score reflecting alcohol use for females compared to males mirror other military research that suggests that female soldiers are less likely to misuse alcohol compared to males (Grossbard et al., 2017; Hawkins, Lapham, Kivlahan, & Bradley, 2010). This speaks to the possibility that the focus on effects of support for female soldiers might be shifted to prioritize other post-deployment outcomes, such as PTSD, depression, mental health comorbidity, and somatic pain (Batuman, 2011; Runnals et al., 2014).

5.5.4 Limitations

The current research should be considered in light of its limitations. First, the data for these analyses are cross-sectional, and we cannot infer causality from the observed associations. Though the current work is not longitudinal, attention was paid to temporal ordering of deployment support indicators and the hazardous alcohol use outcome through parent study design. Reports of deployment support were based on the periods before or during the most recent deployment, and the outcome refers to the current timeframe. The findings represent an initial effort to explore relationships between comprehensive deployment support and alcohol misuse. With support indicators in mind, the current study was unable to examine social support after deployment (Goldmann et al., 2012; Han et al., 2014; Polusny et al., 2011) due to limitations of the data. However, the study provides valuable knowledge about the role of social support during deployment, and does so while also considering the strong effects of current marital satisfaction, an important facet of support for married individuals (Padula & Sullivan, 2006) and in the context of the interpersonal influence on drinking by partner and social ties. Next, social desirability response bias may have occurred in the form of underreported alcohol use behaviors (Cucciare et al., 2016; Milliken et al., 2007; Santiago et al., 2010). However, because of this potential bias, the findings may be more conservative than expected had there been no underreporting. Finally, the findings may not be generalizable beyond R/NG personnel, and future research should focus on examining whether the same patterns of deployment support are reflected in Active Duty personnel. The perception of adequacy and value of certain types of support may be different among Active Duty personnel since they spend their full time engaging in

military training, possibly resulting in feeling more prepared for deployments. They may also be more likely to have long-standing cohesion with their assigned units and military peers.

5.5.5 Conclusions and implications

Despite the limitations, this study's strengths are that it contributes to the understanding of the types of deployment support experienced by R/NG soldiers and provides new information about how such support may affect subsequent alcohol misuse. Since the majority of soldiers likely report average levels of training and unit support with high levels of social support, efforts should be taken to bolster all facets of deployment-related support that are not considered adequately high. Proactively focusing on supportive elements like training and unit cohesion may result in increased social identity and resilience from negative consequences of deployment (Griffith, 2009). In addition, future research and practical efforts should focus on optimizing social support during deployment. Focus should also be paid to integrating soldiers, their families, and their social circles in effort to build more comprehensively supportive environments surrounding deployment. Alcohol interventions are difficult to implement in military settings, and treatment is variable and fragmented across the Department of Defense (Institute of Medicine, 2013b), so we must uncover ways to protect against alcohol misuse and transition to disorder. This research speaks to a preventive way of addressing alcohol misuse through bolstering support across the deployment spectrum, especially support from family and friends.

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Chapter 6. Risk and protective effects of social network characteristics on alcohol use among Army Reserve and National Guard soldiers

6.1 Abstract

Background: Alcohol use is a cultural norm in the military, characterized by communal drinking and drinking to cope with military- and deployment-related stressors. Although civilian-based research has established that peers' drinking behaviors are correlated with individuals' own drinking behaviors, military work has not yet examined social network characteristics that may influence alcohol use. The current study describes characteristics of military personnel's social networks, including drinking behaviors and military affiliation, and examines how those characteristics are associated with military personnel alcohol use.

Methods: The current work includes 421 Reserve and National Guard soldiers and egocentric data on 2,637 social ties who soldiers reported to be important to them in the past year. Descriptive analyses examined the prevalence and concurrence of social ties' characteristics, including military affiliation, substance misuse, drinking influence, sex, and support roles. Unadjusted and adjusted negative binomial regression models were used to examine relationships between each aggregate characteristic (the number of ties with the characteristic in a soldier's social network) and soldier alcohol use. Multivariable models were also examined separately according to soldier deployment history.

Results: Of all soldiers' social ties, almost 14% were military-affiliated, 13% were considered drinking buddies, and 9% were heavy-drinkers. Compared to male soldiers, female soldiers had fewer average numbers of drinking buddies, heavy-drinkers, and

military-affiliated ties in their networks and greater average numbers of female ties, family member ties, and close ties. The estimates of concurrence of military-affiliation with drinking buddy status and heavy-drinking were 21.2% and 7.5%, respectively. According to the regression results, greater numbers of drinking buddies and greater numbers of heavy-drinking ties in a soldier's social network were both associated with increases in soldier AUDIT score, indicating increased alcohol use. Greater average number of days drinking with ties in the past month was also associated with increased soldier AUDIT score. For deployed soldiers only, military-affiliated social networks were protective against alcohol use.

Conclusions: Multiple drinking-related social network characteristics are associated with increased alcohol use among soldiers, and findings complement work that has been done to understand social-ecological factors that influence alcohol use in the military. Interventions may focus on improving adaptive coping mechanisms and providing alcohol-free opportunities for military personnel to socialize. Future research should focus on understanding individual peer characteristics as predictors of social drinking between soldiers and their peers.

6.2 Introduction

The social milieu of the military is supportive of alcohol use, and unhealthy alcohol use is a substantial problem among military personnel (Ames, Duke, Moore, & Cunradi, 2009; Brown, Bray, & Hartzell, 2010; Jones & Fear, 2011; Poehlman et al., 2011). Approximately one-half of military personnel report past-month binge drinking, i.e., having at least 5 drinks in one sitting for men or 4 for women, and 20% report binge drinking at least weekly in the past month (Bray, Brown, & Williams, 2013). Personnel

face significant stressors, e.g., combat stress, reintegration issues following deployment, and PTSD, and drinking serves as a maladaptive way to cope with those stressors (Adams et al., 2016; Bensley et al., 2018; Jacobson et al., 2008; Kline, Ciccone, Falca-Dodson, Black, & Losonczy, 2011; Thomas et al., 2010). Given the culture of drinking in the military, individuals within a soldier's social network may influence his or her alcohol use. There is a strong body of evidence describing how social influence is associated with alcohol use, although most of that work has been conducted with college student and adolescent populations (Borsari & Carey, 2006; Jackson, Denny, & Ameratunga, 2014). In this study, we apply social influence theories toward understanding alcohol use among military personnel; our goal is to examine how social network characteristics are linked to alcohol use among Army Reserve and National Guard (R/NG) soldiers.

Alcohol Use in the Military

Previous research has described the social nature of military alcohol culture, which includes communal drinking rituals and drinking as a way to let loose and promote bonding (Ames, Cunradi, Moore, & Stern, 2007). Military personnel often perceive that their military-affiliated peers drink more than they actually do and more than civilians, indicating the normalization of alcohol use in the military (Pedersen, Marshall, Schell, & Neighbors, 2016). Alcohol use may also be viewed as a way for military personnel to cope with stressors, such as trauma from deployment experiences and difficulties with reintegration back into civilian life (Adler, Britt, Castro, McGurk, & Bliese, 2011; Ames et al., 2007; Mohr, McCabe, Haverly, Hammer, & Carlson, 2018; Young, Pedersen, Pearson, & Neighbors, 2018). One qualitative study examining personnel's perspectives of the military drinking climate shows that, in addition to personnel who drink for social

or recreational reasons, there is a subset of individuals who drink to cope with stress, sometimes alone (Poehlman et al., 2011). Alcohol is widely available to soldiers, with high concentrations of bars and liquor stores on and near military bases and specially discounted alcohol prices meant to acknowledge personnel for their military service. Such factors in the social environment contribute to alcohol misuse (Woodruff, Hurtado, & Simon-Arndt, 2018; Woodruff, Hurtado, Simon-Arndt, & Lawrenz, 2018).

Social Influence Theory & Alcohol Use Among Soldiers

Given the social nature of alcohol use in the military, identifying how social relationships – in conjunction with other individual-level characteristics and stressors – shape soldier alcohol use can yield important insights that can be used to address problem drinking in the military (Link & Phelan, 1995). We apply social influence theory to examine how social networks impact alcohol use among military personnel. Social influence theory provides a framework to explain how individuals are influenced by their social network to conform to group-level behavior patterns (Turner, 1991). Social influence suggests that there are active and passive pathways of influence on alcohol use; active elements include direct offers to use alcohol, whereas passive elements focus on norms and modeling, such as observation of drinking behaviors and perceptions of what is considered normal alcohol use by peers (Graham, Marks, & Hansen, 1991; Wood, Read, Palfai, & Stevenson, 2001).

Influences on alcohol use may come from multiple sources, including marital partners and peers. It is well established that partners influence one another through mirroring one another's drinking behaviors (Leonard & Das Eiden, 1999; Leonard & Homish, 2008). There is a strong body of research on peer social influence and alcohol

use among college students (Rinker, Krieger, & Neighbors, 2016; Wood et al., 2001), adolescents (Hawkins, Catalano, & Miller, 1992; Leung, Toumbourou, & Hemphill, 2014), and civilian adults (Rosenquist, Murabito, Fowler, & Christakis, 2010), and that work shows that peers' drinking behaviors are correlated with individuals' drinking behaviors. Social network characteristics increase the likelihood of alcohol use by the individual. Alcohol misuse is more common among those whose social networks are comprised of peers who engage in heavy drinking (Delucchi, Matzger, & Weisner, 2008; Lau-Barraco & Collins, 2011), and among those whose social network includes people who are considered "drinking buddies," (i.e., people with whom an individual engages in alcohol-related outings at bars or clubs) (Homish & Leonard, 2008; Leonard & Mudar, 2003; Reifman, Watson, & McCourt, 2006).

Drinking with Military-Affiliated Peers and Alcohol Use

Drinking with peers who are in the military may impact soldiers' drinking in different ways than drinking with peers who are not in the military. There is limited research in this area, although some studies provide initial insight. One study examining social network effects on mental health outcomes suggests that soldiers who report mostly socializing with military-affiliated peers may be more likely to report alcohol misuse (Hatch et al., 2013). In addition, research has shown that military-affiliated peers are viewed as essential support for coping with military stress because they more fully understand the unique aspects of the military experience (Ahern et al., 2015; Goldmann et al., 2012; Griffith, 2015; Hinojosa & Hinojosa, 2011). Thus, social support by military peers might be protective in light of alcohol use. Still other research has suggested that military peers may serve multiple roles, with alcohol misuse being a result of personnel

seeking support from military peers through drinking (Ames et al., 2007; Browne et al., 2008). We examine social influence on soldiers' alcohol use, with attention to whether or not peers are military-affiliated; results will enhance our understanding of how military-affiliated peers' drinking impacts alcohol use.

Army Reserve and National Guard (R/NG) Personnel

Previous research on military social influence on drinking has been focused on Active Duty personnel (Ames & Cunradi, 2004; Poehlman et al., 2011), and Reserve and National Guard (R/NG) personnel warrant separate examination. R/NG personnel serve one weekend per month and take part in training, but they are not in the military full-time like Active Duty personnel (La Bash, Vogt, King, & King, 2009). They are embedded in both the civilian and military worlds, typically with full-time civilian jobs and limited military involvement, and they may deal with role ambiguity (Garsten, 1999; Institute of Medicine, 2013). Like Active Duty personnel, R/NG personnel are eligible for deployment and encounter combat situations at approximately the same rate (Milliken, Auchterlonie, & Hoge, 2007; Thomas et al., 2010), which means they are also at risk for trauma and post-deployment stresses that might result in maladaptive coping. R/NG populations are of particular interest for alcohol use as a behavioral health issue (Thomas et al., 2010) and may be more likely to develop alcohol use disorders than Active Duty personnel (14.5% vs 11.7%), although the two groups do not appear to differ in their experience of other mental health outcomes such as PTSD and depression (Cohen, Fink, Sampson, & Galea, 2015). Because of R/NG personnel's unique split between military and civilian life, research is needed to understand their social environment with regard to drinking.

The Current Study

Despite the recognition of alcohol use as a norm in the military, there has not been an interpersonal level examination of the specific social characteristics that are associated with negative alcohol outcomes in military personnel. In addition, previous military research suggests that military-affiliated peers could influence alcohol use positively or negatively; an issue that this study will further clarify. Using data from a sample of Army R/NG couples, the objectives of this study are to: (a) describe characteristics of Army R/NG soldiers' social ties and social networks, including drinking behaviors and military affiliation; and (b) examine how social network characteristics are associated with soldier alcohol use. We also identify which social network characteristics are associated with soldier alcohol use by previous deployment history.

6.3 Methods

6.3.1 Participants and procedure

Current data are from the baseline assessment of Operation: SAFETY (Soldiers And Families Excelling Through the Years), a longitudinal study that is broadly focused on the health and wellbeing of Army R/NG soldiers and their partners (Anderson Goodell, Homish, & Homish, 2018; Heavey, Homish, Goodell, & Homish, 2017; Hoopsick, Vest, Homish, & Homish, 2017; Kozlowski, Homish, & Homish, 2017; Vest, Heavey, Homish, & Homish, 2017). The State University of New York at Buffalo's Institutional Review Board and the Army Human Research Protections Office, Office of the Chief – Army Reserve, and the Adjutant General of the National Guard all approved and vetted the Operation: SAFETY protocol. In addition, the study received a certificate

of confidentiality from the US Department of Health and Human Services to protect participant information.

The Operation: SAFETY study recruited participants over a 15-month period (Summer 2014 to Fall 2015) from 47 Army R/NG units in upstate New York. During their training weekends, soldiers were presented with a study overview and confidentiality procedures, and then were invited to complete a brief screening form to assess whether they were eligible to participate. After completing the screening, soldiers were provided with information to take home and share with their partner to accurately explain the study. Following the in-person screening, all soldiers were contacted within a week about whether they were eligible for the study. Eligibility for Operation: SAFETY was based on six inclusion criteria: (a) the couple is married or living as married; (b) one member of the couple is a current Army R/NG soldier; (c) the soldier is between the ages of 18 and 45; (d) both partners have had at least one alcoholic beverage in the past year; (e) both partners are able to speak and understand English; and (f) both partners are willing and able to participate.

A total of 731 couples were considered eligible for the study, and of those, 572 (78%) agreed to participate, with 83% of those (n = 472) completing at least a partial baseline survey. A final total of 411 couples had both partners who completed the entire baseline survey, and 30 were dual-military where both partners were in the military, resulting in 441 soldiers and 381 civilian partners. Couples where a civilian partner screened for the study (n = 11) were less likely to enroll ($p < .001$). No differences existed on soldier eligibility criteria as well as other preventive health screening variables

(e.g., routine physical and exercise frequency) between those who enrolled and completed versus those who enrolled and did not complete.

The current work uses data on both current soldiers ($n = 421$) and individuals that soldiers reported to be important social ties in the past year ($n = 2637$). Social tie data comes from a social network inventory included in the Operation: SAFETY baseline survey. The social tie data are egocentric, meaning soldiers reported on a range of characteristics for each of their social ties (Marsden, 2011).

6.3.2 Measures

Outcome Variable: Current Alcohol Use

Soldiers' current alcohol use was assessed as the outcome of interest using the Alcohol Use Disorders Identification Test (AUDIT; Babor & Del Boca, 1992; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The AUDIT is a 10-item measure with each item measured on a 5-point Likert scale from 0 to 4, and the summed scale score ranges from 0 to 40. Higher scores indicate greater alcohol use severity (Cronbach's $\alpha_{male} = 0.76$ and $\alpha_{female} = 0.80$).

Social Tie Characteristics

The current study examined eight social tie characteristics of interest. All characteristics were examined using egocentric data from a social network inventory of soldiers' social ties. Social ties were individuals who a soldier considered to be "important to [him or her] in one way or another during the past year" in relation to any of the following: providing emotional support, socializing regularly, helping with practical or financial problems, or supporting the respondent. Soldiers reported on up to 24 important people as their social ties and answered questions relating to the eight

characteristics of interest for each tie (Leonard & Homish, 2008). For analytic purposes, all characteristics were also aggregated at the soldier level to reflect the total number of ties or average within a social network.

The social tie characteristics included: military affiliation, substance misuse, drinking influence, sex, and support roles (i.e., family members and closeness with ties). Social tie substance misuse was addressed for alcohol and illicit drugs. Drinking influence was measured by days drinking with social ties and by whether ties were considered to be "drinking buddies" in the past year.

1. *Military affiliation*. Military affiliation was determined based on whether or not a social tie was "currently in the military."
2. *Heavy drinking.* A social tie's general drinking pattern in the past year was considered "heavy" if he or she was considered by the soldier to be a "frequent or heavy social drinker," "problem drinker," or "alcoholic."
3. *Illicit drug use.* A social tie was categorized as engaging in illicit drug use if he or she had any use of illicit drugs in the past year. Although it is not prevalent in military populations, illicit drug use was examined because it is still possible that social ties could engage in use, with the most common substance being marijuana (Bucher, 2012).
4. *Days drinking*. Days drinking between a soldier and social tie was measured according to how many days during "a typical 30-day period" a soldier drank with each tie.
5. *Drinking buddy*. A social tie who was considered a "drinking buddy" was someone that the soldier "got together with on a regular basis to do

activities that centered around drinking and/or going to bars or nightclubs" (Lau-Barraco & Collins, 2011).

6. *Sex.* A binary variable was used to note whether each social tie was male or female.

7. *Family member.* Family member status was captured by whether or not each social tie was a soldier's family member. Family members included the following: child/stepchild, parent, sibling, extended family member, or in-law.

8. *Close tie.* Closeness between a soldier and social tie was drawn from an item asking about how close the soldier felt to each social tie, with categorical responses of "not at all," "a little," "a medium amount," and "a lot." A social tie was considered a close tie if a soldier reported that he or she felt either "a medium amount" or "a lot" of closeness toward the tie.

Index Soldier Characteristics

In addition to social tie characteristics, the following measures of soldier-specific characteristics were included as predictors in the study analyses.

Sociodemographic and military characteristics. Sociodemographic characteristics for the soldier included age, sex, education (high school or some college versus college completion), and presence of any children in the home. Military characteristics included length of time in the military and whether a soldier had ever been deployed.

Posttraumatic stress disorder (PTSD). PTSD was measured according to past 30-day PTSD symptom severity using the PTSD Checklist (PCL-5). The PCL-5 is a 20-item

instrument with scores ranging from 0 to 80 (Cronbach's α_{male} = and α_{female} = 0.95). Higher scores indicate greater symptom severity (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). The PCL-5 has been adapted from the original PCL to map on to DSM-5 criteria (Bovin et al., 2015; Weathers, Litz, Herman, Huska, & Keane, 1993).

Marital partner's alcohol use. Marital partner's alcohol use was measured using the continuous AUDIT score (Cronbach's α_{male} = 0.76 and α_{female} = 0.80; Babor & Del Boca, 1992). Because the survey was administered to both soldiers and their partners, partner's alcohol use was reported on directly by the partner rather than through the soldier respondent.

Marital satisfaction. Marital satisfaction was measured using the Marital Adjustment Test (MAT). The MAT is a 15-item scale scored from 2 to 158, with greater scores indicating more satisfied marriages (Cronbach's α_{male} = 0.76 and α_{female} = 0.79; Locke & Wallace, 1959). Items pertain to overall happiness with the current relationship and concordance between the respondent and his or her partner on matters such as finances, friends, sexual relations, leisure time, and handling of disagreements.

6.3.3 Statistical analyses

Current analyses are based on a sample of 421 current Army R/NG soldiers and their social ties (n = 2637). Descriptive analyses were conducted to examine means, frequencies, distributions, and intercorrelations of all variables of interest. We also examined summary statistics for the social ties that examined the concurrence of roles – that is, the degree of association of certain characteristics with one another – according to all combinations of the eight social tie characteristics.

We used negative binomial regression models to examine the unadjusted associations between AUDIT score and each aggregate social network characteristic and soldier characteristic. Negative binomial models were used to account for overdispersion in the data (Byers, Allore, Gill, & Peduzzi, 2003). Multivariable negative binomial regression models containing all aggregate social network variables and soldier variables were used to examine adjusted effects on AUDIT score.

An additional set of multivariable negative binomial models examined measures of association by deployment status for males only. Analyses by deployment status were not conducted for female soldiers due to the small sample size of females who had ever been deployed (n = 26). All data management, descriptive analyses, and regression analyses were conducted using Stata 14.2 (StataCorp, 2015).

6.4 Results

6.4.1 Soldier characteristics

The current analyses are based on a cross-sectional subsample of 421 current Army R/NG soldiers (353 males and 68 females) who reported having individuals in their social network beyond a marital partner. Table 6.1 contains a summary of sociodemographic characteristics. The average age was 31.4 years (standard deviation [*SD*] = 6.5), and males were marginally significantly older than females by approximately two years (p = .05). The majority of soldiers were non-Hispanic White (79.6%; n = 335). More females had completed at least a four-year degree than males (41.2% vs 28.0%; p = .03). Approximately 62% of all soldiers (n = 259) had children in the home. When examining military characteristics, the large majority of soldiers was enlisted (84.1%; n = 354). Male soldiers reported an average of 9.9 years spent serving in the military, which

was significantly longer than for females (7.8 years, $p = .01$). Significantly more males had ever been deployed than females (64.9% vs 38.2%, $p < .001$), and 42% of all deployed soldiers had been deployed more than once. The average AUDIT score was 5, and scores were significantly higher among male soldiers than female ($p = .02$); AUDIT scores were significantly lower for partners of male soldiers compared to partners of female soldiers (3.5 vs 5.2, $p < .001$).

6.4.2 Social network characteristics

Soldier respondents reported a total of 2,637 social ties, with an average of 6 ties and a range of 1 to 24. Table 6.2 shows the prevalence of social network characteristics of interest for all ties by soldier sex. Female soldiers' ties had a significantly higher proportion of female ties (66.9% vs 32.0%), family members (54.9% vs 48.9%), and close ties (84.3% vs 77.0%) relative to male soldiers' ties. Male soldiers' ties had higher proportions of ties who engaged in heavy drinking and who were considered drinking buddies (8.9% vs 6.8% and 13.6% vs 10.4%, respectively). For other substance misuse, 6% ($n = 154$) of ties used illicit drugs, and soldiers drank with their ties on an average of 1.4 days in a typical 30-day period. About 14% of all ties were currently in the military, and this estimate was similar across males and females.

Table 6.1 Soldier Characteristics (n = 421), % (n) or m (SD)

Characteristics	Total (N = 421)	Males (n = 353; 83.8%)	Females (n = 68; 16.2%)	p
Sociodemographic				
Age	31.4 (6.5)	31.7 (6.6)	29.9 (5.5)	.05
Race/Ethnicity				
Non-Hispanic White	79.6% (335)	79.3% (280)	80.9% (55)	.53
Non-Hispanic Black	5.5% (23)	6.0% (21)	2.9% (2)	
Hispanic	8.3% (35)	8.8% (31)	5.9% (4)	
Other[a]	4.8% (20)	4.3% (15)	7.4% (5)	
Education level[b]				
High school or some college	69.8% (294)	72.0% (254)	58.8% (40	.03
College completion	30.2% (127)	28.0% (99)	41.2% (28)	
Any children in the home[c]	61.5% (259)	61.5% (217)	61.8% (42)	.91
Military				
Rank				
Enlisted	84.1% (354)	84.4% (298)	82.4% (56)	.06
Officer	15.2% (64)	15.3% (54)	14.7% (10)	
Years served in military	9.5 (6.0)	9.9 (6.2)	7.8 (5.0)	.01
Ever deployed	60.6% (255)	64.9% (229)	38.2% (26)	<.001
Number of deployments				
0	39.4% (166)	35.1% (124)	61.8% (42)	.10
1	35.4% (149)	37.4% (132)	25.0% (17)	
2	16.9% (71)	17.6% (62)	13.2% (9)	
3+	8.3% (35)	9.9% (35)	0.0% (0)	
Psychosocial				
AUDIT score	4.6 (3.8)	4.8 (3.8)	3.6 (3.4)	.02
Partner's AUDIT score	3.8 (3.6)	3.5 (3.5)	5.2 (3.8)	<.001
PTSD symptoms	9.4 (11.6)	9.1 (11.6)	10.6 (11.3)	.33
Marital satisfaction	112.5 (26.9)	112.4 (27.5)	112.5 (23.7)	.99

Note. Categorical totals may not equal column totals due to missing data. *SD* = standard deviation; PTSD = posttraumatic stress disorder.
[a]Includes American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, more than one race, and other specified races. [b]"Some College" includes Trade school, Associate degrees, and other two-year technical degrees, and "College completion" includes four-year degrees and graduate degrees. [c]Includes biological, adopted, foster, and stepchildren.

Table 6.2 also shows aggregate social network characteristics (numbers of ties or average days drinking across ties within a soldier's network) averaged for all soldiers and by soldier sex. Reflecting the results above for the entire pool of female soldiers' ties, female soldiers had a higher average number of female ties in their networks compared to males (4.8 vs 2.0, $p < .001$), and also had a higher number of family members (3.9 vs 3.0, $p = .004$). Female soldiers also had more close ties in their networks (6.0 vs 4.7, $p = .002$). For substance misuse, all soldiers had less than one tie on average who had a heavy-drinking pattern ($m = 0.5$, $SD = 0.9$) and less than one tie who used illicit drugs in the past year ($m = 0.4$, $SD = 0.9$). No differences were observed across soldier sex for either substance misuse characteristic. Male soldiers spent an average of 1.4 days drinking with the social ties in their networks, while female soldiers spent marginally less time drinking with their ties (1 day; $p = .08$). Finally, all soldiers reported having approximately one tie that they considered to be a drinking buddy ($m = 0.8$, $SD = 1.4$) and an average of one tie who was currently in the military ($m = 0.9$, $SD = 1.2$).

Table 6.2 Characteristics of Social Ties and Soldiers' Social Networks, by Soldier Sex

Pooled social ties, % (n)	All Ties (N = 2637)	Male Soldiers (n = 2154; 81.1%)	Female Soldiers (n = 483; 18.9%)	p
Female	38.4% (1013)	32.0% (690)	66.9% (323)	<.001
Family member	50.0% (1318)	48.9% (1053)	54.9% (265)	.02
Close tie	78.3% (2065)	77.0% (1658)	84.3% (407)	<.01
Heavy drinking	8.5% (225)	8.9% (192)	6.8% (33)	.03
Illicit drug use	5.8% (154)	6.2% (133)	4.4% (21)	.28
Average days social drinking[a], *m (SD)*	1.4 (2.7)	1.4 (2.8)	1.3 (2.1)	.59
Drinking buddy	13.0% (342)	13.6% (292)	10.4% (50)	.03
Military affiliation	14.1% (373)	14.3% (307)	13.7% (66)	.31
Network characteristics, m (SD)[b]	All Soldiers (N = 421)	Male Soldiers (n = 353; 83.8%)	Female Soldiers (n = 68; 16.2%)	p
Females	2.4 (2.1)	2.0 (1.7)	4.8 (2.7)	<.001
Family members	3.1 (2.4)	3.0 (2.4)	3.9 (2.4)	<.01
Close ties	4.9 (3.2)	4.7 (3.1)	6.0 (3.4)	<.01
Heavy-drinking ties	0.5 (0.9)	0.5 (1.0)	0.5 (0.7)	.64
Illicit drug-using ties	0.4 (0.9)	0.4 (1.0)	0.3 (0.6)	.58
Average days social drinking with ties[a]	1.3 (1.7)	1.4 (1.8)	1.0 (1.3)	.08
Drinking buddies	0.8 (1.4)	0.8 (1.4)	0.7 (1.3)	.61
Military-affiliated ties	0.9 (1.2)	0.9 (1.3)	1.0 (1.2)	.54

Note. Characteristic-specific percentages may not exactly correspond to column totals due to missing data. *SD* = standard deviation. [a]Past 30 days. [b]Measures represent the numbers of ties with each characteristic of interest per soldier, averaged over all soldiers. The one exception is "Average days social drinking with ties," which is the average number of days drinking across ties per soldier averaged over all soldiers.

6.4.3 Social tie role descriptions

Table 6.3 shows the prevalence of all social ties with the eight characteristics of interest as well as the concurrence of pairs of characteristics. Of the female social ties, only 4% to 6% overlapped with either of the substance misuse types as well as being drinking buddies. Family members ties showed similar results, with related proportions of between 3% and 7%. A majority of family members, approximately 81%, were considered close ties. Of the heavy drinking ties, approximately 32% were also

considered drinking buddies, and 20% also engaged in past-year illicit drug use. Approximately 19% of ties that were considered drinking buddies were female, 21% engaged in heavy drinking as their typical past-year drinking pattern, and 23% were military-affiliated. Approximately 71% of drinking buddies drank with their associated soldiers at least twice a month. Ties who engaged in two or more days of social drinking with soldiers made up at least 21% of each of the other seven social tie characteristic groups. Of the 373 ties that were military affiliated, less than 8% engaged in heavy drinking and less than 1% used illicit drugs in the past year. One-fifth (21.2%, $n = 79$) were considered drinking buddies.

6.4.4 Associations between social network characteristics and alcohol use

Unadjusted and adjusted regression models examined the relationships of social network and soldier characteristics with alcohol use (Table 6.4). The unadjusted estimates of the associations show that the following network characteristics were significantly associated with greater alcohol use: more ties with past-year heavy drinking, more ties who were considered drinking buddies, and more average days drinking between social ties and soldiers (Table 6.4, Model 1). The same three social tie characteristics remained statistically significant after adjustment for all eight social network characteristics of interest and soldier characteristics (Model 2). There was an 8% increase in the adjusted risk ratio (aRR) for every additional tie with a heavy drinking pattern in a soldier's social network (aRR = 1.08, 95% confidence interval [CI] [1.01, 1.16], $p = .04$), a 12% increase for every additional tie in a soldier's network who was considered a drinking buddy (aRR = 1.12, 95% CI [1.06, 1.18], $p < .001$), and a 6%

Table 6.3 Prevalence and Concurrence of Social Tie Characteristics (n = 2637), n (%)

			Support roles		Substance misuse		Drinking influence		
	All social ties[a]	Female	Family member	Close tie	Heavy drinking	Illicit drug use	Drinking buddy	2+ days drinking	Military affiliation
Female	1013 (38.4)	-	664 (50.4)	814 (39.4)	41 (18.2)	40 (26.0)	65 (19.0)	215 (29.5)	64 (17.2)
Family member	1318 (50.0)	664 (65.5)	-	1061 (51.4)	97 (43.1)	63 (40.9)	68 (19.9)	321 (44.1)	35 (9.4)
Close tie	2065 (78.3)	814 (80.4)	1061 (80.5)	-	173 (76.9)	128 (83.1)	284 (83.0)	616 (84.6)	291 (78.0)
Heavy drinking	225 (8.5)	41 (4.0)	97 (7.4)	173 (8.4)	-	44 (28.6)	73 (21.3)	111 (15.2)	28 (7.5)
Illicit drug use	154 (5.8)	40 (3.9)	63 (4.8)	128 (6.2)	44 (19.6)	-	44 (12.9)	70 (9.6)	2 (0.5)
Drinking buddy	342 (13.0)	65 (6.4)	68 (5.2)	284 (13.8)	73 (32.4)	44 (28.6)	-	245 (33.7)	79 (21.2)
2+ days drinking	728 (27.6)	215 (21.2)	321 (24.4)	616 (29.8)	111 (49.3)	70 (45.5)	245 (71.6)	-	111 (29.8)
Military affiliation	373 (14.1)	64 (6.3)	35 (2.6)	292 (14.1)	28 (12.4)	2 (1.3)	79 (23.1)	111 (15.2)	-
Total	2637	1013	1318	2065	225	154	342	728	373

[a]Characteristic-specific percentages may not exactly correspond to total number of ties, due to missing data.

increase associated with greater average days spent drinking between social ties and soldiers (aRR = 1.06, 95% CI [1.02, 1.10], p = .003).

Models 1 and 2 also describe associations between soldiers' characteristics and their alcohol use. Results show that ever being deployed, higher levels of partner alcohol use, and higher PCL scores (indicating greater PTSD symptoms) were associated with increased risk for soldier alcohol use. Having children at home and higher marital satisfaction were associated with decreased risk. Being female was marginally associated with lower risk for alcohol use.

Deployment status was significantly associated with AUDIT score in the overall adjusted model (Model 2), and we examined the relationship between alcohol use and social network characteristics of among males by deployment history (Table 6.4, Models 3 and 4). Deployed soldiers' results (Model 3) largely reflected what was observed for all male soldiers. A main difference was the significant protective effect military-affiliated networks had on alcohol use; for each additional military-affiliated tie in a network, male soldiers' AUDIT scores decreased by 8% (aRR = 0.92, 95% CI [0.86, 0.99], p = .02). Female ties in a network were also protective of alcohol use, with each additional female tie being associated with a 7% decrease in AUDIT score (aRR = 0.93, 95% CI [0.86, 0.99], p = .04).

Among soldiers who had never been deployed (Model 4), having more drinking buddies and increased days drinking with ties were associated with higher AUDIT scores. Having more family members as ties was also associated with higher AUDIT scores (aRR = 1.10, 95% CI [1.01, 1.19], p = .03), whereas having more close ties and children at home were associated with lower AUDIT scores (aRR = 0.93, 95% [0.88, 0.99], p =

.02; and, aRR = 0.61, 95% [0.45, 0.83], p = .002, respectively). Unlike with deployed soldiers, partner's drinking was not a significant characteristic in contributing to alcohol use.

Table 6.4 Associations of Social Network and Soldier Characteristics with Alcohol Use

Characteristics	Model 1: Unadjusted RR (95% CI)	Model 2: Total sample aRR (95% CI)	Model 3: Deployed[a] aRR (95% CI)	Model 4: Nondeployed[a] aRR (95% CI)
Social networks				
Female	0.99 (0.96, 1.02)	0.96 (0.91, 1.01)	0.93 (0.86, 0.99)*	0.95 (0.85, 1.06)
Family member	1.01 (0.98, 1.04)	1.04 (1.00, 1.08)+	1.03 (0.98, 1.08)	1.10 (1.01, 1.19)*
Close tie	1.01 (0.99, 1.04)	0.99 (0.99, 1.00)	1.01 (0.98, 1.05)	0.93 (0.88, 0.99)*
Heavy drinking	1.19 (1.10, 1.27)***	1.08 (1.01, 1.16)*	1.09 (1.00, 1.19)+	1.08 (0.94, 1.25)
Illicit drug use	1.12 (1.03, 1.21)**	1.03 (0.96, 1.02)	1.04 (0.94, 1.16)	1.01 (0.90, 1.13)
Drinking buddy	1.18 (1.12, 1.24)***	1.12 (1.06, 1.18)***	1.10 (1.03, 1.17)**	1.13 (1.01, 1.27)*
Days drinking	1.12 (1.07, 1.17)***	1.06 (1.02, 1.10)**	1.05 (1.01, 1.10)*	1.13 (1.04, 1.22)**
Military affiliation	1.01 (0.95, 1.07)	0.95 (0.90, 1.01)+	0.92 (0.86, 0.99)*	0.99 (0.86, 1.14)
Soldiers				
Age	0.99 (0.98, 1.01)	1.00 (0.99, 1.02)	1.00 (0.98, 1.03)	1.02 (0.99, 1.05)
Female	0.75 (0.62, 0.92)**	0.82 (0.66, 1.02)+	--	--
College education[b]	0.98 (0.84, 1.14)	1.06 (0.92, 1.22)	0.92 (0.76, 1.11)	1.22 (0.94, 1.58)
Children in the home	0.81 (0.70, 0.93)**	0.84 (0.72, 0.98)*	0.93 (0.76, 1.13)	0.61 (0.45, 0.83)**
Years served	1.00 (0.99, 1.01)	0.99 (0.98, 1.01)	0.99 (0.97, 1.02)	0.99 (0.96, 1.03)
Ever deployed	1.18 (1.02, 1.36)*	1.20 (1.02, 1.40)*	--	--
Partner drinking	1.05 (1.03, 1.07)***	1.05 (1.03, 1.06)***	1.05 (1.03, 1.07)***	1.03 (0.99, 1.07)
PTSD symptoms	1.01 (1.01, 1.02)***	1.01 (1.01, 1.01)*	1.01 (1.01, 1.02)*	1.01 (1.00, 1.02)
Marital satisfaction	0.99 (0.99, 1.00)***	0.99 (0.99, 0.99)**	0.99 (0.99, 0.99)*	0.99 (0.99, 0.99)*

Note. PTSD = posttraumatic stress disorder.
[a]Includes only male soldiers. [b]Reference was "high school or some college."
$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

6.5 Discussion

6.5.1 Social networks of R/NG soldiers

The purpose of the current study was to describe Army R/NG soldiers' social ties and networks, and examine how social network characteristics are associated with alcohol use. According to the current findings, less than one in 10 social ties had a regular past-year drinking pattern that was considered heavy, and less than one-fifth of social ties were considered drinking buddies. Male soldiers reported more heavy-drinking and drinking buddy ties compared to female soldiers. The prevalence of military-affiliated ties was 14%, substantially lower than what has been observed in previous military work showing social networks that were over 50% military peers on average (Hatch et al., 2013). Because the previous estimate is based on full-time service personnel and those who were full-time but had left the service, this discrepancy speaks to the idea that the military involvement of R/NG personnel's social networks may be different and less prevalent compared to other military populations. These findings expand existing knowledge of R/NG social identity and military alcohol culture.

This work also examined differences in types of ties when comparing social networks of male and female soldiers. Female soldiers had greater average numbers of female ties, family members, and close ties, and male soldiers had greater average numbers of ties that were engaged in heavy drinking and considered drinking buddies. These findings are in line with other civilian literature that suggests that males have more friends who drink in their social networks compared to females (Mohr, Averna, Kenny, & Del Boca, 2001). In terms of ties' concurrent roles, female ties and family members had low prevalences of substance misuse and being considered drinking buddies. These

results altogether suggest that female soldiers may have more ties who are typically less likely to be engaged in alcohol misuse or illicit drug use and ties who the soldiers may drink with.

With social tie roles and military drinking culture in mind, the overlaps of military affiliation, drinking buddies, and heavy-drinking pattern were all relatively low. Related to the low concurrence of drinking buddy status and past-year heavy drinking, just because a tie is someone who a soldier drinks with, it does not mean that the tie is a heavy drinker. These findings reflect previous civilian work that found that drinking buddies tended to be moderate social drinkers rather than heavy drinkers (Lau-Barraco & Linden, 2014). Furthermore, almost three-quarters of drinking buddy ties drank with their soldier respondent at least twice per month. Post-hoc analyses to examine this point further found that drinking buddies drank with their soldier respondent an average of 3.4 days per month, compared to one day for ties not considered to be drinking buddies ($p <$ .001). These findings together help to conceptualize what military drinking culture is, at least for R/NG personnel.

6.5.2 Influences of social networks on soldier alcohol use

Concerning the regression analyses, regardless of deployment status, increasing numbers of drinking buddies in a soldier's social network were associated with increasing AUDIT score, even when accounting for other influences such as partner drinking. This, coupled with the low rate of overlap of drinking buddies and heavy-drinking pattern, is reflective of previous work proposing that influence on drinking is not necessarily a product of ties' drinking level but more of how a tie is categorized as someone to drink with in the eyes of the individual (Leonard, Kearns, & Mudar, 2000; Leonard & Mudar,

2003). A key mechanism between having drinking buddy ties and individuals' alcohol use is the expectancy of social drinking facilitation that individuals have of such ties (Jones, Corbin, & Fromme, 2001; Lau-Barraco, Braitman, Leonard, & Padilla, 2012). The findings that number of drinking buddies was significant across all groups and average days drinking with drinking buddies was higher than those for non-drinking buddies indicate that, similar to expectancy of socializing, the act of physically drinking together with drinking buddies may be a key component of the relationship with soldier alcohol use. Future work should focus on further examining predictors of drinking between soldiers and social ties as a way to understand this behavioral-focused link to individual-level alcohol misuse outcomes. These results may be useful for practical application by military leadership to focus on providing opportunities for personnel to socialize without alcohol involved.

When looking more closely at deployed status, we found that for deployed males, the number of military-affiliated ties appeared to be protective against increased alcohol use. This coincides with the idea that military peers might be supportive against negative alcohol outcomes since they can also understand the military experience and help fellow soldiers process trauma and avoid feelings of emotional isolation (Ahern et al., 2015; Hinojosa & Hinojosa, 2011). In this deployed group, female ties were also associated with lower AUDIT scores. So, although males were found to have fewer female ties in their networks, the female ties they do have appear to exert a protective effect on alcohol use. This idea coincides with the fact that females may be viewed as more modest with drinking behaviors than males and that people base their own behaviors off of how they view others' behaviors (Eagly, Wood, & Diekman, 2000; Turner, 1991).

For nondeployed male soldiers, family members were associated with higher AUDIT scores, and close social ties were protective, with no significant effects of female or military ties. These points, along with the protective nature of having children in the home, might be explained in two ways. First, nondeployed R/NG soldiers typically have served in the military for less time and may be less socialized into military culture than their deployed counterparts (Anderson Goodell et al., 2018). Thus, they may be more influenced by factors that they are more familiar with from their civilian lives, including family members and having children, and less so by military ties. In addition, previous work shows that even when controlling for PTSD, deployed soldiers deal with post-deployment anger and emotions that are associated with increased alcohol use (Adler et al., 2011). In our results for deployed soldiers, we see risk for alcohol use associated with PTSD symptoms and protective effects of female ties and military ties. Such protective effects would not be seen in nondeployed soldiers because they may not have this unique set of stresses to elicit such need for protection.

Concerning soldier characteristics, partner drinking had a significant effect on alcohol use, even when considering the range of social network characteristics. This finding has been reflected in previous research that has discussed both peers and partners being influences on negative alcohol outcomes (Leonard & Homish, 2008). In addition, we see increased marital satisfaction as protective of alcohol use. These soldier characteristics along with the results for social network characteristics provide a more comprehensive picture of interpersonal influence on R/NG alcohol use through effects of social and marital characteristics. Future research should focus on examining in more detail whether combinations of characteristics elicit stronger effects on alcohol use

outcomes and whether there are similarities between these results and those for Active Duty personnel as well as civilian partners.

6.5.3 Limitations

These findings should be considered in light of their limitations. First, the reader should be careful in his or her interpretation of the findings for relationships between social network characteristics and soldier alcohol use. The use of aggregated variables, as has been done for this study, means that interpretations and conclusions can only be made about the social network as a whole and not about effects of individual social ties. Similarly, this study does not capture the heterogeneity of individual social ties outside of overlap of two characteristics at a time (Wellman & Frank, 2001). We recommend future work to look specifically at unique and joint effects of individual social tie characteristics on soldier alcohol use outcomes. In addition, because the data are cross-sectional, we cannot infer causality from the observed associations between aggregate network characteristics and alcohol use. Two possible explanations for the association are social selection, where soldiers who have issues with drinking are seeking out ties who are engaged in alcohol use or are considered drinking buddies, and socialization, where soldiers learn and mirror drinking behaviors from their drinking ties (McPherson, Smith-Lovin, & Cook, 2001; Steglich, Snijders, & Pearson, 2010). Either way, here our goal was to assess the presence of any notable associations, and longitudinal research should be pursued to help clarify temporality. For social ties, although the respondents could report a maximum of 24 social ties, there could have been issues with bringing to mind all relevant people. While it is not possible to confirm whether respondents named all of their possible important ties from memory, research shows that individuals are less likely

to forget close and reciprocal ties and those that are more recent and frequent contacts (Brewer, 2000). With this in mind, the surveys included prompts to help with recall of people who are important for different reasons, including emotional, practical, and social reasons. Finally, certain findings such as social network composition may not be generalizable beyond R/NG personnel. Since Active Duty personnel typically reside near military bases and are more immersed in military-connected social environments (e.g., peer groups, families), they may have a more prominent military drinking culture, with more military-affiliated peers who they drink with in a ritualized or recreational way (Ames & Cunradi, 2004).

6.5.4 Conclusions and implications

This study contributes new information on how social tie characteristics play protective and risk-related roles in influencing alcohol use by Army R/NG personnel. Findings show multiple active and passive characteristics that may be risky in their influence on alcohol use, including having drinking buddies, peers who drink heavily, and peers with whom soldiers are more frequently engaged in social drinking (Graham et al., 1991; Turner, 1991). These multiple risk factors, and their varied rates of overlap, suggest that more work is needed to uncover the unique and overlapping roles they play on alcohol use. From a social-ecological perspective, this information complements work that has been done to understand environmental factors that influence alcohol use culture in the military (Bronfenbrenner, 1994; Foran, Smith Slep, & Heyman, 2011; Sudhinaraset, Wigglesworth, & Takeuchi, 2016; Woodruff, Hurtado, & Simon-Arndt, 2018; Woodruff, Hurtado, Simon-Arndt, et al., 2018). The study also contributes to what is known about military alcohol culture, with the low prevalence of military-affiliated ties

among R/NG soldiers coupled with their protective relationship with soldier alcohol use among deployed males. The facts that R/NG personnel split their lives between civilian and military roles and typically live at a distance from their assigned military base may invite less opportunity to bond with other military peers (Vest, 2013). However, if R/NG personnel do have military peers, the supportive nature of the relationship appears to supersede the influence, perhaps because of lower proportions of military peers in the overall social network and the absence of concentrations of drinking establishments near base that emphasize alcohol use culture.

These findings serve to inform possible military-initiated interventions. Given that military peers are potentially protective in light of alcohol use, interventions might focus on bolstering more adaptive coping mechanisms through connecting military personnel to one another in small groups after particularly stressful times such as reintegration from deployment. Future research and intervention efforts in the Reserve and National Guard should also focus on understanding what factors predict R/NG drinking with social ties and changing perceptions of social drinking as a coping mechanism to help protect against negative alcohol use outcomes and associated problems.

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Chapter 7. Individual tie and social network characteristics that influence social drinking among Army Reserve and National Guard soldiers

7.1 Abstract

Background: Alcohol use is common among military personnel, and examination of predictors for social drinking is warranted, especially since social drinking is associated with subsequent alcohol-related problems. Existing military literature has typically focused on individual-level predictors of alcohol use. This chapter uses multilevel analytic methods to examine the effects of interpersonal predictors, in addition to individual predictors, on social drinking.

Methods: The current study included 421 soldiers and their 2,637 social ties. Egocentric social network data and multilevel linear regression models were used to estimate the associations of social tie and aggregate social network characteristics of interest (i.e., military affiliation, drinking buddy status, and heavy-drinking pattern) with frequency of social drinking between soldiers and their social ties in the past 30 days. Analyses also included two-way interactions to examine whether the relationships between social network characteristics and days social drinking differed based on deployment status.

Results: Within soldiers, social ties who were drinking buddies and those who had a heavy-drinking pattern were both associated with increased days social drinking between soldiers and ties. Similarly, for a given soldier, increasing proportions of drinking buddy ties and heavy-drinking ties in a social network were associated with additional days social drinking. The effect of increasing proportions of military ties on days of social drinking was significantly greater for deployed soldiers compared to nondeployed soldiers.

Conclusions: Findings from this study contribute to the social-ecological understanding of predictors of military alcohol use, and capture the heterogeneity of individual social ties' influence on social drinking in addition to social network contextual influences. Future interventions may focus on integrating military peers and larger social communities to more successfully engage soldiers to reduce their drinking.

7.2 Introduction

Alcohol use is common in the military; prevalence studies show that approximately 47% of military personnel report any binge drinking in the past month and 20% report weekly binge drinking in the past month (Bray, Brown, & Williams, 2013). Despite that there are risk factors for alcohol use at multiple levels of the social-ecological framework (Bronfenbrenner, 1994; Sudhinaraset, Wigglesworth, & Takeuchi, 2016), most research on military alcohol use focuses on individual-level factors such as demographic characteristics, stress, and posttraumatic stress disorder (PTSD; Adams et al., 2016; Bray et al., 2013; Schumm & Chard, 2012). Because military alcohol use can be a social behavior, this study examines how social tie and network characteristics relate to social drinking among military personnel (Ames, Cunradi, Moore, & Stern, 2007; Ames, Duke, Moore, & Cunradi, 2009).

The military's strong culture of alcohol use is embodied by communal and ritualized drinking and recreational use as a way for groups of military personnel to let loose from the stresses of military life (Ames et al., 2007). Alcohol use is also viewed as an outlet for coping with deployment and service-related trauma; this form of coping is done in groups as a means of bonding over mutual experiences (Jones & Fear, 2011; Poehlman et al., 2011). As has been observed for the drinking environment of college

students, there may be more socially permissive norms surrounding alcohol use in the military (Scott-Sheldon, Carey, & Carey, 2008; White et al., 2006).

Individual and Interpersonal Predictors of Military Alcohol Use

While alcohol use is typically viewed as a behavior that male personnel tend to engage in, drinking among females is of interest as well, especially given that about one in five military members is female (Department of Defense, 2017). Although female soldiers are less likely to misuse alcohol than males (Grossbard et al., 2017; Hawkins, Lapham, Kivlahan, & Bradley, 2010), they have similar rates of any past-month any use as males (82-85%), and they experience similar risk for dependence and productivity (Brown, Bray, & Hartzell, 2010; Department of Defense, 2013). There have been significant increases in rates of past-year alcohol use, high-risk drinking, and alcohol use disorder among all women over the last 15 years (Grant et al., 2017), suggesting that female soldiers' rates of use may be increasing as well. Female soldiers may also deal with unique stressors, such as gender-based exclusion and harassment that may make them more likely to use alcohol to cope (Gradus, Street, Kelly, & Stafford, 2008).

Military research has established connections between unhealthy alcohol use and other individual-level factors, including younger age, and experiences of combat and associated trauma (Bray et al., 2013; Institute of Medicine, 2013; Jacobson et al., 2008; Mattiko, Olmsted, Brown, & Bray, 2011; Wilk et al., 2010). PTSD has also been linked to alcohol use, through the mechanism of self-medication to deal with associated symptoms (Schumm & Chard, 2012). Thus, we will investigate how individual soldier characteristics, including sex, age, deployment history, and PTSD influence alcohol use.

Evidence for how interpersonal-level factors relate to alcohol misuse is less available in military literature. However, there is a strong body of research on peer social influence and alcohol use among college students (Rinker, Krieger, & Neighbors, 2016; Wood, Read, Palfai, & Stevenson, 2001), adolescents (Hawkins, Catalano, & Miller, 1992; Leung, Toumbourou, & Hemphill, 2014), and civilian adults (Rosenquist, Murabito, Fowler, & Christakis, 2010), and that work shows that peers' drinking behaviors are correlated with individuals' drinking behaviors. Alcohol misuse is more common among those whose social network includes peers who engage in heavy drinking (Delucchi, Matzger, & Weisner, 2008; Lau-Barraco & Collins, 2011), and among those whose social network includes people who are considered "drinking buddies," (i.e., people who are more likely to be moderate social drinkers, and with whom an individual engages in alcohol-related outings at bars or clubs) (Homish & Leonard, 2008; Lau-Barraco & Linden, 2014; Leonard & Mudar, 2003; Reifman, Watson, & McCourt, 2006).

In a previous study, we examined how characteristics of military personnel's social networks affect their alcohol use. Mirroring findings from civilian work, the findings showed that having more ties who engage in heavy-drinking and who are considered drinking buddies were each associated with increasing level of alcohol use (see Chapter 6). However, that study used aggregate variables for the number of ties with a given characteristic, e.g., the number of heavy-drinking ties in a soldier's network, as the predictors of interest. The use of aggregate social network variables allowed us to examine characteristics of social networks that may be associated with alcohol use but does not permit us to draw conclusions about the effects of characteristics at the social tie

level. In this study, we use multilevel analytic methods, which account for non-independence of social ties, to examine the effects of ties within a soldiers' social network on social drinking between soldiers and ties.

There have been a couple of military-specific studies that have examined whether military peers are protective or whether they exert risk for soldier alcohol use, and there are arguments for both. Military peers might be supportive against negative alcohol outcomes because they also understand the military experience and may help fellow personnel process trauma and avoid feelings of emotional isolation (Ahern et al., 2015; Hinojosa & Hinojosa, 2011). Our previous findings (Chapter 6) are consistent with this theory. We found that having more military peers in a social network was protective for male Reserve and National Guard (R/NG) soldiers who had been previously deployed, but not for those who had not been deployed. Hatch and colleagues (2013) observed that regular service personnel who reported that at least half of their social network ties were military-affiliated were more likely to engage in alcohol misuse.

Because these latter two studies are based on aggregate measures of ties in the social network, it remains unclear whether military-affiliated ties themselves are risk or protective factors in relation to alcohol misuse outcomes. To more fully address the question of how military-affiliated peers impact alcohol outcomes, we use multilevel models to examine military-affiliation as an individual social tie characteristic in addition to being an aggregate social network measure; this will enable us to understand variation in the effects of both.

Social Drinking in the Military

Engagement in drinking with other people, from here on called social drinking, should be examined in relation to social-level predictors. Most military research has examined alcohol use at the individual level; however, socially motivated alcohol use should also be considered to enhance our understanding of the overall picture of alcohol misuse in the military. Social drinking is associated with subsequent alcohol-related problems (e.g., findings from Chapter 6; Brooks-Russell, Simons-Morton, Haynie, Farhat, & Wang, 2014). In addition, having at least two days per month of social drinking between social ties and their associated soldiers was concurrent with other social tie drinking characteristics, such as drinking buddy status and heavy drinking pattern (see Chapter 6). Because social drinking may lead to alcohol misuse outcomes and is a common component of the soldier alcohol use experience, this study will examine interpersonal predictors specifically in light of social drinking.

The Current Study

Applying the social-ecological framework, this study examines the influences of interpersonal-level characteristics, such as those from peers, in conjunction with soldier-level influences on social drinking in the military. Social drinking is distinct from other alcohol use outcomes and helps to define alcohol use at the interpersonal level. This study builds on past work to examine characteristics of individual social ties as they relate to drinking involvement and military affiliation. The purpose of the present study is to examine the independent and joint associations of social tie, social network, and soldier-specific characteristics with frequency of soldiers' social drinking. We also examine whether the associations of interest were moderated based on deployment

history. We expected that drinking-related social tie and social network characteristics would be associated with greater frequency of social drinking by soldiers, and that soldiers who had ever been deployed would significantly increase the associations for the relationships of interest.

Our current study uses multilevel modeling (MLM) to examine social tie and social network characteristics separately to understand whether individual ties versus contextual groups influence drinking behaviors in military personnel. MLM accounts for error associated with non-independence of nested observations in multilevel data, and allows for simultaneous examination of characteristics at different levels of influence, such as those of soldiers, their overall social networks, and their specific social ties within those networks (Raudenbush & Bryk, 2002; Wellman & Frank, 2001). MLM is useful for comprehensively understanding the impact of influences from different ecological levels and can be applied to social network data where clusters of social ties are nested according to an index person (Marsden, 2011). In this way, we were also able to examine elements of military alcohol culture by including soldier-level alcohol use and norms as well as social tie and network aggregate variables to help understand the more complete social context of military drinking.

7.3 Methods

7.3.1 Participants and procedure

Data for the current research are from the baseline assessment of Operation: SAFETY (Soldiers And Families Excelling Through the Years), a longitudinal study that is broadly focused on the health and wellbeing of Army R/NG soldiers and their partners (Anderson Goodell, Homish, & Homish, 2018; Heavey, Homish, Goodell, & Homish,

2017; Hoopsick, Vest, Homish, & Homish, 2017; Kozlowski, Homish, & Homish, 2017; Vest, Heavey, Homish, & Homish, 2017). The State University of New York at Buffalo's Institutional Review Board and the Army Human Research Protections Office, Office of the Chief – Army Reserve, and the Adjutant General of the National Guard all approved and vetted the Operation: SAFETY protocol. In addition, the study received a certificate of confidentiality from the US Department of Health and Human Services to protect participant information.

The Operation: SAFETY study recruited couples over a 15-month period (Summer 2014 to Fall 2015) from 47 Army R/NG units in upstate New York. During their training weekends, soldiers were presented with a study overview and confidentiality procedures, and then they were invited to complete a brief screening form to assess their eligibility for study participation. After completing the screening, soldiers were provided with information to take home and share with their partner to accurately explain the study. Following the in-person screening, all soldiers were contacted within a week about whether they were eligible for the study. Eligibility for Operation: SAFETY was based on six inclusion criteria: (a) the couple is married or living as married; (b) one member of the couple is a current Army R/NG soldier; (c) the soldier is between the ages of 18 and 45; (d) both partners have had at least one alcoholic beverage in the past year; (e) both partners are able to speak and understand English; and (f) both partners are willing and able to participate.

A total of 731 couples were considered eligible for the study, and of those, 572 (78%) agreed to participate, with 83% of those (n = 472) completing at least a partial baseline survey. A final total of 418 couples had both partners who completed the entire

baseline survey. No differences existed on soldier eligibility criteria as well as other preventive health screening variables (e.g., routine physical and exercise frequency) between those who enrolled and completed versus those who enrolled and did not complete.

The current work uses data from two levels of observation: current soldiers (n = 421) and individuals with whom soldiers had non-marital interpersonal relationships, called "social ties." Soldiers' relationships with their social ties were examined using egocentric data from a social network inventory included in the Operation: SAFETY study assessment. Each soldier nominated up to 24 social ties who he or she considered to be "important to [him or her] in one way or another during the past year" in relation to any of the following: providing emotional support, socializing regularly, helping with practical or financial problems, or supporting the respondent. For each nominated social tie, soldiers then answered a range of questions about demographic and military characteristics, substance use behaviors, and soldier-tie interaction (Leonard & Homish, 2008).

7.3.2 Measures

Outcome Variable: Days Social Drinking with Ties

The outcome of interest is the frequency of drinking with social ties, measured at the social tie level and operationalized as the absolute number of days in the past 30 days that a soldier drank with each of his or her social ties.

Social Tie Characteristics

Social tie characteristics were comprised of three predictors of interest, which were military affiliation, drinking buddy status, and heavy-drinking pattern. Other social

tie characteristics considered in the analyses were ties' sex, family member status, and tie-associated conflict between soldier and partner. All characteristics were measured at the social tie level.

1. *Military affiliation*. Military affiliation was determined based on whether or not a social tie was "currently in the military."
2. *Drinking buddy*. A social tie was considered a "drinking buddy" if he or she was someone that the soldier "got together with on a regular basis to do activities that centered around drinking and/or going to bars or nightclubs" (Lau-Barraco & Collins, 2011).
3. *Heavy-drinking pattern*. A social tie's past-year general drinking pattern was considered "heavy" if he or she was reported by the soldier respondent to be any of the following: "frequent or heavy social drinker," "problem drinker," or "alcoholic."
4. *Sex*. A binary variable was used to note whether a social tie was male or female.
5. *Family member*. A social tie was considered a family member if he or she was any of the following: child or stepchild, parent, sibling, extended family member, or in-law.
6. *Tie-associated conflict with partner*. Soldier respondents reported whether or not they experienced conflict with their marital partner that was associated with each of their social ties.

Index Soldier Characteristics

In addition to social tie characteristics, the following soldier-level characteristics were included in the current analyses.

Sociodemographic characteristics. Sociodemographic characteristics for the soldier respondents included age, sex, race/ethnicity, education level (high school or some college versus college completion), and presence of any children in the home.

Previous deployment. Soldiers were categorized according to whether or not they had ever been deployed.

Posttraumatic stress disorder. PTSD was measured according to past 30-day symptom severity using the PTSD Checklist (PCL-5). The PCL-5 is a 20-item instrument with scores ranging from 0 to 80 (Cronbach's $\alpha = 0.95$). Higher scores indicate greater symptom severity (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). The PCL-5 was adapted from the original PCL to map on to DSM-5 criteria (Bovin et al., 2015; Weathers, Litz, Herman, Huska, & Keane, 1993).

Hazardous alcohol use. Soldiers' current hazardous alcohol use was assessed using the Alcohol Use Disorders Identification Test (AUDIT), a 10-item measure with each item measured on a 5-point Likert scale from 0 to 4 and a summed scale score from 0 to 40 to indicate increased drinking severity (Cronbach's $\alpha = 0.78$; Babor & Del Boca, 1992; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). A binary variable with a cut-point of 8 was used, with scores of 8 or greater indicating current hazardous or harmful alcohol use (Saunders et al., 1993). Research has examined the AUDIT's performance in assessing hazardous drinking in veteran populations, and, in line with

civilian work, has suggested the cutoff of 8 as appropriate for use in military populations (Crawford, Fulton, Swinkels, Beckham, & Calhoun, 2013)

Partner hazardous alcohol use. As was done for soldiers, marital partner's alcohol use was categorized as hazardous using the binary AUDIT score with a cut-point of 8 (Cronbach's $\alpha = 0.78$; Babor & Del Boca, 1992; Crawford et al., 2013; Saunders et al., 1993).

Alcohol use social norms. Alcohol use perceived social norms were measured using the summed score of three items measuring approval of alcohol use according to perceptions of individuals who are important to the soldier (Cronbach's $\alpha = 0.72$; Armitage, Conner, Loach, & Willetts, 1999). The items ask to what degree respondents agree or disagree that important people in their lives think they should drink alcohol, approve of their alcohol use, and want them to drink alcohol. Each item was measured on a 7-point Likert scale, with responses ranging from "strongly disagree" to "strongly agree."

Network characteristics. Network characteristics were represented by three aggregate variables that accounted for proportions of ties in soldiers' networks that were military-affiliated, drinking buddies, and heavy-drinkers.

7.3.3 Statistical analyses

Current analyses used baseline data from the Operation: SAFETY study, and are based on a sample of 421 current Army R/NG soldiers and their 2,637 social ties. The data were structured at two levels, social ties (Level 1) clustered within soldiers (Level 2). We used a multilevel modeling (MLM) analytic approach to estimate the association of individual social tie and social network characteristics with frequency of soldier's

social drinking with social ties. Social ties within a given soldier's social network were assumed to be more similar to one another than to ties in other solders' social networks, which would result in variability in the outcome across soldiers (Raudenbush & Bryk, 2002; Wellman & Frank, 2001). Thus, MLM allowed us to simultaneously model characteristics that were measured at both levels of the data (i.e., individual social tie characteristics and soldier-level network characteristics), and account for the non-independence of social ties within soldiers by partitioning between- and within-soldier variability of effects on the outcome (Hoffman, 2015; Perry, Pescosolido, & Borgatti, 2018).

We conducted descriptive analyses for each level of data, and then used linear regression models to assess effects of the three predictors of interest (i.e., military affiliation, drinking buddy status, and heavy drinking pattern) on frequency of drinking with ties. Multilevel unadjusted linear regression models were used to examine relationships between all social tie, network, and soldier study variables with number of days drinking with social ties. We compared a multilevel null random intercept model to an unconditional ordinary least squares (OLS) model to examine whether there was variability in days drinking with ties that was unique to social ties within soldiers and to determine whether multilevel was preferable to single-level modeling.

Next, we used multilevel linear regression models to address the goals of the study in relation to days social drinking with ties in the past 30 days. The first model included the three predictors of interest, using social tie-level and social network variables, to examine the within- and between-soldier associations with the outcome. Then we used a model with two-way interactions to examine whether the relationships

between the aggregate social network characteristics and days social drinking with ties were different based on deployment status. Both models also included other social tie characteristics and soldier characteristics.

Correlations between predictors were then examined for multicollinearity, with correlations of .80 or greater indicating excessive overlap. No significant multicollinearity was found between the predictors included in these analyses. All social tie characteristics were centered based on soldier-specific proportions (i.e., group-mean centered) to allow us to examine both within- and between-soldier effects (Enders & Tofighi, 2007). All multilevel regression models were two-level models that examined the multivariable effects on the days drinking with ties (Level 1) and variation across soldiers (Level 2). Such variation was modeled using a random intercept, which represented the overall mean days of social drinking added to a soldier-specific random deviation, and random slope to account for the overall effects of predictors of interest plus a soldier-specific residual. For example, a simplified linear regression model that contains only the military affiliation predictor of interest is summarized in Equations 1 through 4 below:

$$\textit{Level 1:} \quad Y_{ij} = B_{0j} + B_{1j}\,(\mathrm{Mil}_{ij}\text{-}\overline{\mathrm{Mil}}_{j}) + e_{ij} \tag{1}$$

$$\textit{Level 2:} \quad B_{0j} = \gamma_{00} + u_{0j} \tag{2}$$

$$B_{1j} = \gamma_{10} + u_{1j} \tag{3}$$

$$\textit{Combined:} \quad Y_{ij} = \gamma_{00} + \gamma_{10}\,(\mathrm{Mil}_{ij}\text{-}\overline{\mathrm{Mil}}_{j}) + u_{0j} + u_{1j}\,(\mathrm{Mil}_{ij}\text{-}\overline{\mathrm{Mil}}_{j}) + e_{ij} \tag{4}$$

According to the combined model (Equation 4), Y_{ij} is modeled as the mean days drinking with social tie i of soldier j; γ_{00} is the overall mean of days drinking; u_{0j} is the

soldier-specific random deviation in days drinking; γ_{10} is the average relationship between tie military affiliation and days drinking; and u_{1j} is the soldier-specific variation in the relationship between tie military affiliation and days drinking. The error term (e_{ij}) reflects the individual social tie differences around the soldier-specific mean days drinking with ties for soldier *j*. All data management, descriptive analyses, and regression analyses were conducted using Stata 14.2 (StataCorp, 2015).

7.4 Results

The current analyses are based on data for a subsample of 421 current Army R/NG soldiers and their 2,637 social ties (Table 7.1). Soldiers were comprised of 353 males and 68 females and were an average of 31 years old. One in five of soldiers was minority status, and 30% had completed four-year college education. Two-thirds of soldiers (n = 259) had children in the home, and 61% had ever been deployed. The average PTSD symptom score was 9.4, reflecting low average severity. Approximately 15% of soldiers and 13% of partners had an AUDIT score of 8+, indicating hazardous alcohol use. Average perceived alcohol use norms was 9.7 (SD = 4.3), indicating moderate perceived approval of alcohol by people who are important to soldiers.

According to Table 7.1's results on social network characteristics, soldiers reported an average of 6.3 ties in their social networks, and on average, they engaged in any social drinking with about half of the ties in their networks. Soldiers' social networks had an average of approximately 14% of ties who were currently in the military, 14% who were considered drinking buddies, and 8% who were heavy-drinking ties. Female ties made up an average of 37% of social networks, with family members comprising 52%, and ties associated with conflict comprising 7%.

Table 7.1 Descriptive Characteristics of Soldiers (n = 421) and Social Ties (n = 2637)

	Soldiers (n = 421)			
	n	%	*m*	*SD*
Soldier characteristics				
Age	421		31.4	6.5
Sex				
Male	353	83.8		
Female	68	16.2		
Race/Ethnicity				
Non-Hispanic White	335	79.6		
Non-Hispanic Black	23	5.5		
Hispanic	35	8.3		
Other[a]	20	4.8		
Education[b]				
High school or some college	294	69.8		
College completion	127	30.2		
Any children in the home[c]	259	61.5		
Ever deployed	255	60.6		
PTSD symptoms	421		9.4	11.6
Hazardous alcohol use	64	15.2		
Partner hazardous alcohol use	56	13.3		
Alcohol use norms	421		9.7	4.3
Social network characteristics[d]				
Size	421		6.3	3.8
% any social drinking	421		0.52	0.34
% military-affiliated	421		0.14	0.19
% drinking buddies	421		0.14	0.23
% heavy-drinking ties	421		0.08	0.14
% females	421		0.37	0.26
% family members	421		0.52	0.31
% ties associated with conflict	421		0.07	0.16

Table 7.1 Descriptive Characteristics of Soldiers (n = 421) and Social Ties (n = 2637), continued

	Social Ties (n = 2637)			
	n	%	m	SD
Individual social tie characteristics				
Days drinking with social ties	2623		1.3	2.5
Any social drinking (>0 days)	1422	53.9		
Military affiliation	373	14.1		
Drinking buddy	342	13.0		
Heavy drinking	225	8.5		
Female	1013	38.4		
Family member	1318	50.0		
Associated conflict with partner	178	6.8		

Note. *SD* = standard deviation; PTSD = posttraumatic stress disorder. Categorical totals may not equal column totals due to missing data.
[a]Includes American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, more than one race, and other specified races. [b]"Some college" includes Trade school, Associate degrees, and other two-year technical degrees. "College completion" includes four-year undergraduate degrees and graduate degrees. [c]Includes biological, adopted, foster, and stepchildren. [d]Measures represent the proportions of social ties with each characteristic of interest per soldier, averaged over all soldiers.

Estimates in Table 7.1 on individual social tie characteristics show that ties were associated with an average of 1.3 days of social drinking in the past 30 days. Approximately 54% of all ties engaged in any social drinking in the past 30 days. For social tie characteristic predictors of interest, approximately 14% of all social ties were military-affiliated, and 13% were considered to be drinking buddies. In addition, about 38% of ties were female, half were family members, and 7% had associated conflict.

We examined relationships between each of the social tie characteristics (Level 1) and soldiers (Level 2) and the outcome, according to the 2,623 social ties who provided data for days of social drinking with their associated soldiers (Table 7.2). A tie being a drinking buddy was associated with significantly more days drinking between the soldier and the tie ($b = 2.37$, $p < .001$), as was engaging in past-year heavy drinking ($b = 1.79$, $p < .001$). Ties who were current military were not significantly related to social drinking. All other social tie characteristics (female ties, family members, and associated conflict) were also significantly associated with frequency of social drinking. Inverse associations

were observed for ties who were female and those who were family members. For the aggregate social network characteristics, each additional 10% of drinking buddy ties in a soldier's network resulted in over two additional days drinking in the past 30 days (b = 2.59, $p < .001$). Greater proportions of heavy-drinking ties were also associated with more frequent drinking among soldiers and their ties ($b = 3.31$, $p < .001$). Similar to the unadjusted estimate at the social tie level, soldiers' proportion of military-affiliated ties was not significantly associated with social drinking. Finally, for soldier characteristics, being in the "other" race category and greater social approval of soldier alcohol use was associated with more days drinking ($p = .04$ and $p = .02$, respectively). Soldier hazardous alcohol use trended toward significance with days social drinking ($b = 0.60$, $p = .06$).

Table 7.2 Unadjusted Associations Between Multilevel Factors and Number of Days Drinking with Social Ties (n = 2623)

	β	*se*	*p*
Social tie characteristics (Level 1)			
Military affiliation	0.07	0.14	.61
Drinking buddy	2.34	0.14	<.01
Heavy drinking	1.64	0.16	<.01
Female	-0.60	0.10	<.01
Family member	-0.39	0.10	<.01
Associated conflict with partner	0.75	0.19	<.01
Social network characteristics (Level 2)[a]			
% military-affiliated	0.54	0.37	.15
% drinking buddies	2.59	0.32	<.01
% heavy-drinking ties	3.31	0.6	<.01
Soldier characteristics (Level 2)			
Age	0.001	0.02	.97
Female	-0.19	0.29	.51
Race/ethnicity[b]			
Non-Hispanic Black	1.11	1.32	.40
Hispanic	0.20	0.53	.71
Other	-0.57	0.28	.04
College completion[c]	-0.06	0.24	.81
Children in the home	-0.28	0.26	.30
Ever deployed	-0.13	0.29	.65
PTSD symptoms	0.002	0.01	.78
Hazardous alcohol use	0.60	0.33	.06
Partner hazardous alcohol use	0.19	0.33	.57
Alcohol use norms	0.06	0.03	.02

Note. *se* = standard error; PTSD = posttraumatic stress disorder.
[a]All social network characteristics were measured according to deciles of proportions. [b]Reference was Non-Hispanic white.
[c]Reference was high school or some college.

Table 7.3 contains results from the null and multivariable MLM linear regression models estimating the associations with days drinking with social ties. Due to missing values across explanatory variables, the multilevel analyses included a subsample of 402 soldiers and 2,378 social ties. We first compared a multilevel null random intercept model (Table 7.3; Null Model) to the null OLS version of the model (estimates not shown for the latter). The resulting likelihood-ratio test (LRT) indicated that the multilevel structure of the null model was a preferred fit for the data to account for variability due to soldiers and dependence of ties within soldier clusters ($p < .001$) (Peugh, 2010; Singer & Willett, 2003; Snijders & Bosker, 2012). The resulting intraclass correlation (ICC) for the Null Model ($\rho = .24$) indicated that 24% of the variance in the outcome is accounted for at the soldier level, justifying multilevel analysis with a random intercept (Muthén, 1991; Muthén & Satorra, 1989). According to this model, soldiers spent an overall weighted average of 1.4 days drinking with their social ties in the past 30 days ($p < .001$).

Table 7.3 also includes a Base Model with the three social tie predictors of interest (military affiliation, drinking buddy status, and heavy drinking pattern) and aggregate social network variables, adjusted for other social tie (i.e., sex, family member, associated partner conflict) and soldier characteristics (i.e., sociodemographic characteristics, previous deployment, PTSD symptoms, soldier and partner hazardous alcohol use, and alcohol norms). A random slope was included in the model for military affiliation based on the rationale that there may be varying preferences for why a soldier might spend time with their military-affiliated ties, which may not all be related to drinking alcohol. This rationale was not applied to the drinking buddy and heavy-

drinking characteristics, and relationships for both with days drinking were assumed to be constant across soldiers.

Table 7.3 Multilevel Models Predicting Number of Days Drinking with Social Ties (n = 2378)

	Null Model	Base Model	Full Model
	β (*se*)	β (*se*)	β (*se*)
Constant	1.36 (0.08)***	1.11 (0.33)**	1.66 (0.41)***
Fixed effects			
Social tie characteristics (Level 1)			
Military affiliation		-0.07 (0.15)	-0.07 (0.15)
Drinking buddy		2.08 (0.15)***	2.08 (0.15)***
Heavy drinking		1.08 (0.17)***	1.08 (0.17)***
Female		-0.29 (0.10)**	-0.29 (0.10)**
Family member		-0.02 (0.10)	-0.02 (0.10)
Associated conflict with partner		0.60 (0.19)**	0.60 (0.19)**
Social network characteristics (Level 2)[a]			
Military-affiliated ties		0.08 (0.40)	-1.10 (0.68)
Drinking buddies		1.97 (0.35)***	2.01 (0.60)**
Heavy-drinking ties		2.61 (0.56)***	2.20 (0.86)*
Soldier characteristics (Level 2)			
Age		0.01 (0.01)	0.01 (0.01)
Female		-0.29 (0.19)	-0.27 (0.19)
Race/ethnicity[b]			
Non-Hispanic Black		1.13 (0.34)**	1.10 (0.34)**
Hispanic		0.10 (0.25)	0.10 (0.25)
Other[c]		-0.64 (0.33)*	-0.57 (0.33)
College completion[d]		-0.08 (0.15)	-0.10 (0.15)
Children in the home		-0.11 (0.16)	-0.09 (0.16)
Ever deployed		-0.03 (0.16)	-0.29 (0.21)
PTSD symptoms		0.01 (0.01)	0.01 (0.01)
Hazardous alcohol use		0.41 (0.20)*	0.39 (0.20)
Partner hazardous alcohol use		-0.02 (0.20)	-0.06 (0.20)
Alcohol use norms		0.01 (0.02)	0.01 (0.02)

Table 7.3 Multilevel Models Predicting Number of Days Drinking with Social Ties (n = 2378), continued

	Null Model	Base Model	Full Model
	β (*se*)	β (*se*)	β (*se*)
Level 2 interaction terms			
Ever deployed x			
Military-affiliated ties			1.81 (0.83)*
Drinking buddies			-0.09 (0.72)
Heavy-drinking ties			0.84 (1.10)
Variance components (random effects)			
e_{ij}	4.63 (0.15)***	3.88 (0.13)	3.88 (0.13)
u_{0j}	1.44 (0.17)***	1.07 (0.13)	1.05 (0.13)
u_{1j}	--	0.73 (0.33)	0.72 (0.33)
Cov (u_{0j}, u_{1j})	--	0.68 (0.19)	0.67 (0.19)
Model summary			
Chi-square (df)[d]	262.83 (1)***	47.01 (15)***	5.6 (3)
ICC	0.24	0.22	0.21
AIC	10786.00	10411.49	10411.88
BIC	10797.99	10515.39	10527.78

Note. *se* = standard error; df = degrees of freedom; ICC = intraclass correlation; AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion.
[a]All social network characteristics were measured according to deciles of proportions. [b]Reference was Non-Hispanic White. [c]Includes American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, more than one race, and other specified races.
[d]Reference was high school or some college. [e]Based on likelihood ratio test comparing current model with the reduced model in the column directly to the left. The estimate for the null model is based on comparison to the non-nested OLS model.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Within soldiers, ties who were considered drinking buddies were associated with 2.08 additional days drinking ($p < .001$), compared to those who were not drinking buddies, and heavy-drinking ties were associated with 1.08 additional days drinking ($p < .001$) compared to non-heavy-drinking ties. Aggregate characteristics were re-scaled to correspond to deciles of ties in the social network. For a given soldier, with every 10% increase in proportion of drinking buddy ties in a social network, the average days social drinking with ties increases by 1.97 days ($p < .001$); increases in the proportion of heavy drinking ties in a social network resulted in 2.61 days drinking ($p < .001$). Both the

within- and between-soldier effects of ties being military-affiliated were not associated with days social drinking.

Additional social tie-level characteristics that were associated with days social drinking were female ties and ties who were associated with conflict between soldiers and their partners. Female ties were associated with reduced days of social drinking with soldier respondents, compared to male ties (b = -0.29, p = .004), and conflict with a partner over a social tie was associated with greater frequency of social drinking (b = 0.60, p = .002). Of all of the soldier-level characteristics, being in the Non-Hispanic Black racial category was associated with 1.13 additional days drinking with social ties compared to being in the Non-Hispanic White category (p = .001), and hazardous alcohol use was associated with more days drinking with social ties (b = 0.41, p = .045). Being in the "Other" racial category was protective of days social drinking (b = -0.64, p = .045).

The Full Model in Table 7.3 built off of the Base Model by adding three two-way Level 2 (soldier-level) interactions, i.e., deployment history multiplied by each of the three aggregate social network characteristics of interest. The effect of proportion of military ties on days of social drinking was significantly greater for ever- versus never-deployed soldiers (b = 1.81, p = .03). There were no significant interaction effects between deployment status and either proportion of drinking buddies or proportion of heavy-drinking ties.

7.5 Discussion

The goals of the current study were to examine the associations between social tie characteristics and days of drinking with social ties among Army R/NG soldiers, and to describe how deployment history moderates the associations.

7.5.1 Influence of ties' drinking behaviors

The findings indicate that soldiers drink more frequently with ties who are characterized as a drinking buddy or as having a heavy-drinking pattern. Soldiers with social networks that are composed of greater proportions of both types of ties are more likely to engage in frequent social drinking. These findings are consistent with what has been shown in previous civilian literature as well as at least one recent military study, described in Chapter 6, that examined R/NG social networks in light of soldier alcohol use. In the study, the authors determined that greater aggregate numbers of drinking buddies and heavy-drinking ties in a social network were both associated with increased soldier alcohol use. These current findings complement previous work by using multilevel analytic methods to demonstrate that individual social ties and social network contexts that engage in alcohol misuse may influence greater frequency of use by soldiers.

We can glean some information about the level of alcohol consumption among the soldier based on social ties who are drinking buddies and heavy drinkers. Although we cannot quantify how much alcohol is being consumed while soldiers drink with their ties, people who socially drink tend to drink more or less based on what is being done by others in the close social group at the time (Caudill & Marlatt, 1975; Collins, Parks, & Marlatt, 1985). Drinking buddies tend to be more moderate or social drinkers than heavy drinkers (Lau-Barraco & Linden, 2014). Thus, in addition to soldiers drinking more frequently when they have greater presence of drinking buddies and heavy-drinkers, they are likely drinking at least moderate quantities of alcohol, i.e., two to three drinks in a setting. In addition, although drinking buddies tend to drink less than heavy drinkers,

having ties who are drinking buddies may result in heavy drinking by the index person over time (Homish & Leonard, 2008; Reifman et al., 2006).

7.5.2 Military-affiliated ties

Previous evidence is mixed for whether military peers may be protective against negative soldier outcomes, due to understanding shared military experiences, or risk factors for soldier drinking, due to the culture of personnel using alcohol to socialize. Thus, social ties' military affiliation was also examined in light of social drinking between soldiers and their ties. Results showed that overall a tie's military affiliation was neither protective nor risky with respect to soldiers' frequency to engage in drinking with that tie. However, soldier deployment status provides more context about how military social ties may relate to soldier social drinking. The effect of increasing military-affiliated composition of a social network is significantly greater for deployed soldiers than that for nondeployed soldiers, resulting in a risky relationship between increasing numbers of military ties and frequency of social drinking. Future work should examine contextual factors such as quantity of consumption and typical social setting to understand more about soldiers' alcohol use expectancies and whether military ties are viewed as preferred sources for socializing through binge or heavy drinking.

With consideration of deployment status, these findings are consistent with what was observed by Hatch and colleagues, although the latter sample included both deployed and nondeployed personnel in one group (Hatch et al., 2013). It is important to note that they used a binary variable comparing at least 50% military ties to less than 50%, which may have masked variation in effects of deployment on alcohol use. The current findings are different from what was observed in Chapter 6, which found that the number of

military ties for deployed personnel was inversely related to alcohol use. An explanation for the contrast may be the different outcomes used in each study. With Chapter 6 findings, military ties may be protective of increases in AUDIT score, which could also be interpreted as increases toward hazardous or harmful drinking that reflects maladaptive coping. With the current study, military ties may encourage greater frequency of social drinking, reflecting more of the military culture of using alcohol to bond over mutual military and deployment experiences.

7.5.3 Soldier level associations

When examining soldier-level variables, we observed that alcohol use norms were significant in the unadjusted analyses but ultimately lost significance in the multivariable models. Other research has examined injunctive alcohol norms (perceptions of peers' approval) and demonstrated positive associations of approval with alcohol consumption (Halim, Hasking, & Allen, 2012). The difference in findings may be related to the current outcome of interest being frequency of social drinking rather than alcohol use disorder, the latter of which may be more associated with stigma that could guide social disapproval of alcohol use (Fortney et al., 2004; Krieger et al., 2016). We conclude that at least for the current analyses level of social approval of alcohol use was not associated with soldiers' frequency of social drinking.

7.5.4 Limitations

This study should be considered in light of several limitations. It is possible that the social network data used for the current study may not have accounted for all important past-year social ties in soldiers' lives. Although soldiers could report a maximum of 24 people to provide a comprehensive picture of important relationships,

there could have been issues with bringing to mind all relevant people. While it is not possible to confirm whether respondents named all of their possible important ties from memory, individuals are less likely to forget close ties and ties that are more recent and frequent contacts (Brewer, 2000). With this in mind, the surveys included prompts to help with recall of people who are important for different reasons, including emotional, practical, and social reasons. In addition, because the social network data were egocentric, soldiers reports of social tie characteristics are based on their perceptions of ties, so there could be mis-estimation in how a soldier characterizes others' drinking. Thus, this study's findings as they relate to social ties should be considered in light of soldiers' perceived norms rather than the social ties' actual drinking behavior.

Caution should be taken when generalizing findings to other military populations. Because the population under study was comprised of Reserve and National Guard personnel, social network composition may be different from Active Duty populations, especially as it relates to military-affiliated ties. Active Duty personnel typically reside near military bases and are more immersed in military-connected social environments (e.g., peer groups, families), so they may have a more prominent military drinking culture, with more military-affiliated peers who they drink with in a ritualized or recreational way (Ames & Cunradi, 2004).

7.5.5 Conclusions and implications

This study contributes to the understanding of interpersonal influences on alcohol use behavior by military personnel. Based on multilevel analytic methods, findings demonstrate that social tie- and social network-level characteristics associated with risk for increased social drinking frequency include drinking buddy status and heavy-drinking

patterns. With these findings, this study was able to capture the heterogeneity of individual social tie influence that could not be concluded by the work in Chapter 6 (Wellman & Frank, 2001). Military-affiliation influence by overall social networks may be risk factors in the case of deployed soldiers. This information complements work that has been done to understand other social-ecological factors that influence alcohol culture in the military (Bronfenbrenner, 1994; Foran, Smith Slep, & Heyman, 2011; Sudhinaraset et al., 2016; Woodruff, Hurtado, & Simon-Arndt, 2018; Woodruff, Hurtado, Simon-Arndt, & Lawrenz, 2018).

These findings may be useful for interventions that are focused on reducing the presence as well as the effects of military drinking culture. In line with influences on alcohol use behaviors at multiple social-ecological levels, efforts may mirror what has been suggested in civilian literature and incorporate individual soldiers, military peers, leadership, and larger social communities (Perry et al., 2002; Toumbourou, Gregg, Shortt, Hutchinson, & Slaviero, 2013). Finally, military efforts may focus on shifting expectancies of socializing away from alcohol use through counter-messaging and opportunities for organized military peer bonding, civic engagement, and other recreational activities not involving alcohol (Bowen, Martin, Mancini, & Nelson, 2001; Darkes & Goldman, 1993).

7.6 References

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Chapter 8. Discussion

The overall goal of this study was to investigate the associations between social support and social influence and alcohol misuse among military personnel using data from a study of health and wellbeing of Army Reserve and National Guard (R/NG) personnel and their partners. We conducted three distinct aims, which included: (1) use of latent profile analysis to classify deployment-related support in relation to hazardous alcohol use, (2) estimation of the link between aggregate social network characteristics and alcohol use, and (3) examination of the effects of individual social tie and network characteristics on frequency of social drinking. The results for each aim are detailed in Chapters 5 to 7, respectively. This chapter will summarize findings for each of the research aims, integrate the findings and their relevance within the larger body of literature, and describe future research and practice implications. We will conclude with limitations, strengths, and overall conclusions.

8.1 Summary of principal findings

8.1.1 Aim 1: deployment-related support and hazardous alcohol use

Aim 1 (Chapter 5) used latent profile analysis (LPA) to empirically classify deployment support and regression to examine how deployment support was related to hazardous alcohol use. The three support indicators used for classification were: (a) training and preparation before deployment, (b) unit support during deployment, and (c) social support from family and friends during deployment. The LPA resulted in a three-profile solution as the most parsimonious and interpretable model. The three profiles differed according to their levels of each of the three support types and were labeled High Social Support, Low Social Support, and High Overall Support.

The relationship between deployment support profile and hazardous alcohol use was quantified using a three-step Vermunt-corrected logistic regression model (Vermunt, 2010) that was adjusted for soldier-level covariates. The Low Social Support profile was the reference profile, and findings indicated that expected membership in the High Social Support profile relative to Low Social Support was protective against hazardous alcohol use, with reduced odds by 75%. The Overall High Support profile did not demonstrate a protective effect, although this null finding may be the result of small expected sample membership.

8.1.2 Aim 2: social network influences and alcohol use

Aim 2 (Chapter 6) shifted focus from examining the protective effect of support to understanding the relationship of social influence and risk for alcohol use outcomes. We used data from an egocentric social network inventory to describe characteristics of soldier's social networks, concurrence of such characteristics, and the influence of characteristics on soldiers' alcohol use. Approximately 14% of all ties listed by soldiers were military-affiliated; 13% were drinking buddies, and 9% had a past-year heavy-drinking pattern. On average, soldiers reported having spent less than two days social drinking with their ties in the past 30 days. For concurrence of such characteristics, 21% of military ties were drinking buddies, and 8% had a heavy-drinking pattern. The concurrence of drinking buddy status with heavy-drinking pattern was low as well, at 21%.

We used negative binomial regression to examine the relationships between aggregate numbers of ties with given characteristics and alcohol use. Results showed that having more drinking buddies, more heavy-drinking ties, and more days of social

drinking between soldiers and ties were all positively associated with increased soldier alcohol use. For soldiers who had ever been deployed, military-affiliated ties were protective against alcohol use, reflected by an 8% reduction in rate of alcohol use with every additional military tie in a soldier's social network.

8.1.3 Aim 3: social tie influence and social drinking

Aim 3 (Chapter 7) expanded upon Aim 2 (Chapter 6) analyses by using multilevel analytic methods to examine within- and between-soldier effects of social tie-specific characteristics on frequency of social drinking between soldiers and social ties. Within soldiers, social ties who were considered drinking buddies and ties who had a heavy-drinking pattern were both associated with more days of social drinking between soldiers and ties. For a given soldier, higher proportions of drinking buddy ties and heavy-drinking ties were associated with more days of social drinking. In the full sample, social ties' military affiliation was neither protective nor associated with risk for social drinking. However, when examining effect modification by deployment status, the effect of proportion of military ties on days of social drinking was significantly greater for ever- versus never-deployed soldiers.

8.2 Synthesis of findings

8.2.1 Protective factors

Findings from this dissertation speak to the interpersonal experience of soldiers and enhance our understanding of support as a protective factor against alcohol misuse outcomes in this group. This work is unique in that it offers information about R/NG soldiers, whose military experience is distinct from that of Active Duty personnel. These results are consistent with previous studies of civilians and military personnel, reflecting

the protective effect of support from family and friends in relation to mental health outcomes (Goldmann et al., 2012; Han et al., 2014; Thoits, 2011). The current findings add to the existing literature, as they are the first to demonstrate protective effects of social support experienced during deployment, and examine support in relation to alcohol misuse.

Higher levels of support from family and friends during deployment appears to be particularly useful for reducing the likelihood of hazardous alcohol use. Two possibilities exist that help explain this relationship. First, through regular communication, expressions of emotion, and companionship, social support may serve as a stress buffer to help to neutralize the threat of combat and traumatic deployment experiences (Cohen, 1988; Vogt, Smith, King, & King, 2012). In addition, soldiers' perceptions that life back home is being taken care of through instrumental support may keep them from worrying about the state of home life while they are away and help them focus on their deployment mission without distractions (Vogt et al., 2012).

Another protective interpersonal factor is having female peers in the social network; having women in the social network may be associated with consuming less alcohol and drinking less frequently. These findings were consistent civilian literature, which shows that women drink less and are less likely than men to engage in competitive drinking and other binge behaviors (Borsari & Carey, 2001; Eagly, Wood, & Diekman, 2000).

Taken together, the findings on protective factors indicate a possible gender-specific effect, with presence of females being protective. Currently, most military partnerships are comprised of male soldiers and female civilian partners, reflecting the

subsample used for the LPA analyses in Chapter 5 (Aim 1), so support from family and friends likely entails the female partner as one of the primary sources. As the military continues to become more diverse, with more women joining and increases in non-traditional families (e.g., families with female military personnel and dual-military families with both partners in the military), the effects of social support and alcohol misuse may also evolve. Efforts will be needed to ensure that adequate support is provided to soldiers during deployment regardless of which partner is back at home.

8.2.2 Dual roles of military peers

Peers' military affiliation was examined in relation to alcohol misuse. In the overall sample, there was no evidence that military peers serve as either risk or protective factors in relation to soldiers' alcohol misuse. This finding speaks to the reality of military alcohol culture among R/NG personnel. A possible explanation for the limited influence of military peers on drinking is the limited access that R/NG personnel have to their military peers on a regular basis (Greden et al., 2010). Because R/NG personnel typically live at a distance from their assigned installation, the frequency of seeing most military peers would be once per month during training weekends.

Situations when military peers appeared to exert influence were when we considered soldiers' deployment status. For R/NG soldiers who had been deployed, findings showed a contrast of effects for military peers on alcohol misuse; presence of military peers in social networks was protective of alcohol use but a risk factor for frequency of social drinking. These findings indicate varying risk and protection of military peers in light of what alcohol outcome is being considered. More specifically, military peers may be useful in protecting against increased alcohol use as a result of

maladaptive coping with deployment or combat-related issues. On the other hand, military peers may be associated with risk for increased frequency of social drinking, speaking more to the military culture of using alcohol to socialize and bond over mutual military and deployment experiences. Findings in total are indicative of post-deployment as a potential critical intervention period to build resilience and avoid issues like increased social drinking with military peers.

8.2.3 Risk factors

This dissertation found certain interpersonal characteristics to be more influential in encouraging alcohol misuse among R/NG personnel. Specifically, individual ties and overall social networks that were characterized by drinking buddy status and heavy-drinking patterns were associated with risk for both alcohol use according to the AUDIT as well as social drinking frequency. Research examining social network drinking characteristics and alcohol outcomes of index respondents among college students and civilian adults shows similar findings (Delucchi, Matzger, & Weisner, 2008; Homish & Leonard, 2008; Lau-Barraco & Collins, 2011; Leonard & Mudar, 2003; Reifman, Watson, & McCourt, 2006). Such findings also reflect that there are two separate types of social network influence, given that drinking buddies appear to be more moderate social drinkers compared to heavy drinkers (Lau-Barraco & Linden, 2014). Although we were not able to examine quantity of consumption when soldiers' drank with their social ties, we can infer based on research showing that people who socially drink tend to drink more or less based on the patterns of others with whom they socialize (Caudill & Marlatt, 1975; Collins, Parks, & Marlatt, 1985). Thus, in addition to soldiers drinking more frequently when they have greater presence of drinking buddies and heavy-drinkers, they

are likely drinking at least moderate quantities of alcohol, i.e., two to three drinks in a setting.

8.3 Implications

8.3.1 Future research

Future research should use longitudinal analyses to clarify temporality of the present cross-sectional associations. Such work might involve assessing support types across the deployment spectrum as they occur (i.e., assessing pre-deployment training and preparation prior to deployment) to obtain responses reflecting real-time experiences of perceived support adequacy. Longitudinal work will also help establish causal ordering of the associations between social network characteristics and alcohol misuse. Establishing causal ordering will shed light on theories of selection, soldiers picking peers according to their own drinking preferences, versus socialization, soldiers acquiring drinking habits according to what is reflected by their peers' drinking behaviors (McPherson, Smith-Lovin, & Cook, 2001; Steglich, Snijders, & Pearson, 2010).

The current work was unable to examine results according to soldier sex due to sample size limitations. Thus, future work should focus specifically on oversampling female personnel and understanding their interpersonal experiences in relation to alcohol misuse. In Aim 1 (Chapter 5), we were unable to examine profiles of support for women; however, such work is still warranted given that experiences of support may be fundamentally different for women, especially as they relate to other outcomes such as PTSD and depression. Research should also seek to understand more about social network alcohol misuse influences for women, which may be different from men.

Finally, work should be pursued to provide a greater understanding of R/NG personnel in light of social drinking. Current results reflect low prevalence and overlap of social ties' military and drinking characteristics and contrasting effects of military ties on alcohol misuse. Given that these findings are contrary to what is shown in existing literature about alcohol military culture, future work might employ focus groups or other qualitative research to understand what military alcohol culture means to R/NG personnel. Themes of interest might be the presence of drinking influence and opportunities during drill weekends, interaction with military peers and in relation to drinking outside of training weekends, and reasons for drinking with military versus non-military peers.

8.3.2 Interventions and clinical practice

Greater focus should be placed on bolstering support for soldiers and families in relation to deployments. Improvements might be made to existing family resources and support groups to emphasize family and friend support as an important tenet in preparing for an upcoming deployment. Specifically, efforts might focus on working with soldiers, families, and other close social ties to establish knowledge and mutual expectation for what is considered adequate exchange of support. Information on related topics might also be highlighted through family readiness programs and social media group messaging.

R/NG families are not as embedded in the military community as are Active Duty families (Burrell, Durand, & Fortado, 2003). They are also typically burdened by the stress of having a family member deployed, losing income from the soldier partner being away from his or her civilian job during deployment, and typically not having an

immersive environment to connect with other military families (Griffith, 2015; Lapp et al., 2010). Thus, improvements are needed to make family programs more inclusive of R/NG families as well as families that are non-traditional, i.e., couples with a female soldier and male civilian partner, dual-military couples, and same-sex couples (Parcell & Maguire, 2014). Expansion of such programs may decrease family stress and expand their capacity to understand what deployed soldiers need from them prior to and over the course of deployment. Resources that are made more accessible to support R/NG families will in turn help families support their soldiers in productive ways.

Interventions that employ the direct support of military-affiliated peers should be considered to help reduce soldiers' unhealthy alcohol use behaviors. Military-affiliated peers may be helpful in the post-deployment phase, particularly in the case of post-deployment reintegration and with processing experiences of combat and associated trauma (Ahern et al., 2015; Hinojosa & Hinojosa, 2011), and may be helpful in deterring soldiers from coping with alcohol. In addition, because R/NG personnel are geographically dispersed, they lose daily contact with one another once they have returned from deployment, so such efforts to facilitate military peer support are particularly useful in the R/NG (Greden et al., 2010).

Interventions may also focus on the provision of opportunities for R/NG military personnel to engage with one another in activities that do not involve drinking, such as civic duty or other recreational activities (Bowen, Martin, Mancini, & Nelson, 2001; Darkes & Goldman, 1993). Other military programs have capitalized on "using culture to change culture" by appealing to personnel to encourage one another toward treatment seeking because they, more than anyone else, understand one another's experience

(Emmanuel, 2009; Greden et al., 2010). By using a similar strategy, military personnel may be useful in rallying their peers to engage in non-alcoholic activities despite the common cultural marker of socializing with alcohol.

Finally, community- and policy-level efforts might focus on limiting the concentration of bars and alcohol outlets on and around R/NG military bases. The presence of such influences in the physical environment may encourage increased alcohol consumption (Woodruff, Hurtado, & Simon-Arndt, 2018; Woodruff, Hurtado, Simon-Arndt, & Lawrenz, 2018). Although the limited training of R/NG personnel means that they spend two days at their assigned bases once per month, focus on limiting physical access to alcohol is still relevant. Schedules for drill weekends are often variable in terms of free time: although R/NG personnel may engage in full-day field training in some instances, they are also at least as likely to have a "workday" schedule that ends in the early evening. Shorter daily schedules allowing for recreational time afterward may include socializing with fellow military peers over alcohol (M. E. Lane, personal communication, October 12, 2018).

Monthly drill weekends are a critical time to intervene because many R/NG personnel travel to their assigned bases, which are often outside of their hometowns, and are away from home duties for weekends at a time. Military-led strategies for this period may first focus on efforts to bolster the organizational culture of individual R/NG bases and then initiatives by base leadership to employ a combination of tactics (Pfeiffer et al., 2012). Such tactics may include messaging toward a culture shift around alcohol, family- and military peer-involved interventions, and organized opportunities for activities

without alcohol for downtime during and immediately after drill weekends when personnel may look to their peers to unwind from training.

8.4 Limitations

Findings from this dissertation should be considered in the context of a few limitations. First, the population under study was comprised of soldiers who were either married or living as married, and in which both partners had at least one alcoholic drink in the past year. In relation to any alcohol use in the past year, the majority of individuals in the military report drinking in some capacity, with just 16% of personnel reporting past-year abstinence (Department of Defense, 2013). Thus, findings from this work are generalizable to the majority of military personnel who have consumed some form of alcohol in the past year. Related to marital status, findings may be reliably generalizable to families and couples that are married or living as married in all branches of the R/NG, which make up approximately 45% of the total R/NG force (Department of Defense, 2017). However, because married military personnel tend to drink at lower rates than other military personnel (Bray, Brown, & Williams, 2013), caution should be taken when translating the findings to soldiers who are single or in casual dating relationships. Because other non-married R/NG populations may drink more and spend more time socializing over drinking, some of the findings from this dissertation are more conservative than they might otherwise be.

In addition, although some findings have relevance for Active Duty soldiers, there are key differences among Active Duty versus R/NG soldiers regarding the concepts under study. The former are typically more proximally located to a military base, have more extensive access to additional support services, have more military-affiliated peers,

and may encounter a stronger alcohol culture. Thus, caution should be taken in generalizing these findings to Active Duty and other subsets of military personnel.

Because the data for this work was cross-sectional from the baseline survey of Operation: SAFETY, we cannot infer causality from the observed associations. Though the investigation was not longitudinal, temporal ordering of constructs was established by design. For example, for Aim 1 (Chapter 5), reports of previous support were based on before or during the most recent deployment, thus preceding current hazardous alcohol use. Because the present work is cross-sectional, findings represent an initial effort to explore relationships of interest and alcohol misuse outcomes.

Analyses were limited to measures that were included in the existing data set. For example, in Aim 1 (Chapter 5), we were not able to measure social support post-deployment, although we know from previous work that it is a key protective factor for other mental health outcomes in military populations. For Aims 2 and 3, we were not able to contextualize support from social ties other than through soldier's reported level of closeness to ties. Other measures of support examining emotional and tangible support would have been helpful to understand their potential protective effects when examined in tandem with social tie drinking characteristics (Cohen, Mermelstein, Kamarck, & Hoberman, 1985; Cutrona & Russell, 1990).

Finally, study data were self-reported, which – although a routine strategy for assessing substance use behaviors – might have resulted in social desirability response bias in the form of underreporting on subject matter that might be considered sensitive (Lincoln, Ames, & Moore, 2016). However, the questions used for the present work were minimally sensitive and focused on drinking behaviors, versus illicit drugs and

other matters of illegality such as domestic violence. It is possible that some respondents may have tempered their responses out of concern that their military leadership or partner might find out their answers; however, the Operation: SAFETY team utilized a study design that was careful to assure confidentiality and anonymity of responses and had soldiers answer surveys in private rooms at their own pace.

8.5 Strengths and public health significance

This dissertation has strengths that contribute to its public health significance, particularly for military mental health. First and foremost, this work speaks to the priorities outlined by a recent Institute of Medicine report calling for greater comprehensive understanding of substance use and treatment in various military populations (Institute of Medicine, 2013). The work discussed in Chapters 5 through 7 helps to address the gap in military research related to the understanding of how interpersonal factors' impact alcohol misuse outcomes. This dissertation was unique in its application of a social-ecological lens to military drinking to better understand soldiers' interpersonal factors that may be predictors of alcohol misuse (Sudhinaraset, Wigglesworth, & Takeuchi, 2016). Such examination has been limited in past military research, with most epidemiologic research focusing on individual-level factors of sociodemographic characteristics, deployment experiences, and mental health comorbidity (Bray et al., 2013; Institute of Medicine, 2013; Jacobson et al., 2008; Mattiko, Olmsted, Brown, & Bray, 2011; Schumm & Chard, 2012; Wilk et al., 2010).

This work also complements existing research that focuses on understanding what modifiable factors may exist for impacting military mental health (Cohen, Fink, Sampson, & Galea, 2015; Goldmann et al., 2012) by more thoroughly exploring social

support and networks, and extending the reach to alcohol misuse outcomes. Specifically, findings contribute to the understanding of the military drinking context from the perspectives of interpersonal support as well as social network influence. Understanding the effects of these modifiable factors helps to inform opportunities for future interventions and improvements on existing programs

Although current overseas activity is not as high as it has been in the recent past with Operations Iraqi Freedom and Operation Enduring Freedom, the U.S. military continues to play a role in international relations, both in the Middle East and beyond. At least one branch of the military, the Army, has recently reported that it will be ramping up personnel recruitment efforts and expanding both its Active Duty and Reserve Components (Army, 2017). This increase reflects the expectation from the current presidential administration to rebuild the U.S. military en masse, increase spending, and recruit new military personnel over the coming years ("John S. McCain National Defense Authorization Act for Fiscal Year 2019, H.R. 5515," 2018; The Washington Post, 2017). Deployments will continue to be a necessity, and research on how deployment affects the relationship between interpersonal factors and alcohol misuse will therefore continue to be relevant for the future health of military personnel.

Finally, this dissertation contributes to research on the understudied population of R/NG personnel. R/NG personnel are a subgroup that has similar deployment and combat exposure as Active Duty personnel, but that also experiences a unique split between military and civilian life and associated stressors. Few studies have been conducted to understand military alcohol culture, and those that have are based on Active Duty populations and emphasize individual factors that influence alcohol outcomes,

versus examining social environments. Ultimately, this dissertation helps clarify the reality of interpersonal factors and alcohol use behaviors as they apply to the unique experiences of R/NG personnel, although many conclusions might be translated to other military populations. This work is also a catalyst for future military alcohol research, and speaks to the need for such research to acknowledge both the specificity and generalizability of its conclusions based on the military population being addressed.

8.6 References

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Appendix A. CURRICULUM VITAE

CURRICULUM VITAE

Erin M. Anderson Goodell

PERSONAL INFORMATION

University Address:
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Permanent Address:
202 Pine Cone Trail
Ormond Beach, FL 32174

Email address: eander60@jhu.edu
Phone: (919) 260-6074
Citizenship: United States

EDUCATION

PhD, Mental Health
2014 to present

Johns Hopkins University, **Bloomberg School of Public Health**
Department of Mental Health, Baltimore, MD
Doctoral Candidate
Pre-doctoral Fellow, NIDA Drug Dependence Epidemiology Training Program
Doctoral Thesis: "Interpersonal risk and protective factors for alcohol misuse among Army Reserve and National Guard soldiers"

ScM, Epidemiology
2012 to 2014

Harvard University, Harvard T.H. Chan School of Public Health
Department of Epidemiology, Boston, MA
Masters Thesis: "The relationship between parental military deployment and adolescent externalizing disorders: Results using data from the National Comorbidity Study-Adolescent Supplement (NCS-A)"

BS, Public Health, *cum laude*
2003 to 2007

University of North Carolina, Gillings School of Global Public Health
Department of Health Policy and Management, Chapel Hill, NC
Undergraduate Thesis: "Providing a voice: Support for rural family caregivers of relatives with dementia"

RESEARCH & PROFESSIONAL EXPERIENCE

***Postdoctoral Research Fellow*, Department of Mental Health, Johns Hopkins Bloomberg School of Public Health,** Baltimore, MD

Starting January 2019
Mentors: Renee M. Johnson, PhD and Johannes Thrul, PhD

***Research Assistant,* Department of Community Health & Health Behavior, School of Public Health and Health Professions, University at Buffalo,** Buffalo, NY

August 2015 to present
Mentor: Gregory G. Homish, PhD

- Conducts research related to social support, social influence, and substance abuse as part of a research team using data from Operation: SAFETY, a longitudinal study of health and wellness of Army Reserve and National Guard soldiers and their partners.
- Collaborates and provides substantive input and feedback on team members' research.

***Research Assistant,* Department of Health Care Policy, Harvard Medical School,** Boston, MA

January 2013 to July 2014
Mentor: Ronald C. Kessler, PhD

- Conducted literature reviews on violence and suicide in active military and veteran populations, and synthesized information into comprehensive literature tables in support of Army STARRS study.
- Developed and implemented variable coding schemes across multiple versions of Army STARRS survey instruments.
- Managed content on National Comorbidity Survey (NCS) website and conducted updates to language translations of instrument scales as well as other survey documents.
- Proofed manuscripts for submission to peer-reviewed journals, and reviewed progress reports for submission to funding organizations.

***Research Analyst,* RTI International,** Research Triangle Park, NC

August 2008 to January 2013
Supervisor: Robert M. Bray, PhD

- Served as project manager for military behavioral health and mental health research, which included managing multi-million dollar budgets for government contracts and grants, regularly interacting with federal clients, conducting literature reviews, recording proceedings at client meetings, and monitoring research project timelines and progress.
- Led data collection teams, and was responsible for logistics and successful administration of behavioral health surveys.

- Assisted with data tasks including coding, data management, and table shell production.
- Drafted text for public health research proposals, IRB submissions, and final reports of findings from behavioral health surveys.
- Contributed text as a member of a team tasked with producing Substance Abuse and Mental Health Services Administration (SAMHSA)-sponsored US state reports that included data from the National Survey on Drug Use and Health (NSDUH), Drug and Alcohol Services Information System (DASIS), and Center for Mental Health Services (CMHS).

***Research Intern,* University of North Carolina, Institute on Aging – Center for Aging and Diversity,** Chapel Hill, NC

May 2006 to February 2007
Mentor: Peggye Dilworth-Anderson, PhD

- Conducted telephone interviews with rural caregivers of relatives with dementia to gather qualitative data on retention of care-giving skills learned in community training sessions.
- Coded intervention evaluations measuring rural caregiver knowledge of dementia.
- Conducted literature reviews for research proposals on dementia.

PROFESSIONAL ACTIVITIES

Professional Affiliations

Student Member	Society of Behavioral Medicine, 2015 to present
Member-In-Training	The College on Problems of Drug Dependence, 2018 to present

Conference Activities

Co-chair	"Greatest American Heroes: Veterans and Military," 80th Annual Meeting of The College on Problems of Drug Dependence, 2018

Peer Reviewer

American Journal of Public Health	2016 to present
Stress & Health	2018 to present

HONORS AND AWARDS

2018	*NIDA Director's Travel Award* The College on Problems of Drug Dependence
2014-2018	*Drug Dependence Epidemiology Training Fellowship* (T32DA007292) National Institute on Drug Abuse

2017	*Distinguished Student Travel Scholarship* Society of Behavioral Medicine Awards Committee, Chair Edwin B. Fisher, PhD
2017	*Patricia H. Rosenberger Award for Outstanding Student/Fellow Abstract* Society of Behavioral Medicine, Military & Veterans' Health Special Interest Group
2017	*Meritorious Student Abstract* Society of Behavioral Medicine Conference Program Committee
2016	*Student Conference Fund Award* Johns Hopkins Bloomberg School of Public Health Student Assembly
2016	*Patricia H. Rosenberger Award for Outstanding Student/Fellow Abstract* Society of Behavioral Medicine, Military & Veterans' Health Special Interest Group
2013	*Department of Epidemiology Scholarship* Harvard T.H. Chan School of Public Health
2009-2011	*Spot Awards for Excellence* RTI International, Research Triangle Institute, NC
2003-2007	*Dean's List* University of North Carolina, Chapel Hill, NC

PUBLICATIONS

Peer-Reviewed Articles

Anderson Goodell, E. M., Homish, D. L., & Homish, G.G. (in press). Characteristics of U.S. Army Reserve and National Guard couples who use family readiness programs. *Military Behavioral Health.* doi: 10.1080/21635781.2018.1515131

Brooks-Russell, A., Ma, M., Levinson, A. H., Kattari, L., Kirchner, T., **Anderson Goodell E. M.**, & Johnson, R. M. (in press). Adolescent marijuana use, marijuana-related perceptions, and use of other substances before and after initiation of retail marijuana sales in Colorado (2013-2015). *Prevention Science.*

Brown, J. M., **Anderson Goodell, E. M.,** Williams, J., & Bray, R. M. (2018). Socioecological risk and protective factors for smoking among active duty U.S. military personnel. *Mil Med, 183*(7-8), e231-239. doi:10.1093/milmed/usx021

Heavey, S. C., Homish, D. L., **Anderson Goodell, E. M.**, & Homish, G. G. (2017). U.S. reserve soldiers' combat exposure and intimate partner violence: Not more common but it is more violent. *Stress Health, 33*(5), 617-623. doi:10.1002/smi.2748

Williams, J., Brown, J. M., Bray, R. M., **Anderson Goodell, E. M.**, Rae Olmsted, K., & Adler, A. B. (2016). Unit cohesion, resilience, and mental health of soldiers in basic combat training. *Mil Psych, 28*(4), 241-250. doi:10.1037/mil0000120

Leow, J. J., Martin-Doyle, W., Rajagopal, P. S., Patel, C. G., **Anderson, E. M.**, Rothman, A. T., . . . Bellmunt, J. (2014). Adjuvant chemotherapy for invasive bladder cancer: A 2013 updated systematic review and meta-analysis of randomized trials. *Eur Urol, 66*(1), 42-54. doi:10.1016/j.eururo.2013.08.033

Manuscripts In Preparation

Anderson Goodell, E. M., Fillo, J., Homish, D. L., & Homish, G. G. Effects of deployment-related social support on hazardous alcohol use among Army Reserve and National Guard couples.

Anderson Goodell, E. M., Linton, S. L., Johnson, R. M., Latkin, C., Homish, D. L., & Homish, G. G. Individual tie and social network characteristics that influence social drinking among Army Reserve and National Guard soldiers.

Anderson Goodell, E. M., Johnson, R. M., Latkin, C., Homish, D. L., & Homish, G. G. Risk and protective effects of social network characteristics on alcohol use among Army Reserve and National Guard soldiers.

Anderson Goodell, E. M., Leoutsakos, J. M., Johnson, R. M., Linton, S. L., Homish, D. L., & Homish, G. G. (in preparation). Profiles of deployment-related support and hazardous alcohol use among Army Reserve and National Guard soldiers.

Anderson Goodell, E. M., Williams, J., & Bray R. M. (in preparation). Post deployment stress and marital functioning among US Active Duty service members.

Technical Reports

Lane, M. E., Tueller, S., **Anderson, E. M.**, & Yetukuri, V. (May 2012). *Integrated Mental Health Strategy (IMHS) Strategic Action #23: Chaplains' Roles.* Report prepared for Department of Veterans Affairs and Department of Defense.

Brown, J. M., Bray, R. M., Williams, J., Lane, M. E., Reyes Guzman, C., Spira, J., **Anderson, E. M.**, & Rae Olmsted, K. L. (March 2012). *Basic Combat Training Mental Fitness Study*. Report prepared for the United States Army.

Bray, R. M., Rae Olmsted, K. L., Brown, J. M., Witt, M., Lane, M. E., **Anderson, E. M.**, & Mattiko, M. J. (August 2011). *State of the Behavioral Health of the United States Coast Guard*. Report prepared for the United States Coast Guard.

Bray, R. M., Pemberton, M. R., Hourani, L.L., Witt, M., Rae Olmsted, K. L., Brown, J. M., Weimer, B. J., Lane, M. E., Marsden, M. E., Scheffler, S. A., Vandermaas-Peeler, R., Aspinwall, K. R., **Anderson, E. M.**, Spagnola, K., Close, K. L., Gratton, J. L., Calvin, S. L., & Bradshaw, M. R. (September 2009). *2008 Department of Defense Survey of Health Related Behaviors among Active Duty Military Personnel*. Report prepared for the Department of Defense and United States Coast Guard.

TEACHING

Guest Lectures

Anderson Goodell, E. M. (2016). *Assessment and Comorbidity of Substance Use Disorders.*

Classroom Instruction

Year	Course/Description	Enrollment
Fall 2015	**The Epidemiology of Substance Abuse and Related Problems**	30
& Fall 2016	*Teaching Assistant*, Johns Hopkins Bloomberg School of Public Health, Department of Mental Health	

PRESENTATIONS

Scientific Meetings

Anderson Goodell, E. M., Leoutsakos, J. M., Johnson, R. M., Homish, D. L., & Homish, G. G. (March 2019). *Classes of deployment-related support and hazardous alcohol use among Army Reserve and National Guard soldiers.* Abstract accepted for oral presentation at 40th Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine, Washington, DC.

Fillo, J., Homish, D. L., **Anderson Goodell, E. M.**, & Homish, G. G. (November 2018). *Lifetime military sexual trauma exposure among U.S. Army Reserve and National Guard soldiers: Alcohol, drug, and mental health correlates.* Abstract accepted for oral presentation at Annual Meeting for the American Public Health Association, San Diego, CA.

Anderson Goodell, E. M., Homish, D. L., & Homish, G. G. (June 2018). *Deployment, traumatic brain injury, and social influence on recent illicit drug use among U.S. Army Reserve and National Guard couples.* **NIDA Director's Travel Award.** Oral presentation and session co-chair at 80th Annual Meeting for The College on Problems of Drug Dependence, San Diego, CA.

Anderson Goodell, E. M., Homish, D. L., & Homish, G. G. (April 2018). *Effects of social support during and after deployment on hazardous alcohol use among Army Reserve and National Guard couples*. Oral presentation at 39th Annual Meeting &

Scientific Sessions of the Society of Behavioral Medicine, New Orleans, LA.

Anderson Goodell, E. M., Homish, D. L., & Homish, G. G. (June 2017). *Social influence on recent illicit drug use among Army Reserve couples.* Poster presentation at 79th Annual Meeting for The College on Problems of Drug Dependence, Montreal, Canada.

Anderson Goodell, E. M., Homish, D. L., & Homish, G. G. (March 2017). *Characteristics of Army Reserve families who use family readiness programs.* **Meritorious Student Abstract. Patricia H. Rosenberger Award for Outstanding Student/Fellow Abstract. Distinguished Student Travel Scholarship.** Oral presentation at 38th Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine, San Diego, CA.

Roth, K. B., & **Anderson Goodell, E. M**. (October 2016). *All-cause mortality in a cohort of HIV-positive men: Differences in survival by level of depressive symptoms at HAART initiation*. Poster presentation at the Annual Meeting for the American Public Health Association, Denver, CO.

Anderson Goodell, E. M., Cercone Heavey, S., Homish, D. L., & Homish, G. G. (June 2016). *Social ties and substance use among reserve soldiers in single and dual military households.* **Johns Hopkins Bloomberg School of Public Health Student Assembly Student Conference Award.** Poster presentation at 78th Annual Meeting for The College on Problems of Drug Dependence, Palm Springs, CA.

Cercone Heavey, S., Homish, D. L., Devonish, J. A., **Anderson Goodell, E. M.**, & Homish, G. G. (June 2016). *Peer networks, marital satisfaction & nonmedical use of prescription drugs (NMUPD) among Reserve soldiers & partners.* Poster presentation at 78th Annual Meeting for the College on Problems of Drug Dependence, Palm Springs, CA.

Anderson Goodell, E. M., Homish, D. L., & Homish, G. G. (April 2016). *Intimate partner violence in single- and dual-military partnerships among Army Reserve soldiers.* **Patricia H. Rosenberger Award for Outstanding Student/Fellow Abstract.** Poster presentation at 37th Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine, Washington, DC.

Briefings

Lane, M. E., Scheffler, S., Aspinwall, K. R., **Anderson, E. M.,** & Hourani, L. L. (October 2009). *Overview of 2009 Health-Related Behavior Survey of the Reserve Component.* Prepared for Assistant Secretary of Defense for Reserve Affairs.

ADDITIONAL INFORMATION

Technical Skills

- Statistical software: Stata, Mplus, R, SAS
- Network analysis software: UciNet, NetDraw
- Web development software: Adobe package (Acrobat, Dreamweaver)

Community Involvement & Leadership Roles

2010 to present **Fundraiser & Runner** – Hope for the Warriors (H4W)

2016 to 2017 **Teammate & Volunteer** – Back on My Feet (BoMF), Baltimore, MD